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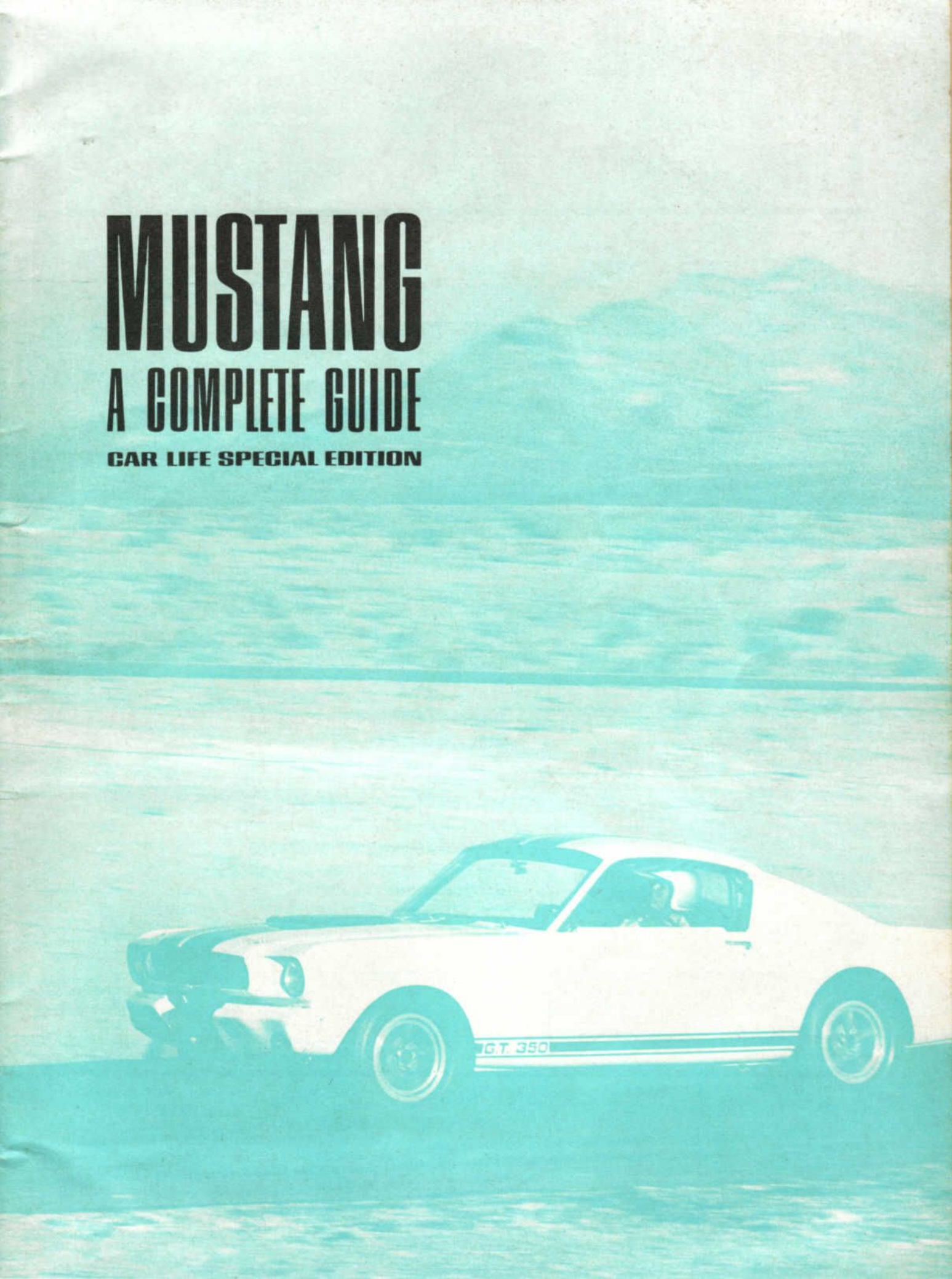

MUSTANG
A COMPLETE GUIDE

A CAR LIFE SPECIAL EDITION

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BY DONALD N. FREY, VICE PRESIDENT-GENERAL MANAGER FORD DIVISION

THE MUSTANG
has created a lot of excitement

around our Company – and, for that matter, around the whole industry. I suspect even our competitors would agree that the Mustang has been the big story in the auto business since its introduction in April of 1964. . . .

I must admit that we had a pretty good feeling about the Mustang even before it was introduced. We had researched the market so thoroughly that we figured we could darn near tell you the color of the socks a prospective Mustang customer would wear.

As a starter, we had literally thousands of facts and figures about the growing youth market. A good example of this is our highly publicized Bucket Seat Study, which we conducted at colleges in eight cities across the country. The study indicated that 42% wanted bucket seats for "first dates," but only 15% preferred them to standard bench seats if they were going steady. (I guess the youth of the country hasn't changed too much since my day!)

In addition to such studies, the Mustang itself had been shown to selected groups – including many of the leading automotive writers around the country, who previewed the cars some months prior to public introduction so they could prepare stories for publication at the time the Mustang was introduced publicly.

Almost without exception, these seasoned writers – and other preview groups as well – were unstinting in their praise of the Mustang . . . they assured us we had a winner.

In the beginning, we had simultaneous cover stories in *Time* and *Newsweek* featuring the Mustang and Lee Iacocca, our Ford Division general manager. To the best of our knowledge, this was the first time in history that a product and a businessman had made the covers of both these major news magazines – and on the same day, yet!

There were numerous other magazine articles, including one in *Playboy*. (We were hopeful of making the center spread, but apparently the Mustang just couldn't measure up to their stock feature!)

Even before these stories appeared, though, we started receiving orders – thousands of them from people who had never even *seen* the Mustang.

When the big day finally arrived – the day we would show the Mustang to the public for the first time in dealerships around the country – there was a minimum of work done around our offices. Everyone was asking: How's the Mustang going?

Well, as you know, it went well. On introduction day, approximately 4 million people visited Ford dealerships to see the Mustang. More than 22,000 retail orders were written. This rush continued and we soon found that we couldn't make Mustangs fast enough to keep up with the huge, ever-increasing demand.

We originally were building the new cars only at our assembly plant in Dearborn, Mich., where we have a capacity to build about 1300 units daily. However, we had planned even before the introduction to add a second plant, and we converted our San Jose, Calif., assembly plant to Mustang production in July to boost capacity to approximately 1800 units a day.

Still the demand continued at a pace exceeding our production capabilities and we recently converted our Metuchen, N. J., assembly plant to Mustang production. We are now able to turn out more than 50,000 Mustangs a *month*.

Now, a shortage of production capacity on a hot model is a nice problem to have, but it requires some big decisions. Converting assembly plants is an expensive proposition requiring millions of dollars.

As our program developed, we needed answers to a lot of questions. What kind of people were buying the Mustang? What were their ages? Their income? Their education? What kind of cars were they trading in? What options were they buying? We had to prove what we were already pretty

darned sure of – that the Mustang was here to stay and not just a passing fad like hula hoops or those teen-age dances that seem to change every two or three weeks.

Our marketing research people burned a lot of midnight oil and came up with some interesting statistics.

We discovered that the average age of Mustang buyers was 31, with more than half of them between 20 and 34. This helped confirm our pre-Mustang confidence in the growing importance of these young people as prospective car buyers.

At the same time, though, we were pleased to note that about 16% of Mustang owners were in the 45-to-54 age group – indicating that the Mustang's appeal was not by any means restricted to the younger set.

Next, we found that better than 40% of all Mustang buyers were in the $5000-to-10,000 income bracket, suggesting that our pin-pointed price advertising had attracted a lot of interest. On the other side of the coin, though, was the fact that almost 15% of all buyers were making *$15,000 or more* each year. Obviously, they were attracted to the Mustang by something other than a low price tag.

Another interesting fact was that 52% of all Mustang owners had some college education and another 38% were high school graduates. Stability? Good risks? You bet!

We also found out that the Mustang appealed to a wide cross-section of the public – men and women from all walks of life – with at least one out of four buyers classified as managers or proprietors of various businesses.

The Mustang had been advertised as "a car you build yourself." Or, as one of our executives put it–"The Mustang is like an Erector set – a do-it-yourself kit." You could purchase the low-priced economy model and by adding options you could create a sports car or even one with a high degree of luxury.

We found that the customer was indeed buying options – lots of them! Eighty-five per cent of all Mustangs were being sold with white-sidewall tires, 80% with radios, 50% with automatic transmissions and 15% with the so-called Rallye Pack – designed especially for the customer who drove his car "for the fun of it."

One more very important factor in our analysis was the types of cars being traded in on Mustangs.

Significantly – from our somewhat partisan viewpoint – more than 50% of the trades were competitive makes. There is no way of being certain in such matters, but in our business these competitive trade-ins usually indicate conquest sales. In other words, buyers you've taken away from the other guy. And a 50% conquest rate is – to put it mildly – very gratifying.

What do all these facts and figures add up to? In a word – success! We were pretty sure we had a winner even before the Mustang was introduced. After researching the early buyers, we knew it!

And if the marketing studies weren't enough to convince us, sales were!

Mustangs weren't available in sufficient quantity to make much of a dent in the market at introduction time and in the auto industry you have to deliver the goods before you get credit for them. Advance orders just aren't considered.

However, the Mustang quickly proved its mettle in the market, and sales climbed steadily upward to where the car captured 3.2% of the market in 1964 despite the fact that it was not introduced until April. During the 8½ months in 1964 following its introduction, the Mustang outsold all but three other car lines – a truly remarkable record for a new car.

On December 18 – just eight months after the Mustang was introduced – our dealers sold the 250,000th Mustang. By the end of the year, sales totaled more than 263,000.

This mark, incidentally, was achieved even though our dealers never did get enough Mustangs to meet customer demand. At the present time, there still is a backlog of retail orders.

There's another interesting story about the Mustang – the number of other business people who want to get on the bandwagon.

One musical combo asked permission to change its name to "The Mustangs" so . . . as its manager wrote . . . the Mustangs could "help stamp out the Beatles." Other people are bringing out driveable scale-model Mustangs, designing Mustang clothes, Mustang sun glasses, Mustang key chains and tie tacks and cuff links. In fact, Mr. Iacocca received a bolt of beautiful drapery material from a company that remembered it had a little-used print stored away called "Wild Horses." They changed the name to "Mustang" and sold great gobs of it!

People have reacted to the Mustang *personally* . . . people of all ages, in all lines of work, at all economic and social levels. We've received literally thousands of letters from people who just had to sit down and tell us what a great car they thought the Mustang was and how it influenced their lives and the lives of their families and friends.

A young lady in St. Louis – incidentally, we get a lot of letters from women – wrote:

"Yes, it is true that blondes have more fun; but now I'm convinced that blondes have more fun in a new Mustang."

And, speaking of blondes, an older woman in Waynesburg, Pa., wrote congratulating us on our "good horse sense" in styling the Mustang and added:

"We saw the Mustang in our town this week. The young colt who was driving it had a beautiful blonde corraled in the front seat. My husband (the old stallion) said the Mustang was better looking than the blonde."

And, finally, here's one from a gentleman in Brooklyn, N. Y., that we really prize. He wrote:

"I'm not much on cars: I haven't been, in fact, since the Thunderbird got pregnant.

"Furthermore, even without stall-ins, World Fairs and the like, New York is no place to have a car. Pet owners urge their dogs to urinate on the wheels; slum kids steal the aerials; cops give tickets (and who knows someone who can fix them?); pigeons roost (and worse); the streets are always torn up; the soot dusts down a car within 10 min.; taxis bump you; buses crush you; inside parking requires a second mortgage on the house; gas costs 30% more than anywhere else in the world; the insurance rates are incredible; as soon as you park your car on the street, it is time to move it to the other side of the street, or to another neighborhood; the garment center is impassable, the Wall Street area is impenetrable, going to New Jersey impossible.

"So, as soon as I can raise the nut, I'm buying a Mustang. Which is the highest compliment I can muster."

DEVELOPING THE MUSTANG

Market Research Showed the Way

Market research is a curious thing. It can generate an Edsel and create a Mustang. It justified a Falcon just as it hatched a Thunderbird. Without it, salesmen would have to rely on perceptive judgment, manufacturers would have to read the enthusiast magazines and an entire specialized profession might well wither and die.

Yet, because of it, there can be advances, improvement, better things. Men can propel themselves to high places as well as drop from sight. Consumers ultimately get what they have so long demanded, though desire may have given way to disgust in the meantime. And, because of market research, the automobile industry has produced a Mustang.

The saga of the Mustang is intimately intertwined with market research. Without it, the Mustang would not be; without the Mustang, market research would have stagnated. Each has been responsible for the enhancement of the other. The Mustang owes its birth to a concept fertilized by market research, and market research owes a new-found respectability to its offspring's success. Most important, people everywhere have something different and better and exciting, called the Mustang.

Henry Ford II alluded to market research when he told Hearst interviewer Bob Considine: "Let's talk about the Mustang. We sold 50,000 more of them in their first three or four months of production than all the Edsels we sold in 2½ years. That's the greatest acceptance any new car ever had, with the exception of the Model A."

"Essentially," puts in Lee A. Iacocca, the former general manager of Ford Division who rode his Mustang up the corporate ladder, "the Mustang is a car that was designed for a market looking for a car.

"We have market research going all the time, full-blast. We have experts who watch for every change in the customer's pulse beat, who keep tabs on every statistic from the rate of which kids graduate from high school, to the number of repossessions by the automobile finance companies.

"For a long time," Iacocca added, "we have been aware that an unprecedented youth boom was in the making. The population was growing fast, but the number of youngsters in the 16-24 age group was growing even faster. People were making more money, getting better educated, moving to the suburbs, even buying second homes. We could show you statistics confirming that the more money people make, and the better educated they are, and the more they spend, the more they spread their lines of travel between work and home, the more cars they buy."

But while they were buying more

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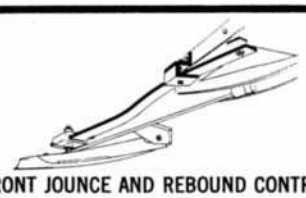

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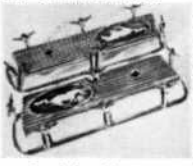

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Market Research Showed the Way

cars, Iacocca pointed out, "people were also getting more sophisticated, more discriminating, better informed. Their interests broadened and diversified, and their moods changed with their interests. So," he added pointedly, "did their buying habits."

The man who was marketing manager for Ford during the debut of the Mustang, Chase Morsey Jr., takes it from there:

"We had observed these things – the tremendous surge in population, particularly in the young age groups; the growth of multiple-car-owning families; the increase in the number of higher-income groups; the growth in college enrollments. It was our purpose to tie all those factors together into a kind of package which literally led directly to the Mustang, and also explained why we were so convinced this car would have a special meaning for all America."

Pulling out charts and graphs, Morsey moved first to population factors. A chart showing projected growth between 1960 and 1970 put 11.5 million more people in the 15-19 and the 20-24 age groups by the latter date. "The 15-19 group will increase by 41% and the 20-24 category by a whopping 54% in this period," Morsey pointed out. "Why is this important? It's because the influence we have with these young people does a lot to set our overall image with the general population.

"Young people are trend-setters in cars, clothes and many other commodities. They also generate a great deal of influence in the make and kind of car their parents buy. More importantly, perhaps, they exercise a potent purchasing force in their own right. And another thing we think important about this market: These young people are going to be better educated."

A graph showing the growth in college enrollment projected 7 million at 1970. "That's almost double the enrollment in 1960," Morsey explained, "and by 1980 there'll probably be 9 million college students. Now, why is this important? Because college educated people buy cars at a phenomenally higher rate than non-college people."

In multiple car ownership, Morsey had a chart showing growth between 1956 and 1963. By the end of that period, 13 million families owned two or more cars – 1.8 million of those families owning three or more. "This can be simply stated: Two drivers, two cars," Morsey interjected.

The importance of this was made graphic by a study of buying habits of this group. Multi-car families accounted for 21% of the total housing units, and their buying rate was about twice that of others – accounting for 40% of new car sales each year.

Morsey's chart of increased personal income and wealth carried projections from 1960, which was used as a base year. By 1975, the graph climbed to incorporate a 156% increase in over-$10,000 incomes, adding 10.6 million "spending units" to the economy in that over-$10,000 category. Similarly, families in the $5000-$10,000 annual income category will increase by 27% in that time, but the under-$5000 category will see a 7% decrease.

There has been a 53% increase in women drivers since 1956, said Morsey, resisting an obvious quip; but male drivers have only increased by 6%. "The movement to suburbia has almost required the housewife to have a second car for her shopping trips, her little league chauffeuring. Furthermore, she may be a working wife and need another car.

"When you consider these factors, you begin to realize what we're dealing with. We're dealing with a changing America, an America where people have specialized tastes and specialized needs," Morsey continued. "So we

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looked at the types of cars this market had been buying. We found that multiple car owners and young people did indeed have specialized tastes in automobiles."

Iacocca had characterized the market that had been emerging as one "no one could quite gauge. The fastest-growing, best-spending segment of the car-buying public was made up of people 16-24 years old – high school and college students, young marrieds, young working men and women. They didn't have much money to spend, but a good part of what they had went for transportation.

"Those who bought new cars wanted style plus either economy or high performance – at the lowest possible price. They wanted cars that looked expensive but weren't, really. They also wanted cars that were fun to drive and cars that held up well so they'd bring good prices at trade-in time.

"Our research had told us," Iacocca continued, "that, to satisfy this market, we needed a handsome car with a sporty flair; one offering a tremendous versatility in performance and appointments. Research – and experience with such fine, but low-volume automobiles as the 2-seater Thunderbird – also had told us the car needed four seats and a good-sized trunk."

Morsey, shuffling through his charts and reports, pulled out the car preference summary for the potential market. It showed 6% of all cars owned by people earning $6000 or more are foreign cars and 4% are convertibles. "But look at our selected categories. Six per cent of the cars owned by young single people are foreign made and 14% are convertibles. And among young marrieds, the differential is even greater. Of single car owners, 13% are foreign and 5% convertibles. With multi-car young marrieds, 15% are foreign and another 15% are convertibles.

"What did they like about their cars? Well, we found 36% of all people under 25 wanted a 4-speed floor shift, contrasted with 9% in the over-25 age grouping. Also, 35% of the young people liked bucket seats, vs. 13% in the older group. Both groups placed a high value on maneuverability in traffic – a point that we wanted to watch particularly in view of the large number of women who would be driving the Mustang."

One of the touchiest questions, Morsey indicated, was the preference for either 2- or 4-passenger capacity – particularly in view of the continuing popularity of long-discontinued 2-passenger Thunderbirds. Though never intended to be (nor was it called) a sports car, the early 'Bird did catch the germ of sporting flair and found many among the sports car set susceptible to its spell. Still, it didn't sell well enough (53,166

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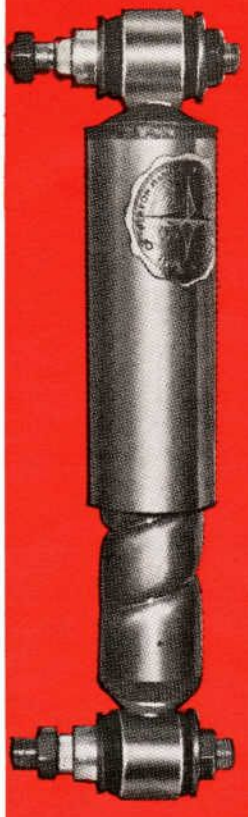

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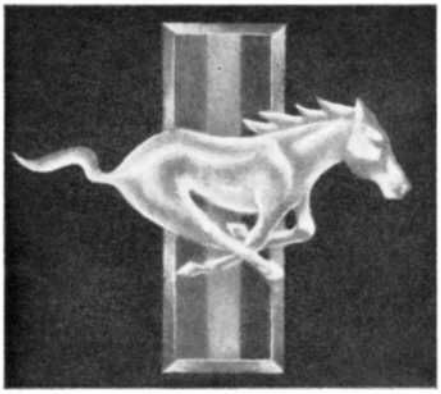

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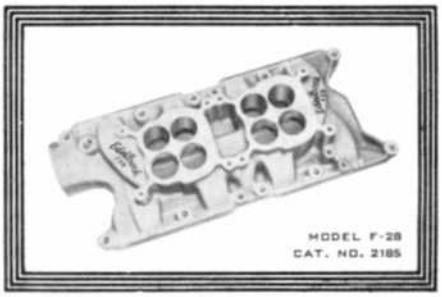

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Market Research Showed the Way

units in three years, 1955-57) and for 1958 was enlarged to 4-passenger configuration and upgraded to luxury status.

Letters from owners of the 2-seaters, however, began streaming steadily into FoMoCo executive offices calling for the return of the original 'Bird. Maneuverability and size seemed to be the main qualities the devotees missed.

Soon after the changeover, the imported car invasion also reached really significant proportions. Ford plugged the gap with the Falcon while market researchers plumbed the psyches of representative imported sports and economy car buyers to determine just what it was they liked. The experts found the aforementioned traits of bucket seats, floor-mounted shift mechanisms that really worked, maneuverability and lack of excess bulk as important criteria. But, most surprising, there was an overwhelming demand for a full 4-place configuration with some usable trunk space.

Owners of foreign sports and economy cars had been polled on a 2-passenger package and three 4-passenger packages. Though they were not identified, the latter three were the Volkswagen accommodations, those from a Corvair Monza, and the Mustang specifications. "Little preference was shown for the 2-passenger package," Morsey said, "but the Mustang package rated 33% with foreign sports car owners and 71% with foreign economy car owners. Thus, the 4-passenger decision was made."

Morsey had one other chart, showing price breakdowns for the industry. It showed the basic Mustang price zeroed in on an area that constituted 22% of the industry (at 1963 volume levels) though none of the price segments were identified. That would be an area of 1.6 million units annually but, as Morsey pointed out, it was "in a $200-300 range of an area that constitutes 63% of the industry – which, during 1963, amounted to 4.6 million units."

Thus, the Mustang was to be spotted in a sizable market potential zone, at least from a price standpoint. (It will be recalled just how much impact actually did occur at announcement when the price was emphasized – overly so, said some competitors.)

"All of the product characteristics we sought for the Mustang are presently available on the market in some car or other – but not in the right combinations," Morsey admitted. He ticked off the characteristics: Low-priced as possible (volume); seat four with front bucket seats; adequate trunk; both good performance and economy (engine options); "soundly and exquisitely styled"; and versatile – adaptable to a wide va-

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ety of tastes.

What had evolved by that time was three divergent trends which had to be tied up into this "car designed for a market looking for a car." The answer was in options – factory-installed extras which could be ordered on the base car to channel that particular one to the buyer's particular proclivities.

"The buyer could make of the car almost anything he wanted to," explained Iacocca. "It's an ideal compromise for the guy who wants a sports car but either can't afford it or has a couple of kids. It's a potential status, or luxury, car for the well-heeled buyer who can leave the showroom with all the options installed, or for the less-well-heeled Joe who wants to start out with the basic car and add the options as he goes along. And it's a good, sensible family car with enough inside space, trunk room, economy, and low cost to fill the bill with the young marrieds."

Iacocca recalled that Mustang II, first shown at Watkins Glen in the fall of 1963, "was a definite feeler on public reaction" to what was to be the production Mustang. "Actually," he admitted, "the decision to produce the car had been made some time before we began exhibiting it, but reaction to it helped us determine last-minute refinements on the ultimate car. The flood of letters convinced us that there was a sizable market for this car."

Then, there was some sneak pre-testing of early prototypes, using 52 young and struggling married couples as guinea pigs. "At first," Iacocca related, "some of them expressed doubts about the car's practicality. We had expected that, because we had deliberately picked people who weren't likely prospects for the car. They all owned standard-sized, low-priced cars – their only car – and had two children below high school age.

"Once they heard the price, they couldn't believe it. You should have seen the change. Those who thought they had spotted impractical features, suddenly began searching for a rationale that would convince them it was just the right car for them," the executive said. After final pre-production probing such as this, he added, the company had no worries. "People would want this car because it offered them status at low cost," he went on, "because it satisfied – in one package – their need for basic transportation and their desire for comfort, style, handling, and a choice in performance capabilities."

Later, Iacocca was to say at the national introduction: "We have achieved in this car some of the most significant mechanical and functional breakthroughs in the history of car-building – particularly in the area of weight control. We have succeeded in wrapping up, in this one package, all of the best

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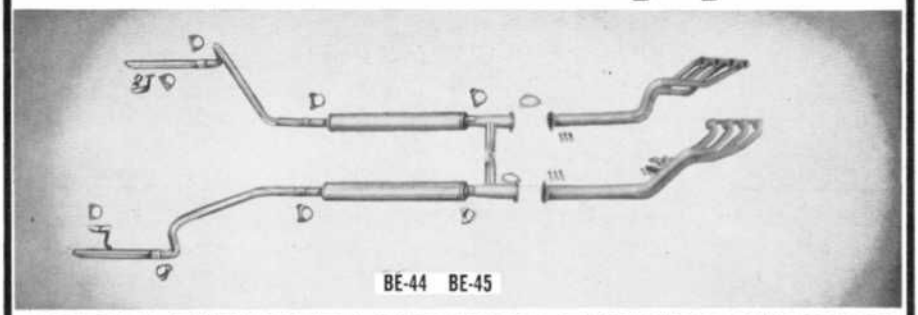

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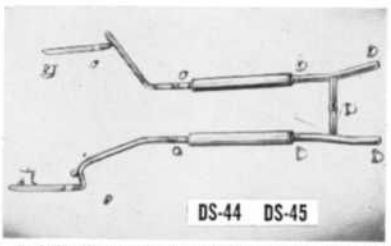
MUSTANG DUAL EXHAUST SYSTEM



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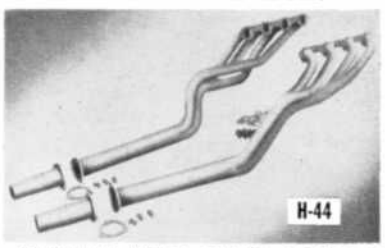
DS-45	289 CIE Hi-Perf. (except convert.)	59.95
DS-45A	289 CIE Hi-Perf. convert	59.95

MUSTANG DYNO-TUNED HEADERS ©



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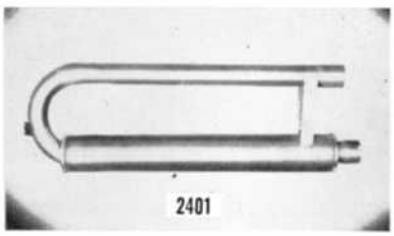

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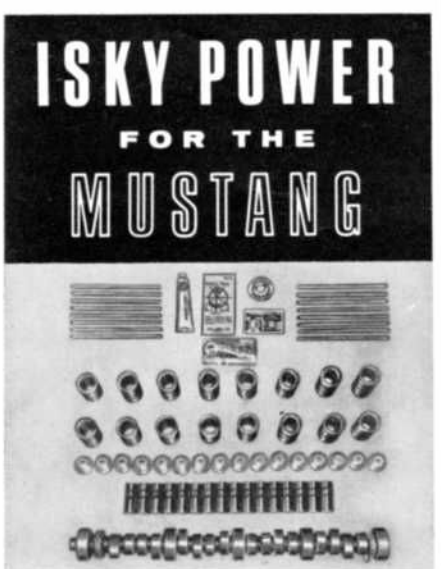

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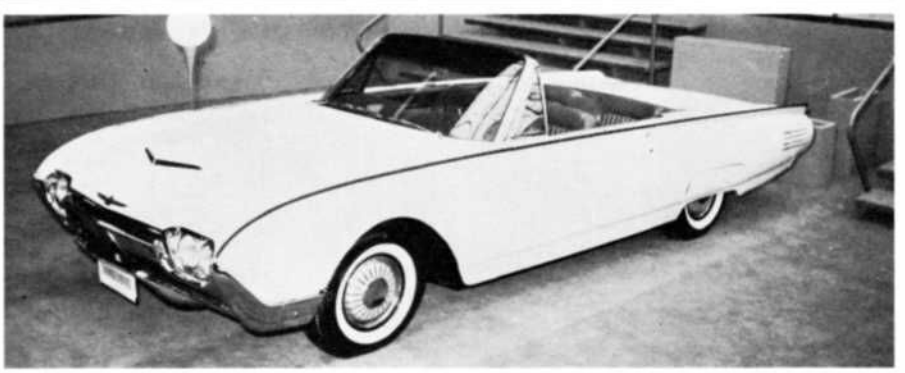
Market Research Showed the Way

elements of that elusive objective known as 'total performance.' "

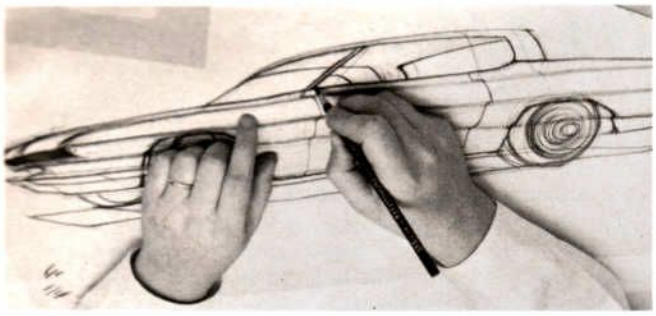
The then-general manager was fond of referring to the car as "the third historic offering by Ford Motor Company of a totally new type of car that has importance for the masses." The first, of course, was the Model T "which placed a new-fangled means of locomotion into the steering hands of a public which theretofore had had little hope of ever owning an automobile"; the second, the Model A; and now, Mustang.

Mustang was unveiled to the public in a setting as unusual as the era it was designed to fit: The New York World's Fair in the spring of 1964. National news magazines gave cover play to the story, along with newspapers and general interest magazines – and even some college editors – all joining the regular enthusiasts' press in carrying the word to the market. Simultaneous commercial time was used on all major television networks. Even the inevitable "leaks" beforehand failed to dampen the interest of the public, which swarmed to dealer showrooms by the thousands during the first weeks.

It was all too much for production capacity, at first, but once the back orders began to be filled, one could take stock. Market research, which similarly had spawned an Edsel that lasted for only 110,000 units over three years, had been vindicated. Once production caught up, the sports car set started proving Iacocca's faith in "wrapping up . . . in one package . . . total performance." And just a little later, after 1965 finally rolled around, that general manager was rewarded with new vistas – as vice president of Ford Motor Co. in charge of all North American car and truck operations.



BIGGER 'BIRD came along in 1958 when wheelbase was lengthened to 113 in. so 4-passenger format could be adapted. Some 36,510 '58s were sold and when more streamlined '61s appeared, sales jumped to 71,326 for the model year. Further restyling was done in 1964 and, below, disc brakes were made standard equipment with the 1965 Thunderbirds.



DEVELOPING THE MUSTANG: STYLING

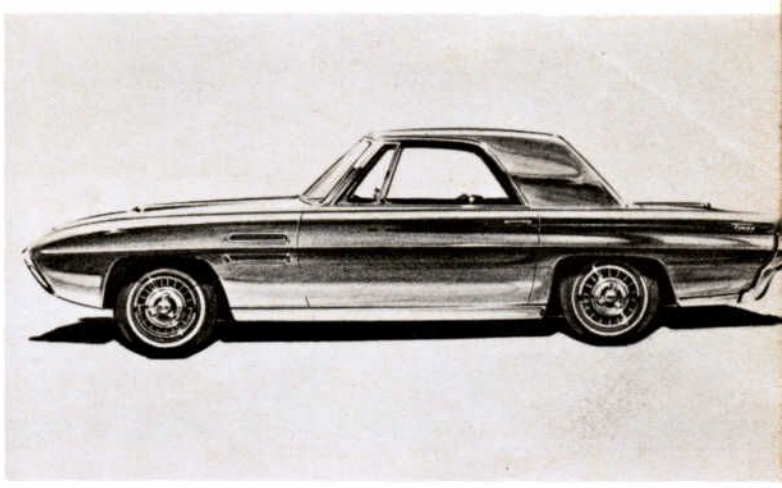
BY GENE BOOTH

Talking about the styling involved in producing the Mustang always brings a satisfied smile to the face of Gene Bordinat, dapper vice president and director of styling for Ford. Well it should, for the car has received critical acclaim – from proponent and detractor alike – since before it was even publicly unveiled. In line and proportion, it is a stylist's *tour de force*, and is remarkable indeed for a mass-produced, inexpensive automobile. Bordinat should be pleased.

"Reduced to its practical effect in the total scheme of things, the Mustang was the kind of new idea that both Thunderbird and Continental were," Bordinat suggests, "not only as a new product concept, but as a bold styling interpretation of what we believed the market was ripe to receive. It was the result of one of the most exciting and most satisfying design programs with which I have been connected in my 25 years in automotive styling."

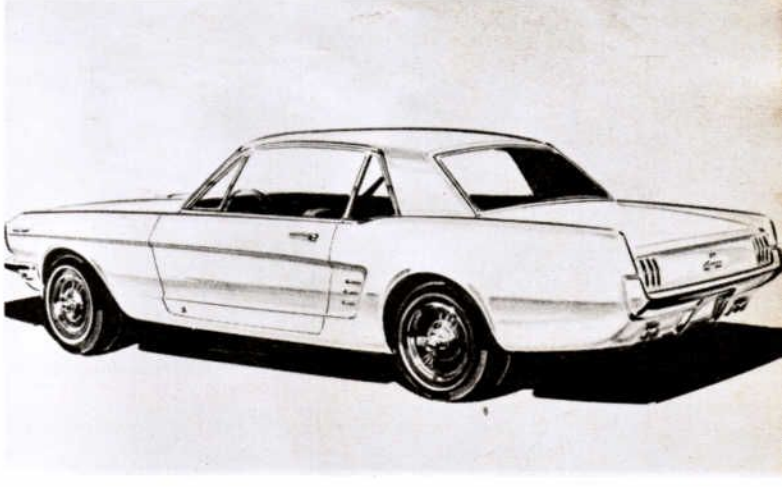
Competitors have shown a chagrined appreciation of the car, too. There is the story, perhaps apocryphal, that a Mustang was unveiled along with the 1965 models at a private showing for top GM brass, well before their public introduction day. S. E. Knudsen, Chevrolet's hard-driving general manager, stepped up to GM President John Gordon and asked: "Don't you wish we'd said that, Jack?"

Most appreciative, however, has been the buying public. Customers liked the style, the design, the concept so well that they snapped up every available car on introduction day, created such a backlogged demand that production was expanded to two other plants, and populated the nation's highways with over 400,000 of the cars before its first birthday had been observed.



DESIGN PROGRAM begins with sketches and renderings but full-scale clay model (left) is needed for final judgment. This was T-Bird-like Median, sketched above.

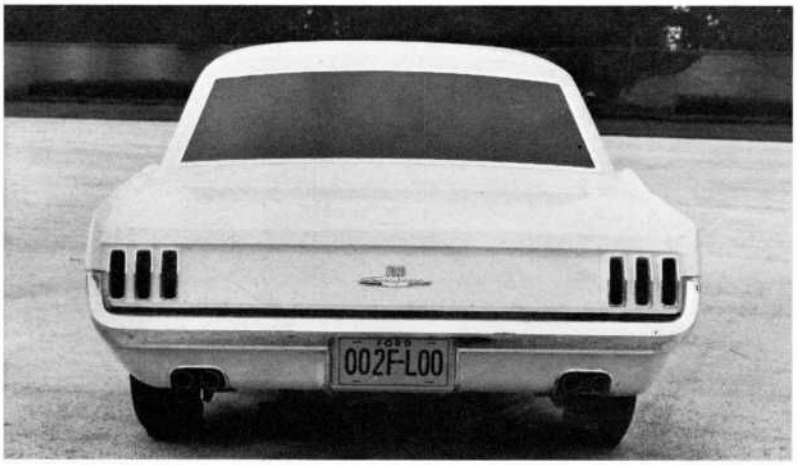
AVVENTURA WAS name carried by more than 12 proposals but bulky example (above) didn't have winner's litheness.



Such acceptance surprises Bordinat only in degree. The Mustang was, in the final analysis, "the fruits of advanced engineering, forward styling programs, good market research and astute product planning tied together in an integrated program." It is a vehicle "characteristic of the automobile business," he continues. "It signifies how you must be constantly alert to new opportunities for new offerings, regardless of how complete your range may seem to be at a given time."

In Bordinat's bailiwick, there were a number of small sporty cars being designed in the Corporate Projects Studio during 1961, about the time some of the early market re-

STYLING

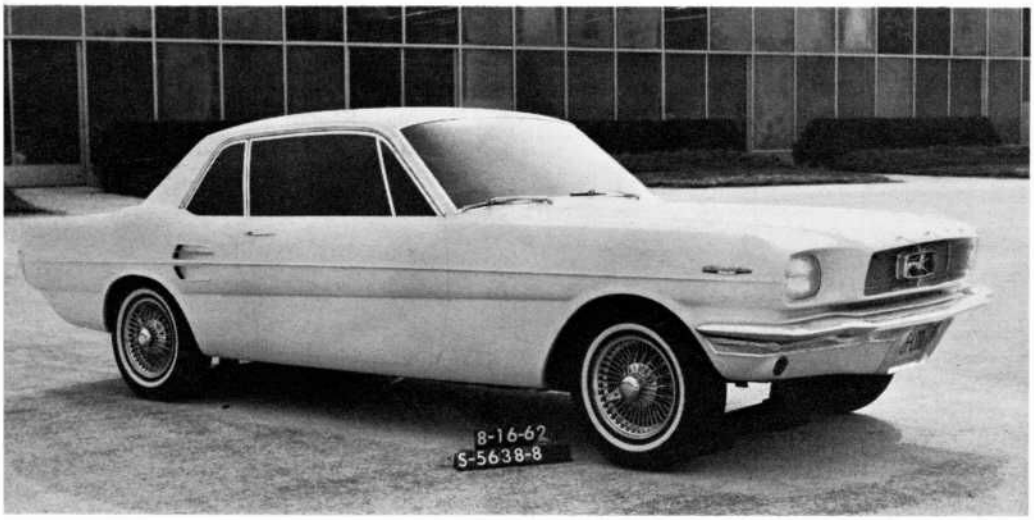


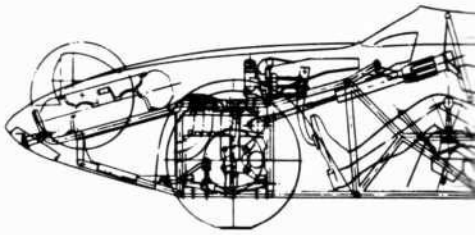
search findings were beginning to focus on what Chase Morsey termed the "bucket seat explosion." Among these were cars called such things as Mina, Median, and – simply – Open Sports Car. The projects at this time were handled by Corporate Projects, which is responsible for advanced models before they become assigned to a particular division. Specific styling studios for Ford and Lincoln-Mercury, largely subsidized by the divisions, were too busy with production styling problems to be concerned about advanced concepts at the time.

These designs were reviewed by the product planning committee, resulting in the initial recommendation to continue work on a 4-passenger model – by then called "Median Sports Car" – which had been built up in clay and which, stylists recall, "captured some of the feel of the 1955-57 2-passenger Thunderbirds." This led to several other models, some of which were called "Avventura" but one of which was the Allegro X-Car, introduced publicly in August, 1963.

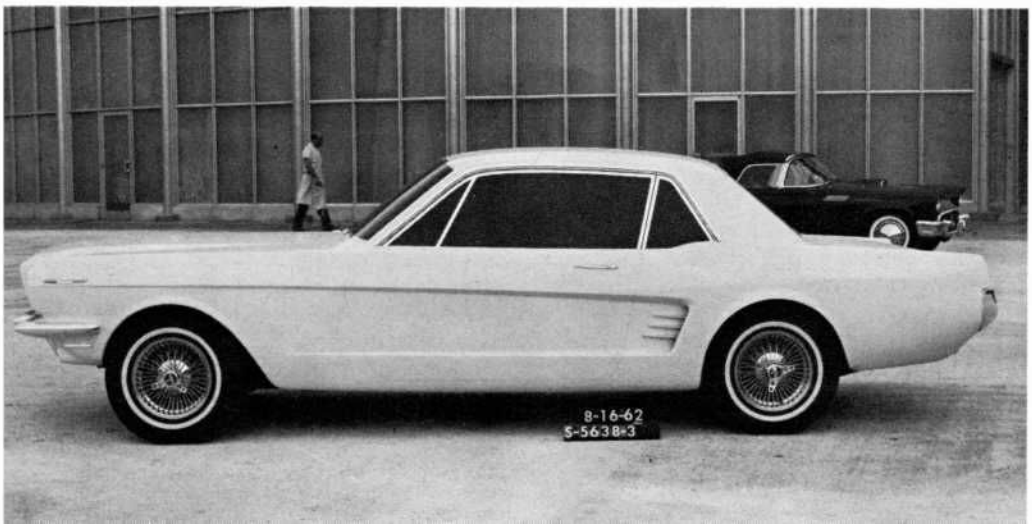
There were, in fact, 13 Allegro cars, each differing slightly in exterior styling and wheelbase as well as experimenting in passenger packages – 2-passenger, 4-passenger, and 2+2 arrangements. In all, six of these later models were publicized in an appetite-whetting campaign (called "testing public reaction") for ultimate unleashing of the Mustang at a propitious moment. One of these was the original Mustang, the 2-passenger Mustang I.

FORD STUDIO'S model, called Cougar, went into production with little change. Passenger side treatment was rejected as "too busy" in favor of driver's side styling.





TINY MUSTANG I created excitement whenever it appeared but lent only name to final car.

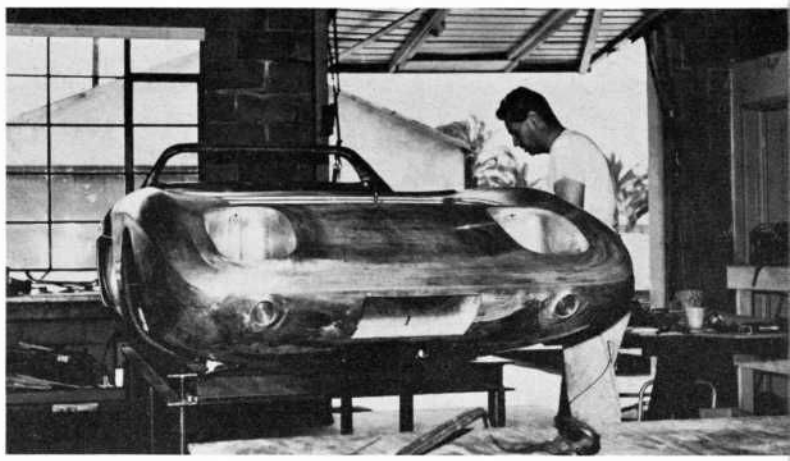


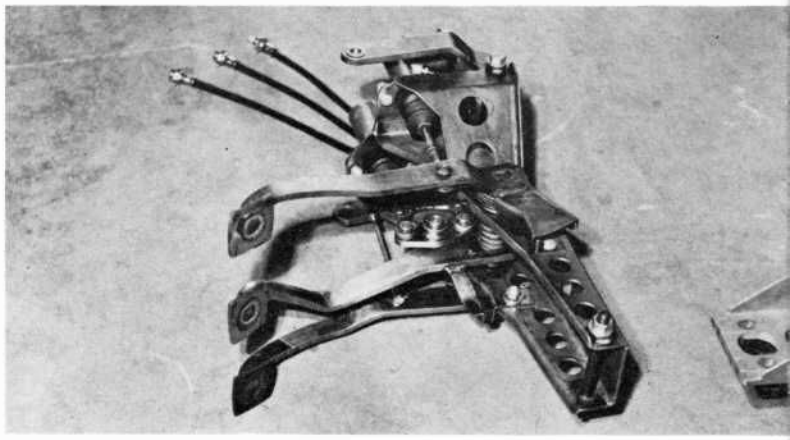
"Though it was introduced several months before the Allegro," Bordinat reveals, "Mustang I actually was completed well after the Allegro. It was a different package and styling theme, because we wanted to leave absolutely no avenues unexplored."

What was being explored was almost purist sports/racing machinery. Mustang I had a watercooled V-4 engine mounted amidships and full 4-wheel independent suspension. In appearance it could have served as a Dearborn prototype for the Lotus Elan and it set many a *pur sang* heart beating wildly. Bordinat's stylists also were busy at that time building a sleek fastback coupe body on a Cobra chassis which was publicized even after the Allegro and was called the Cougar II.

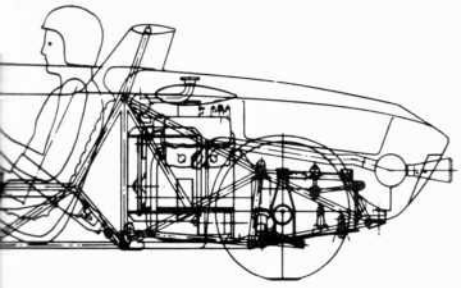
"Both of these cars attracted a great deal of favorable reaction from the public," the styling director admits. "The styling of each was successful enough to elicit mail urging the company to begin production. But both were 2-passenger models and we were not convinced that there was a sufficiently large market to justify production." Market research had been busy discounting the 2-passenger, letter-writing devotees, as has been seen.

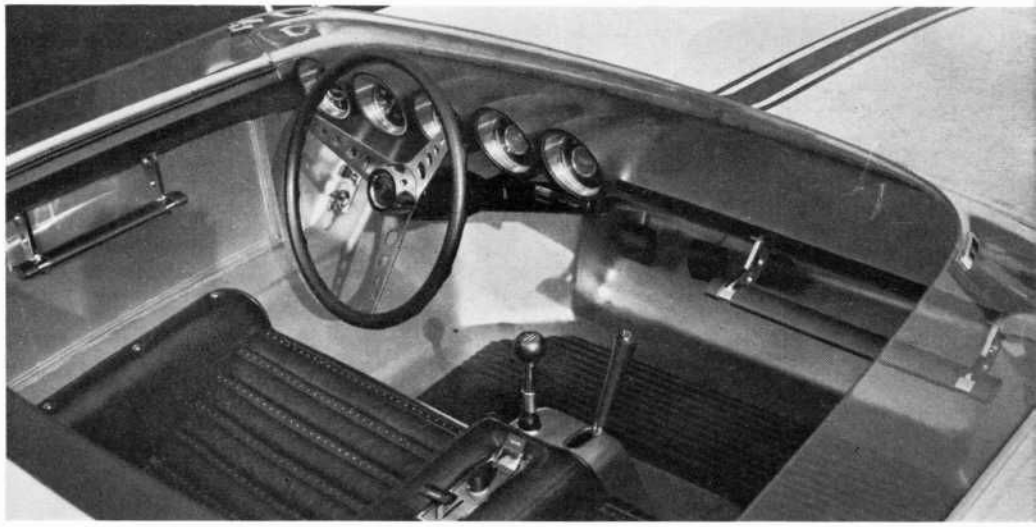
The "firm decision" to produce a highly-styled and sporty 4-passenger car came after assessing reaction to those experimental cars as well as market research data and other factors, Bordinat says. That decision resulted in Mustang II, first displayed at Watkins Glen in September, 1963. It was for this car that a design team headed by Joe Oros in the Ford Studio took over and the subsequent production Mustang program was launched. It is worth noting, however, that had an adverse public reaction occurred at Watkins Glen, the





PUBLIC REACTION to Mustang I was positive, but 2-passenger capacity was negative for company. Sliding pedal fixture with fixed seat was featured in rear-engine car.





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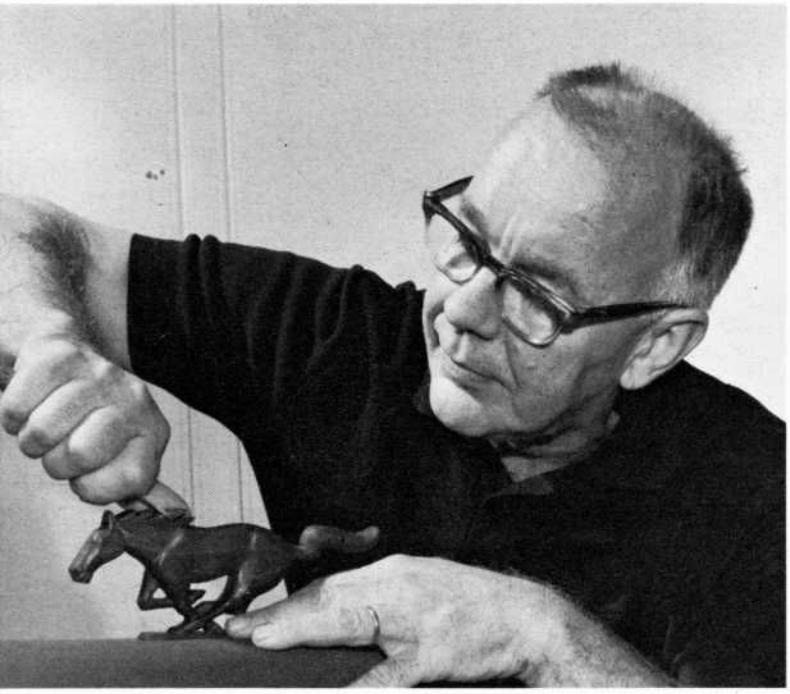
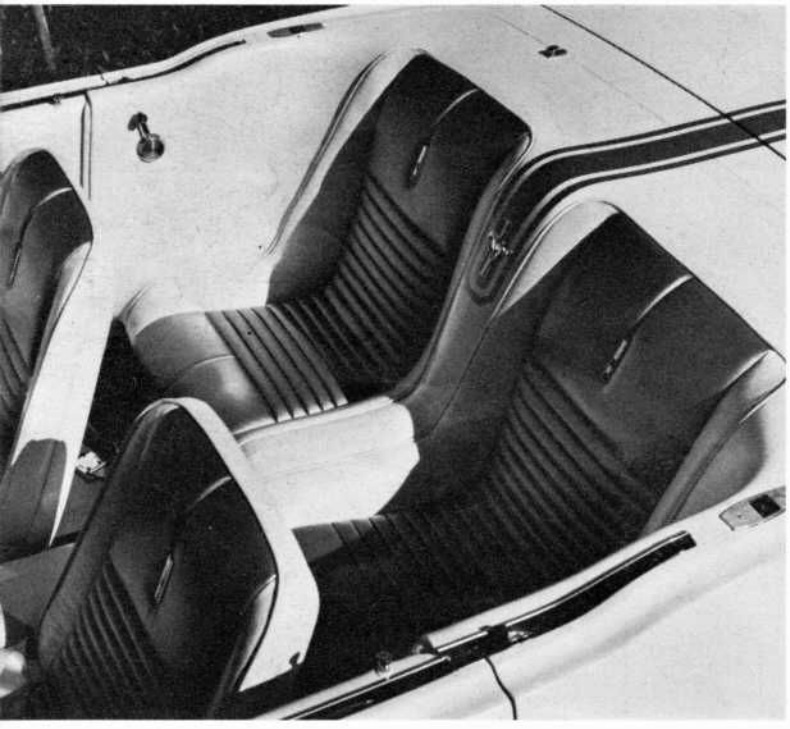


GALLOPING MUSTANG emblem was carved from mahogany, to serve as die model for grille centerpiece, by Waino Kangas, veteran sculpter for Ford Styling.



MUSTANG II, despite removable hardtop, was bold preview of ultimate production car — eight months early.

We demanded – and received – engineering flexibility and inventiveness that made it possible for us to win what we call 'the battles of the inch.' Individually, these small dimensional differences won't make or break a car. Collectively, however, they make all the difference in the world."

What was involved in this sequence of events is not mentioned by Bordinat, but corporate insiders fill in a tale of corporate power-politics. Development engineers, according to this account, were kept in the dark about the forthcoming car until after the final decision on Sept. 10, when the committee chose the Cougar over the revised Allegro, approved the basic sheet metal and set it as a 1965 model with two body styles – a 2-door hardtop and a soft-top convertible. The die had been cast by the time engineers were informed of the project and feasibility studies were begun, but obviously no one talks publicly about this departure from normal procedure.

At this point, the sheet metal, glass, bumpers and moldings of the car were unique to it. Chassis, engine, suspension and drive-line components were from Falcon or Fairlane. Overall length was the same as the 1964 Falcon, 181.6 in., but wheelbase was 1.5 in. less at 108 in. and height was reduced a substantial 3.1 in. to 51.4 in. – in line with component and dimension requirements which had been set down the preceding Aug. 1. (At that time it had been agreed, it might be mentioned, that mere variations of Falcon sheet metal would fail to appeal to the potential market thought to exist for a car of Mustang's concept.)

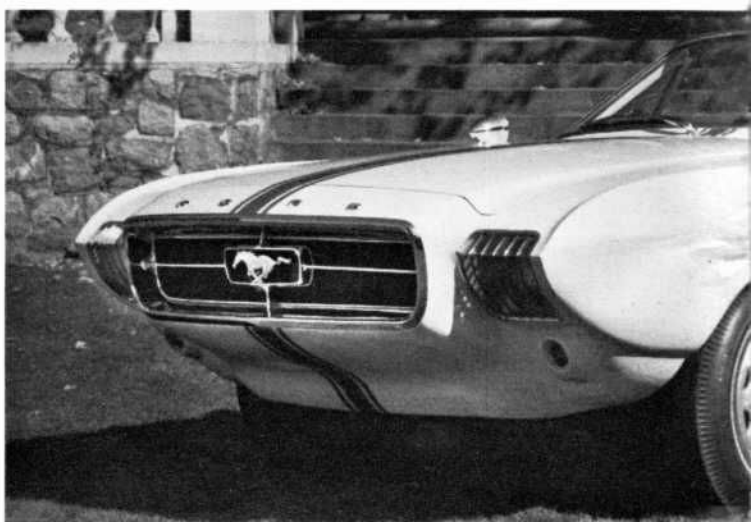
Bordinat continues: "The close-fitting rear bumper, in our estimation, was essential to the lithe and lively look. Here the battle of dimensions was waged over fractions of an inch. If the gap between bumper and sheet metal had become an inch greater, the resultant effect would have detracted from the appearance of the entire vehicle.

"The Mustang was styled with classically aesthetic proportions: Long, low hood; low overall height; close-coupled passenger compartment and a short rear deck. They are proportions easy to attain in a 2-passenger car. You know how much purists admire the European styling approach to low-volume, high-cost 2-passenger models.

"But attaining these proportions in a 4-passenger car is something else again. The hood is long and it seems even longer because of the perky hop-up just above this point. The full, round wheel openings are a sports car characteristic suggestive of power and performance which further distinguishes the car from the conventional sedan," the styling chief observes.

There are other subtle design details which are important to the lively look: Simple lines with little added ornamentation; single headlights and a separate, small grille;

REAL TIP-OFF was 4-passenger capacity, with individual bucket seats. Most production sheet metal had been finalized.



minimum size bumpers; and more "roll-under" (the angle made by the sheet metal from its widest point on the side toward the lowest point below the rocker panel). The Mustang violated a company standard for roll-under with a more acute angle than that standard permitted.

"We did this," explains one of the stylists, "to expose the wheels and tires more – the more they show, the more gutty a car looks." But the car was approved despite the violation and, in fact, encouraged stylists to try "other slight deviations from previously sacred standards" on still-forthcoming 1966 and 1967 cars.

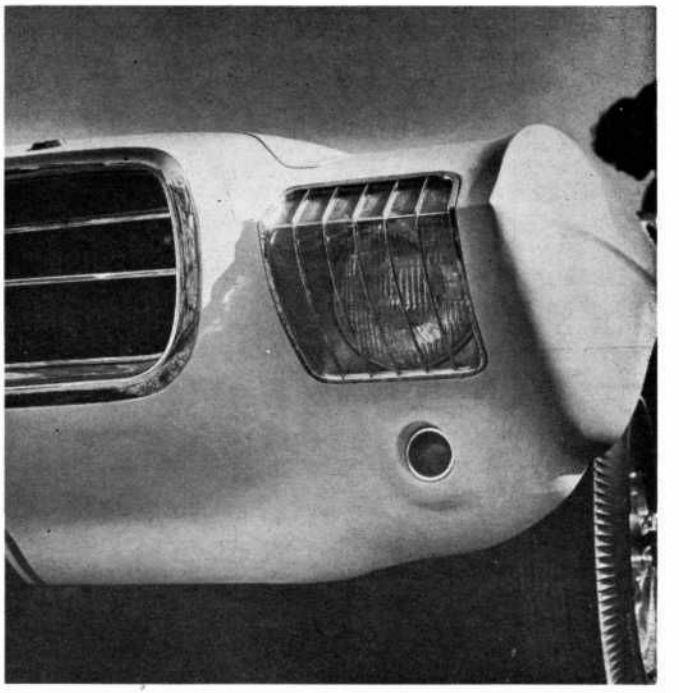
But perhaps the most amazing thing about the lines and proportions which were to become the showroom-ready Mustang is the fact that all were placed on paper in three days time. "We were called in at the very end, just as insurance," Oros has said, "because management wanted to be sure it had all ideas available." In the two weeks his team was allotted, they talked it out first and then drew up their conclusions in that short span of time so that the clay modelers could go to work. Then, to cut down on the odds, the clay model was painted a dazzling white as a tactical gimmick to make it "leap out" from the six other competitors.

While the exterior modeling was going on, several interior design proposals were being worked up. The one for Oros' Cougar was a Forget-The-Cost type which left only its deeply hooded instrument panel for final production. Most of the final interior came from an eye-catching show cars and some from several other interior designs. Most striking features were the suspended accelerator pedal and the use of leather-grained sheet metal for door panels and the rear seat side panels which "coved" into the seat back *à la* Thunderbird. Bucket seats, inspired by the Lotus Elan, had heavy bolsters around the edges of the seat and the seat back to more closely approximate true sports car bucket designs than was true of most domestic production cars.

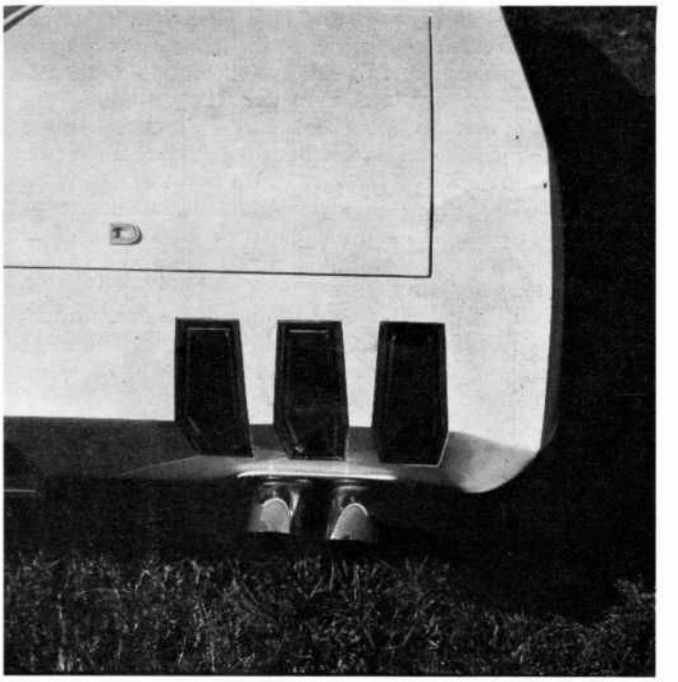
Bordinat sums up the car as "highly styled in the same sense that the Thunderbird and Continental are highly styled. It is as close as we know how to come in designing a car that has the emotional appeal of good styling without the added expense attendant to Thunderbird luxury. I like to think of it as the car for the masses with styling for the elite."

Another stylist puts its more simply: "Studio people went all-out for a car they loved from the beginning. Unrequited love, of course, is a fact of life in styling studios – a clay model which delighted in so much tender loving care until midnight last night may well be today's rejected 6000-lb. lump of mud."

There were quite a few rejected lumps of mud around after that overcast August morning, but the Cougar – later briefly renamed "Torino" and ultimately Mustang – was not among them. And it remained the same simple and smooth design which it first was when Joe Oros and his crew wheeled it into the courtyard from its pre-production incubator.



POINTED FENDERS and covered headlights were thin disguise for ultimate front end. Separate insert taillights were altered as production economy.



INTERIOR FEATURES were showier than production version, came from one of early proposals.

DEVELOPING THE MUSTANG: ENGINEERING

BY GENE BOOTH

Sitting there in all its glistening, pristine glory, it was a beautiful sight. Sleek lines sparkled in gleaming white. A purposeful snout thrust forward, visually sliding the passenger cabin rearward to where it was snubbed short by a bit of a bulge, not unlike the jut of its namesake's haunch. It was the winning clay model in Ford's just-revealed sporty car project, code-named T-5, with sightless windows still of gray decal and bumpers and bright metal of smoothed out aluminum foil.

Eyeing it for the first time in Ford's production styling studio were the men from Engineering who had just received their assignment: Build it. The lean, low lines appealed to them as auto men, but appalled them as Ford Motor Co. engineers. Their briefing had included a resume of decisions already made – no Falcon retread, it was to be a 1965 model in two body styles, utilizing the greatest production economies possible. In addition, some goals were outlined: Make it inexpensive, make it sturdy, make it light and make it acceptable for a variety of power trains.

The task fell under the supervision of genial, bespectacled J. J. (Jack) Prendergast, executive engineer for light vehicles, who 18 months later could chuckle over the initial apprehensions of his engineers. After all, he could say, a production engineer would probably try to design a new car like a pair of shoeboxes, welded together at a wide flange extending the length of the centerline. But this was something different, a serious challenge tossed to them by the styling studio.

Aside from the major limitations of light weight and cheap price with which the engineers had to contend, there were the immediately obvious (to a FoMoCo engineer) problems of a hoodline that was too low, a roll-under at the lower edges which was too extreme and a bumper-to-sheet metal clearance which was much too scant.

"Styling kept the engineers out too long," Prendergast was later to recall. "They had wrapped up some new ideas in packaging and sheet metal which might have gotten modified otherwise. And at that time (August, 1961) there was some marketing data available – and not much else – to back up the decision. But then it grew in concept. At first it was supposed to just compete with the Monza, being sold to women and as a second car. If it had stayed there," the engineering executive smiled, "we could have stopped with the 6-cyl. engine."

Though they weren't handed the proverbial sheet of paper clean of previous scribbling, the engineers did have a great deal of leeway. Basic dimensions obviously had been set and to this, Prendergast explained, "we had to fit in what we knew couldn't give problems." Sound and shake problems had to be overcome in designing a new body/chassis, which for all practical purposes was to be unitized in result if not in concept.

"We knew we weren't getting out of the Fairlane, Comet and Falcon what we wanted," Prendergast said. "So we took what we had learned on the negative side in the Falcon and Comet, and what we had learned on the positive side with the Fairlane, and applied it to the Mustang."

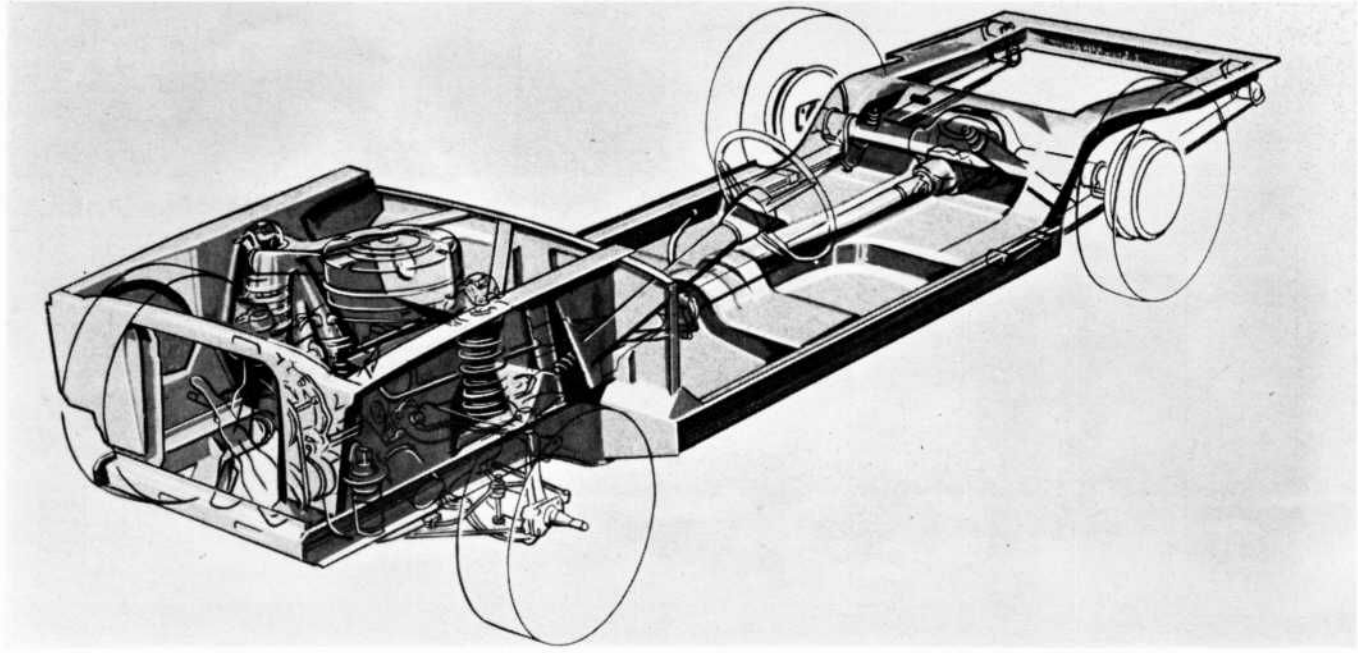
With the anticipated variety of power supplies which were to result, it was "absolutely essential that the car have a firm base to build on," he said. The platform-type frame, evolved from previous light car experience, was designed to be "really in the middle." All of the various chassis components were attached to the underside, and all of the body components were installed topside.

"This requires a stiff backbone, which in our platform was provided by the uninterrupted tunnel running straight through from the toe-board to the rear axle kick-up. Stamped crossribs and welded-up reinforcements added some extra strength," Prendergast explained.

The all-welded platform frame provided the key to the design goal of minimum weight with maximum strength. Box-section front and rear side-rails were welded onto heavy, boxed-in rocker panels. Five heavy-gauge crossmembers joined the sides into a ladder-type configuration. Front and rear side-rails were extended under, and welded to, the floor pan and its sturdy propeller-shaft-tunnel backbone.

In front, a deep box to surround the engine compartment

MUSTANG'S BASIC platform chassis represented considerable departure from Falcon/Comet construction; more nearly follows Fairlane format. Boxed-in engine compartment and rigid floor produce a shake-free, tight chassis.



was welded up of full-height, heavy-gauge stampings for cowl, side panels and radiator support. Integral torque boxes, welded up where the side-rails joined the rocker rails at front, were part of the original frame because of their success in the Fairlane. But the engineers found that the torque boxes actually made the hardtop frame so stiff it amplified shake problems, so they were specified only for the convertible. And convertible frames, which already used heavier gauge steel in some areas, received an additional longitudinal strap of steel welded between C sections of the rocker rail to offset the loss of structural rigidity from the lack of a roof structure.

This crossbreeding and distillation of previous Falcon-Fairlane experience eliminated shake problems for the Mustang—to the point where road noise from the working wheels was the only remaining area of concern, according to Prendergast. To that sturdy sub-structure, the outside body panels (save for the front fenders) were welded once those first-impression problems were solved.

The rakish roll-under of the lower body panels, the engineers insisted, would result in paint chipping problems from stones thrown by the wheels during normal service. But they bent up some panels in those shapes, tried them out on engineering vehicles and discovered that the FoMoCo textbook was in error. Stone throw patterns were not as extensive as anticipated and the design was actually better in this respect than the Monza, which had been without particular public complaint on this score.

Similarly, the low hoodline necessitated a lower air cleaner for the carburetor to permit the necessary inch or so of rocking clearance called for "in the book." Engineers redesigned the air cleaner to sit lower over the carburetor, a change which was made ahead of time for all Falcons and Fairlanes. The radiator top tank was also redesigned, eliminating the too-high filler neck by "countersinking" it down to clear the hood. Such changes made in components shared with other cars, not incidentally, reduced the investment necessary to produce the Mustang simply by increasing interchangeability.

Above all, engineers were determined to keep it simple. As Ford had amply demonstrated with the Falcon, the route to light weight followed the trail of design simplification. One engineer, explaining that idea, pointed out that two English sports cars which Engineering had been using for tests had had to have clutch jobs – at a cost of $700 each. "We don't want the Mustang owner to ever have to pay that kind of money," he said, "even if the whole clutch has to be replaced for some reason. And we don't expect our clutch to give any trouble anyway."

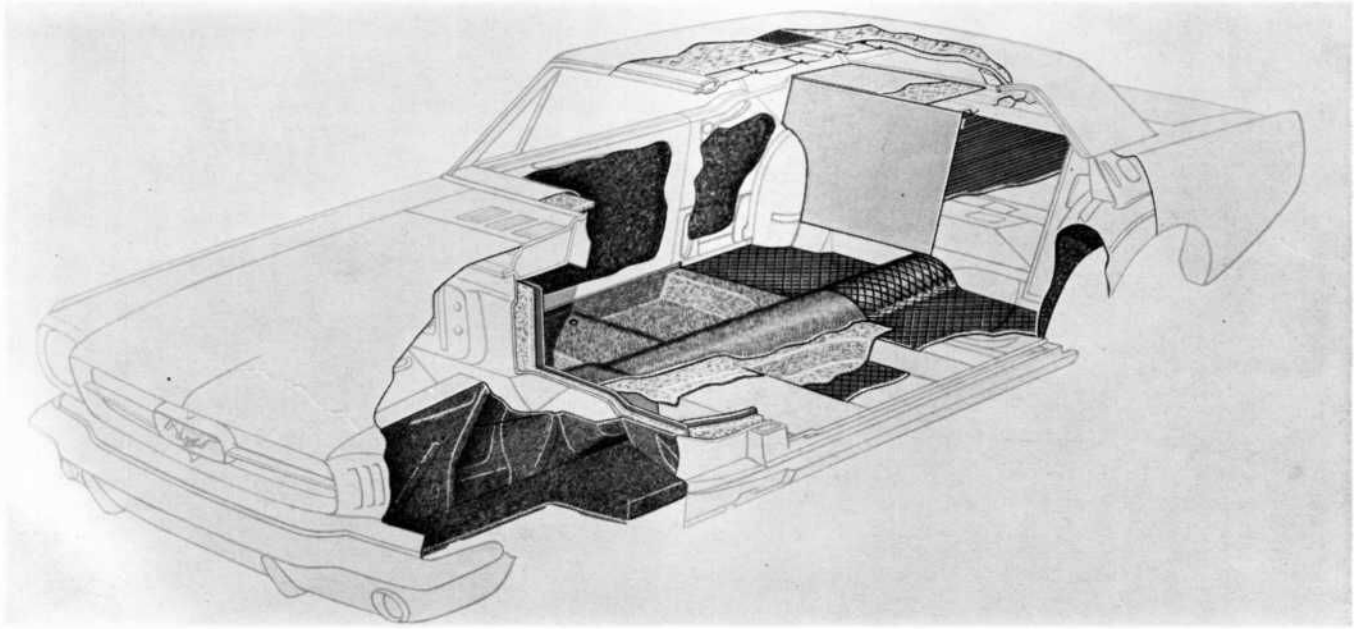
STRAIN GAUGE indicators measure torsional rigidity during bending tests in the Ford Engineering Center's structures lab.

Early in the engineering process, Prendergast revealed, the staff "started building a Thunderbird." But then-General Manager Lee A. Iacocca stepped in to halt that. His concept was for a "do-it-yourself car" in which the buyer was given exactly what was wanted and no more. There would be the lengthy option list which could make the car as luxurious as the 'Bird, but the total cost would still be less than special-order cars with more limited volume.

Other influential executives saw the car as a highly-styled economy car, which it had started out to be. And at the same time, some highly-placed engineering people wanted an all-out sports car. This three-way tug-of-war, which never quite disappeared during the development, resulted in the ultimate emergence of all three philosophies in the production car. The buyer was to simply take his choice and order his car accordingly.

"The real character of a car is generally determined by the powerplant selected for it," Prendergast observed. "If you're economy-minded, you pick an economy engine; if you want

SOUND-PROOFING of the Mustang's interior involves several layers and types of material. Result is pleasing absence of noise.



ENGINEERING

all-out performance, you'll want a big V-8 with four-on-the-floor." To meet such requirements, four engines were initially specified. They were the 170-cu. in./101-bhp Six, the 260/164 V-8, and a pair of 289-cu. in. V-8s rated at 210 and 271 bhp respectively. Later, as the Ford engine line was upgraded in September, 1964, the offerings changed to the 200-cu. in./120-bhp Six and three 289s of 200, 225 and 271 bhp. Three- and 4-speed manual transmissions and a 3-speed automatic would couple to the engine. Every transmission, of course, would be controlled by a floor-mounted lever.

Suspension components drew heavily from Falcon Sprint, Comet Caliente and Fairlane experience. The independent front suspension used coil springs mounted atop the upper A-arm, and a single, stamped, lower control arm located by an angled drag strut. Typical Hotchkiss drive, using 3-leaf semi-elliptic springs 53 in. long, was specified at the rear. Rubber bushings were liberally installed at all mounting points in the effort to isolate harshness. Most significantly, a special handling option was a design consideration. For it, stiffer springs, larger and recalibrated shock absorbers, larger front anti-roll bar, faster steering ratio and stronger wheels with bigger tires were specified.

Recirculating ball-and-nut steering from the Falcon was adapted, with overall ratios of 27:1 standard and 22:1 powered (via linkage assist). For the Sixes, 9-in. Falcon brake drums were felt to be adequate with 131 sq. in. of lining area, but the 10-in. drums from Fairlanes, with 154 sq. in. of lining area, were specified for V-8s. Optional front wheel disc brakes, however, remained under development well past the production deadline and were delayed until the following September. And, in relating chassis design background, Prendergast recalled another problem: "The three different tire and wheel sizes we were planning presented some difficulty in adapting the same wheel envelope to them."

In keeping with the differing demands which had begun to crystallize, the decision was made to keep three types of rear axles flowing to the production line. A Falcon-derived axle with 7.25-in. ring gears was to be used with the Sixes, the Fairlane-developed 7.75-in. geared unit would take the lower-powered V-8s, and the HP-271 engine would get tougher 8.75-in. ring gears from the Galaxie.

Engineers then faced the problem of muffler location for such a low vehicle and ultimately came up with a transverse placing which would allow a somewhat larger than necessary muffler to be installed.

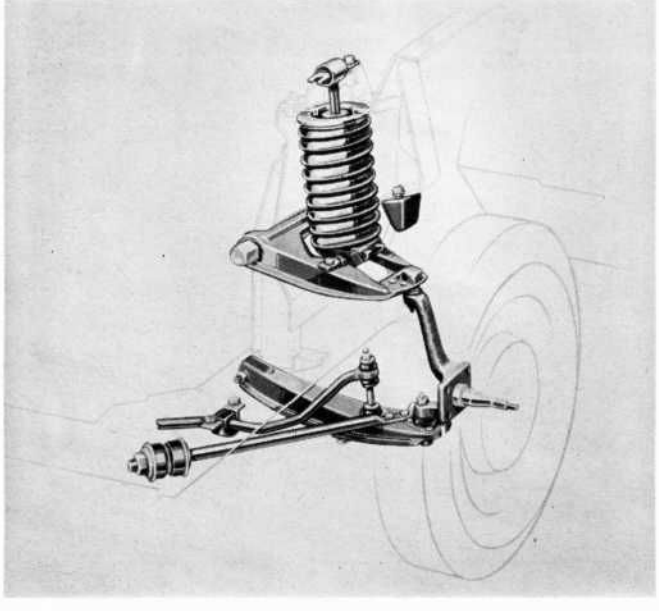
"Considerable time had been spent on reviewing the chassis and power train specifications for the car," Prendergast said, "since these would determine whether its character was an economical family car, a luxurious personal car or an all-out high-performance car. I'm not sure whether it's a family kind of sports car or a sports kind of family car," he chuckled, "but no matter what it's called, I think it turned out as something special in the way of driving fun."

That word "fun" is the key. All the letters the company had been getting, pleading for the return of the 1955-57 Thunderbird (despite the fact that the 4-passenger 1958 model outsold all the earlier 2-passenger models combined), had alluded to the "pleasure" of that highly-regarded car. But Prendergast pointed out the pertinent comparisons: The Mustang was only 0.2 in. longer but 0.5 in. lower, had the same tread with a 6 in. longer wheelbase, weighed 400 lb. less "and had substantially better space utilization because it could carry four passengers."

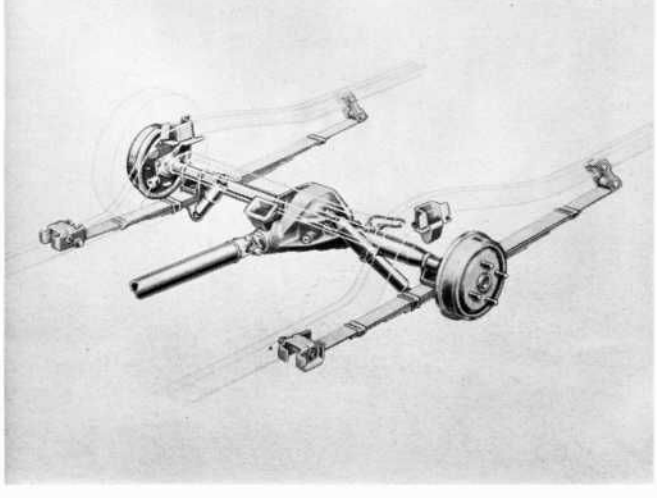
The most telling improvement, however, was in performance. Although the '57 'Bird had a slightly larger engine (292 vs. 289 cu. in.), the Mustang would out-accelerate it and still return 3 mpg better fuel economy, the executive reported. This, plus the vastly improved, long-term achievements in reliability and durability from using established chassis and power train components.

Once the initial production schedule had been kept, Prendergast and his engineers could look back with justifiable pride in the obstacles they had overcome in developing the Mustang. The original resentment at Styling's refusal to compromise had all but disappeared. Attention was then turned to the next step – a fastback 2+2 configuration to join the hardtop and convertible. This was Engineering's baby, the platform for the serious high-performance projects that had been put off until the showrooms finally had been filled.

For it, the engineers worked up a simple flow-through ventilation system for high-speed comfort. Dual-grilled vents, opened by simple sliding plates, were installed in the blind quarter pillars to suck stale air out of the closed car. Then they added another feature which Styling had rejected long before as being much too costly: The special fold-down rear seat. The idea for converting the rear to a flat storage area for real GT-type travel had been part of the original interior scheme for that gleaming white clay model, but it had been temporarily shelved in favor of the cove-type seat.



SUSPENSIONS FOR the Mustang are conventional in concept and do an effective job. Front has coil spring atop upper A-arm, stamped beam lower arm and drag strut; rear suspension is by multi-leaf springs and rubber-bushed shackles. Shock absorbers angle forward.



THE 1965½ MUSTANGS

TAILPIPES THROUGH the rear skirt are part of the GT option package, along with dual exhaust pipes.

A tribal rite too instinctive for even the Mustang to surmount is the custom called the Annual Model Change. In fact, the Mustang had undergone two by the time it had been in production for one year, thus formalizing a fast-charging pace which has infected Ford Motor Co. since the car was just a gleam in a stylist's eye. "Frankly," declares general manager Donald N. Frey, "we have no intention of standing pat with the Mustang." Such words are the epitome of understatement.

There was still a 6-week waiting period when Mustangs got their first overhaul. That was in conjunction with the normal new car announcements in September, 1964, when the 2+2 fastback model was added to the line. A revised engine line-up and the appearance of the long-awaited front wheel disc brakes also marked that occasion. The second occurrence came when the car observed its first birthday.

Despite all the emphasis on front bucket seats during the car's development, when customers finally had the car to spend their money on, there developed a bit of disenchantment. So, to make "an even more practical everyday car," said marketing manager Frank Zimmerman, a full-width bench-type seat was added as a $25 option. Actually a pair of the buckets with a padded over-the-hump connector, the seat has a fold-down central armrest.

A second change (although in the Mustang's case "changes" are really "additional options") was a special glamor-type interior treatment listing for $109.40. Woodgrain trim strips for instrument panel, glove box door, optional console and door handles match a special simulated wood-rim steering wheel – which became optional (for $32.20) for all cars. Carpeting was extended up the door panels, pedals were outlined with bright metal strips, and special seat and door panel upholstery is used. The latter incorporated galloping horses across the seat back and integral armrests in the door panels.

A third option was aimed more at "those who want their Mustangs to breathe fire," according to Zimmerman. It was the GT option, a package of several higher-performance items previously available, with a few new additions. This package came with either the 225- or the 271-bhp engine, front wheel disc brakes, special handling suspension, fast steering ratio, and the Rallye Pac – all prior options. Innovations were a pair of twin fog/driving lamps, so-called "Flamethrowers," installed in the grille, twin chrome exhaust trumpets jutting through the rear skirt and a special tri-stripe paint trim on the rocker panel like that on the 200 mph GT-40.

In addition, both the luxury and the GT packages came with a new instrument panel in place of the former Falcon-like arrangement. This had five actual gauges, smaller ones for fuel, water temperature, oil pressure and alternator flanking a larger round speedometer. With the Rally Pac, the GT Mustang finally got the dash full of dials which enthusiasts have wanted. Finish on the panel was simulated wood for the luxury package, camera-case black in the GT.

The changes, Frey says, "are designed to give even greater versatility in the Mustang's three basic areas of appeal – the practical car, the sport-type car, and the luxury car. We have the market largely to ourselves at the moment, but we see plenty of indications that our competitors plan to counter with their own versions of this new breed of car. We plan," Frey adds, "to be that much further ahead of them."

EXTRA "FLAMETHROWER" driving lights in the grille are included in the GT package; so are triple-paint stripe and chromed letters along the rocker panels.

MUSTANG SPECIFICATIONS

ENGINES

No. cyl.—cu. in. displ.	6-170*	6-200	8-260*	8-289	8-289	8-289HP
Bore, in.	3.50	3.68	3.80	4.00	4.00	4.00
Stroke, in.	2.94	3.13	2.87	2.87	2.87	2.87
Compression ratio	8.70	9.20	8.70	9.30	10.00	10.50
Carburetion	1 x 1	1 x 1	1 x 2	1 x 2	1 x 4	1 x 4
Bhp @ rpm	101@ 4400	120@ 4400	164@ 4400	200@ 4400	225@ 4800	271@ 6000
Torque @ rpm	156@ 2400	190@ 2400	258@ 2200	282@ 2400	305@ 3200	312@ 3400
Bore spacing, in.	4.080	4.080	4.380	4.380	4.380	4.380
Block length, in.	27.9	27.9	20.84	20.84	20.84	20.84
Weight, lb.(approx.)	356	380	482	485	485	485
Valve lifters	hydr.	hydr.	hydr.	hydr.	hydr.	mech.
Valve timing	13	07	21	16	16	30
sequence, deg.	47	65	51	70	70	72
	46	55	57	52	52	78
	14	21	15	24	24	24
Valve lift, intake, in.	0.348	0.348	0.380	0.368	0.368	0.457
exhaust	0.348	0.348	0.380	0.380	0.380	0.457
Intake dia., in.	1.527	1.649	1.670	1.781	1.781	1.781
Exhaust dia., in.	1.266	1.388	1.389	1.450	1.450	1.450
Stem dia., in.	0.310	0.310	0.342	0.342	0.342	0.342
Valve length, in.	4.260	4.225	4.860	4.863	4.863	4.863
Spring press., valve open	150	150	169	169	169	247
Spg. lgth., valve open	1.220	1.220	1.390	1.390	1.390	1.320
Tappet clearance, intake/exhaust	0/0	0/0	0/0	0/0	0/0	.020/ .021
Cooling capacity, qt.	9.5	9.5	14.5	15.0	15.0	15.0
Coolant flow, gpm/1000 rpm	8	8	16	18	18	16
Carburetor make	Ford	Ford	Ford	Ford	Ford	Ford
Primary barrel dia., in.	1.438	1.437	1.438	1.437	1.080	1.562
Secondary	----	----	----	----	1.188	1.562
Crankshaft material	cast	cast	cast	cast	cast	cast
Vibration damper	yes	yes	yes	yes	yes	yes
Bearing material	sbb	sbb	sbb	clb	clb	clb
Crankpin diameter	2.124	2.123	2.123	2.123	2.123	2.123
Main bearing dia.	2.249	2.249	2.248	2.249	2.249	2.249
No. mains/thrust on	4/3	7/5	5/3	5/3	5/3	5/3
Bearing lengths, front	1.020	1.015	0.885	0.885	0.885	0.885
to	1.020	1.015	0.885	0.885	0.885	0.885
rear	1.270	1.015	1.132	1.132	1.132	1.132
	1.020	1.015	0.885	0.885	0.885	0.885
		1.270	0.885	0.885	0.885	0.885
		1.015				
		1.015				
Timing drive	chain	chain	chain	chain	chain	chain
Bare piston wt., oz.	17.28	17.10	18.76	21.27	21.27	21.41
Clearance at top land	.0171	.0250	.0189	.0387	.0387	.0388
skirt	.0014	.0011	.0027	.0011	.0011	.0011
Top comp. ring surface	chrome	chrome	chrome	chrome	chrome	chro.
width	.078	.078	.0777	.0778	.0778	.0778
Oil ring width	.188	.188	.188	.188	.188	.188
Piston pin dia.	.9122	.9121	.9122	.9121	.9121	.9121
length	3.03	3.03	3.02	3.02	3.02	3.02
Rod length, crt. to crt.	4.715	4.715	5.154	5.155	5.155	5.155
Rod weight, oz.	18.65	18.65	19.97	19.97	19.97	20.71
Rod material	dfs	dfs	dfs	dfs	dfs	dfs
Rod bearing dia.	2.124	2.123	2.124	2.123	2.123	2.123
length	0.805	0.805	0.721	0.721	0.721	0.721
Fan diameter, in.	14	15.5	17	17	17	16
Spark setting, deg./idle rpm	6/525	6/525	10/575	6/575	6/575	12/750
Spark plug make	Autolite	Autolite	Autolite	Autolite	Autolite	Auto.
threads, mm.	18	18	18	18	18	18
model	BF-82	BF-82	BF-42	BF-42	BF-42	BF-32
gap	.034	.034	.034	.034	.034	.034
Breaker gap	.025	.025	.015	.015	.015	.020
cam dwell, deg.	36	37	27	27	27	34
tension, oz.	18	19	18	19	19	30
Spark advance data:						
Centrif. starts, rpm	none	none	1025	1100	1100	1000
max. adv., deg. @ rpm	none	none	22@ 4000	28@ 4000	28@ 4000	22@ 5000
Vacuum adv. starts, in. Hg.	0.22	1100	n.s.	1.0	6.0	none
max., deg./in.	31.5/ 6.3	31/ n.s.	n.s.	22/ 17	22/ 17	none
Fuel pump, psi	4.0/ 5.0	4.0/ 5.0	4.5/ 5.5	4.5/ 5.5	4.5/ 5.5	4.5/ 5.5

* 6-170 and V-8-260 are discontinued engines in Mustang. Abbreviations: clb, copper lead with babbitt overlay; sbb, steel-backed babbitt; dfs, drop forged steel; hydr., hydraulic; mech., mechanical.

CHASSIS SPECIFICATIONS

	Six	V-8	HP
Clutch, make	Long	Long	Long
type spring	coil	coil-centr.	
disc dia., in.	8.50	10.40	10.40
disc inside dia.	5.38	6.75	6.75
plate pressure	1305	1269	1611
3-spd. trans., make	Ford	Ford	n.a.
synchro low?	yes	yes	n.a.
ratios, 1st	2.79	2.79	n.a.
2nd	1.70	1.70	n.a.
3rd	1.00	1.00	n.a.
4-spd. trans., make	Ford(GB)	Warner	Ford
synchro low?	yes	yes	yes
ratios, 1st	3.16	2.73	2.32
2nd	2.21	2.07	1.69
3rd	1.41	1.51	1.29
Cruise-O-Matic pat.	PRNDDL	PRNDDL	n.a.
cooling system	water	water	n.a.
converter stall ratio	2.14	2.02	n.a.
geared ratios	2	2	n.a.
ratios, breakaway	5.26	4.97	n.a.
1st	2.46	2.46	n.a.
2nd	1.46	1.46	n.a.
3rd	1.00	1.00	n.a.
Axle ratio, man.	3.20	3.00	3.89
automatic trans.	2.83	2.80	n.a.
pinion offset	1.50	1.50	2.25
ring gear dia., in.	7.25	7.75	8.75
Fnt. brake drum, dia.	9.0	10.0	(11.38)
width	2.25	2.25	(disc)
Rear drum, dia.	9.0	10.0	10.0
width	1.50	1.75	1.75
Swept area, sq. in.	212	251	328
Gross lining, sq. in.	131	154	n.s.
Wheels, standard	13x4.5	14x5	14x5
optional	14x4.5	----	15x5.5
Man. strg. ratio, o. a.	27.0	27.0	27.0
gear ratio	19.8	19.8	19.8
turns, lock-lock	4.64	4.64	4.64
Pwr. steering			
ratio, o.a.	21.7	21.7	21.7
gear ratio	16.0	16.0	16.0
turns, lock-lock	3.73	3.73	3.73
power assist, type	linkage	linkage	linkage
Kingpin angle, deg.	7.00	7.00	7.00
Anti-roll bar dia., in.	0.69	0.69	0.84
Brake anti-dive			
in front?	yes	yes	yes
Front springs, type	coil	coil	coil
spring rate, lb./in.	220	240	290
ride rate, lb./in.	82	89	108
Rear springs, length	53.0	53.0	53.0
leaf width	2.50	2.50	2.50
spring rate, lb./in.	85	85	110
ride rate, lb./in.	101	101	132

(n.a. — not available; n.s. — not specified.)

THREE BASIC styles of the Mustang are the hardtop coupe, the convertible and the fastback coupe. All are four-passenger, although the fastback is listed as a "2+2," which means rear seat space is limited to "occasional" usage.

DIMENSIONS

Wheelbase, in.	108.0
Tread, front, Six	55.4
V-8	56.0
rear	56.0
Overall length, in.	181.6
Overall width	68.2
Overall height	51.1
Frontal area, sq. ft.	19.4
Box volume, cu. ft.	366.4
Front overhang, in.	33.6
Rear overhang, in.	40.0
Front approach angle, deg.	24.4
Rear departure angle, deg.	16.7
Front hip room, in.	54.7
seating	2 x 21.0
Rear hip room, in.	50.9
seating	2 x 18.0
Ground clearance, in.	5.2
Turning circle, ft.	38.9
Tire size, std. Six	6.50-13
V-8	6.95-14
Fuel tank capacity, gal.	16.0

BODY STYLES

	Hardtop	Fastback	Convert.
Curb weight, lb.	2570	2620	2755
Shipping weight, lb.	2465	2515	2650
Base price, std. Six	$2372	$2589	$2614

EXTRA COST OPTIONS

(Retail prices for extra-cost options, to be added to price of basic Mustang.)

	Price	Addl. wt.
289 cu. in./200 bhp V-8	$108.00	270
289 cu. in./225 bhp V-8	162.00	310
289 cu. in./271 bhp V-8 (incl. spec. handling pkg.)	442.60	361
Cruise-O-Matic, 6-cyl.	179.80	51
Cruise-O-Matic, V-8	189.60	17
4-speed manual, 6-cyl.	115.90	45
4-speed manual, V-8	188.00	13.5
Disc brakes, front	58.00	n.s.
Limited slip differential	42.50	n.s.
Rally-Pac (clock/tachometer)	70.80	n.s.
Special Handling package	31.30	n.s.
Styled steel 14-in. wheels	122.30	n.s.
Power brakes	43.20	11
Power steering	86.30	28
Power top, convertible	54.10	n.s.
Emergency flashers	19.60	n.s.
Padded visors	5.70	n.s.
Retracting seat belts	7.55	n.s.
Air conditioner	283.20	75
Bench front seat	24.95	n.s.
Back-up lamps	10.70	n.s.
Heavy duty battery	7.60	n.s.
Anti-smog valve	5.30	n.s.
Console	51.50	n.s.
Console, w/air conditioner	32.20	n.s.
Steering wheel, deluxe	32.20	—
Tinted glass, full	30.90	—
Tinted windshield only	21.55	—
Push-button radio and antenna	58.50	7
Rocker panel molding	16.10	n.s.
Vinyl roof cover	75.80	n.s.
Wheel covers, "knock off hubs"	18.20	n.s.
Wire wheel covers	45.80	n.s.
6.95-14 Red Band tires (V-8s)	49.60	n.s.
Visibility group — remote control mirror, day/nite mirror, 2-speed electric wipers and windshield washer	36.60	n.s.
Accent group — body side paint stripe and rocker panel molding, less rear scoop ornament		
(hardtop and convertible)	27.70	n.s.
(fastback)	14.20	n.s.
Luxury interior group — includes 5-dial instrument panel	109.40	n.s.
GT equipment group — includes front disc brakes, grille-mounted driving lights, special handling package, dual exhausts, body-sill paint stripes and emblems.		
225 and 271-bhp V-8s only	168.60	n.s.

ROAD TEST:

THE CLASSIC MUSTANG

When the Mustang was unveiled in the Spring of 1964, Ford Motor Company called it a 1965 model to emphasize its newness. There had been some question in the minds of many whether it was really going to be all new, or whether it would be a special-bodied Falcon. Advance leaks of details about dimensions and powerplans contributed to the impression of a Falcon-Mustang relationship similar to Volkswagen-Karman Ghia.

Once the engineering story was available, however, in the form of the final metal-and-rubber cars, there could no longer be any such question. The car was distinct from the Falcon, though it uitilized major Falcon components, and in the higher powered versions it was indeed closer to the Fairlane. As engine size went up, Fairlane drive-trains were automatically installed.

But there was another question about the 1965 designation that had to await answering at the more traditional announcement time of September. The question concerned engines. During the 1964 model year, Falcons were equipped with either 144- or 170-cu. in. Sixes, both versions of the same block, or, as the top option, the thinwall 260-cu. in. V-8 of Fairlane derivation. The Fairlane, on the other hand, had as basic engines the 200-cu. in. version of the 6-cyl. block as well as the 260 V-8, but most commonly was built with the enlarged 289 V-8.

For the Mustang, engineers gathered from both parts bins. The standard Six at announcement was the 170, developing 101 bhp at 4400 rpm. Then the buyer had a choice: The 260 V-8 rated at 164 bhp at 4400 rpm with single 2-barrel carburetor, or the larger 289 which developed 210 bhp at 4400 with a single 4-barrel carburetor. The solid-lifter, 271-bhp version of the 289 was not immediately available and did not become so, in fact, until late in the summer. That one was, for all practical purposes, an actual 1965 model since its availability hardly preceded that of the new models in the other Ford lines.

It was when the 1965 announcement circus was underway, however, that it became evident two special Mustangs now had a place in the specialized car category. The dropping of the 260 engine from production (for all Fords) and the substitution of the 200-cu. in. Fairlane Six for the Mustang meant only one thing: 260 Mustangs and 170 Mustangs were now collectors' items, or if you will, "Classics."

How did it happen that the Mustang could be classic-ized between April and September? Many factors were involved, but the basic decider was public demand. The 289/210 Mustangs were far and away the leader in buyer orders during the hectic time following April when production fell so far behind sales. Dealers originally had a "market mix" which researchers had determined would handle most-on-the-spot buyers, and they did. So many buyers were left standing in line after the initial shipments had been snapped up that production couldn't keep pace. But, in concert with the initial concept of tailoring their own car to their own specifications, they were ordering 289 V-8s. There was a concurrent under-current of skepticism about the adequacy of the 170 Six, although they were being ordered at a rate about equal to the 289s.

So, Ford acted by dropping the 260 and 170, substituting a 2-barrel 289 of 195 bhp (later 200 bhp) and the Fairlane 200, still with single throat carburetor and 120 bhp. Thus were two classics born.

It's all a little sad, in a way. Both of the classic Mustangs were highly satisfying and pleasant vehicles, fitting ideally into their predetermined niches in the Mustang picture. *Car Life* editors tested the pair in Dearborn before introduction day and came away convinced that they performed with the best Detroit has brought out. The report stated the cars "may well be, in fact, better than any domestically mass-produced automobile on the basis of handling and roadability and performance, per dollar invested."

Only one of the five pre-production cars which CL tested had the 260-cu. in. V-8 and Cruise-O-Matic, and it was fitted with the normal off-the-shelf suspension components. Handling characteristics had that typical Ford feel – which is to say, confidence-inspiring if a bit nose-heavy – until the car was pressed. Then, when deliberately stormed too fast around the Dearborn test track handling circuit, with its series of turns of lessening radii, the Mustang came into its element. So long as power was judiciously applied, it seemed to lift its nose and negotiate the bends in a perfect drift. Only minor steering corrections were necessary to maintain this attitude, despite road surface irregularities; body lean (and hence adverse tire scrub) was at a minimum.

The margin between drift and broadslide, of course, is as narrow as a tug on the steering wheel, but not once was the car's attitude anything but the former while at speed. On the other hand, the plowing of understeer caused some worry as to whether the road would be wide enough when the same circuit was attempted at lesser velocities. At such moments, however, throttle-induced oversteer (with two aboard) quickly righted the wrong.

Even to those conversant with Ford Fairlane and Mercury Caliente handling, such characteristics with the stock, general-purpose underpinnings on the Mustang were exhilarating. It was obvious that the car had borrowed more sus-

pension from those two than from the Falcon, though its dimensions had led some (including us) to expect the Mustang to be merely a Falcon Sprint "special."

There should be little doubt that the special handling suspension options could produce a nearly optimum vehicle for serious, European-style rallying and American-style road racing. Aiding and abetting this fine edge of handling excellence, of course, was the selection of wheel and tire options available when the car was ordered.

Straight-line performance of the car was expected to be brisk and our test figures show that it was. But the biggest surprise to our testers was the performance of the 6-cyl. basic Mustang. This car, which had differing spring rates at each wheel (for engineering tests) and thereby was eliminated from handling considerations, demonstrated a lurch off the line that was startling, in view of the engine's marginal performance in earlier Falcons of our acquaintance.

The performance improvement must definitely be attributed to the 3-speed automatic transmission. Hooking this transmission to the engine rather than the Falcon 2-speed proves the truth of that old adage: "If it won't go, gear it." Here is a car that, while designed for the little woman with its economical Six and efficient automatic, avoids the stigma of underpowering by a most effective utilization of available torque.

Best balanced of the Mustangs tested was the 260 with automatic. With the 2-barrel carburetor and 3.00:1 rear axle ratio, it should return quite acceptable fuel mileage figures to a vast segment of car buyers. Had it not been equipped with air conditioner, its performance figures would have been more inspirational.

With all the emphasis on go-power, the brakes assume greater importance. Here again, it seems that more development work is in order. The disc brake option, which hadn't materialized at the time of the test, was expected to bring this characteristic up to the standard set by the rest of the design. The CL decelerometer registered stopping powers in the 18-21 ft./sec./sec. range, that vast average for all domestic cars, but some insight into the problem may have been lent by Executive Engineer Jack Prendergast.

One of the design objectives involving brakes was pedal pressures at 0.7 G stopping power. Once this pressure (65 lbs. for the Six, 72 lbs. for the V-8) was achieved, further development on brakes apparently ceased. Hence these cars – and by inference other domestic cars – are engineered only to provide 0.7 G (which translates into 18 ft./sec./sec. stopping rate on the decelerometer) as a result of a ratio established by an engineering and cost per unit minimum.

Steering on the test cars was quite precise, but the purists will still feel that the faster ratio remains too slow. An annoyance was the deep-dish steering wheel, projecting too far toward the driver's chest, even with the seat at its most rearward notch.

These Mustangs have had a significant effect on the domestic automobile scene, more so perhaps than had they incorporated revolutionary concepts. They stood as the culmination, the sum total of 35 years of development, executed with an awareness of the proper order of motoring requirements.

But our testers made one error in judgment then. The Mustang 260, they reported, "will undoubtedly be the hottest-selling combination, providing as it does quite respectable acceleration and performance for the minimal extra cost of V-8 and automatic." The ever-fickle public outwitted us as well as the Ford marketing planners, plunking down even more cash to opt for the highest power they could get for their Mustangs. One result was a serious shortage of 289 engine blocks, which persisted through the end of 1964. Another was the determination to accept less-desirable weight balance in return for accelerative performance by rejecting the 260. And, of course, there was the result of creating a Mustang Classic.

MUSTANG ROAD TEST

Classic 164-bhp V-8

SPECIFICATIONS

List price	$2587
Price, as tested	3441
Curb weight, lb.	2950
Test weight	3400
distribution, %	58/42
Tire size	7.00-13
Tire capacity, lb. @ 24psi	3680
Brake swept area	251
Engine type	V-8, ohv
Bore & stroke	3.80 x 2.87
Displacement, cu. in.	260
Compression ratio	8.70
Carburetion	1 x 2
Bhp @ rpm	164 @ 4400
equivalent mph	105
Torque, lb.-ft.	258 @ 5200
equivalent mph	53

EXTRA-COST OPTIONS

260/164 V-8, Cruise-O-Matic, power steering, power top, radio, air cond., console, wsw tires.

GEAR RATIOS

3rd (1.00) overall	3.00
2nd (1.46)	4.38
1st (2.46)	7.38
1st (2.05 x 2.46)	15.1

DIMENSIONS

Wheelbase, in.	108.0
Tread, f & r	56.0
Overall length, in.	181.6
width	68.0
height	51.0
equivalent vol., cu. ft.	364
Frontal area, sq. ft.	19.2
Ground clearance, in.	5.5
Steering ratio, o/a	21.7
turns, lock to lock	3.7
turning circle, ft.	38.0
Hip room, front	2 x 21
Hip room, rear	43.7
Pedal to seat back, max.	43.0
Floor to ground	10.0
Luggage vol., cu. ft.	8.8
Fuel tank capacity, gal.	16.0

PERFORMANCE

Top speed (4200), mph	101
Shifts, @ mph (auto.)	
3rd ( )	
2nd (4400)	72
1st (4100)	40
Total drag at 60 mph, lb.	145

FUEL CONSUMPTION

Normal range, mpg	n.a.

CALCULATED DATA

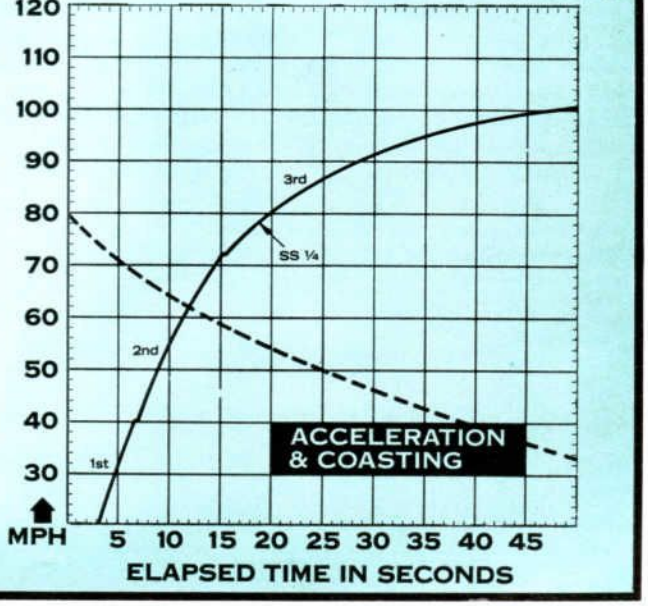
Lb./bhp (test wt.)	20.7
Cu. ft./ton mile	111
Mph/1000 rpm	24.0
Engine revs/mile	2505
Piston travel, ft./mile	1200
Car Life wear index	30.5

ACCELERATION

0-30 mph, sec.	4.8
0-40	6.5
0-50	8.8
0-60	11.2
0-70	14.5
0-80	20.0
0-100	48.0
Standing ¼ mile, sec.	18.8
speed at end, mph	78

SPEEDOMETER ERROR

30 mph, actual	30.5
60 mph	63.0
90 mph	94.5



ROAD TEST:

MUSTANG 6-CYLINDER

If Ford Motor Co. had had the foresight to build the Mustang in Europe, with its new-for-1965 200-cu. in. Six, the car would have been hailed by automotive enthusiasts everywhere as an example of exceptional engineering and, perhaps, even as A Real Sports Car. After all, the "secretary's sports car," as the basic Mustang has come to be known, has perfectly acceptable performance for Europe. Its 90 mph top speed is respectable enough, its engine, had it come from Europe, would be viewed as a marvel of engineering ingenuity, and to have an automatic transmission hooked to such a huge powerplant would be hailed as the utmost in luxury.

Moreover, it easily outruns Volkswagens and assorted cars of similar ilk, its handling and maneuvering is sprightly enough, it cradles one in American comfort and relatively embarrassing richness, and it can brag about tough and tenacious relatives while disdaining itself any appearances in the competitive pits and paddocks.

So it is that, in getting acquainted with this Stewardess' Six-Pack, we see the engine as an interesting development, if not a marvel of engineering achievement. The 200-cu. in. Six is a thorough redesign of the earlier block which had been in use since the 1960 models. It's the largest of the 144 (now discontinued) 170-200-cu. in. family of engines, with an oversquare, 3.68 x 3.13-in. bore and stroke. Engineers have laid in three additional webs for the main bearings and redesigned the crankshaft to ride in them, thereby bringing the engine up to snuff in an era of 7-main bearing 6-cyl. designs. Strength and stamina thus assured, attention was then turned briefly to the upper end.

In the cylinder head, it was found that valves of 1.62 and 1.36 in. could be accommodated without strain, representing enlargement from 1.52 and 1.27 in. intakes and exhausts, respectively. Camshaft timing was altered, too, the new sequence of 7-65-55-21 being on the wilder side, though hardly enough to notice. Compression ratio was increased from 8.7 to 9.2:1. The resultant 4-bhp increase still peaks out at 4400 rpm and the torque peak of 190 lb.-ft. – up from 174 – still comes at 2400 rpm. The significant cost of this work is an additional 15 lb., for a total engine weight of 380 lb.

One of the benefits of the 7-bearing design is increased engine smoothness, though modern vibration dampers and other design considerations seldom let the older 4-main engines seem particularly obtrusive. There's no doubt that this revamped Six is smooth, but it wasn't something measurable. In fact, because of carburetor bothers which never really were sorted out during the time of the test, this particular example had an annoying shake problem at idle.

It is in the carburetion that fiddling would be most desirable. This engine has a single throat Zenith of 1.437 in. venturi diameter, somewhat hopelessly overwhelmed by all that increased valve area and hardly capable of supplying the demand of those pumping 3.68-in. pistons at full greed. In normal trim, with air cleaner and mufflers in place, the engine drew the line against further effort at about 4000 rpm. It is unfortunate that most emphasis in bolt-on power accessories nowadays is on V-8 engines because Sixes such as this would be such practical and pleasing subjects for a bit of attention. While there would be nothing remotely complicated about multi-barrel manifolding, which is just what this engine cries out for, the preferred methods seem to be to simply pop in a big V-8 engine rather than bother with Six.

The Mustang is a perfect example of the problems which crop up with such substitution. When the next larger engine, the 289-cu. in./200-bhp V-8, is ordered, there's an immediate jump in front-end weight by some 100 lb. Then, power steering is certainly desirable, so that adds another 50 lb. When the V-8 is installed, the car is automatically equipped with heavier front suspension components, larger tires, wheels, brakes, rear axle and lesser related components. So there is a net gain of 300 lb. involved, then, in adding 80 bhp (some of which is siphoned off by the power-steering pump anyway) because of the substitution of largely Fairlane-based running gear for previously used Falcon-based components. It wouldn't take much in the way of carburetion work and camshaft timing to equal the power/weight improvement with the lighter basic car.

Still, demand for V-8 Mustangs is running at about 80% of production (at $100-some premium in base price), so the more popular route obviously is via bigger engines. But there is another penalty involved, the deteriorating front/rear weight distribution from that originally designed. Now all Mustangs (save, perhaps, those getting sohc 427-cu. in. engines) are capable of good handling. This is particularly true of the Six, so long as basic springing is taken into consideration. They have reasonable understeer, kept within reasonable limits. If there is one weak spot, it is rear axle tramp; more often than not some conscious effort will be necessary to compensate for the skipping around which the rear wheels develop upon abrupt unloading. Relatively speaking, however, the Six goes about its task a little better because it's 1), closer to basic design in weight distribution; and, 2) not so potent that it overpowers its rear-wheel cornering ability by brute torque. At speed, it's so easy to slip the Six into a drift while bombing along a meandering road that one soon begins to feel like an expert.

Just for the record, this 2600-lb. car is sprung somewhat softly, in the modern manner, but is well controlled by its

SEVEN-MAIN 6-cyl. engine of 200 cu. in. was substituted for original 170 in fall of '65.

MUSTANG INTERIORS can be augmented with tunnel covering console, tach-and-clock "Rally Pac."

shock absorbers. Anyone wishing to reduce the sponginess can simply install heavier-duty shocks. Off-the-shelf, however, it has a ride which certainly should please any secretary, stewardess or housefrau.

About the only piece of extra-cost equipment on this particular car was the 3-speed Cruise-O-Matic transmission. This was controlled by a T-handle on the floor (no console) but it seemed to have more looseness than we like in an automatic, shifting too slowly and erratically. However, when pushing the car to the limit for acceleration times, it turned out to be smarter than our drivers. Several runs made by manually holding gears to higher rpm produced poorer times than those where shifting was automatically accomplished. The best times were recorded with the lever in the D2 spot, stuffing the foot to the firewall and driving off the line.

Much of the pleasantness of this car is the result of having the automatic with its 2.14:1 torque multiplication, thereby utilizing the somewhat limited torque of the Six to its greatest extent. Had there been some higher (numerically) final drive than the stock 3.00:1, the snappiness of the car would have been more evident. Mustang Sixes with manual transmission come with 3.20:1 rear gears, but the gear spacing with either the 3- or the 4-speed is somewhat less happy. The English Ford-adapted 4-speed has gearing of 3.16 low, 2.21 second, 1.41 third, and 1.00:1 high—far too widely spaced to be of much more than novelty value.

Though it really wasn't needed, the Bendix linkage-assist power steering reduced the pull necessary on the rim to an uneasy lightness. But more important, use of the 16.0:1 gear reduced overall ratio to 21.7 and the number of wheel turns between locks to 3.73. As such, it has about the minimum quality of quickness which can be tolerated in a vehicle of this type.

Another pleasure with this particular car was the brake performance. Deceleration rates of 22 ft./sec./sec. (maximum) were consistent and above average. In fact, such performance is little worse than that of the optional disc brakes. To achieve this with the 9-in. Falcon drums is, to say the least, remarkable. Total swept area is a minimal 212 sq. in., so the credit must be given to the light overall weight and a somewhat tougher molded asbestos lining material than has been used heretofore. With overall performance judged better than average, one need have no fear of letting the girl-friend drive this car.

Tall gals, by the way, find the Mustang doesn't interfere with bouffant hair-dos. The bucket seats are quite close to the floorboards and one sits down in the car, rather than perching upon it. But the petite gals might just complain a bit about this very thing. It's possible that a woman of diminutive stature would be staring more at looming hood than open road. There are adjustments which can be made to the seat, but seating position should be checked against personal preferences. The new "bench seat" option, which actually is a pair of the present buckets joined by an over-the-hump connection, really doesn't change the situation since most of the same mounting hardware is used.

Although there are some new dress-up options for the Mustang which have their main appeal to Gal Friday, the basic bottom-of-the-line Six comes in very presentable form. Full vinyl and carpet and color-keyed interiors leave a tasteful impression on the womenfolk, as well they should. Things fit together well, but the gals may complain a bit more often about the poorly operating glove box door latch. From there, however, additional degrees of luxury are offered, including simulated wood trim all over the inside, embossed horses galloping across the seat backs, and door panels with integral arm rests and pistol-grip handles (all newly announced last spring).

With all that sort of thing going for it, the verdict on the Mustang probably should be: Those doggone Yankees really have gone and built a car almost as interesting as anything the Europeans have!

MUSTANG ROAD TEST

6=Cyl. / Automatic

SPECIFICATIONS

List price	$2372
Price, as tested	2785
Curb weight, lb.	2670
Test weight	3000
distribution, %	54/46
Tire size	6.50-13
Tire capacity, lb. @ 24 psi	3340
Brake swept area	212
Engine type	IL-6, ohv
Bore & stroke	3.684 x 3.13
Displacement, cu. in.	200
Compression ratio	9.2
Carburetion	1 x 1
Bhp @ rpm	120 @ 4400
equivalent mph	104
Torque, lb.-ft.	190 @ 2400
equivalent mph	57

EXTRA-COST OPTIONS

Cruise-O-Matic, power steering, radio, wsw tires, smog device, tinted windshield, back-up lights, rocker trim.

GEAR RATIOS

3rd (1.00) overall	3.00
2nd (1.46)	4.38
1st (2.46)	7.38
1st (2.46 x 2.14)	15.8

DIMENSIONS

Wheelbase, in.	108.0
Tread, f & r	55.4/56.0
Overall length, in.	181.6
width	68.2
height	51.1
equivalent vol., cu. ft.	366
Frontal area, sq. ft.	19.3
Ground clearance, in.	5.5
Steering ratio, o/a	21.7
turns, lock to lock	3.7
turning circle, ft.	38.9
Hip room, front	2 x 21
Hip room, rear	43.7
Pedal to seat back, max.	43.0
Floor to ground	10.0
Luggage vol., cu. ft.	9.0
Fuel tank capacity, gal.	16.0

PERFORMANCE

Top speed (3800), mph	90
Shifts, @ mph (auto.)	
3rd ( )	
2nd (3800)	61
1st (3700)	35
Total drag at 60 mph, lb.	140

FUEL CONSUMPTION

Normal range, mpg	19-22

SPEEDOMETER ERROR

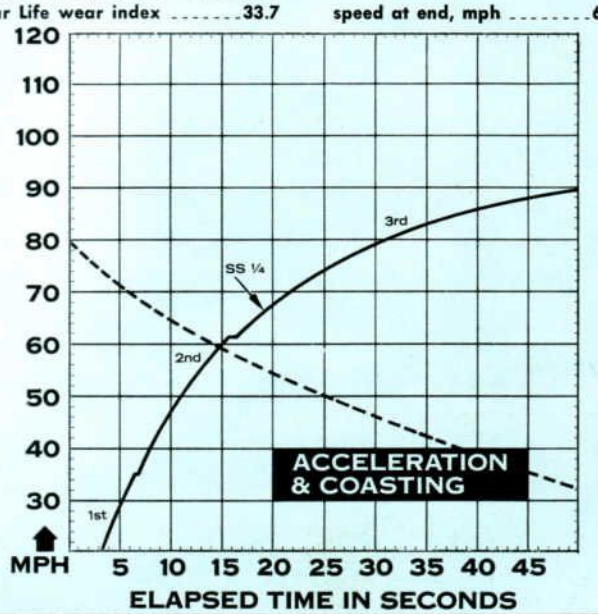
30 mph, actual	28.1
60 mph	56.2
90 mph	85.0

CALCULATED DATA

Lb./bhp (test wt.)	25.0
Cu. ft./ton mile	97.9
Mph/1000 rpm	23.6
Engine revs/mile	2540
Piston travel, ft./mile	1326
Car Life wear index	33.7

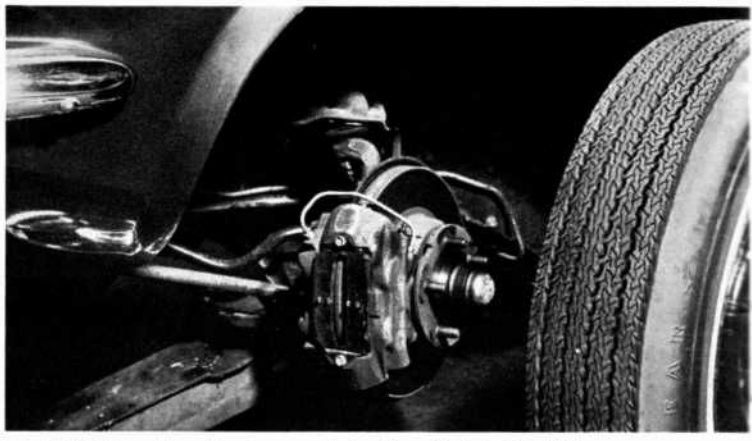
ACCELERATION

0-30 mph, sec.	5.3
0-40	7.8
0-50	10.8
0-60	15.1
0-70	21.7
0-80	30.5
0-100	
Standing ¼ mile, sec.	19.5
speed at end, mph	67



ROAD TEST:

MUSTANG WITH DISCS



DISC BRAKE used on Mustang consists of ventilated, 11.375-in. disc and 4-cyl. caliper. Pads are easily exchanged for new.

Mustang has everything going for it except exclusivity. It's impossible to drive more than a few miles without spotting one or more. They've grown so commonplace that Mustangs don't bother to wave at each other. Not that they could expect recognition from those who remember the special art of waving, but some sort of camaraderie might have been hoped for. Anyway, it didn't happen and now there's discouragement in numbers.

That was all part of another era, a time when brave iconoclasts took to newly re-discovered sports cars from overseas in revolt against growing Detroit ostentation and ossification. Certainly it was a rare wavee who was seated in a car which commanded an annual production rate approaching a single month's output of Mustangs. That was basic to the ritual, and dearness in price served as another criterion. But few, very few, were more unadulterated automobile than the range pony from the Rouge River Valley.

It has been more than one year since the first of the thundering herd pounded over the horizon. It was an epic scene: News magazines reported the event in depth, corporate medicine men rhythmically beat the tom-toms, crowds of the curious and the enthusiastic inspected the all-too-rare specimen which could be held in some dealer's corral. There were scoffers and doubters aplenty; there still are. But there were also those who detected the bloodlines of the thoroughbred, the sinewy stock of the tough cactusland cayuse and the nimble balance of a polo pony all blending into a hybrid breed. Those who saw this apparently numbered thousands and so began some of the most spirited horse-trading ever seen inside this country's sales barns.

During that first year, Mustangs were purchased in such ever-increasing numbers that only three other brands could claim more action, if not reaction. This automobile in 12 months' time outdistanced at least a dozen other major domestic brands – including, it should be noted, some other potent and racy machinery – though it had handicapped itself by a few years in the sales race. Hardly a recognized measuring point passed that the Mustang didn't surpass some record in its breakneck overhaul of its competitors. At the end of its first nine months, it had surpassed the unthinkable 250,000 landmark in sales; before its first anniversary, 400,000 had been sold and it was still running strong. Is not popularity in itself some measure of the machine?

JUST A pair of Mustangs, both with disc brakes! The one in the foreground is a V-8, the other a V-12.

Of the three makes still ahead of Mustang in sales, none could be considered more than a mere appliance devised to pamper man's lethargy, strangle his rapidly dwindling road space, and satisfy his acquisitional instincts for largesse. The Mustang appeals to other appetites and may well carry a message for those cars it has passed as well as those which it still presses.

To discover (or more correctly, to rediscover) those traits which have helped Mustang gallop to its present pinnacle, we borrowed one of the most popular versions of the car. It was powered by the 225-bhp V-8, driving through an automatic transmission, and was fitted with the optional front wheel disc brakes which had been so long awaited. The conservative dark green color was complemented with a two-tone green interior, and with a thin, white pin-stripe outlining the side panel indentation in place of the phony rear scoop, it was a picture of tastefulness.

Here was a car that wanted to run. With the relatively long 3.00:1 rear axle ratio, it was in its element on long open stretches of highway. It could cruise contentedly hour after hour without faltering, all the time exhibiting a healthy respect for the price of gasoline. There are, of course, more economical Mustangs – but they are not quite so happy when great stretches of time and distance are to be faced.

Yet, it also had a certain impatience when forced into running short errands. Though not the sprinter some of its higher-powered and shorter-geared companions are, it nonetheless let the driver know it preferred to do and be done with these menial chores with briskness and dispatch. Idling around town to gawk at the scenery was a situation which made this car decidedly unhappy.

With free-breathing 4-barrel carburetion, its engine almost craved exercise. The torque converter of its 3-speed Cruise-O-Matic transmission would whisk it away from the stop light and, if one wasn't paying full attention, have shifted into high and be charging away from the traffic pack before the driver awoke to the fact. Part of the reason for this, to be sure, was its lack of fussiness. The engine and transmission worked so well together around town that there is only the low hum of an underhood lullaby to intrude on the driver's reverie.

Adding to the pleasantness and, in some cases, exhilaration, of the car was its nimbleness and responsiveness. While not quite on par with some imported cars, it was of a quality to shame most other domestic autos. The Mustang's major vice was present, to be sure, in an occasional reluctance to keep its rear tires working during periods of exuberant cornering – particularly on wet or rough pavement. But even this was well within bounds and easily corrected and controlled.

The 6.95-14 tires with which the test car was fitted keep its handling qualities on the plus side. But the tires also contributed to a sizeable speedometer error, just as they enhanced the aforementioned impression of easy distance driving. The ultraconservative speedometer readings, in particular, meant that the braking tests were more spectacular than bargained for, as later calculations revealed.

The brakes – one of the primary reasons for testing the car – were the optional 11.375-in. front wheel discs of ventilated cast iron with regular 10-in. rear drums. Usual testing procedure is to apply full pressure, just short of locking the wheels, twice in succession from 80 mph and recording the maximum deceleration rate. The disc/drum system performed quite well, registering a best-of-the-line 23 ft./sec./sec. with no evidence of fade. The rear drums did show a tendency to bind from the effects of a lighter rear loading and the natural weight shift toward the front, but this was easily controlled by backing off the pedal slightly. Braking effectiveness, in fact, was almost directly proportional to the amount of pedal pressure, since the system did not include power assist. It was just as well that they did a better than average job of pinching off speed, however, because the road used for the test ended rather abruptly at a highway department barrier. Had the drivers known they were stopping from almost 10 mph faster, or had they been in a car with lesser brakes, the deceleration rates would have registered a sudden all-time high.

Fat-treaded tires are not to be discounted in their aid to braking as well as traction (which amount to the same thing), but the normal road test braking results corresponded well with earlier comparative tests which *Car Life* conducted among all five domestic makes which offer the disc systems. At that time, 10 consecutive stops were made from 80 mph and the Mustang averaged between 24 and 26 ft./sec./sec., with a one-time best stop of 29. However, the same tendency for the rear to lock was evident then, to a greater degree than was the case with Continental and Thunderbird. It would seem that the pressure limiting valves for the rear hydraulic lines on the latter two, designed to overcome this problem, did somewhat the better job. They cut in at 450 psi line pressure while the Mustang's goes to work at only 300.

Nonetheless, the Mustang's disc brake option (which costs $54 extra) overcomes one of the two major shortcomings which the car has had for the serious driver. The other – quicker and even more precise steering – is still to come. But the car now is able to stop as well as go, which can be the more important consideration when things get tight.

And "tight" is a perfect description of the test car after the drivers rolled up many miles on it. Despite its lower-priced nature, this – and most other Mustangs we have tried – seemed solidly built. No creaking joints or groaning body panels materialized, which says volumes about the basic engineering involved in the platform frame. There was some drumming noise transmitted through the body from the road surface, as is true of all unitized cars, but it was hardly objectionable. The non-fussy nature of the engine conspired with the taut construction to make this example a real Quiet One.

During the past year, various owners have complained in some measure about the Mustang's seating and comfort, particularly on longer trips. Though our test drivers took special note of this, they could find only one area for complaint: The lack of rear seat armrests, in company with the "coved" rear seat back, left passengers behind with nothing to hang onto when the maneuvering began to get brisk. Cornering at anything above turning-into-the-driveway speeds meant the rear passengers were sliding around a bit.

Still, in the final analysis, we found ourselves growing more attached to the Mustang. Those feelings of fondness which it awakened in us when it first appeared have stayed with us and, if anything, intensified as we have tried successive specimens.

MUSTANG ROAD TEST

225-bhp disc brakes

SPECIFICATIONS

List price	$2372
Price, as tested	3152
Curb weight, lb.	2890
Test weight	3220
distribution, %	56/44
Tire size	6.95-14
Tire capacity, lb. @ 24 psi	3680
Brake swept area	328
Engine type	V-8, ohv
Bore & stroke	4.00 x 2.87
Displacement, cu. in.	289
Compression ratio	10.0
Carburetion	1 x 4
Bhp @ rpm	225 @ 4800
equivalent mph	117
Torque, lb. ft.	305 @ 3200
equivalent mph	78

EXTRA-COST OPTIONS

289/225 V-8, smog device, radio, auto. trans., console, power steering, 6.95-14 wsw tires, rocker molding, padded visors, disc brakes, back-up lights, tachometer & clock, tinted windshield.

GEAR RATIOS

3rd (1.00) overall	3.00
2nd (1.46)	4.38
1st (2.46)	7.38
1st (2.46 x 2.02)	15.1

DIMENSIONS

Wheelbase, in.	108
Tread, f & r	56.0
Overall length, in.	181.6
width	68.0
height	51.1
equivalent vol., cu. ft.	365
Frontal area, sq. ft.	19.3
Ground clearance, in.	5.5
Steering ratio, o/a	21.7
turns, lock to lock	3.7
turning circle, ft.	38.9
Hip room, front	2 x 21.0
Hip room, rear	50.6
Pedal to seat back, max.	43.0
Floor to ground	10.0
Luggage vol., cu. ft.	8.8
Fuel tank capacity, gal.	16.0

PERFORMANCE

Top speed (4500), mph	110
Shifts, @ mph (auto.)	
3rd ( )	
2nd (4300)	72
1st (4000)	40
Total drag at 60 mph, lb.	144

FUEL CONSUMPTION

Normal range, mpg	15-18

SPEEDOMETER ERROR

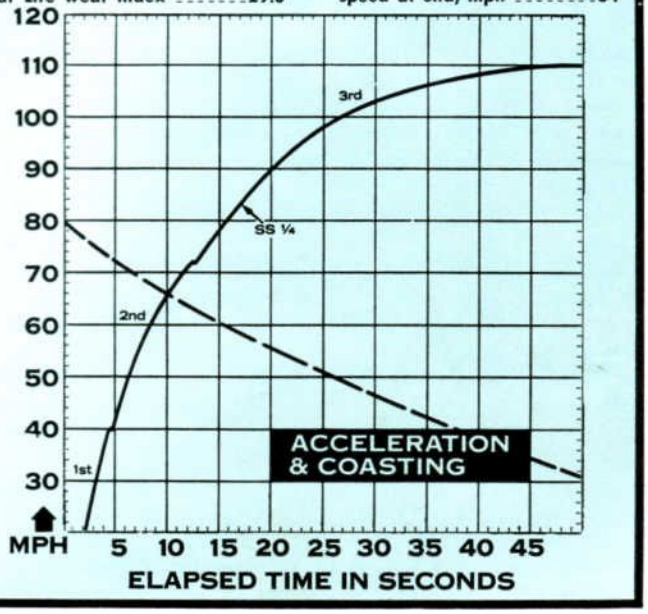
30 mph, actual	32.9
60 mph	62.5
90 mph	98.9

CALCULATED DATA

Lb./bhp (test wt.)	13.8
Cu. ft./ton mile	128
Mph/1000 rpm	24.4
Engine revs/mile	2460
Piston travel, ft./mile	1180
Car Life wear index	29.0

ACCELERATION

0-30 mph, sec.	3.5
0-40	4.5
0-50	6.1
0-60	8.5
0-70	11.7
0-80	15.8
0-100	26.8
Standing ¼ mile, sec.	16.8
speed at end, mph	84



ROAD TEST:

HIGH PERFORMANCE MUSTANG

Likening the Ford-produced automobile to its purposeful namesake is pretty easy to do, particularly where the High Performance Mustang version is concerned. The attributes of the muscle and bone mustang would seem to be those of the steel and rubber Mustang. It's the sort of car a man can become attached to, although he probably won't feel quite as romantic about it as The Cowboy does about His Horse.

The HP Mustang is specified here because of its obvious superiority to the more mundane everyday Mustang. Where the latter has a style and a flair of design that promises a road-hugging sort of performance, and then falls slightly short of this self-established goal, the HP Mustang backs up its looks in spades. It promises, it delivers, and for good measure it does even more than one could reasonably expect.

The editors had the opportunity of trying one of the first production-line HP Mustangs and it was a delightful experience to all who drove the car. We put it through our usual paces (see data panel) and added a few hi-jinks just for fun. We took it up and down our favorite mountain road, where it acquitted itself with vigor and nobility, and we took it on some high-speed desert highway runs; then we just pottered around town, commuting through traffic to and from our offices and battling the freeway tides.

For a high-performance sort of car it is unusually versatile; it accepts without fuss any treatment outside of fourth-gear starts. It is docile enough for 2-gear (second and fourth) driving, yet it is fierce enough to achieve under-16-sec. quarter-mile bursts of acceleration and stable enough to challenge and master that twisting mountain road. And in 1500 miles of this now-torturous, now-easy testing, we uncovered only one weakness of structure, a faulty clutch disc spring.

To cope with the power from the HP 289 V-8, Ford equips the Mustang with a 10.40-in. heavy-duty clutch disc and semi-centrifugal cover assembly. This latter makes the clutch grip harder as rpm increase, but also tends to raise the pedal pressure needed to release the clutch at high engine rpm. A weak spring in the test Mustang caused incomplete release of the disc and consequent "hanging up" of the gears when rapid shifts were attempted. This condition was worsened when the clutch release actuating rod became kinked, and finally the clutch would not release at all. Some quick service at our friendly local HP dealer (Shelby-American, Inc.) put the car back onto the road, the problem apparently cured by the replacement of the spring and the rod.

The key component in the transformation of the ordinary Mustang to one suiting the HP label is the powerplant. Where the standard engine is an in-line ohv 6 cyl. of 200 cu. in. and 120 bhp (formerly 170 cu. in. and 101 bhp), Ford offers optional V-8 power at 289 cu. in./200 bhp, 289/225 and 289/271 (with another 260-164 discontinued) levels. Obviously, horsepower increases, performance rises accordingly. So, the 289-cu. in./271-bhp unit is going to give the highest performance and thus this is the "HP" unit. Since the time this appeared, however, special Shelby Mustangs called GT-350s have gone into production and blurred that distinction, but they are relatively limited in availability.

There's more than just a label here, of course, as this 271-bhp engine is basically identical to the ones which powered the potent little AC Cobras (before the 1965 racing season) and the HP Fairlanes. More than just higher compression (10.5:1 vs. 9.00:1), these are HP engines from crankshaft to carburetor. Cranks, bearings, rods and pistons are all tougher, more durable design and material, the camshaft is of much "wilder" specification, lifting valves higher and leaving them open longer (306°) for optimum breathing at high rpm, the heads have more open ports and the carburetor, a single 4-throat Holley unit, has larger barrels and somewhat richer jetting than would be used in the normal 4-barrel unit.

These improvements over the standard sort of V-8 are aimed at giving the HP-289 a whole new area of operation – over 5000 rpm, where the other engines are flat out from gasping for air. Indeed, we found the optimum shift points for the HP Mustang to be 6500 rpm, where a 289/225 tested earlier had to be shifted at 4800 rpm. In testing the Cobra at one time, however, we found that it could be shifted happily at an even higher point (6800-7000 rpm) because of a more "open" exhaust system – from which the HP Mustang could benefit, too.

Straight-line acceleration is not the forte of this engine/axle combination, however. The test car had 3.89:1 differential gears, which were just a little too low (numerically) for good drag racing acceleration (4.11s or 4.56s are available) and a little too high for ground-gulping road-running. The Mustang option list includes a set of 3.50:1 gears and these, we feel, would give the car a little more room to stretch out in. With the 3.89s the car just barely pulls 6500 rpm, which works out at 120 mph top speed. With 3.50s, the mph/1000 ratio would increase from 18.5 to 20.5 whereas with 4.11s it would drop to 17.5 (with the same tires.)

The transmission is Ford's new-last-year 4-speed synchro-

mesh unit, which replaced the Warner Gear T-10 box formerly used in Ford products. The newer unit has extremely good gear spacing, 2.32:1 working out well as a starting gear, 1.69:1 being in about the right range to use for tight cornering, and 1.28:1 making a fine passing gear. The balk-ring synchros make shifting sure and easy.

The other part of the high-performance label applies to the suspension, where the Mustang achieves a notable level of cornering and directional stability. Again, standard components are replaced with units of sturdier specifications. Front and rear roll rates are increased with stiffer springs while shock absorbers are recalibrated to provide a firmer damping of spring action. Briefly, the specifications are thus:

	HP	Normal
Anti-roll bar dia., in.	0.840	0.690
Roll rate, ft. lb., front	438	308
rear	340	260
Spring rate, rear, lb./in.	110	65
Spring jounce, front	230	130
rear	230	140
Spring rebound, front	320	160
rear	370	210
Shock absorbers, cycles/min.	170	n.a.
stroke, in.	3.00	n.a.

The effect of this stiffening is to increase the resistance to body roll during cornering, thus keeping the tires at more desirable angles of contact with the pavement. Although this does nothing to improve the hefty forward weight bias (56%), it does help combat the strong understeer such a situation creates. Coupled with the ultra-low profile, wide-tread Firestone Super Sport 5.90-15 racing tires, the result is a fine-handling car capable of sticking to any highway at any speed it can attain.

(It should be noted that shortly after our test was made, the company quietly dropped the Firestone tire option and offered instead the U. S. Royal 800 tire with dual red-striped sidewalls. Handling characteristics with the new tires probably are affected only mildly since the same 6-in. rims are used.)

The understeer is still strong and particularly resists any turning of the car off a straight line at low speeds, where the optional manual steering ratio of 21.0 – 3.5 turns, lock to lock, adds to the muscle-power required. But once a good drifting turn is started, the car's attitude can be controlled with the throttle and most corners can be accomplished in spectacular fashion. At about 80-85 mph the car achieves a "neutral steer" in fast cornering and it is at about this speed that true 4-wheel drifts can be developed.

Heavy-duty brakes unfortunately are not included in the High Performance package and at the time of the test there were no options available except for a power booster. However, the Mustang now has a disc brake system option to fill such a glaring void. The HP Mustang tested had the same brakes as all other V-8 Mustangs and the results of our stopping tests were about the same: Barely adequate for normal use but too quick to fade for safe high-speed stopping.

The actual body/frame structure of the HP version is the same as other production Mustangs and as such continues the low-priced bargain concept. Indeed, while the HP packages (the stiffer suspension can be purchased with any engine) add upwards of $450 onto the base price of the car, it is still possible to get a rip-snorting, big-muscled go-pony for right around $3000 – a real bargain in performance.

It's all the more a bargain because the same sportive interior appointments – the full carpets and color-matched vinyl upholstering – remain in the car.

We can only add that this is the sort of Mustang that Ford ought to build more of; it has the guts of its namesake, the looks of a thoroughbred and the fleetness of a Native Dancer. It's been some time since we enjoyed doing a road test so much; in the words of another, non-automotive (Ol' Ern') Ford, "It was rode hard and put away wet."

MUSTANG ROAD TEST

289 271 High Performance

SPECIFICATIONS

List price	$2345
Price, as tested	3210
Curb weight, lb.	3050
Test weight	3360
distribution, %	56/44
Tire size	5.90-15
Tire capacity, lb.	n.a.
Brake swept area	251
Engine type	V-8, ohv
Bore & stroke	4.00 x 2.87
Displacement, cu. in.	289
Compression ratio	10.5
Carburetion	1 x 4
Bhp @ rpm	271 @ 6000
equivalent mph	111
Torque, lb.-ft.	312 @ 3400
equivalent mph	63

EXTRA-COST OPTIONS

HP-271 V-8, 4-speed transmission, handling pkg., Firestone SS tires, Rally-Pac, back-up lights, radio, w.s. washer, padded visors.

GEAR RATIOS

4th (1.00) overall	3.89
3rd (1.29)	5.02
2nd (1.96)	7.63
1st (2.32)	9.12

DIMENSIONS

Wheelbase, in.	108.0
Tread, f & r	56.0
Overall length, in.	181.6
width	68.0
height	51.1
equivalent vol., cu. ft.	365
Frontal area, sq. ft.	19.3
Ground clearance, in.	5.5
Steering ratio, o/a	21.0
turns, lock to lock	3.5
turning circle, ft.	38.0
Hip room, front	2 x 21.0
Hip room, rear	43.7
Pedal to seat, back, max.	43.0
Floor to ground	10.0
Luggage vol., cu. ft.	8.8
Fuel tank capacity, gal.	16.0

PERFORMANCE

Top speed (6500), mph	120
Shifts, @ mph (manual)	
3rd (6500)	93
2nd (6500)	71
1st (6500)	52
Total drag at 60 mph, lb.	120

FUEL CONSUMPTION

Normal range, mpg	13-16

SPEEDOMETER ERROR

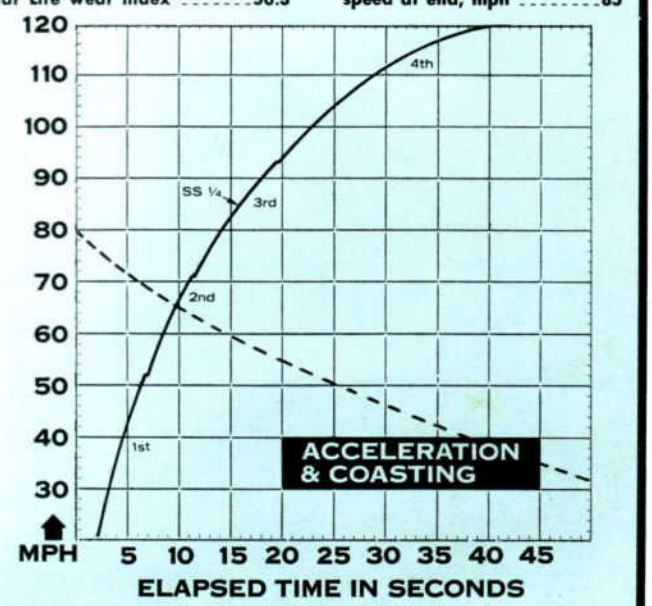
30 mph, actual	27.3
60 mph	56.0
90 mph	85.1

CALCULATED DATA

Lb./bhp (test wt.)	12.4
Cu. ft./ton mile	161
Mph/1000 rpm	18.5
Engine revs/mile	3240
Piston travel, ft./mile	1550
Car Life wear index	50.3

ACCELERATION

0-30 mph, sec.	3.1
0-40	4.5
0-50	6.3
0-60	8.3
0-70	11.0
0-80	14.2
0-100	22.5
Standing ¼ mile, sec.	15.9
speed at end, mph	85



ROAD TEST:

MUSTANG 4-SPEED

Variety is one of the important characteristics of the Mustang, particularly since the choice of an engine in any automobile determines in large measure the basic character of that car. With Mustang, for example, it is possible to get 427 throbbing and snorting cu. in. with overhead camshafts, provided your name is among the select few at the top of the dragstrip honors list. At the other extreme, an almost mincing and dainty demeanor results from placing an early 170-cu. in. Six in harness. In between these benchmarks, an amazing assortment of images may flash through any given Mustang driver's mind, depending upon the engine from the Ford collection he has selected to power his car.

Most engines are based on the 289-cu. in. thinwall block which first saw service in the Fairlane as a basic, 221-cu. in. V-8. It grew to 260 cu. in., then to 289, and by the time Carroll Shelby proved that wondrous things could happen with it, what the British call "stage tuning" had become an accepted fact. In dropping the 260 block from the Ford inventory during the fall of 1964, it was necessary to provide a replacement "regular fuel" V-8 to be the basic, or standard, V-8 for the Mustang line – better than the Sixes, but something less than Eights, which are referred to as "performance" or "high performance." The niche was filled by a 289 engine with 2-barrel carburetion and no British-type tuning to speak of.

Prior to the 1965 model year, this engine was rated at 195 bhp at 4400 rpm and churned out 282 lb.-ft. of torque at 2400 rpm. But in Ford's never-ending battle with Chevrolet in the marketplace, these figures were almost identical to those published for the better-selling arch-rival's 283-cu. in. engine, similarly set up. Consequently, as 1965 models were announced Ford announced revised ratings for both this engine and a 4-barrel version. Henceforth, the 289 with 2-barrel carburetor would be 200 bhp at 4400 rpm, still with 282 lb.-ft. of torque. The 4-barrel-equipped engine was rated at 225 bhp at 4800, up from 210 bhp at 4400, and had a revised torque peak of 305 lb.-ft. at 3200, up from 300 at 2800.

Among changes made to result in this were an increase in compression ratio from 8.7 to 9.2:1, slight freeing up of valve timing and an increase in valve sizes to 1.781 in. intakes and 1.450 in. exhausts, up from 1.670 and 1.389 in., respectively. As a result, the 200-bhp version in the test Mustang really suffered with West Coast regular fuel, even though the 9.2 compression was not too high for that grade in other parts of the country.

Aside from that, there is another drawback to this engine. Larger valves and freer valve timing have enhanced the engine's ability to breathe better, it is true, but the installation of a 2-barrel carburetor exacts its penalty. Another British term comes to mind in this connection – "dual choke." That is about what happens when a carburetor with only two barrels of 1.437 in. diameter regulates the amount of atmosphere which the churning pistons are permitted to pump. Just when the engine starts getting up a head of steam, it runs out of wind. Engine speed above 4500 rpm turns into a strained and asthmatic struggle which isn't worth the effort.

With a manual transmission like the Ford-built 4-speed, the engine can be forced to rev on up to 5000, but this is of little benefit. The final agonizing 500 rpm takes about as long to achieve as the first 4500 and acceleration suffers.

Similarly, when equipped with the 3-speed Cruise-O-Matic transmission, gear holding can be forced beyond the normal 4200 rpm w.o.t. shift points. But the skill required to outwit both the gearbox and the engine's affliction means that more consistent acceleration times are achieved by letting the transmission shift for itself. The average driver is best advised to merely floorboard the throttle and drive off down the dragstrip.

Yet, the buyer of a Mustang such as this isn't really likely to be driving on dragstrips, unless he does initially out of curiosity. He is most apt to be driving on expressways between suburbs and business office, a utilization for which this Mustang is ideal. When not strained or abused, the "basic" V-8 performs most adequately in normal service and provides a bonus from that very carburetion constriction in

289 V-8 engine fits neatly into front compartment, leaves space for power steering and brakes, even air conditioning.

TRUNK SPACE is small but adequate on hardtop Mustangs. Spare tire and jack equipment are readily available.

the form of better fuel mileage. The Mustang, after all, represents only 15 lb. for each of the 200 horses, a ratio many standard cars are hard-pressed to achieve.

Dad can feel pleased with himself because of the 4-speed he can use to extract optimum performance from the engine's limited rev range. Depending on rear axle selected, the engine can do as much as an average owner is apt to demand from it. With the standard 3.00:1 gears and the 6.50-14 tires on the test car, it would cruise all day at a strain-free 24.7 mph for each 1000 rpm in high. Dropping down into third to negotiate a sharper-than-expected corner, or for some spirited passing, changes to a 1.36:1 ratio which, while not exactly ideal, is certainly adequate with the rear gears used.

The 4-speed supplied with the 289/200 does not come with the more ideal Ford gearset used in HP Mustang applications. That transmission had a 2.32:1 first, 1.69 second, and 1.29:1 third, all much better when really serious driving is in order. Combined with the 3.89:1 rear axle, really spirited performance is in order – but that is another Mustang and another road test.

Clutch operation in the test car was light and positive. Of semi-centrifugal design, the 10.4 in. single plate clutch operated at 1269 lb. pressure – more than adequate in view of the relatively limited torque generated against it.

Normal rate suspension components on the Mustang are really a mixed blessing. The car by its very concept encourages driving a bit harder than one otherwise would and standard spring rates and shock absorber valving are too much toward the light side to withstand much of that. Their compromise is in keeping with Detroit's practice of tailoring the riding qualities toward softness, which the American car-buying public has been conditioned to demand.

This car can be horsed around a great deal more than one would expect, provided its occupants are willing to suffer the consequent roller-coastering. Roadability and handling are on a high order once the body-lean barrier is crossed. It is pointless, of course, to abuse this car in such a manner, but it still is reassuring to know that the car would see you through a tight spot when necessary. An enthusiastic driver is going to order his car with heavy-duty suspension components anyway, regardless of some sacrifice in riding qualities (which may not be all that bad).

The basic Mustang design has its front roll center located slightly more than 2 in. above ground level, contrary to the predominant American practice of placing it at ground level or below. This means that the front wheels remain somewhat better placed in relation to the road surface, in effect, during jounce and rebound. The most noticeable improvement is at the outside front wheel during cornering, which tends to plant more tread rubber more firmly on the ground with the higher center location. The anti-roll bar keeps both front wheels in a manageable relationship to each other by countering the effect of weight shift during body lean.

At the rear, the roll center is located at 9.3 in. above ground, where it naturally falls with the Hotchkiss-type live axle and leaf spring layout. The resultant roll axis, combined with Mustang's frontward weight bias, contribute to the basic understeering nature of the beast. Here again there has been engineering compromise to suit American tastes, but there also has been the recognition of enthusiast demands for better handling. When the Mustang is on the road, understeering effect is at a minimum and the handling qualities approach neutral.

Oversteering while cornering can be induced with excess throttle, of course, even with the test Mustang's 200 bhp. This partially results from the lighter loading of the rear axle and, indeed, is most bothersome on rough road surfaces. There the lack of sufficient (in our view) shock damping and control is most glaring and in fact is the primary situation for criticism of the car's roadability. Heavy-duty suspension components do a great deal to overcome such axle tramp, but some sort of traction bars would be even better. And again, soft spring rates *per se* do not cause the problem, they merely aggravate it.

The fact is, weight distribution is not vastly improved from domestic automotive practice, despite the visual appearance of having moved everything back behind a long hood. Rear wheels still carry less than 45% of the weight and the 485 lbs. of engine metal are still balanced over the front axle centerline. The change from a 260 block to a 289 doesn't add more than a dozen pounds at most, however, so blame cannot be concentrated there. Instead, it is a basic design practice dictated by asking the question: "What happens when you have a full load of passengers?" By keeping the frontward weight bias (with only a driver aboard), load equalization as additional passengers are carried still stops short of rear-end heaviness in order to maintain the basic handling characteristics. Mustang reacts consistently whether one or four are aboard. Ford engineers admit that it could handle better with only a driver aboard by altering the weight distribution,

TASTEFUL interior is Mustang hallmark. 4-speed's shift lever projects unashamedly up from drive-line tunnel.

ANY PATCH of open road invites enthusiastic driving when your Mustang is equipped with a stick transmission.

but they point out that cars with near 50-50 distribution in Mustang's dimensional range are invariably 2-passenger cars. To have the rear seat is to invite compromise.

Adding to that front end weight was power steering, which with 3.73 turns lock to lock from 21.7:1 overall gearing provided adequate quickness for the normal suspension. Mustang still uses linkage booster power assist, saving not only in basic cost but also in road feel. The filtering out of road surface irregularities which often characterizes the integral pump-and-gear type of powered assist is much less pronounced and the Mustang driver has a greater sense of what the front wheels are doing. In common with most Ford products, however, it is possible to overrun the powered assist in tight parking situations, where the engine is idling and the wheels are cramped from lock to lock rather rapidly.

Some sort of running change has apparently been made in steering wheel placement since the first Mustangs were produced. Or it may be that our drivers are merely growing accustomed to driving them. But it seems that the seats may have been tilted back slightly to move the shoulders a bit farther from the wheel, thereby permitting a more comfortable and controllable "straight-arm" driving style.

Perhaps the weakest point in the Mustang design is its brakes. The non-powered stock brakes, with run-of-production linings, are only adequate for light service. The commuter use to which this test Mustang lends itself may well be too severe for them. The drums, as is true with all V-8 Mustangs, are 10-in. diameter Fairlane units providing 251 sq. in. swept area. They were capable of hauling down the car from 80 mph at 20 ft./sec./sec. deceleration twice, but only by fighting rear lock-up all the way. Without power, it took a strong but sensitive right leg on the pedal, which seemed a little overly spongy during such treatment. One solution to this would be to insist on the heavy-duty brakes with their harder lining material, but the better recommendation would be to invest in the optional front-wheel disc brakes with their greater fade resistant characteristics.

All Mustangs, regardless of engine or other options, share some basic things in common. All have what are undoubtedly the best bucket seats in domestic production, with back deeply ridged around the edge for lateral support and cushion properly padded for long-mile comfort. All have an excess of rich vinyl upholstering – in seats, door panels, dash shelf, and headlining – which is tastefully color-keyed and highly practical. All share wall-to-wall molded pile carpets that manage to fit into place without the gaposis that so often plagues cars in this class. And all come with a host of standard equipment for which competitors charge extra, not the least of which are the padded dashboard and inside visors.

But there is still that variety which comes from an extended list of engines and options. This Mustang, aside from the 289/200 engine and the power steering, didn't take advantage of that list. There was the console, which the car is better without even though it incorporates a cute little hidden compartment up front under the dashboard, and a transistor radio to satisfy resale requirements. The 4-speed transmission, too, costs extra (as does the automatic) but it's difficult to believe that buyers would settle for the standard 3-speed, excellent and fully synchronized though it may be.

Even though from that diversity which is available this car was fairly basic, it could not be considered plain. It has a style which sets it apart, a flair that appeals to the sophisticated, and wholesomeness which is appreciated by the practical. It has a seductiveness about it that a man can appreciate even though it really doesn't intend to deliver all its promises. And that's a pretty good antidote for the tedium usually associated with commuting to the office.

MUSTANG ROAD TEST

200-bhp 4-Speed

SPECIFICATIONS

List price	$2372
Price, as tested	2796
Curb weight, lb.	2930
Test weight	3310
distribution, %	56/44
Tire size	6.95-14
Tire capacity, lb. @ 24psi	3680
Brake swept area	251
Engine type	V-8, ohv
Bore & stroke	4.00 x 2.87
Displacement, cu. in.	289
Compression ratio	9.3
Carburetion	1 x 2
Bhp @ rpm	200 @ 4400
equivalent mph	109
Torque, lb.-ft.	282 @ 2400
equivalent mph	59

EXTRA-COST OPTIONS

289/200 V-8, 4-speed trans., wsw tires, tinted windshield, radio, visibility group, knock-off hub caps, rocker mldg., power steering

GEAR RATIOS

4th (1.00) overall	3.00
3rd (1.36)	4.08
2nd (1.93)	5.79
1st (2.78)	8.34

DIMENSIONS

Wheelbase, in.	108.0
Tread, f & r	56.0
Overall length, in.	181.6
width	68.0
height	51.1
equivalent vol., cu. ft.	365
Frontal area, sq. ft.	19.3
Ground clearance, in.	5.5
Steering ratio, o/a	21.7
turns, lock to lock	3.73
turning circle, ft.	38.0
Hip room, front	2 x 21
Hip room, rear	50.6
Pedal to seat back, max.	43.0
Floor to ground	10.0
Luggage vol., cu. ft.	8.8
Fuel tank capacity, gal.	16.0

PERFORMANCE

Top speed (4400), mph	109
Shifts, @ mph (manual)	
3rd (4400)	80
2nd (4400)	56
1st (4400)	39
Total drag at 60 mph, lb.	140

FUEL CONSUMPTION

Normal range, mpg	15-18

SPEEDOMETER ERROR

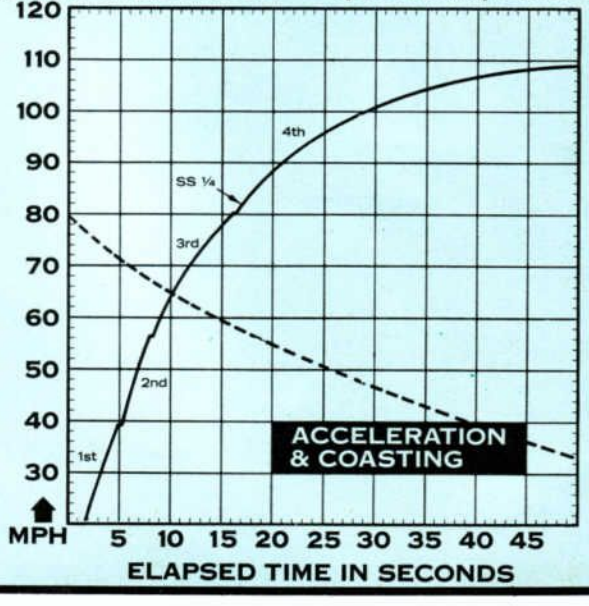
30 mph, actual	27.0
60 mph	57.0
90 mph	86.0

CALCULATED DATA

Lb./bhp (test wt.)	16.6
Cu. ft./ton mile	122.7
Mph/1000 rpm	24.7
Engine revs/mile	2430
Piston travel, ft./mile	1164
Car Life wear index	28.4

ACCELERATION

0-30 mph, sec.	3.6
0-40	5.1
0-50	6.9
0-60	9.0
0-70	12.2
0-80	16.5
0-100	29.3
Standing ¼ mile, sec.	17.0
speed at end, mph	82



ROAD TEST:

SHELBY-AMERICAN GT-350

Back during the Middle Ages, that period between the time Johnny (B.C.) Hart's "gullible simp" invented the wheel and Henry Ford's arrival in the world, people used to turn to sorcerers and magicians for potions to cure their ills and allay their troubles. Most people nowadays don't believe in sorcerers, since quantum physics and new math make them technologically unemployable. But it should be reported that there is one of the old-style wizards still plying his trade, and the magic balm which he dispenses is avidly sought by a few furtive sufferers of tired blood and bland togetherness.

This modern day Merlin practices his black art not in a dank cave or hidden hovel secreted in a dark forest, but beside an ultra-modern time machine emporium. There, thousands of people daily trudge in groups of a hundred or so into the open maws of huge aluminum tubes, emerging four hours later or less in another country, another world, or at the very least another city, unaware that they had almost brushed shoulders with a source of even greater wonderment.

He is Carroll Shelby. He rebuilds cars. Correctly. He takes about 100 Mustangs each month, worth about $2300 each, and gives them his own version of a tune-up that costs another $2200.

This raw-boned Texan does a lot of things to Mustang 2+2 fastbacks that slide under the ministering hands of himself and his apprentices. The cars arrive at his magic laboratory without hoods, rear seats, or grilles, and they're all white with black interiors. When they leave, they've gained a fiberglass hood that's fastened by genuine racing pull-pins, a plastic rear floor for a vinyl-shrouded spare to rest atop, and huge blue stripes along top dead center and bottom rocker panel edge. There's a "GT-350" painted in broad strokes, so there'll be no doubt as to what is being viewed.

The most important thing which is done, because no one

HORSE OF another choler, the GT-350 is a red-blooded, tail-switching range-runner. Shelby-American does the transfusion.

PAUL E. HANSEN PHOTOS

ALL ASPECTS of performance are improved, from braking and acceleration to handling. The Cobra touch is much-evident.

SHELBY GT-350

else does it, is relocating the inner pivot points for upper suspension arms. This little touch alone makes a vastly-needed improvement in the car, raising the roll center at the front so that the car corners flatter and more precisely. Front wheels maintains a more perpendicular attitude toward the road, regardless of body roll and side loadings, because of it.

The Shelby treatment also involves a much stouter anti-roll bar between lower front suspension arms to raise the roll moment and insure the flattest cornering possible. At the rear, a pair of traction bars are fitted to a revised axle pad, with arms running forward to a mounting point directly above the spring hanger centerline – for which portions of body metal must be cut away. Extra sturdy double-acting shock absorbers complete the suspension work.

Under the hood, Shelby works more of his Cobra-derived magic. This can be liberally characterized as blueprinting an already factory-blueprinted engine. Primarily, the passages for inhaling and exhaling are given much clean-up and open-up treatment. Since these modifications, as well as more detailed explanations of suspension changes, are covered in detail elsewhere in this book, it should suffice to say that this Mustang's "350" designation is barely exaggerated from a dynamometer's standpoint.

So set up, this Mustang really rambles. Figures on the data panel illustrate vividly the straight-line performance, but are much too inadequate to describe this beast in action. Acceleration is enough to leave one breathless, although it is necessary to remember that the tach needle should be kept hovering above the 4000 mark for the most spectacular results. This is not difficult to manage, however, with the nicely spaced ratios in its Warner Gear T-10 transmission. The latter, it might be noted, was chosen over the somewhat tougher Ford 4-speed because of its weight-saving aluminum case. With the final drive ratio in the test Mustang the speedometer needle would easily come to rest on the 120 peg. Since the tach was registering 6000 rpm, this trued out to a back-stretch straightaway speed of 105 mph with the fat 7.75-15 Goodyear Blue Dots which were fitted.

Although this was the street version of the GT-350 (there is an even more stark and lightened competition version), it was an exceedingly loud car. A set of thin-wall tubing headers molding into straight-through tailpipe enlargements which masquerade as mufflers was the primary reason for that. So long as one doesn't deliberately bait policemen by revving up the engine in their vicinity, the system is probably legal. The dual tailpipes are bent outward to vent their wrath just in front of the rear tires and this, too, contributes to the overall noise level: The full blast of ripping exhaust assaults the driver from just below ear level.

There was one bother involved with the test car which almost made it mandatory to have a 7/16-in. box-end wrench as standard equipment. That was the tendency for the exhaust headers to work loose with even mild driving. This was attributed to incompatible expansion properties of metals in heads, headers and header bolts. As this appears, the situation will have been corrected, but on the test car at least it was necessary to refasten the headers in place about once a day. Their loosening, it goes without saying, added significantly to the decibel level inside the car.

Noise or no noise, however, this was a car that was designed for the man who wants the maximum from his car. And that pre-supposes a dual-purpose car: Commute to the office with it during the week, then paint numbers on it and race it weekends. As it stands, it runs B Production in SCCA races and will provide a good driver with potential winning machinery. Anyone really serious about winning, however, would prefer the lighter and quicker competition version.

WOOD-RIMMED steering wheel, tachometer and oil pressure gauge cluster are part of S-A treatment; so are huge seat belts.

BLANK grille and horse emblem are characteristic to GT-350. Racing stripes, hood scoop and hood safety locks are standard.

It is on the road course that this car belongs. Shelby modifications have guaranteed that the worst of the production car ghastlies have been eliminated. It still maintains basic understeer characteristics, but the descriptive "near neutral at speed" was never truer. It is a car with great gobs of forgiveness for driver boobery, which is just as well since it insists on one of a Ken Miles stature to extract its full potential. No little measure of this forgiving capacity is due to the huge tread patches with which the Goodyears paw the track. Side loadings of almost devastating force are required to make those tires quit working in the corner. Suffice it to say that none of our test drivers were brave enough to call this bronco's bluff. When we overcooked, as we did once on Riverside Raceway's Turn 7 – a sharp downhill left-hander coming off an equally sharp rise – the tires merely scrubbed off speed, sideways, while we backed off the throttle enough to regain steering control.

This was one car in which there need be no qualms about brakes. Unfortunately, it also was one in which our test crews failed to measure our now-customary deceleration rates. Nevertheless, there was never the slightest concern with stopping power in street use. Pedal pressures were slightly higher than most people now expect, though hardly prohibitive, and fade was largely an academic question. In racing situations, however, that may not hold true although appearances to date have demonstrated no problem. One concern which remained during hard usage, however, was a legacy of the Mustang's most serious vice – rear axle hop. This occurred only in severe race-course braking situations, when weight transfer effect was sufficient to let a lighter loaded rear end lift enough for the huge drums there to lock.

In tight maneuverings on very short courses or exceedingly twisting roads, the GT-350 could conceivably still be a handful. But Shelby's substitution of the quickest gears to yet appear for the Mustang steering has been a great improvement. For those who complain about an absence of road feel, this is the answer. There is definite feedback as part of the price of very quick (for a domestic car) steering and the wood-rimmed aluminum wheel borrowed from the Cobra needs a steady grip to reduce its jerky oscillations. Steering is non-power assisted, but its heaviness is not objectionable.

It might be noted that engineers from both Shelby-American and Ford plunged in to isolate and correct one problem which surfaced as first production GT-350s began racking up mileage. Limited slip differentials, which are actually Galaxie units, seemed to develop an inability to cope with the demands placed upon them. This resulted in some erratic power transmission between rear wheels, which in turn, caused various degrees of rear-end steering. The test car, though afflicted with this trauma, didn't persevere beyond the annoying stage, but it was disconcerting in its presence.

Little in driver comfort has been sacrificed by the GT-350 over that of the off-the-shelf 271-HP Mustang. The same carpeting and bucket seats – among the most comfortable and secure in domestic production – are used. The flatter (and slightly smaller in diameter) steering wheel improves driver position. And the Air Force seat belts, even if less stylish, are vastly greater security than Linus blankets.

Still, despite almost immeasurable improvement in balance and handling and cornering and braking, we came away from the GT-350 with somewhat mixed emotions. It out-performed the last fuel injected Corvette Sting Ray which CL tested, for quite a few dollars less. That, of course, is certainly one recommendation. But the cost is not measurable in dollars to many, and the difference is between gentility and boorishness, between manners and manhandling, between the sophisticated and the strident. On balance, however, it really comes down to the name of the game, and that is To Win. That's our game, too, and Shelby and Ford are playing it with the GT-350. This is one time we'll have to close the textbooks, ignore all pretensions, and shout: I'll take it, I'll Take It! Ol' Wizard Shel has us in his spell.

MUSTANG ROAD TEST

Shelby-American GT-350

SPECIFICATIONS

List price	$4311
Price, as tested	4584
Curb weight, lb.	2790
Test weight	3140
distribution, %	55/45
Tire size	7.75-15
Tire capacity, lb. @ 24 psi	4400
Brake swept area	381
Engine type	V-8, ohv
Bore & stroke	4.00 x 2.87
Displacement, cu. in.	289
Compression ratio	11.5
Carburetion	1 x 4
Bhp @ rpm	285 @ 5000
equivalent mph	102
Torque, lb.-ft.	325 @ 3000
equivalent mph	61

EXTRA-COST OPTIONS

Cast magnesium wheels, Shelby-American tune-up.

GEAR RATIOS

4th (1.00) overall	3.89
3rd (1.20)	4.67
2nd (1.62)	6.30
1st (2.36)	9.18

DIMENSIONS

Wheelbase, in.	108.0
Tread, f & r	56.5/57.0
Overall length, in.	181.6
width	68.2
height	51.2
equivalent vol., cu. ft.	366
Frontal area, sq. ft.	19.3
Ground clearance, in.	5.5
Steering ratio, o/a	19.1
turns, lock to lock	3.75
turning circle, ft.	38.0
Hip room, front	2 x 22
Hip room, rear	n.a.
Pedal to seat back, max.	43.0
Floor to ground	10.0
Luggage vol., cu. ft.	5.5
Fuel tank capacity, gal.	16.0

PERFORMANCE

Top speed (6100), mph	124
Shifts, @ mph (manual)	
3rd (6500)	110
2nd (6500)	82
1st (6500)	56
Total drag at 60 mph, lb.	133

FUEL CONSUMPTION

Normal range, mpg	12-16

SPEEDOMETER ERROR

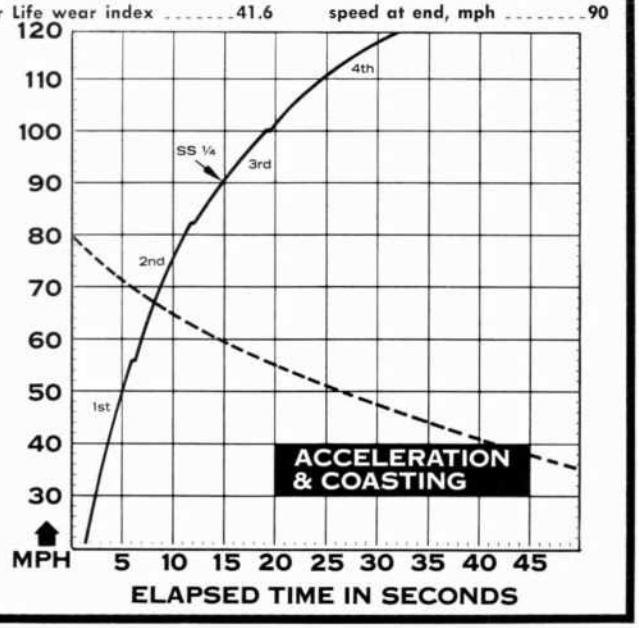
30 mph, actual	26.4
60 mph	50.4
90 mph	75.1

CALCULATED DATA

Lb./bhp (test wt.)	11.0
Cu. ft./ton mile	157
Mph/1000 rpm	20.3
Engine revs/mile	2950
Piston travel, ft./mile	1410
Car Life wear index	41.6

ACCELERATION

0-30 mph, sec.	2.4
0-40	3.6
0-50	5.2
0-60	6.8
0-70	8.7
0-80	11.2
0-100	19.0
Standing ¼ mile, sec.	14.7
speed at end, mph	90



THE BUTTERFLY & THE DRAGON

BY RICHARD BACH

We were humming along the highway in a 1965 Ford Mustang, listening to it, driving it, getting the feel of it, sort of, for a magazine article. From the road behind us came a faint roaring, gnashing sound, a blur in the rearview mirror.

The little Mustang coupe feels just like a Falcon. Or a Comet or a Chevelle or any other family car. Quiet and smooth and soft; it doesn't roll its wheels upon a hard-surface highway, it floats above it. An impatient snorting, now, from behind. Like a highspeed dragon bellowing back there.

Comfortable and businesslike, the Mustang. Close your eyes and you have no idea what kind of car you are driving. At 50 mph it tracks straight as a velvet dart along the narrow roads. Try to turn it, though, make quick little left-rights with the wheel, and it wallows wildly back and forth, sloshing heavily from side to side, leaving no doubt that it is a comfortable, smooth straightline family car, and certainly no tightly wound racing machine. There is not the faintest doubt of that. Suddenly, looming to completely fill the rearview mirror with smoke and orange flame, to shriek one last time in gears changing down and blurred spinning engine-thunder and blue pure energy bolting the air, slipping to the left and howling furiously past, spraying our little car with rubbersmoke and powdered asphalt and utter fierce contempt, a racing-striped cannonshell from whose path we had been pulled only at the last instant, by the mercy of God.

In the split microsecond that it passed us, we caught one subliminal view of the thing, and a number painted, and then it was gone, blue fury disappeared over the horizon and vanished in an angry cloud of flying highway bits.

We gripped our Falcon-like steering wheel tightly, and while our vision returned, we were confronted by an incredible thought. That thing that had passed, that starship at light-speed, was a Ford Mustang! And its number, blazed and glowing still in our eyes, was GT-350.

It took a long time. In three miles, blinking, floating soundlessly along the road, we deduced that G meant Gran. T, then, was Turismo. And 350? We couldn't guess. Cruising speed. Engine rpm, surely, in thousands.

And, we thought, by now he's in Iowa, but wouldn't it, someday, be fun to sit in that car? In the place where the driver sits? But we shook it out of our mind, and completed our test of the straight-six automatic-shift coupe.

It is an extremely honest car, we discovered. The interior leads one to expect no flashing or unusual speed or performance, and there is none. But still it has a strange appeal to it. Pull over to the side of the road, stop, get out, walk around the car, puzzled about the elusive appeal. This cheapest Mustang has those hubcaps that used to annoy rational people with their fakery of wire or magnesium wheels, which are now such standard fakery that they are ignored. In front, the simple grille is barred behind a tin-stamped cross and an image of a frightened horse, stamped from a plated pineapple can. What could have been a simple square taillight assembly has been chromed and sectioned into six separate red lenses. Conventional automotive fakery, all. Offer the natives some shining bangles, the policy, and they will love it, come begging for more asking for colored beads glued on. But in spite of the fakery and the contempt for the buyer, we puzzled what is it about this automobile that is so appealing? And suddenly, as we stood by the side of the road, frowning, we saw that appeal, what it is that forgives that Mustang its debts. For the car, we saw, the whole car, is 8 in. long and 2 in. wide. The whole car. The complete Ford Mustang is that little curve of metal at the fateful point two-thirds of the way back along the fender line, that little jag upward, as though the molten metal had flowed up over a smooth submerged stone.

Around this, of course, the company added a lot of sheet metal, a roof, a place for seats and a driver, a few wheels, an engine. But the car, the bright pulsing car-ness of the Mustang and the reason for its appeal, is that 8 in. of curving metal. Without that, "Mustang," for the world, would mean a horse and a fighting airplane from 20 years past.

And, too, this automobile holds the mark of a designer who doesn't despise the man who would buy his creation. He knew that the bangles and the gewgaws were expected, of course, and that high authority would never allow things so radical as simplicity and smooth clean lines to masquerade for beauty, so he designed first the car, and then the gewgaws, cleverly. The stamped-tin cross-and-horse, for instance, is attached in only two narrow places. The work of a minute with a hacksaw, and there, a smooth simple grille. The six-lens taillights could be quickly removed, and replaced with a pair of simple single-lens units. The hubcaps, of course, should be thrown away. And standing there, in 10 min., the original, the simple, the beautiful design that lived in the dream of that designer. There is the appeal of the Mustang.

Its performance makes no difference, for a Mustang owner is not just buying performance. He is buying this rare look, this astonishing simplicity. Stepping into his Mustang is stepping into a well-tailored suit, or a handsome suede jacket, one that fits well and in which he looks well for the world. The Mustang is a machine that can be taken easily, happily for granted. It was clearly designed for that person who wishes to recognize the excellence of simplicity, to hold something in common, that one lifting curve of molten metal, with the cars that live for the race and with the men who live for the cars.

We lifted the hood and smiled. Of course. The first reason for the undistinguished performance is this little engine. Suspended in the center of a great wide empty space, the little straight-six looked startled to be there, as if it had been resting on a flower when someone snuck up from behind and clapped an empty Mustang-shell down over it. What would it be like, we wondered, if the promise of the Mustang design was fulfilled in performance, if someone came along and made its Cinderella-dream true, what kind of machine would that be? And we couldn't help thinking, as we drove on, of the machine that had gone blazing past.

Suddenly, there it was. Solitary and still, by the side of the road. Like a sword in a stone. As if there was an inscription emblazoned: *Anie Manne Who Mastereth This Machiene Shalle Bie King Of The Realme.*

One cannot ignore a challenge like that, but yet it was with some caution that we approached the sleeping dragon. It looked much like that Mustang that had come direct from the designer, evading all eyes but those of the Taillight Inspection Team, who had made certain that the six lenses were installed, per directive. The grille was smooth and uncluttered, with only one tiny horse at a far corner. And the wheels, of magnesium alloy, needed no hubcaps. This was the 2+2 Mustang, of slightly different body style than the family version, but the car was the same.

The door was open, and offered an invitation. Come here inside, it said, where it is dark and cool and you may look out upon the world from a position of great power. We did wish to be King Of The Realme, but we stood aside and carefully gauged our dragon. There is nothing modest about it. The fiberglass hood is held down by two manual-release

pins, arrogantly exposed, proclaiming that this hood travels at speeds so great that nothing but exposed steel locks can hold it down. The huge exhaust stacks end an inch ahead of the rear wheels, the flaming gases are caught and smashed into the ground, pressing the sound of the engine into the earth, so that time itself cannot remove it, and so that the world will know that it has been rolled upon by a giant.

It was not necessary to look at the engine, for performance is no longer told by engine displacement. Performance is measured now by the width of the rear tires, and these on the GT-350 are fully three times as wide as the stock Mustang. Performance is measured too by steering wheel design, and this machine has a wood-rimmed steering wheel, smaller than the standard Mustang's, and carrying (we recoiled, involuntarily) a Cobra emblazoned upon it. There was no question that this was indeed a machine of giants.

Yet, strapped now into the driver's seat and enclosed in black leather upholstery, we were brought up short by the instrument panel. It was pulled from a Ford Falcon. The only difference along the whole board was an auxiliary instrument panel, mounted high on the dash and canted to face the driver; holding a tachometer and an oil pressure gauge. There was a sign DISC BRAKES, melted into the brake pedal, which is either advertising for the Disc Brake people or an indication that the pedal should be operated in a certain special way. We hoped that it was advertising. From the inside of the GT-350, save for the steering wheel and that ominous canted tachometer with a redline at 6500 rpm, there was no hint of danger. We touched the starter.

The engine rattled off like a homemade bomb, and were it not for the seat belt we would have been thrown from the car at that instant. And as we huddled in the driver's seat, the bomb kept going off, burst after burst after burst, its concussions making the GT lurch and shudder, suddenly aware that there was a challenger on its back. There was, we knew, not a moment to spare. The very first moment is the time to assert authority. We slammed the machine into first gear, pressed the tachometer to 4000 rpm, and let go the clutch. Like a dragon out of a rodeo-chute, the biggest wildest dragon out of the biggest hardest chute anywhere, the 350 roared, and pinned us into the seatback. The steering wheel is something to hang on to, we discovered in those first split seconds. Turn it anywhere you want, it makes no difference, for the front wheels are jerked off the ground by the blast of the dragon's rush. The driver of a GT-350 sits in a little cab atop this huge wild beast; he can move the controls, but what results is entirely beyond his control. The gearshift and accelerator rods extend down into the heart of a blazing atomic furnace, and moving them turns a pure molten proton-stream bursting into the GT driveshaft. A few little energy bursts and the GT is erupting through 70, through 85, through 100 miles per hour.

As with any atomic furnace, there is no hint that it will ever run out of power. At 105 indicated, the rear of the fiberglass hood began vibrating wildly, and we wondered if the hold-down pins aren't designed to shear at 130 to blow the hood away and crush new air into the furnace. And through it all was the terrific detonation, the instant crackling thunder of this machine, tearing the ground to shreds, striking down living things that stand by the roadside. The engine runs on sun-heat and pure sound, and there is no way to escape it. Rolling the windows up makes no difference, it is just as loud as it is with them down.

Pulling hard back on the reins, backing throttle and setting locks, the GT can be slowed. At 3000 rpm, less than half its rated speed, the machine is shuffling at 61 mph. Anything less than this, and the powerplant gags and chokes in idle. 50 mph for a GT is an agonized crawl.

The GT-350 Mustang is about as easy to steer as a runaway boxcar, even with the front wheels back down on the road. Grip the wooden wheel and turn it hard over with all the strength you can command, and the car slews sullenly to one side, knowing that in turns one cannot move so quickly as on straightaways. "This thing," we could only gasp in the midst of the detonations and the sun-heat and the hyperspeed down a highway blurred and gone, "is a Ford?"

Cut all the switches, damp the atomics reacting, slam hard down on the Disc Brake pedal, open all doors, drag all feet and the GT coasts reluctantly to a stop, smoking slightly, waiting there for the next would-be ruler of a realm.

That man isn't us. Give us that straight-six butterfly caught in an empty Mustang-shell. We will drive happily along the sidelines and pay our humble respects, from a distance, to the kings and to their dragons.

PAUL E. HANSEN PHOTO

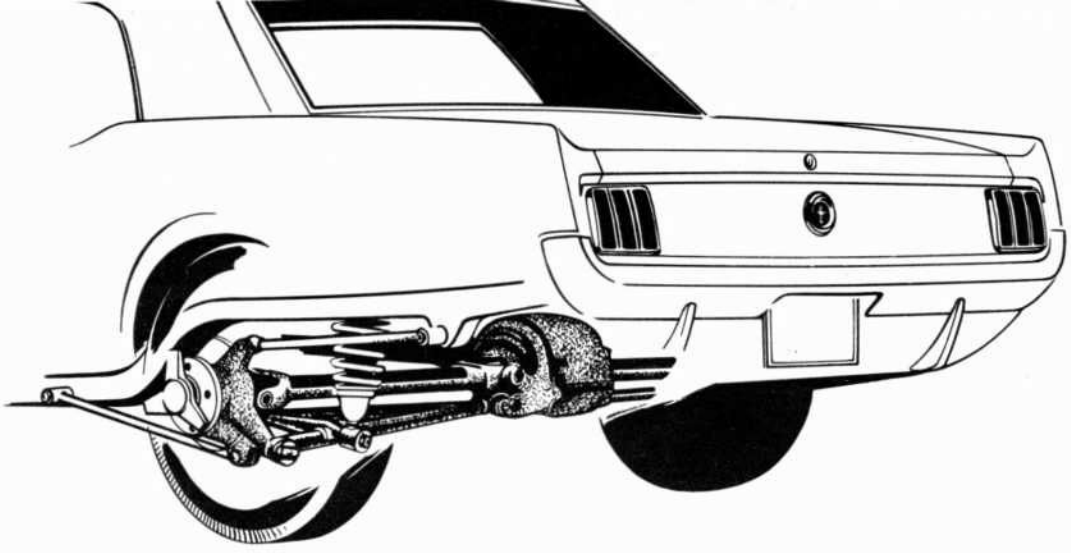


ILLUSTRATION BY RON BERRY

THE NEVER-NEVER MUSTANG

BY GENE BOOTH

A spirit of reckless daring pervaded Ford Motor Co. at the time of the Mustang's unveiling. The company, while showing off its brand new, pulse-quickening type of car, told the world its big secret: There was going to be a hot Mustang with Independent Rear Suspension.

The collective sigh that went up could have been heard in Stuttgart or Coventry. "Independent Rear Suspension!" the car buffs marveled. "Why, that's just what this car needs to really show its tail to Jags and 'Vettes and things."

Frank Zimmerman, Ford's performance vehicles man at the time, observed, "We'd like to come in ahead of the Sting Rays and right behind the Cobras." Zimmerman detailed how Carroll Shelby would develop and campaign the IRS cars under Ford colors. It was also believed that the forthcoming IRS provided some of the reasoning for the fastback 2+2 Mustang body style, also not yet developed. Such willingness to expound upon a vehicle even before the hardware had materialized was a rare departure from Detroit traditions.

As things turned out, not very many buyers waited to see the IRS Mustang. Even so, development work went ahead through the summer.

The IRS design was based on that of the slipper-shaped Ford GT (not the GT-40), which had been entrusted for development to Britain's Eric Broadley when his own Lola GT showed such a similarity in design concept. Suspension geometry was based on that of the mouth-watering Mustang I 2-passenger sports/racing car which Ford had unveiled before the actual production Mustang project really got underway.

In common with most IRS designs, the differential case was solidly attached to the frame. Double-jointed axle shafts were fully articulated with universals at each end and carried power to wheels attached to special forged hub carriers. But production pricing and the platform frame of the regular Mustang brought about some changes from the suspension links used on the space-framed Mustang I. The lower tubular A-arm was re-shaped somewhat, but still pivoted in an inverted position, with the apex now swinging from a point at the differential case base. Similar but reversed upper A-arms, which had pivoted from Mustang I's space frame, were discarded in favor of a pair of Watts links from the production frame rail to hub carrier; the top one ran forward from the frame kick-up to the hub carrier, the bottom one trailed from a mounting ahead of the wheels. Concentric coil springs/shock absorbers mounted on a special bracket welded across the A-arms and angled upward to a brace across the axle kick-up. The whole arrangement was called 4-link, since the non-splined half-shafts also served in the locating task.

This layout reduced rear roll center from the normal 9.5 in., with 15-in. wheels and standard Hotchkiss suspension, to 7 in. above ground level. In addition, front roll center was raised about 1 in. above normal, to 3 in., by altering suspension pivot points. The result was minimal adverse body lean during cornering, in conjunction with the front anti-roll bar fitted; more even side-loadings on tires in turns, thereby equalizing the work of all four; and effectively "quickening" the steering characteristics, for reasons related to the above.

With all tires thus more firmly planted on the ground, handling couldn't help but improve; that commonplace Mustang problem of rear axle tramp, for instance, disappeared almost completely. It was still possible to lose traction when cornering sharply on rough surfaces, but those very surfaces proved another advantage: Vastly improved riding qualities. Rough stuff could be attacked at speed without qualms, knowing the suspension was going to do the bouncing rather than the car.

And there it was, all built-up and waiting for a high-level signal to begin production. But the signal never came. Ford by this time had other programs in the works which, for one reason or another, held more promise from the standpoint of pure competition: The GT-40 program was being perfected and the 427-cu. in. Cobra II already had full independent suspension. Production people figured that in the limited volume in which IRS Mustangs most probably would sell, the feature would add about $200 to the base price; it was considered to be too costly.

But the *coup de grace* came at the hands of the racing people themselves. Carroll Shelby, in perfecting his GT-350 version of the Mustang, set up the IRS with exactly the same equipment which the 350 boasts: Wide, fat Goodyear racing tires on strong wide-rim wheels, healthy blueprinted engine identical to the 350's, quicker steering gears and big strong brakes. Under no circumstances – using the same drivers or different drivers – was the IRS able to surpass the GT-350 lap times around the Willow Springs (Calif.) course.

Unable to match, let alone excel, the qualities of a less costly and more conventional Hotchkiss-suspended competitor, the Never-Never Mustang had suffered a fatal blow. There was no doubt that its day was over and it soon would drive to the Great Proving Grounds in the Sky, its parts scavenged and cobbled onto other Ford newcomers.

ENGINES FOR THE MUSTANGS

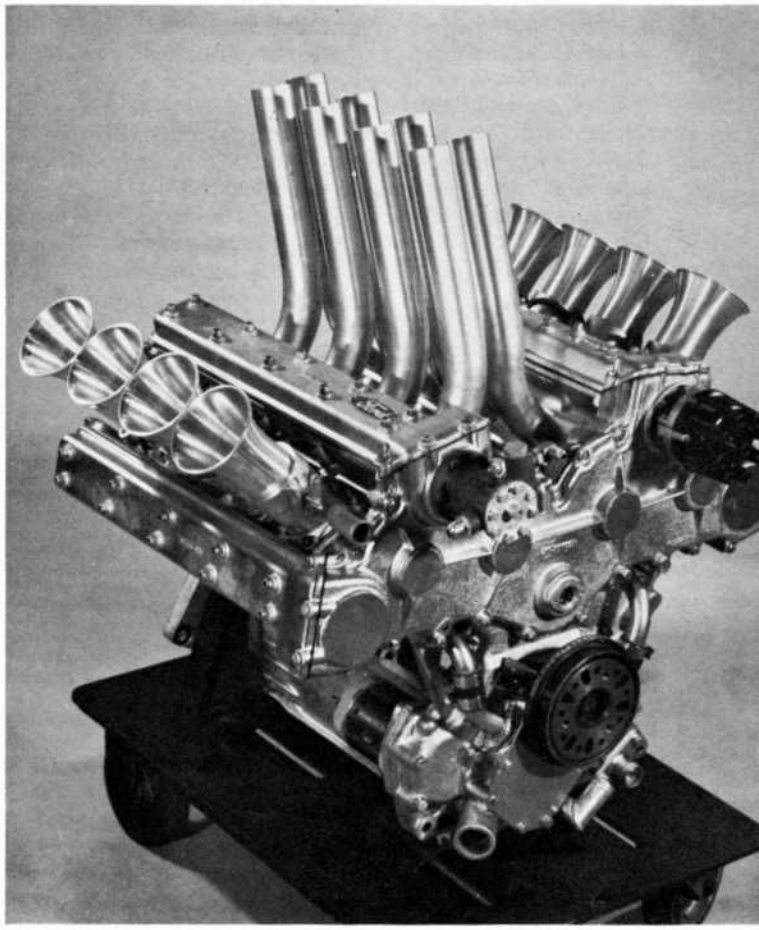
BY ROGER HUNTINGTON

If there is any current American production engine that has a chance of displacing the small Chevrolet V-8 as the standard power in home-built sports cars, hot rods, competition cars and other limited-production high-performance cars, it would have to be Ford's lightweight V-8. It has many of the qualifications necessary to do the job: Light weight, compact size, high rpm potential, space for moderate increases in bore and stroke, a rugged lower end, low price and, very important, a growing inventory of low-cost used parts in the salvage yards. The small Chevrolet has all these ingredients, too, plus a 7-year head-start in the junkyards; but the small Ford is coming on strong.

We see it in wider and wider use every day. Its use in Ford and Mercury production car lines has expanded greatly in the last two years, actually replacing the old 292-cu. in. engine (dating from 1954) as the standard V-8 option in all lines. The Mustang and Cobra sports cars are based on this engine. It's being used as a factory installation in the British Sunbeam Tiger, plus several other limited-production British sports cars (Griffith, etc.). We see the engine in more and more home-built sports cars and hot rods, competition cars, jalopy racers, ski boats. And, of course, there is Ford's official use of the basic design in all-out racing at Indianapolis and on the big sports car circuits of the world. This engine has a promising future in the world of quick cars.

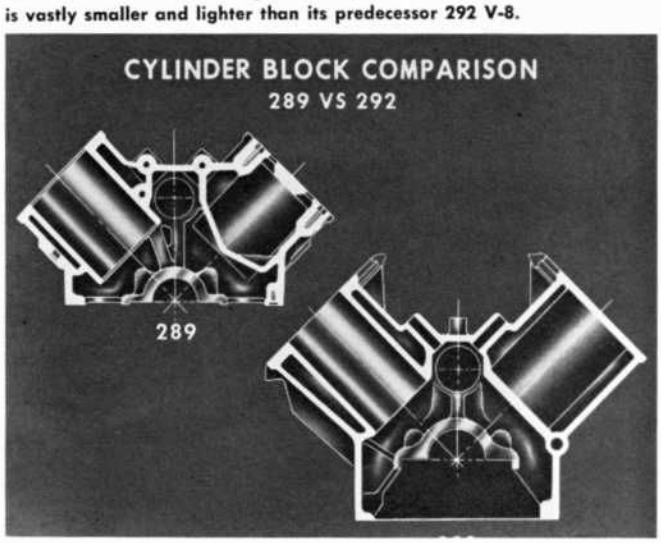
We're sure Ford engineers didn't have any exciting super-performance applications in mind when they introduced the new engine in late 1961 for the new Ford Fairlane and Mercury Meteor intermediate-size cars. The fact is that Ford just about had to have a brand new V-8 engine that was light, compact, economical and had all the latest design improvements. The basic 292-cu. in. V-8 dated from 1954 and was generally obsolete in design features – as well as being too big and heavy to comfortably fit into the corporation's compact cars. The big Ford engine (352-390 cu. in.) was a little more modern, dating from '58; but also was too big and expensive for the lower-priced cars. A brand-new design was clearly indicated.

The new engine was a brilliant compromise between size, weight and cost, and future performance and economy potential. The Ford design team, headed by Bill Gay and George Stirrat of the Engine & Foundry Division, tried to develop a design that could be readily adjusted to fill dozens

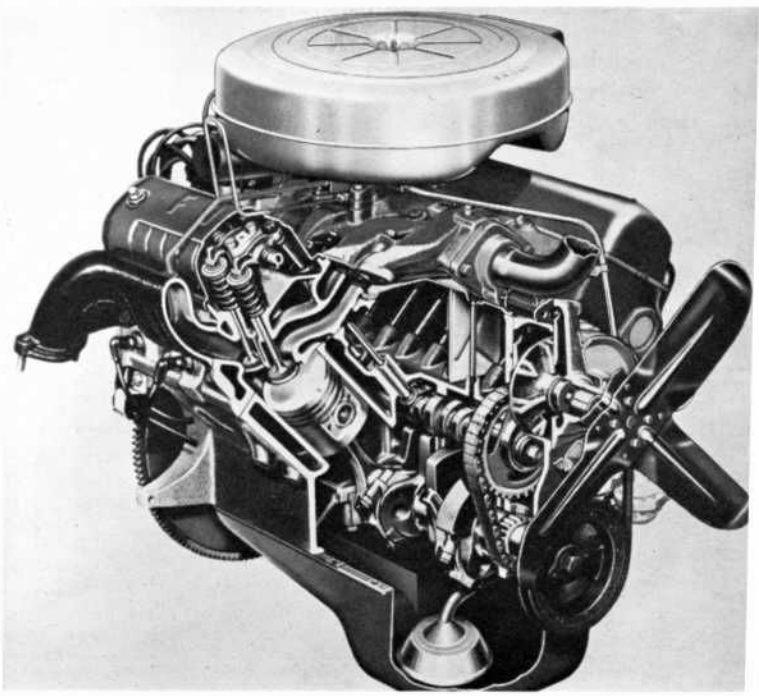


MOST INTERESTING development of the Fairlane-Falcon-Comet-Cobra-Mustang engine is the double-overhead-cam adaptation for Indianapolis.

DESPITE NEARLY similar displacements, the 289-cu. in. Ford V-8 is vastly smaller and lighter than its predecessor 292 V-8.



THE 292 V-8 was Ford's first overhead-valve V-8, had a deep Y-block skirting around crankcase which was to add rigidity.



ENGINES

of widely-varying needs in the next few years. They designed in all the flexibility that they could, while still putting it into a small, light package that could be manufactured in high volume at the lowest possible cost.

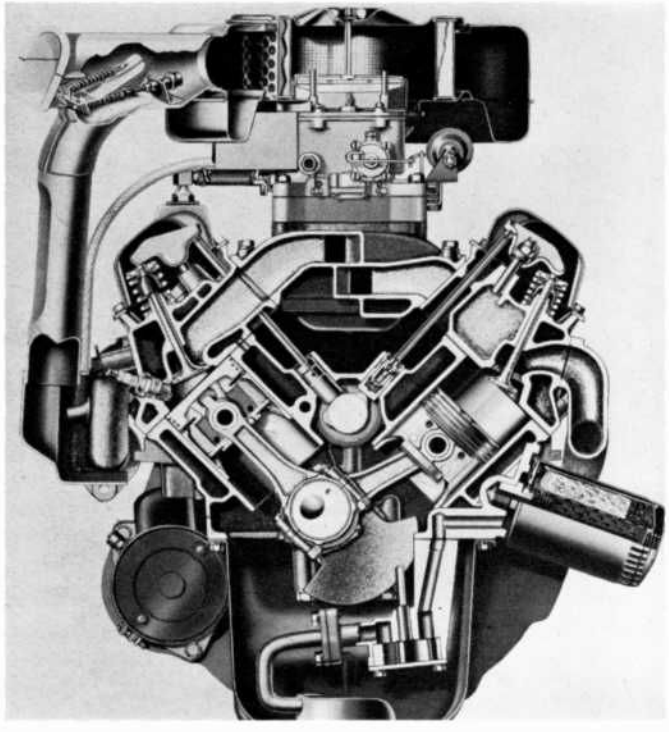
Consider what they achieved: The original 221-cu. in. version of the engine was 6.1 in. narrower than the old 292, 0.88 in. lower in height, and weighed 125 lb. less. (Actually around 450 lb. with accessories, but no flywheel or clutch — which was nearly 100 lb. lighter than the original 265-cu. in. Chevrolet V-8.) The output of the new engine was 145 bhp, compared with 170 bhp for the 292, but fuel economy was better. No official information is available on manufacturing costs, but engineers in on the design say there were dozens of components on the 221 that cost less to make than corresponding parts of the 292.

The remarkable part of this whole picture is that the small Ford engine has since been expanded to 289 cu. in. and 200 bhp (standard configuration) with very little increase in size, weight or cost. Size is about the same, weight is up about 20 lb., and the engineers say costs haven't changed significantly.

The new engine had many important new features. A very low stroke/bore ratio (3.50 x 2.87 in. stroke), plus short 5.51-in. connecting rods permitted a very compact, rigid cylinder block layout with small external dimensions. A bore center span of 4.38 in. gave room for reasonable bore increases with short overall engine length. Actually, the crankcase was so compact that only 70% of the required cranktrain counterweighting could be applied to the crankshaft, because of diameter limitations. The rest had to be applied externally on the flywheel and vibration damper. Then weight was shaved by using modern, thinwall casting techniques for the block and heads. Ford engineers had perfected these methods on the 6-cyl. Falcon engine of 1960. The casting cores are baked right in their boxes, and fewer of them are used, to reduce core distortion and misalignment that require thicker casting walls when using conventional oven-baked cores. Casting weights can be reduced up to 20% by using these thinner walls. This was a big secret of the lighter weight of the new Ford engine, along with the compact dimensions that required that much less material. It was the lightest, smallest "full-size" American automotive V-8 of all time.

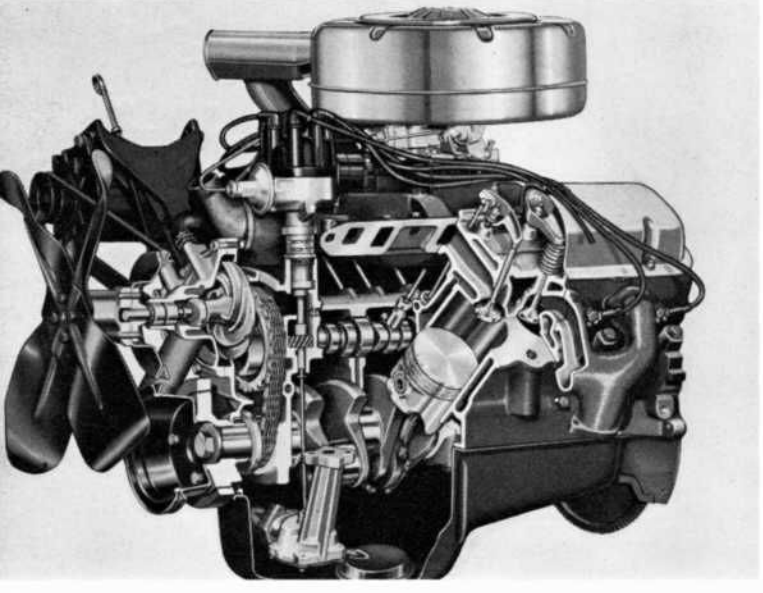
Cylinder heads featured quite conventional wedge-type combustion chambers and fairly hefty valves and ports. Head diameters were 1.59 and 1.39 in., respectively, for intake and exhaust. Integral valve guides were used. Rocker arms were carried on stud-mounted ball-joints, with oil fed to the valve gear through hollow pushrods, similar to the layout used on the Chevrolet V-8 introduced in 1955. An essential difference, though, is that Ford casts its cup-type rocker arms in clusters, while Chevrolet stamps them out. This is a very efficient, economical valve gear design and the reduction in reciprocating mass with the light rockers and hollow pushrods raises the rpm potential.

The intake manifold had several interesting features. Ports

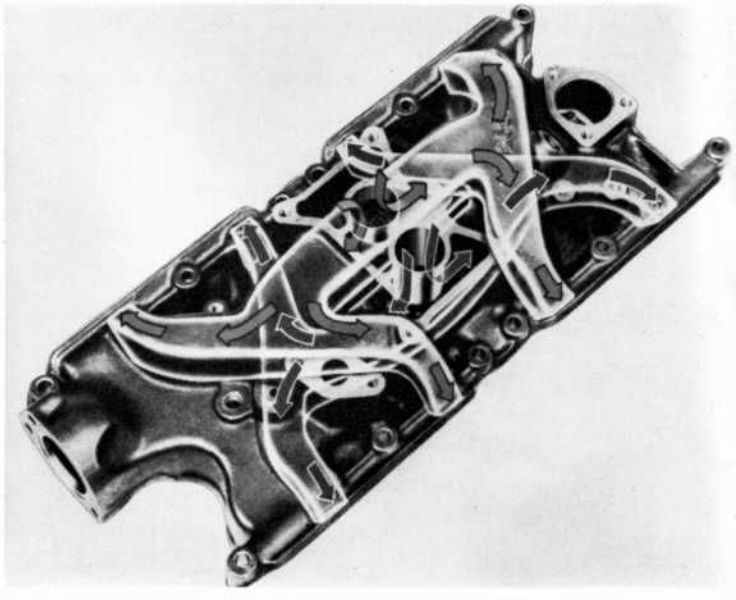


SECTIONAL VIEW of the 221-260 V-8 shows compactness of the overall design. Big bore, ultra-short stroke are featured.

BALL-STUD mounted rocker arms did away with cumbersome rocker arm shafts, were lighter, gave more reliable and efficient service.



EVENLY-SPACED intake ports and balanced, two-plane fuel/air mixture distribution help make V-8s efficient, easy on gas.



were spaced evenly along the length, instead of being grouped in pairs, as is more usually the case, to give even fuel/air mixture distribution. The manifold casting also acted as the cam chamber cover, to save weight and cost. The original plan was to heat the manifold with water instead of exhaust gas, to eliminate the troublesome exhaust heat-control valve. But casting and space difficulties forced Ford to compromise on partial exhaust heat with a water-heated spacer under the carburetor. This arrangement was the source of one of the problems on the early engines. Apparently not enough heat was getting to the proper areas of the inlet tract. Mixture distribution was so poor that the engineers had to enrich the carburetor considerably to prevent stumbling and surging at low speeds. Fuel economy nose-dived. The problem was finally solved by eliminating the water-heated spacer, putting water passages into the upper part of the manifold, and designing a more normal exhaust crossover into the manifold, with fins on the manifold floor below the carburetor to get a larger heat transfer area. Later engines show excellent fuel economy and low-speed response.

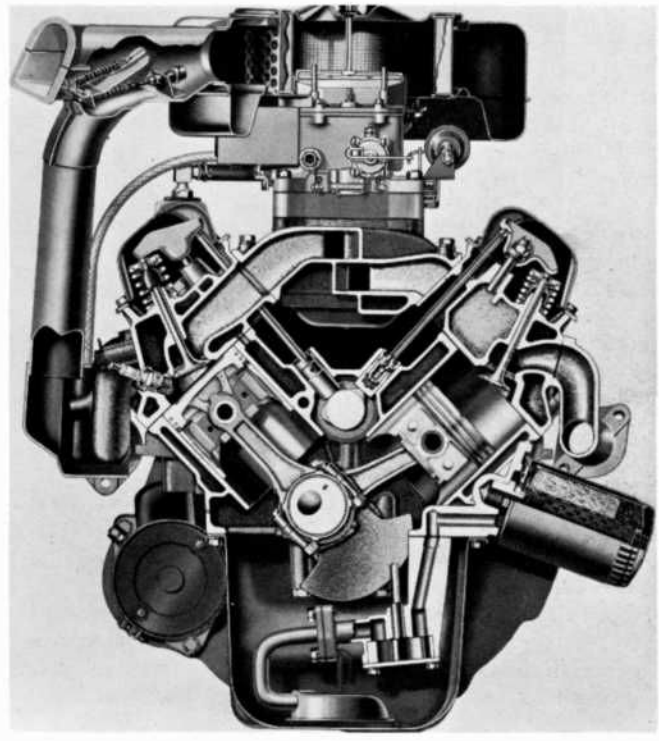
An interesting feature in the water pump was the use of curved impeller vanes, which raised the pump efficiency from 30 to 48% and reduced the horsepower required to drive it at 4000 rpm engine speed from 5.4 to 2.6. The cooling system flowed 60 gal./min. at 4000 rpm. Very efficient system.

This is the engine that went into the Fairlanes and Meteors in 1962 and has since been adapted for the Falcons, Comets, full-size Fords and Mercurys, plus the Mustangs and Cobras. It is undoubtedly one of the most technically-advanced V-8 designs on the American market.

Needless to say, power development started almost before the original design went into production. Even in '62 a larger-bore (3.80 in.) version was offered as optional equipment, with 260 cu. in. and rated 164 bhp at 4400 rpm with 2-throat carburetor and 8.7:1 compression. About this time Carroll Shelby started investigating the 260 engine for his Cobra project. He used the English AC Ace body and chassis, with the small Ford engine feeding to a Warner T-10 4-speed. At that time Ford wasn't directly involved with Shelby, other than the agreement to sell him standard 260 engines for installation in his converted sports car. But Shelby did some wild development on this engine in his own laboratories that triggered a lot of interest among Ford engineers.

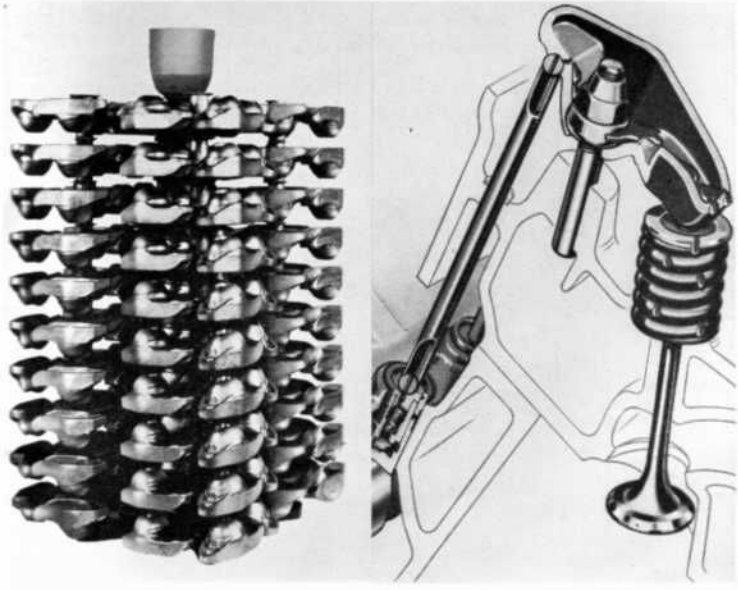
For instance, for his original 1962 Cobra prototype, Shelby used the 260 engine, but hopped it up with bigger valves and ported heads, 9.2:1 compression, hot solid-lifter cam, and a 4-barrel carburetor on his own manifold. He rated the combination at 260 bhp at 5800 rpm. But that must have been conservative because *Road & Track's* road test of the 260 prototype showed a 0-60 mph time of 4.2 sec., and the quarter-mile in 13.8 sec. at 112 mph terminal speed. It reached 153 rpm on the Riverside Raceway straightaway, with more acceleration left! The combo could rev easily to 7200 rpm. Furthermore, this was only Shelby's first stage of tune. He also offered an all-out 260 engine with hotter cam and dual-throat side-draft Webers on special ram intake stacks. He claimed 325 bhp for this one and no one had any reason left to doubt it.

Needless to say, the developments didn't go unnoticed at

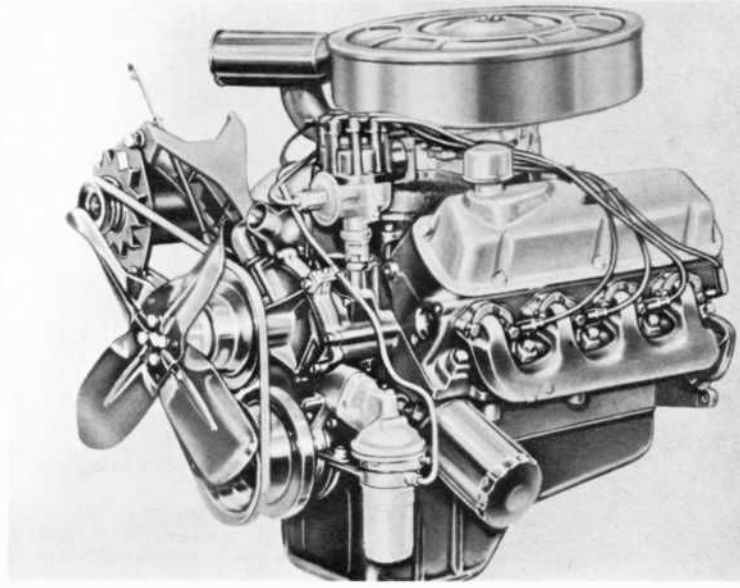


289 CU. IN. section looks virtually identical to 260, but narrowed water jackets surrounding bore are tip-off to its larger size.

ROCKER ARMS are cast in clusters to lower unit cost. Arms are mounted on pressed-in studs, lubricated through hollow push-rods.



ALTHOUGH 289 looks identical to 260 externally, it has heads with larger ports and valves, increased compression, 4-in. bore.



ENGINES

Ford Engineering. The professional engineers immediately went to work on a high-performance version for optional use in '63 Fairlanes, and possible later use in Falcon and Comet compacts. They first increased the bore to 4 in., retaining the original 2.87-in. stroke, to give 289 cu. in. The heads were re-designed with larger valves and ports, compression was raised to 10.5:1, a hot solid-lifter cam was adopted, a new cast-iron manifold carried a large 4-barrel carburetor, new streamlined exhaust headers were developed and the lower end was beefed up with special bearings and stiffer rods. They rated the combination 271 bhp at 6000 rpm. Apparently, the actual usable bhp wasn't any greater than Shelby's own 260 variation, but the extra cubic inches gave more low-end torque. This one could rev to 7000 with its solid lifters and it made a smooth, reliable, high-performance street engine for Ford's lighter cars. This engine is now very popular among the Mustang buyers.

It was just about this time, in mid-1962, that Ford officials began to think seriously about attacking the Indianapolis scene with a modified Fairlane pushrod V-8. Shelby's success with his Cobra modifications, plus the dyno-room experiences of Ford engineers while developing the high-performance 289, indicated that the basic design might have some really high specific output figures with decent reliability – with a little concentrated engineering and some special parts. This was also the time that Ford was starting its "Total Performance" campaign to attract the youth market, and the Indianapolis idea seemed like a good way to push this along. Also, Colin Chapman of British Lotus racing car reputation, was available to design and build the cars, procure the necessary drivers and manage the team. This would relieve Ford of any responsibility other than the engines. The idea looked better and better. By October, 1962, the project was full steam ahead to put two Lotus-Ford racers in the 1963 500-mile race.

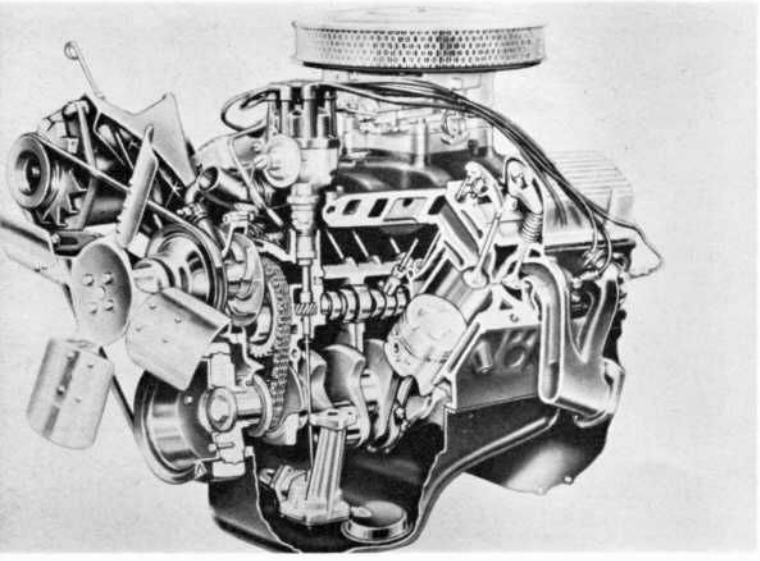
Ford's basic objectives on that first Indianapolis engine were: 1) Run gasoline fuel and make only one pit stop; 2) Use carburetors in place of fuel injection, to further promote the passenger car image; 3) Limit engine weight to 350 lb., to fit in the small Lotus cars; 4) Use battery ignition instead of magnetos; and, 5) Develop a minimum of 325 dependable bhp from the maximum 255 cu. in. allowed at Indianapolis.

Of course, dozens of vital changes had to be made on the 260 Fairlane engine to adapt it for Indianapolis. Essentially, the block and heads were cast in aluminum, with steel cylinder sleeves and valve seat inserts and O-ring type gaskets around the bores. The heads had larger valves and modified port passages developed through special flow studies. A special forged crankshaft was used (made from an experimental forging die for a truck crank) and stock connecting rods were shot-peened and polished to relieve stress raisers. Forged pistons gave 12.5:1 compression. The lower end was further modified with a dry-sump lubrication system, large magnesium oil pan, cross-drilled crankpins, overplated copper-lead bearings, and the chain-cam drive was changed to all gears to drive the cam, oil pumps, distributor and water pump. This latter change required entirely new magnesium front cover castings.

There were interesting valve gear modifications. The original stud-mounted ball-joint rockers proved inadequate, as the studs would break or strip and the ball-joints would gall under the necessary 8000-rpm speeds and 450-lb. spring tensions. Eventually they had to revert to conventional cast rocker arms on rocker shafts, with flat lifters on a very hot, 0.51-in. lift cam. The induction system consisted of four dual-throat 58-mm Webers (downdraft) on a special ram-type manifold. Transistor ignition by Autolite was used.

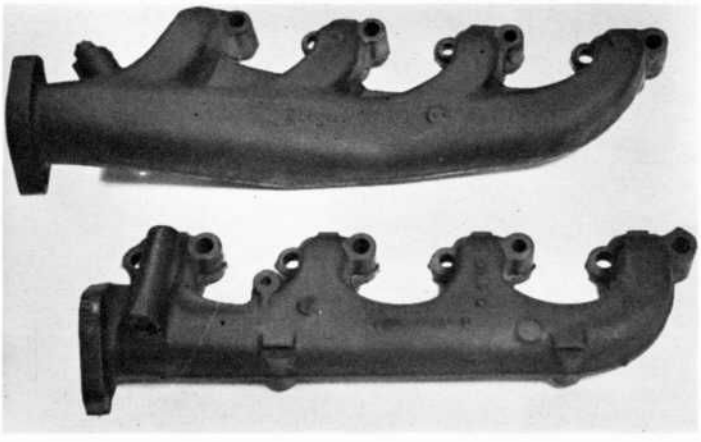
It's history now that Ford engineers achieved their goals with horsepower to spare. The '63 race engines developed 376 bhp at 7200 rpm on 103-octane gas and weighed 343 lb. without the exhaust stacks. They could turn 7500 rpm easily and run at 7000 all day. Driver Jim Clark finished second in the race, behind Parnelli Jones, in the controversial "dropping oil" incident. But it was a moral victory, very encouraging to Ford officials, and certainly successful in impressing the youth market. It is also interesting to note at this point that Ford engineers predicted the maximum lap speed of the Lotus-Ford race car within 0.5 mph by programing the acceleration and braking on a computer, using known Lotus performance figures with dyno power curves of the engine. They also ran several 500-mile races right in the dyno room, by programing the dynamometer to change load and speed in a pre-set pattern to simulate the engine operation over one lap, then running the program 200 consecutive times. The engineers were pretty sure before the engine ever went out on the track that it could run fast for 200 laps without breaking anything. This is the kind of thing that can be done when the big companies take an interest in racing. It might not be so good for racing . . . but it makes fascinating technical reading.

Ford officials were so encouraged by the '63 Indianapolis results that they decided to go all-out with a more complete-



HIGH PERFORMANCE engine for Mustangs is 271-bhp variation on the 289 theme. Compression is 10.5:1, it has hot cam, solid lifters.

STREAMLINED 289-HP header (top) has far better gas-flow characteristics than the stock 260 header (below).



ly-modified Fairlane engine for the '64 race. The immediate goal was set at 425 bhp on gasoline without exceeding 400 lb. engine weight, and with the ability to sustain at least 8000 rpm for the full 200 laps if necessary. Everyone knew this meant new double-overhead-cam cylinder heads, to get the necessary port and valve area and reduce valve gear reciprocating mass for that high rev range. It was felt that most of the lower-end parts could be retained from the '63 engine, since there was no sign of any serious weak spot at speeds up to 7500 rpm. Accordingly, they kept the '63 block, lubrication system, forged crank and main caps. However, they designed entirely new connecting rods with stiffer shanks and larger pins, new forged pistons with domed tops to fit the new heads and they adopted special micro steel-backed copper-lead bearings that could withstand 10,000 psi bearing pressures.

The new dohc head design was very interesting. Ford engineers decided on four valves per cylinder instead of the usual two, to reduce valve weight and allow better exhaust valve cooling by having a smaller diameter (the ability of a valve to dissipate heat drops swiftly as the diameter goes up). Many different port configurations were studied. The final design was influenced a lot by space considerations in the small Lotus cars. What they did was to core the intake ports down through the heads between the cam towers, then bring the exhaust ports out toward the center of the V. This put the carburetion components in a more accessible location and allowed a greater flexibility of exhaust system design because the stacks came right out above the engine. (Exhaust ports on the outside of the heads would have been an unworkable situation.) The four overhead camshafts were driven by a complex train of 14 spur gears on ball bearings in new magnesium front cover casting; noisy – but completely reliable.

On the early dohc engines, Ford engineers tried to stick with Weber carburetors to help promote the passenger car image. But it soon became obvious that Hilborn fuel injection would not only give better upper range breathing, but the system required less space and blended into the car body contours better. However, it is well known that the Hilborn f.i. was designed primarily for alcohol fuels that don't require sharp control of the fuel/air mixture ratio over a range of loads and speeds. To get the system to work well with gasoline, Ford engineers had to modify it with dual economizer valves and a secondary by-pass – to prevent loading up on the overrun and to give quicker throttle response coming off the corners. When these things were worked out they had a very efficient fuel feed system for Indianapolis use.

And they certainly got the power. After the project was well under way it was decided to qualify the cars on methanol fuel and race on 103-octane gas. The peak outputs were about 425 bhp on gasoline and 475 on alcohol, both at 7800-8000 rpm. The cams were designed with 306° duration and 87° overlap, to bring in the maximum torque around 6500 rpm where the cars came off the turns. Most of the mechanics geared to hit around 8000 on the straightaways, though A. J. Watson geared for a peak of 8800 rpm for qualifying on Ward's car. There were no problems in these high rev ranges after an early weakness in the con rod bolts was pinpointed. Incidentally, the new dohc engine just made the 400-lb. limit; it weighed 396 without the exhaust tubes.

The 1964 Indianapolis race itself was full of problems for Ford. Some of the most promising Ford-powered cars went out with troubles not related to the engine. Bobby Marshman ran off the track and knocked off a drain plug. Eddie Sachs was involved in a fatal crash. Both the official Ford-Lotus cars were eliminated by tread chunking on the British Dunlop tires that team manager Chapman had elected to use. Rodger Ward managed to finish second behind A. J. Foyt, after making five pit stops for fuel. The night before the race, contrary to Ford orders, A. J. Watson had switched his injectors to methanol fuel. Apparently the metering goofed up somehow, because Ward was only getting 3 mpg in the race, and it very nearly cost them second place.

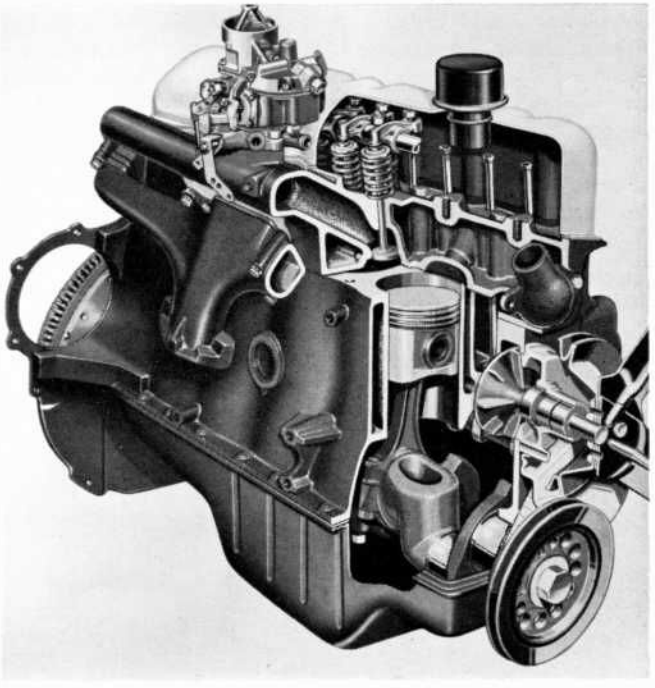
Obviously, Ford officials weren't too discouraged, because they are building 50 of these dohc engines for the '65 race and offering them through Meyer-Drake to all comers at $15,000 each. One of them just has to win – about half the cars will have them.

There has been other significant performance development of the small Ford V-8, too. For one thing, Carroll Shelby has "frozen" specifications on a line of special speed equipment and now produces it in volume for distribution through Ford dealers under the Cobra label. This makes the stuff legal for production sports racing and for the Factory Experimental classes at the dragstrip. He has everything from mild street cams and reworked heads to $1200 Weber carburetion systems. More than one all-out Cobra-equipped 289 is pulling well over 400 horses at 7000 rpm. We recall Doug Nash hitting 121 mph trap speed on the dragstrip with a 289 Comet that weighs nearly 2700 lb., and that certainly takes more than 400 bhp.

Furthermore, the California speed equipment industry has jumped onto the Fairlane wagon. You can get about any piece of speed equipment you want for this basic engine and more is coming out every day. Mickey Thompson manufactures a complete line, including GMC supercharger kits. Admittedly, the engine is far from displacing the small Chevrolet V-8 as the standard in light competition cars, but it's making progress. Pete Robinson of Atlanta, Ga., runs a blown Fairlane-powered gas dragster that weighs less than 1000 lb. and regularly turns e.t.s in the mid 8s at 175 mph. He turns 8000-9000 rpm in the traps, even with pushrods.

Yes, it's a great little engine with a big future ahead of it. The dohc version has a firm place in American big-time racing and the speed equipment industry will assure the basic pushrod engine a lasting place in hot rodding. And with the all-out sports-racing versions of the Cobra and Mustang (GT-350) coming on strong, we can be sure that factory engineers won't be forgetting performance development right away.

FIRST MUSTANG engine was this 170-cu. in. 6-cyl. ohv unit from the Falcon-Comet line. It was later dropped for 200-cu. in. Six.



GEARING THE MUSTANG

BY ROGER HUNTINGTON

Getting the right transmission and rear axle gearing in any car is just as important as getting the right combination of engine and chassis equipment. It can have a tremendous influence on the overall performance, flexibility and economy of the car.

Of course, we should point out right here that we have great faith in the ability of factory engineers to choose optimum gearing combinations. We can't go far wrong with the standard gearing that comes with a given car model; it is selected only after a lot of study and testing. But standard gearing must necessarily be a compromise, to cover varied driving requirements. This chapter is to help the buyer possibly select different, non-standard gearing combinations for special requirements in his Mustang. He still has to sacrifice here and there; but he may be able to get more of what he wants by sacrificing more of what he doesn't care about.

In the first place, even though we have the usual wide choice of transmission options in the Mustang, we have no optional gear ratio combinations for factory-installed transmissions. Only the standard gearsets can be installed on the production line. Here are those standard transmission ratios for the different engines:

MUSTANG TRANSMISSIONS

	200 1V Six (120 bhp)	289 2V V-8 (200 bhp)	289 4V V-8 (225 bhp)	289 Hi-Perf. (271 bhp)
3-speed, all-synchro	2.76	2.79	2.79	n.a.
	1.69	1.70	1.70	n.a.
	1.00	1.00	1.00	n.a.
4-speed, all-synchro	3.16	2.78	2.78	2.36
	2.21	1.93	1.93	1.78
	1.41	1.36	1.36	1.41
	1.00	1.00	1.00	1.00
Automatic 3-speed	2.46	2.46	2.46	n.a.
	1.46	1.46	1.46	n.a.
	1.00	1.00	1.00	n.a.

As mentioned, no optional gearsets are available for any of these transmissions that can be installed to special order on the assembly line. However, in some cases there are interchangeable gearsets used by other Ford Motor Co. models that could be dealer-installed after the car is delivered. Of course this would be an expensive change because of the high labor cost, even assuming we could get full credit on the standard gears returned (which isn't always the case). But, if it's worth it, here are some of the possibilities:

For the all-synchro 3-speed V-8 transmissions we could substitute the closer-ratio gearset used with the bigger engines in the big Fords. This set has a low ratio of 2.42 and 2nd gear of 1.61. The initial jump off the line would suffer a little with the faster low gear, but the closer ratios – especially with synchro on all three gears, and even more so with handy, floor-mounted shifting lever – would be nicer for fast cornering and accelerating on twisty roads. As a general rule for fast road work, the closer the ratios the better, whether it is three speeds or four. But, of course, initial acceleration suffers. Close ratios are only good above about 20 mph. If we want to be competitive in the traffic light Grand Prix we'd better keep the standard ratios!

Six-cyl. Mustangs ordered with 4-speed get Ford's British-built "Dagenham" design as used on Zephyrs. The ratios listed are the only ones available for this box. The 225-bhp V-8 uses Ford's new 4-speed for the big cars, but with wider gear ratios to allow for the lower torque of the 289-cu. in. engine. We could substitute the big car gearset in this box to get closer ratios of 2.32, 1.69 and 1.29. But, caution: Do not try to use these close gears with the standard 2.80 and 3.00:1 rear axle gears that come with the 200 and 225-bhp engines in the Mustang. The combination would be pretty sick off the line. There's not enough overall torque multiplication in low for this combination of cubic inches and weight. We should use these closer gears only if we go up numerically in axle ratio. In this case they would be preferable to the standard ratios with 2.78 low.

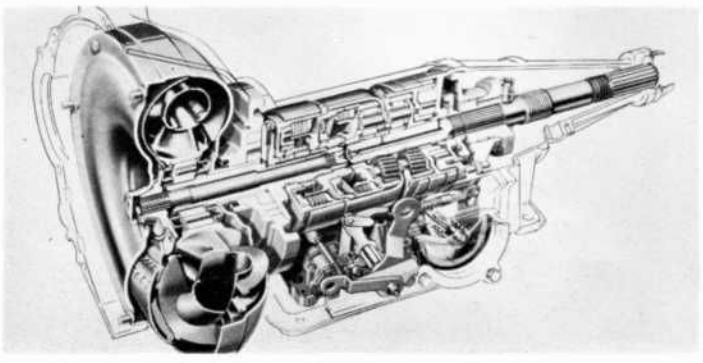
As this is written Ford is installing the Warner T-10 4-speed in Mustangs ordered with the 289 high-performance engine (271 bhp). Apparently, it's more a matter of inadequate production capacity for the new Ford 4-speed than anything else, since the new Ford design seems to be stronger for a high-output engine. (Ford is using the T-10 in some other high-performance models that are produced in small quantities.) Anyway, there are several different interchangeable gearsets available for the T-10. There wouldn't be any point in going to wider ratios. However, the B-W people produced a few special gearsets for Fairlane and Galaxie drag racing models in 1964 which had ratios of 2.36, 1.66 and 1.23. They're expensive – but they're an interesting possibility.

It should be mentioned at this point that a few 1965 Mustangs with the 289-4V engine are coming through with T-10 transmissions, using the same gearset as the high-performance jobs (2.36 low). These models could also use that Warner close-ratio gearset, but we would advise it only for drag racing with higher axle ratios. It wouldn't be a good combination with the standard 3.00:1 axle gears.

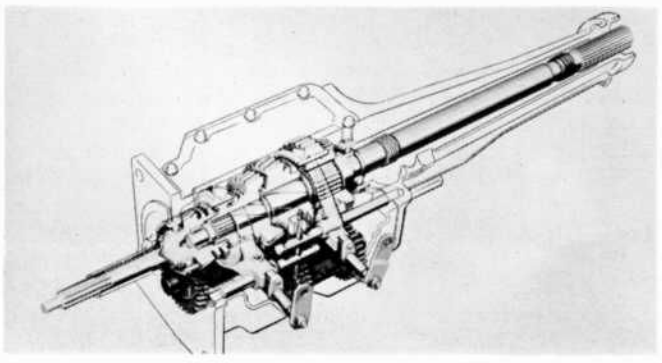
For Mustangs equipped with the Cruise-O-Matic 3-speed and torque converter, there are no variations possible in transmission ratios.

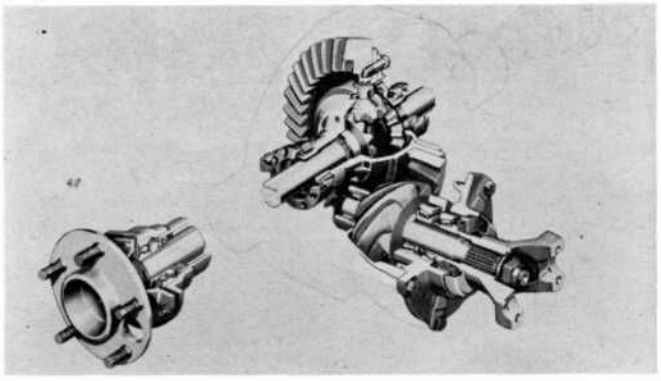
Now to axle gears. Actually, there are no optional assembly-line ratios for any of the 1965 Mustang engines except

CRUISE-O-MATIC transmission used in Mustang has three forward speeds and torque converter. It is smooth and utterly reliable.

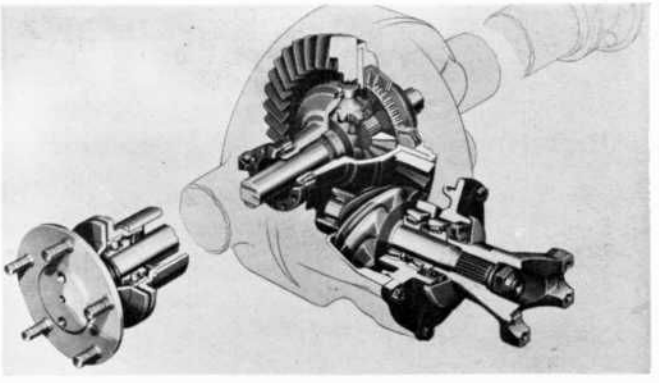


THREE-SPEED manual transmission is the Ford-designed box with 2.79 and 1.70 gears, synchronous meshing on all forward speeds.





MUSTANGS with non-HP 289s get standard Fairlane rear axle components; 289-HP gets big Ford Galaxie 8.75-in. ring gear.



LIMITED SLIP differential is available for all V-8 equipped Mustangs, including Galaxie-axle HP.

the 271-bhp high performance. The standard ratio is the one we'll have to be satisfied with unless we arrange for dealer installation of a different gearset. Here are those standard ratios, all of them available with limited-slip differential, at extra cost:

	3-speed	4-speed	Automatic
200 IV Six	3.20	3.20	2.83
289 2V V-8	2.80	2.80	2.80
289 4V V-8	3.00	3.00	3.00
289 High Perf.	3.89	3.89	n.a.

The optional assembly-line ratios for the high-performance 289 engine are 3.50 and 4.11. Neither is listed as being available with limited-slip, but these gears are available with this in certain Galaxie models, which have interchangeable rear axles, so this should be a simple dealer installation.

We have to remember here that there are three distinct rear axle assemblies used with various engines in the Mustang. The Six used the light Falcon axle, for which Ford makes gearsets of 2.83, 3.20 and 3.50 ratio. Any of these gears could be dealer-installed with any transmission if the car was originally built with the 6-cyl. engine. Mustangs carrying the 289 2V or 4V V-8 use the standard Fairlane axle, which is considerably stronger and heavier than the Falcon. Ford parts books list these gearsets for this axle: 2.80, 3.00, 3.25, 3.50 and 3.80. Any of these could be dealer-installed from mass production parts. All are available with limited-slip.

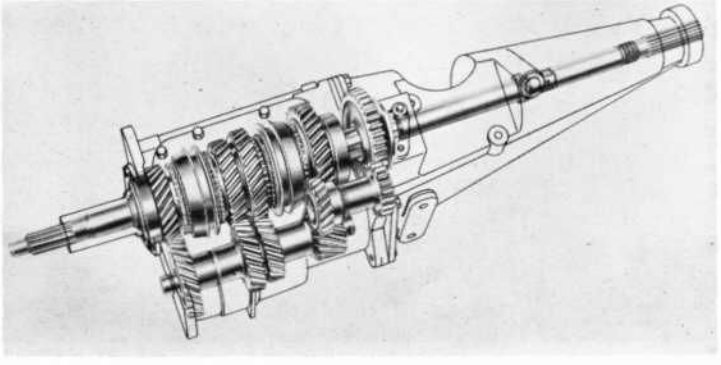
Now the high-performance 289 Mustang uses big Ford Galaxie rear end with the 8.75-in. ring gear (but with narrowed tread width). The parts book lists the following gearsets for this axle: 3.00, 3.25, 3.50, 3.89, 4.11. Just recently Ford has added a mass-produced 4.57:1 gearset that will bolt right into this center section. These new 4.57 gears would be just about right for the dragstrip. And, if we want to go even stiffer, Ford makes a special heavy-duty version of this axle, with larger side bearings, ring gear bolts and 4-pinion differential. Ford has racing gearsets all the way up to 5.83 ratio for this axle. These gears would fit the standard Galaxie center section by sleeving out the bolt holes and grinding for clearance around the differential case on the ring gear. It's a straightforward machine shop job. Many have done it.

We won't go into detail on specific recommendations for gear ratio changes, as the basic principles of wise gearing are pretty well known. If a lot of our driving is on the open highway, we'll like a numerically lower ratio. Mustang fans say the standard 2.80 gears with the 2V V-8 are wonderful on the road. But we should always remember that we need a transmission ratio near 3:1 in low gear to get off the line with these low axle gears, so we don't have to use excessive clutch-slipping. Never try to use these low axle gears with close-ratio transmission gears. On the other hand, we can use a numerically higher gear if most of our driving is at medium speeds around town. The 3.50 and 3.89 ratios are nice here. These also can be used with close-ratio transmission gears. This is the best combination for fast driving on twisty country roads with lots of hills, curves and 2-lane conditions. The close-ratio transmission gears not only are nice for acceleration for 20 mph up, but they're better for downshifting to use the engine for braking.

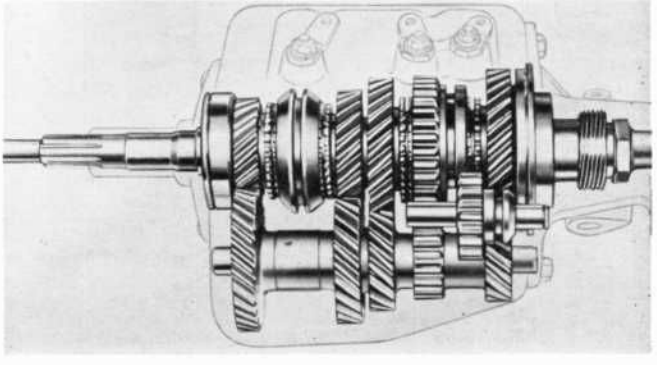
In our opinion the 4.11 gears are strictly for the man who is willing to sacrifice plenty for maximum acceleration and response. We don't like them in everyday driving, even around town. But many of our friends do – they wouldn't be without their "4.11s" in any utility car they own! Suit yourself. Of course, the 4.57 gears are strictly for the dragstrip. The engine whine, vibration and poor gas mileage are objectionable even in city driving. But this ratio is definitely needed for the quarter-mile. Many fellows have tried to compromise with 4.11 gears for both street and strip, and have been disappointed. We've yet to see a dragstrip winner that made a nice street machine!

One final word: Don't forget tire size in the overall gearing problem. A smaller tire requires a numerically lower gear ratio to give the same relationship between engine rpm and road speed. In other words, 3.50 gears with a 13-in. tire are about like 3.89 gears with 14-in. This is why the Falcon axle only has ratios up to 3.50. Keep this in mind.

WARNER GEAR T-10 4-speed is being installed in the HP Mustangs, some other 289s. It offers wide selection in transmission gearsets.



ENGLISH FORD 4-speed is used with Mustang Sixes, has wide-spread ratios to provide suitable performance.



THE CUSTOM MUSTANG

GOOD EXAMPLE of what custom treatment can do to improve the character of a car is Hurst Products' Mustang. Utilizing Hurst's new wheels, a blanked grille backed by driving lights, it comes out strong and purposeful.

The Mustang lends itself well to custom treatment, whether it be merely a set of different wheels, a super-tuning treatment for the engine or a whole carload of extra accessories. And, with the wide variety of equipment readily available through parts stores, mail-order houses and new car dealers, the Mustang owner should have little trouble in creating an outstanding car.

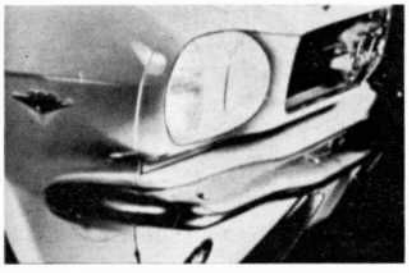
One of the joys of customizing a car is selecting equipment and modifications to fit a precise purpose. Obviously, the car's manufacturer can't satisfy everyone's tastes, so this is where the custom equipment comes in handy. For instance, look at the Hurst Hustler: A vehicle primarily to show off *Hurst Custom Forged Wheels*, it indulges minor customizing in the "improvement" category. The grille center section has been removed, leaving bare the nice black mesh screen backing. A pair of high-intensity driving lights has been installed behind the screen, between it and the radiator shroud, to provide the additional lighting needed for high-speed driving. A streamlined, racing type outside mirror has been substituted for the normal mirror and, that's all. But look – the car emerges as a simple, purposeful, distinctive, one-of-a-kind vehicle. Mr. Hurst will never misplace it in a crowd.

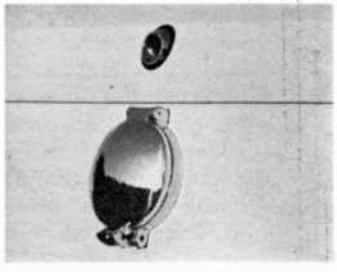
Andy Hotton Enterprises goes another step for its *2+2 Night Rally Kit*, offering a completely new below-bumper splash shield of heavy-duty fiberglass which has recesses in it for a pair of driving or fog lights. The kit requires no alterations to remaining sheet metal and comes in primer so that it may be painted to match the car. At $49.95, it includes the lights.

When the stock Mustang grille bars are removed, a gap appears between the ends of the lower trim pieces. EELCO makes a fixer for it, the *Mustang Bull Nose*, Part No. 3540, $2.95, which deftly covers the spot. Other EELCO custom components for the Mustang's snout are a pair of wire-mesh headlight grilles (No. 3533), $11.95 per pair, which are chrome-plated and attach by sheetmetal screws; and, a plain chrome bar grille replacement (3542), at $8.95. EELCO also makes a rugged, die-cast, flip-top gas tank cap which is theft-proof and highly decorative (No. 3532), $15.95.

Headlight covers of aerodynamically-shaped plexiglas are

2+2 NIGHT RALLY kit from Andy Hotton adds driving lights.

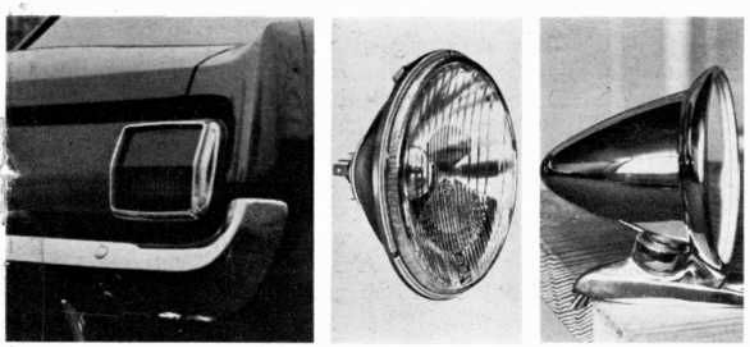




HEADLIGHT COVERS of plastic from Weiler; right, EELCO's gas cap. GRILLE BAR and bull nose pieces from EELCO.

Goodies 'n' Things To Create the Personal Carriage

VERTICALLY-BARRED "Elegant" grille from Products d'Elegance is an easy, 20-min. swap for the standard Mustang trim.



BIG EYE taillights from MAC; EFPE's Cibie lights; Speedmaster mirror.

NO. 803 Grille, license filler and fog lights from MAC.

DRIVING LIGHT kit from Rallye Engineering; Berry Plasti-Glass parts.

manufactured by Weiler Products Co. These *Plexiglas Headlight Covers* sell for $9.95 per set, which includes installation materials.

Those racy looking, teardrop-shaped outside rearview mirrors are available from Racing Safety Equipment Inc. The *Sport 3004 Speedmaster Mirror* is top-mounting and can be installed in less than 3 min. The shell is chrome plating over brass and the 4.5-in. lens may be ordered either convex or flat. Price is $7.95 each.

Rallye Engineering makes a driving light installation that looks simple and efficient, and charges only $25.95 for the twin lamps, a toggle switch, fuse and wiring. The lights have a power rating of 100,000 cp and give a usable range of ⅝ to ¾-mile. Those interested in the *Rallye Driving Lamps* should check their state regulations before ordering, as some states do not allow such powerful units.

Another potent highway-lighter is the *Cibie High Speed Driving Lights* conversion kit offered by Efpe Co. These replacements have 80,000 cp in high beam, have a dazzle-free no-glare low beam. They draw 4 amps, and cost $18.95 per pair. Efpe also sells an iodine-quartz rally lamp of 200,000 cp which burns a half-mile hole through any darkness, as well as offering other Cibie driving and fog lamps.

A really complete line of outside and inside custom equipment is offered by Mustang Accessories Co. The list includes three custom grilles for the front (and one for the rear), walnut inlays for dash panel and glove box door and console, headrests, foglights, electric trunk openers, tonneau covers and wood-rimmed steering wheels. MAC's *No. 804 Grille* is constructed of heavy chromed steel, fits into the regular grille opening and costs $59.95; a less-expensive similar grille in polished aluminum will be available later. No. 815 grille molding filler ($1.95) fits over the gap left when the stock grille is removed and is included with all MAC custom grilles. A rear grille, which matches the No. 804 front grille, converts the Mustang tail to the "Grand Prix" look, and costs $32.50.

An alternate treatment for the Mustang taillights is the MAC *Custom Tail Light* bezel (No. 830, $8.95 per pair), which simply screws into place and gives a "big eye" look. These bezels can be used as the basis for several interesting variations. MAC makes a Ferrari-type grille (No. 803, $59.95) in chromed steel, also offers it at a lower price in polished aluminum. Shown with the 803 are the No. 812 CRL fog/running lights ($37.50 per pair) which fit into the front pan with minor cutting and can be had with either clear or amber bulbs, and the license indentation filler (813, $6.95) which covers the license indentation when a plate is not required. It bolts on but can easily be leaded or 'glassed over for the slick look.

A grille of different flavor is made by Products d'Elegance. Its *Mustang "Elegant" Grille* costs $29.95 and fits directly into the stock opening. Of flat, vertical bars, it is chrome-plated for looks and durability. The kit includes a lower-molding gap cover. It installs in 20 min. or less.

Mustang high-performance, lightweight components are made by *Berry Plasti/Glass*. Berry's fiberglass parts include front and rear bumpers (3-4 lb. each, $21), hood in either stock or high-riser form (16.5 lb., $98), or custom hood with air scoop (17 lb., $112). Fenders weigh 6.5 lb. each ($68) while the trunk lid is 11 lb. and $83. Berry is also making a fastback hardtop for the convertible and fiberglass doors which will be available at a later date. A vinyl tonneau cover costs $50.

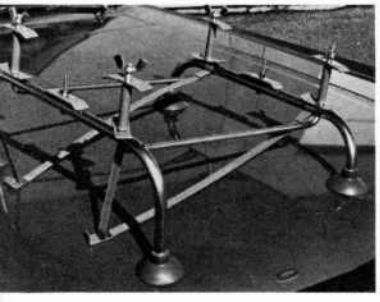
Robbins' *Mustang Tonneau Cover* is custom-styled and has a heavy-duty, center Talon zipper, a custom-fitted steering wheel pocket and Robbins' exclusive full-length zipper guard which protects dash and upholstery from zipper scratches and prevents rain from seeping through the zipper teeth. Hand-made to individual orders, the Robbins' tonneau cover comes in black, tan or white double-textured vinyl ($67.50) or black or white single-textured vinyl for $57.50.

The Custom Mustang

MUSTANG MUKLUK car cover by MG Mitten.

CANELL Type A Ski Rack.

WEATHERGUARD cover from Vilem Haan.

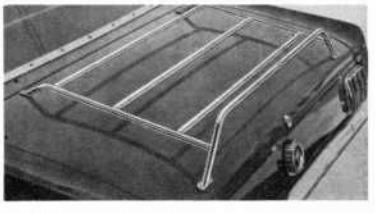


AMCO Ski Rack fits on back.

RACK offered as Ford Option.

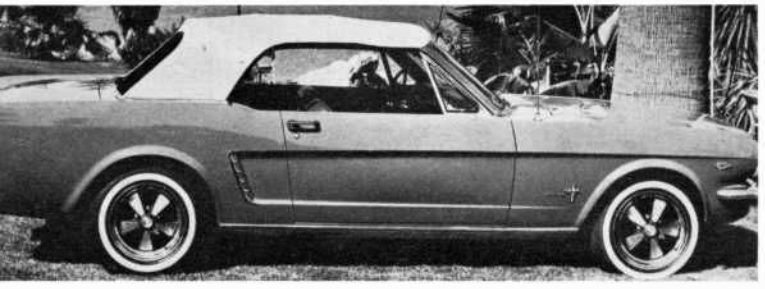
TONNEAU cover from Robbins.

DECK luggage rack by Canell.



AMCO rear deck luggage rack.

MAG-TYPE custom wheels (DBR-800-M) by Wheel Corp. of America.



Complete car covering, obviously water and girl-proof, can be had from Vilém B. Haan, the sports car accessory impressario. Tailored for the Mustang, the *Weathergard Cover* is 100% waterproof with a live rubber coating reinforced by cotton material. Its silver finish reflects the sun and keeps the car cool. It carries a 24-month guarantee against cracking, peeling or shrinking. Haan's water-repellent *Sungard Cover*, $31.95, is silicone treated and fully washable.

Amco's *Mustang Luggage Rack* bolts on easily and nearly triples luggage capacity. Constructed of heavy-gauge tubular steel, it is finished with three separate coatings of chrome plating to assure long-lasting protection from the elements; $29.95. Amco also makes a slick 2-pair ski rack for the Mustang which carries skis longitudinally along the rear deck. Also triple-chrome-plated, it mounts on suction cups on the lid and is held in place by clips and straps.

Ford dealers offer a different type of ski rack, one that carries skis laterally across the rear deck. However, the *Mustang Option Rack* handily converts into a luggage rack when the "quick-change kit" ski clamps are removed. The complete rack may either be permanently mounted, or mounted with spring-locked rubber-coated clamps for quick attachment or detachment.

Canell Company's *Type A Ski Rack* is the more conventional roof-top variety and features built-in cylinder locks and push-button bar releases. It holds six pairs of skis and has provisions for adding pole-carrying fittings. List price is $34.95. Canell also makes a *Rear Deck Luggage Rack* (Type 67) for the Mustang of highly polished aluminum alloy. It can be reversed and adapted for use as a ski rack, with the addition of ski clamps, or removed and stored in the trunk, leaving only the chromed fittings on the trunk.

Mustang Mukluk by MG Mitten Inc. is a tailored cover made of moisture-repellent but "breathing" fabric which protects the Mustang against dust, dampness and grime, but which cannot harm the finish; $30.50, postpaid. MG Mitten also sells a *Talbot Mirror* of the type much favored by the sporty car set. Streamlined and chrome-plated, the housing holds a non-glare, blue-tinted mirror of high quality, either convex or flat. Two mounting styles available: "300" has U-bolt mount; "303" uses self-tapping screws. Either, $7.95.

Wheels & Tires

Few items can change the appearance of the Mustang more than a set of custom wheels and the choice of these runs from ordinary chromed, reversed-rim wheels to magnesium cast alloy racing types.

Currently enjoying great vogue are the composite types, with a chromed, stamped steel rim and a cast alloy (aluminum or magnesium) center section. *Cragar S/S Wheels*, from Bell Auto Parts, list for $40 each and feature a pressure cast aluminum center welded, via steel tabs cast into the aluminum spokes, to the steel rim.

Hurst Performance Products makes another composite custom wheel, of forged aluminum center and heavy-duty plated steel rim. The *Hurst Custom Forged Wheel* is riveted together with an overlapping stabilizer plate over the aluminum side, to provide additional strength. A choice of three different hub caps and several finishing techniques gives the buyer a choice of 24 different styles. Hurst's Mustang wheels list at $69.50 each (including all fittings).

All permanent-mold cast aluminum, the Ansen Automotive Engineering *Apollo* and *Arrow* wheels fit all Mustangs with 5-lugbolt patterns and are available in both 14- and 15-in. sizes. The Apollo has round spokes, the Arrow flat-faced spokes, and each wheel is registered with its own serial number. Ansen's list price is $59.50 each wheel.

Wheel Corp. of America combines a polished chrome steel rim with an aluminum alloy hub for its special Mustang wheel, the *Rader DBR-800-M*. For a custom touch, the center section is anodized black and then the outer spoke sur-

faces machined to a fine, contrasting finish.

Another recently announced custom wheel is the *Magnum 500* from Motor Wheel Corporation, one of the largest and oldest suppliers to the automotive industry. The all-steel Magnums make use of a new deep-draw die-stamping process which allows low-cost but high-strength spoke formation. The *Magnum 500 Deluxe* has polished, plated chrome rim and spokes; the *500 Custom* is painted magnesium gray. Both have blacked-out bolt pockets.

One of the widest lines of custom wheels comes from Astro Enterprises. *Astro Standards* list for $34.95 each in sizes to fit Mustangs and are plated steel construction. *Astro Customs* are available (for $44.95 per wheel up) in widths up to 10 in. Astro Customs are all-steel in construction, finished in polished triple-plating and list at $49.95 each; knock-off caps and chromed lug nuts are extra.

Simple knock-off type hubcaps may be just enough of a custom touch and Atlas Auto Products markets reasonably priced caps under *Atlas KnockOffs* name. They are chromed and simple to install as they replace the normal hubcap.

Wide-rimmed, one-piece castings of Tenzalloy, the *ET Mag* wheels from Wheel Centre Co. are available for the Mustang in both 14- and 15-in. sizes. The wheels are standard in a machined finish; a polished finish costs $20 extra per set. The list price of $50 per wheel, however, includes a set of lug nuts. Wheel Centre claims them to be the best-selling one-piece aluminum-based wheel on the market.

A complete variety of street and competition wheels in either magnesium or aluminum is marketed by American Racing Equipment, whose "mag" wheels have long been standard for all-out competition cars. The *Torq-Thrust Wheels* shown are offered in 12 combinations of rim diameter, width and offset to give the serious competitor the best possible selection of wheel/tire equipment. Prices range $60 to $92.50 for these wheels, with lug nuts and hub covers additional. Cast-aluminum wheels, suitable for street use, are $49.

Sporting cars and sporting drivers need sporting, high-performance tires, such as the *Dunlop SP-41*. These radial ply tires give better braking, better cornering and better acceleration and top speed because of their braced-tread design. Dunlop says the braced tread (four bracing plies atop two normal, radial plies) acts like a hoop which moves independently of carcass distortion due to flexing or cornering forces. Dunlop dealers can offer specific fitment, balancing and inflation recommendations to Mustang owners.

Michelin Tire Corp. of France utilizes three layers of steel cords to brace the tread of its *Michelin X* tires. These radial ply tires are much valued by rally drivers for their distortion-free characteristics, reduced rolling resistance and long life. Available in two tread designs, "Stop," which is generally preferred for high-performance work, and the "SDS," the Michelin X has direct replacements for Mustang sizes – for 6.50-13, the 6.40/7.00-13X ($34.20); 6.95-14, either 5.90-14X ($35.50) or 7.00-14X ($37.90); 5.90-15, the 165-380/165-15X ($35.30). Federal Excise Tax must be added to all prices.

Introduced just last year, Firestone's new *Super Sports 500* was designed for use on high-speed, high-performance domestic cars such as the Mustang. Development tests included endurance runs at a constant 145 mph. The tire uses nylon cord at a greater than normal cord angle (although not a radial ply) and tread elements are tied together for increased stability. Available in either white or black sidewall, the SS-500 has a distinctive checkered surface design on its shoulders.

Greater high performance safety and strength is said to result from the use of a higher cord angle and nylon cords in the construction of U.S. Royal's *Super Safety 800XP* tires. The tread is wider than original equipment tires, to give better traction and performance. These Royals are readily iden-

TORQ-THRUST wheels from American Racing Equip. are cast magnesium.

CRAGAR S/S wheels.

E.T. Mag; Wheel Centre.

ASTRO Custom wheel.

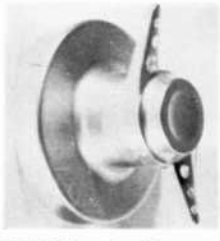
MICHELIN X Stop tread.

DUNLOP radial-ply tire.

BLUE DOT by Goodyear.

MAGNUM 500 wheel.

RADER DBR-990 wheel.



ATLAS' knock-off cap.

KUSTOMAG wheel, Firestone tir

ANSEN Arrow cast alum

SUPER Safety 800XP tires from U. S. Royal.

tified by dual red circles, and are available from all U.S. Royal tire dealers, or they can be ordered as optional equipment with new Mustangs.

Designated by Goodyear Tire & Rubber Company engineers as a "130-mph" tire, the brand-new *Power Cushion Blue Dots* are just beginning to show up on high-performance Mustangs. Carroll Shelby has chosen them as standard equipment on his Shelby-American Mustang GT-350. The carcass utilizes nylon cords rather than the rayon used in normal Power Cushions. They come in blackwall only, at $39 each at all Goodyear retail stores.

Shock Absorbers & Spring Helpers

Heading the list of things to make ol' Mustang behave better are *Monroe Load-Leveler* shock absorbers. These combined shock dampers and suspension stabilizing devices provide surer, safer cornering, eliminate sway from crosswinds and compensate for overloads in the trunk. The rear Load-Levelers consist of a variable-rate coil spring and a heavy-duty shock absorber inside it. The front Load-Levelers are similar, but have a constant-rate coil spring. When used together, the two sets provide considerably higher resistance to body roll in cornering, thus greatly improving directional stability. They are $42.50 per set (front, FL-247; rear, LL-503).

The Air Lift Company offers a unique method of giving added suspension control to Mustangs. Said to eliminate the wheel-hop problem, the *B-97 Air Lift* package has been especially designed for Mustangs. Air Lifts are butyl air cylinders surrounded by a light coil spring, which fit between the car's leaf rear springs and chassis. Air pressure can easily be varied to provide for a variety of conditions, one of which is to "preload" the chassis for a better drag racing "bite." Available from speed shops and automotive parts dealers for $43.95 per pair.

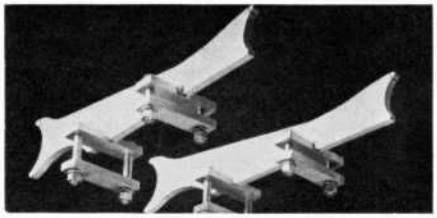
An even simpler method of gaining rear axle control for drag racing purposes is the *Spring-Masters* offered by Dragmaster Co. These clamp-on bars fit on top of the regular rear springs to prevent rear axle windup on acceleration. They extend from axle housing to spring eye, but do not hamper ride as they aren't attached at either point. Easily installed and removed, the Spring-Masters are $24.95.

Both front and rear stabilizing units are offered by the Hellwig Products Corp., long-time makers of spring-helping devices. Two new Hellwig units especially designed for Mustangs are said to greatly improve stability and handling characteristics, without impairing the Mustang's soft ride. The front *Wild Horse Stabilizer* by Hellwig is designed to ride in neutral position, coming into play when the suspension encounters dips and corners. The rears prevent bottoming and wheel-hop. Installed together, the Hellwig pair makes a readily apparent improvement. Both front and rear stabilizers are quickly adjustable and install without welding or drilling.

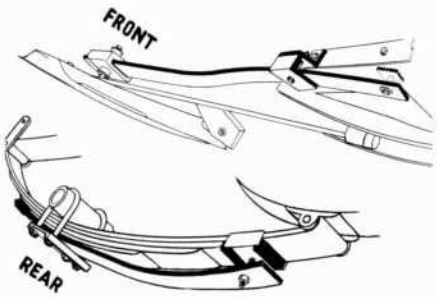
Aimed at helping out the motorist who wants to carry overloads or pull trailers with his Mustang is the *Service Spring UH-105*. This Universal Helper adds 5-700 lb. to the Mustang's carrying capacity, is installed without welding or drilling and costs only $19.90 per set from the Service Spring Co. It features an adjustable rear cushion to compensate for varying loads.

DeMarcellus, Knowlton & Associates approach the stabilizing problem from a different aspect and market their *Curve-Master* in a special model for the Mustang. The Curve-Master is an anti-roll (or anti-sway, if you will) bar of 0.75-in. diameter, extending between the rear wheels. It promotes better traction by reducing body lean in cornering, also reducing wheel-hop and lessening understeering (plowing) characteristics. Only two drilled holes are required for installation. The kit is $19.95.

The Custom Mustang

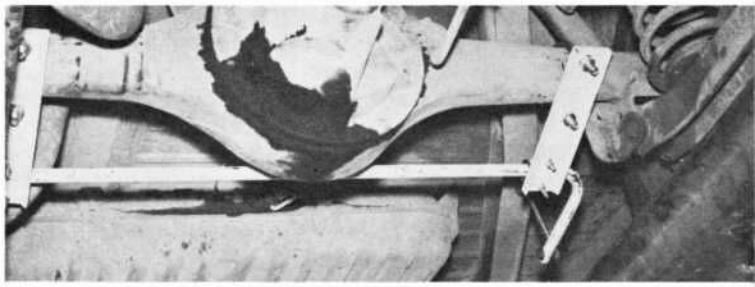


SPRING-Master spring helpers.



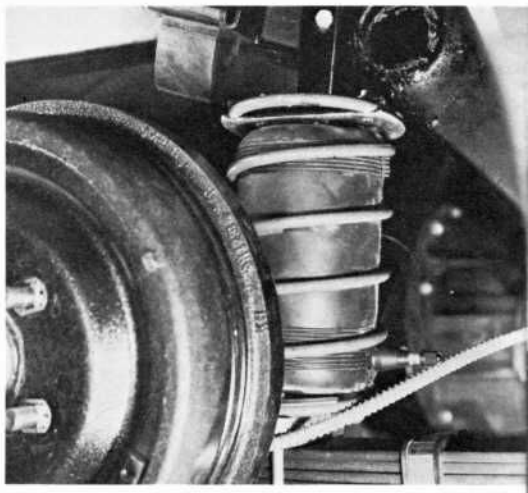
HELLWIG stabilizers, front and rear.

MONROE Load-Levelers.



CURVE-Master rear anti-roll stabilizer.

QUAD by Drag-Fast.



AIR LIFT handling package.

HURST Swifter Shifter gloves and Competition Plus shift linkage.

TRACKSTAR wheel, RSE.

NARDI wood-rim wheel and lace-on cover from Vilem Haan.

KNOBS by Amco.

PRODUCTS d' Elegance.

GRANT Custom wheel.

ROSEWOOD knob.

MG Mitten's shift knob.

CRAGAR wheel & horn.

CONSOLE converter and horseshoe shiftknob from EELCO.

SUPREME Specialties' dash plate. EATON air conditioner.

WALNUT dash, glovebox door, console inlays from Mustang Accessories.

Interiors

Perhaps the finest hand-crafted replacement steering wheel on the sports car market is the one made by the Enrico Nardi shop of Italy. Laminated of select mahogany, the rim is hand-rubbed to a high brilliance and richness. The hub and spokes are highly polished Duralumin. For the Mustang, the *Nardi Woodrimmed Steering Wheel* costs $90 and can be ordered through Vilém B. Haan. Haan also offers a *Steering Wheel Glove* that laces onto the standard wheel to give it a positive and sensitive grip and lessen vibration. Foam-backed and laced-on, it cannot slip once in place. In black or saddle tan, it is $6.95.

Cragar Division of Bell Auto Parts has a *Custom Steering Wheel* that utilizes a high-gloss, metal-flake-impregnated plastic for the rim and polished chromed steel for hub and spokes. Available in a variety of colors, it lists at $18 for the wheel, plus $16.50 for the horn kit.

Trackstar Woodrim Steering Wheels for the Mustang are 16 in. in diameter and are of a dished, 3-spoke design. Rim is mahogany, hub and spokes of aircraft aluminum. Complete with mounting boss for horn button, it is $49.50 from Racing Safety Equipment Inc.

Formed in resilient plastic, the Grant Industries custom steering wheel incorporates finger grips on the underside of the rim. Made in 23 different colors, it has a 15¾ in. diameter and a deep-dish hub in chromed steel. The *Grant Custom Wheel* lists for $22.50, the horn kit adds another $16.50.

Manual-shift Mustangs can gain increased efficiency with a custom shift conversion such as that made by Drag-Fast Sales Inc. *Drag-Fast's Quad 4-Speed* permits full-throttle power shifts at any rpm, has a spring-loaded reverse lock-out, adjustable gear stops, oilite bronze and hard alloy bushings and pre-formed heavy-duty control rods. The Quad lists at $95.06, the similar 3-speed 7000 for $64.20, and the Custom H 3-speed for $47.16.

Swifter shifting has long been a Hurst Performance Products trademark. In fact, Hurst proved there were better shifting mechanisms than the factory-supplied components and started a whole industry. Hurst's considerable talents have been applied to the Mustang and as a result the *Competition Plus Shifter* measures up to all demands. At $94.50, it fits with bolt-on ease. Less expensive is the *Syncro/Loc Shifter* for the Mustang 3-speed gearbox. It lists at $69.50 and offers dual pattern usage. Gear stops are adjustable and a nylon impact bearing eliminates metal-to-metal contact at the pivot point of the lever. Also shown are the *Hurst Swifter Shifter Gloves* ($3.50), designed for non-slip grip of wheel or stick.

EELCO's Hollywood Hoss Accessories include a pair of console trays to convert the Mustang driveshaft tunnel into a collector's item. Dished to hold objects such as sunglasses, maps, purses, small packages, etc., they also have cup-holding indentations. No. 3536 ($23.95) fits non-console-equipped Mustangs, No. 3537 *Mustang Console* ($19.95) attaches over the factory-installed unit. Either one requires only four screws to attach. Completing the EELCO interior treatment is the *Horseshoe Shift Knob*, at $2.95 an intriguing custom item.

Mustang Shift Lever Knob from MG Mitten Inc. has its emblem inset under clear lucite, in a hardwood base. The hand-finished wood provides just the right touch of elegance and the knob costs only $3.75.

Racing Safety Equipment offers a *Rosewood Shift Knob* at $3.75 which features the Mustang insignia in silver or gold. Kit is complete with a tube of Loctite for proper positioning of the aluminum bushing on the shift shaft. Can also be ordered with a silver or gold shift pattern instead of insignia.

Turned hardwood *Elegant Shiftknob* for the Mustang comes from Products d'Elegance, and has insignia inset under a lucite cover. In walnut, it is $3.50; in chrome, $3.25.

The Custom Mustang

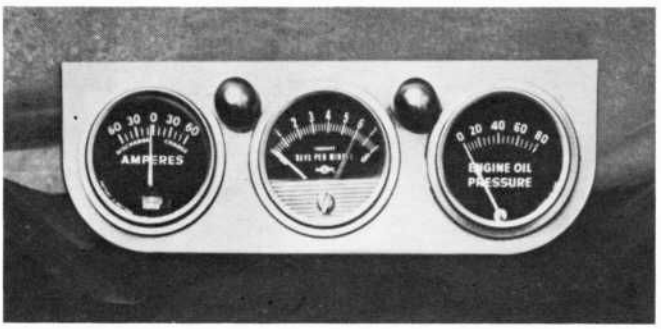
PANEL-full of VDO instruments, Customs by Grotz.

CALIFORNIA Speedtach.

TRANSITACH 250 by Delta Products.

CHARGICATOR from Imperial.

MOTOMETER tach from Fisher.



DIXCO's Custom Trio.

MILES Instruments' MPG Computer.

AMCO's *Mustang Shiftknobs* can be ordered in either select Eastern Walnut or chrome finish. Walnut knobs ($3.75) are hand-rubbed to bring out the rich natural grain, then given a special weather-resistant sealer. Chrome knobs ($3.25) or walnut may have Mustang emblem, crossed flags, St. Christopher, 3-speed or 4-speed shift patterns inset.

Top-grain walnut in a hand-rubbed oil finish is used for Mustang Accessories' *Walnut Dash Inlays.* No. 809 kit, $8.95, covers glove box door and gauge panel; No. 810A ($8.95) covers the top of the console except for steel center band. Inlays for the horn-rim spokes and the plastic center of the steering wheel are $2.95 the package.

Personalized-Engraved Dash Plate from Supreme Specialties is a 4 x 1-in. polished silver or brass plate which carries the Mustang emblem and the inscription "Made Especially for . . ." or "Custom Built for . . ." or simply the owner's name. Adhesive backing allows easy attachment to any smooth surface of the car's dash. Plates are $3.95 postpaid, and buyer should specify name to be engraved, choice of phrase, choice of silver or brass.

Eaton Manufacturing's *Air Conditioner* is an add-on type designed for easy installation in all Mustang models. Accessory kits adapt it to all engine options. The unit has twin blowers which can circulate conditioned air throughout the car. Available from dealers and automotive radiator service outlets, it lists at $250 plus installation.

Matched case instruments – tachometer, vacuum gauge, clock and altimeter – are available from Airguide Instrument Co. in its Sebring line. The *Sebring Altimeter* reads from 0-15,000 ft. and is illuminated ($15.95); the clock ($19.95) is electric and has a sweep second hand. The *Sebring Mark II 270° Tach* has three times the needle travel of conventional electronic tachs, has an illuminated 0-9000 rpm dial and an adjustable shift-point indicator. It costs $34.95. The Airguide *Scat Tach* offers a low-cost tach in an unusual, square-cornered housing for $19.95. Dial reads 0-8000 rpm.

A 250° reading electronic tachometer is the *Teleflex Mark 27* from Teleflex Inc. The dial reads 0-6000 rpm and has aircraft-type illuminated face and an adjustable red-line pointer. Teleflex's patented, self-contained pulse-former circuit uses a taut band meter movement that is claimed to give instant response without lag or bounce. The optional surface mount is available in five colors – "zero reflect" black and crinkle finish red, blue, tan or silver.

California Speed-Sports Shop's *California Speedtach* is a $25.95 instrument which works with either battery or magneto ignition. It carries a full-year guarantee and requires no adjustment at installation.

The *Chargicator* is ideal for Mustang operation as it accurately and continuously shows the condition of the battery and electrical circuit. It indicates such faults as under- or over-charging, faulty components or battery cell failure. Can be installed in-dash or under with a universal bracket. $22.95 from Imperial Motor Products.

Moon Equipment Co. offers a complete line of speed/sport instruments, many of which are suitable for Mustang owners' use. Notable among these is the 8000 rpm, 270° sweep all-transistor *Moon Tachometer* at $55 which can be used with transistor or magneto ignition systems as well as the standard system. Moon also has auxiliary panels and switches which can be combined to form any custom installation. Shown is a panel with tach, oil pressure and amp gauges, with a pair of accessory switches.

The *Custom Trio* installation by Dixco Inc. Products Division is ideally suited to the Mustang. The Custom gauge panel includes 0-8000 rpm tachometer, ampere and engine oil pressure gauges in a chromed, die-cast panel which has front lighting. The complete kit is $52.75 and is easily in-

stalled below dash or, with a $5.95 chrome housing to cover the rear of the Trio, above the dash.

A wide variety of individual instruments can be had from VDO Instruments, from tachometers to clocks and temperature and pressure gauges. VDO's *Concentric 6000 rpm* model is particularly effective as it utilizes full-face reading for a three-times larger than normal indication. $69.95, it can be mounted flush in the dash or under- or over-dash. Diameter is 3⅛ in. VDO's matching face 0-120 mph speedometer is $20.95, or $35.95 with trip indicator. Ammeters in matching but 2 1/16-in. faces are $5.05, fuel gauges $10.75, clocks $22.50 and oil pressure gauges $10.75.

A completely-equipped dash full of VDO instruments is offered by *Customs by Grotz* and features seven gauges in a teakwood patterned Formica panel. Each kit includes a Becker Europa am/fm radio, retractable antenna, door plates and all necessary wiring, hardware and instruction. The kit is $420 and includes a chromed-mesh grille which sells for $34.75 separately.

Delta Products Inc. makes a pair of *Transitachs* and claims both use the very best available components, the most careful assembly, inspection and calibration. Model 250 has a 250° sweep, 0-8000 dial and costs $49.95; Model 90 has a 90° sweep 0-8000 dial and is $39.95 complete with housing and hardware for installation.

The *MotoMeter Tachometer* is imported by A. R. Fisher Products Corp. and sells for $59.50 (an above/below dash mounting bracket in chrome is $1.95 extra). Its illuminated, 0-7000 rpm dial has a 270° pointer swing. Another Moto-Meter product from A. R. Fisher which is sure to interest cold-country Mustang owners is the outdoor thermometer with pointer and dial readout. A red signal light flashes on when outdoor temperature drops below 32° F, warning the driver of possible icing conditions on the road. The *Moto-Meter Thermometer* (Model 1007) is priced at $8.95 and an under-dash bracket is $1.75 extra.

An unusual guide to engine efficiency is the *Performance Meter* offered by Miles Instrument Co. A miles-per-gallon of fuel computer, it can indicate which gasoline works best in the engine, what the most economical cruising speeds are, and overall engine condition. The complete kit is $59.50.

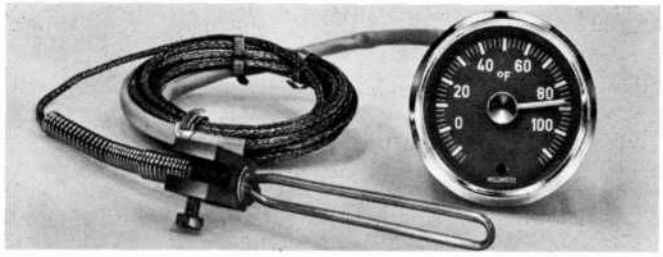
Engines

The valve cover to end all valve covers is the boast of EELCO about its special *Mustang Valve Covers*. A unique Mustang design is cast in deep relief on the face amid attractive polished aluminum ribbing. Polished all over, these gleaming covers give an engine compartment dazzling appearance; $49.95 per pair. Complementing the covers are the EELCO chrome-plated *Wing Nuts*, which are $1.60 each or $19.20 per set of 12.

Just the opposite style are the Moon Equipment Company's *No-Name Valve Covers*, cast in aluminum and highly polished. Moon's covers are designed to take any of eight different Moon breathers (extra cost) and are $46 per pair.

Edelbrock Covers carry the traditional Edelbrock name in relief between the raised ribs and are of polished aluminum finish. The cast covers are said to reduce engine noise and heat; $52.25 per pair.

Offenhauser Sales' polished cast-aluminum valve covers include a hole for the standard breather engine and list for $55 per pair. Offenhauser also has a complete line of manifolds and adapters for the 221-260-289-cu. in. Ford engines used in the Mustang. The *Single Quad Manifold* has its base drilled to enable installation of most of the larger quad carburetors and costs $89.50. The *Dual Quad* comes complete with adapters which will enable installation of the larger quads, and is designed for maximum performance; $92.50. A new wrinkle in manifolding is the *Ram Induction Adapter*, $29.95 each, which converts present manifolds to ram-in-

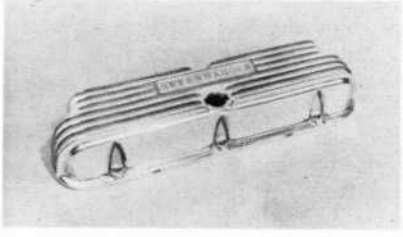


ICE-alerting outdoor thermometer from Fisher.

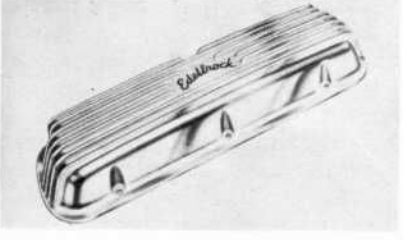

AIRGUIDE Scat Tach.


MOON'S tach and gauge panel.


ELECTRIC clock; Airguide.

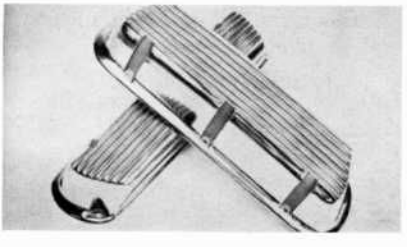

OFFENHAUSER's cast aluminum covers.


TELEFLEX Mark 27.

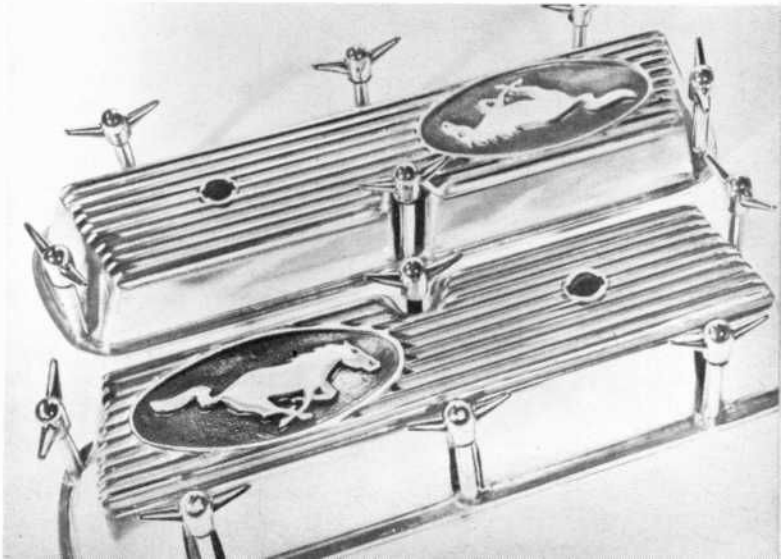


EDELBROCK valve cover.


SEBRING 270° tach.


NO-NAME valve covers by Moon.

HOSS-EMBOSSED covers and chromed wing-nuts from EELCO.



ducting equipment. Designed to accommodate most quad carburetors.

Weiand Power & Racing Equipment has a big-bore dual quad manifold for the 260-289 V-8 which features 180° firing order. Designed for Carter AFBs, it gives 15-25% improvement in ¼-mile acceleration, highway passing speeds and all-out top speed. The *Weiand Pegasus* is $92.50 in cast finish, or $101 in polished show finish. An installation kit which includes all fittings, fuel block, hose and progressive throttle kit is additional.

Also using the balanced 180° firing order, Edelbrock's *F-28 Dual Quad* for the Mustang 260-289 engine boasts a sweep-around port design. Edelbrock claimed 17% reduction in 0-60 mph time, 25% reduction in 40-70 mph time with this manifold and Carter AFB carburetors. The manifold is $92.50, the installation kit $25.50. Edelbrock's unique *X-F8 Dual Quad Ram Log* is guaranteed to outperform any other dual quad manifold on the market today. Drilled to accept Carter AFB or Holley carburetors, the manifold includes complete instructions and jet-size information. $159.50, the linkage kit is $25.50 more.

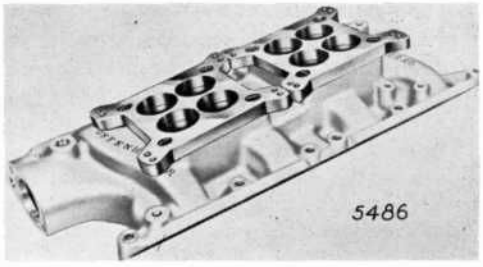
Weber Carburetors and a special Cobra manifold to mount them are now available at Shelby-American Inc. (contact Sonny Balcaen); Shelby was recently appointed U. S. distributor for the biggest bore 48 IDM Weber which is the dual-throat model shown.

Racer Brown's new *Revmaster 101-M* mechanical lifter camshaft and kit assembly increases effective duration of valve opening to 280° with 0.450 in. lift. Said to outperform the 289/271 Ford High Performance camshaft by considerable margin, it is still sufficiently tractable for street use. It will rev to 7000-plus rpm when combined with the recommended valve spring and retainer kit. Idle is slightly lumpy but the engine pulls strongly from about 2500 rpm upward. Can be used with either single or dual 4-barrel carburetion and mechanical advance ignition. The camshaft lists at $60, the kit, with compatible lifters, special damper-type valve springs, aluminum spring retainers, spring shims and break-in compound is $64.30 more. Racer also makes a 7000-rpm hydraulic lifter cam, the *Revmaster 202-H*. It has 296° duration and 0.450 in. lift; list is $60, and the matching set of high-performance hydraulic lifters with damper valve springs, aluminum retainers, etc., is another $80.30. Racer says it is compatible with automatic transmissions, too. Roller-lifter cams for competition are a Racer Brown specialty and these can be had in a wide assortment of profiles.

Eliminator Roller Cams from Potvin Equipment Co. fit all 260-289-cu. in. Ford engines. The cams are made from high-speed steel alloy in five different grinds, from 284 to 335° duration. The camshaft and kit is complete at $320 from Potvin or speed shops.

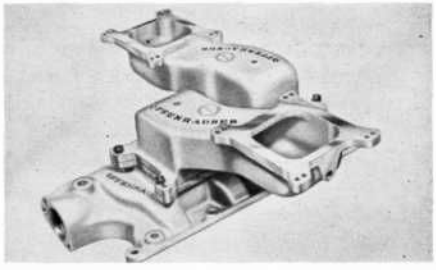
Crower Imperial Cams are available in either roller or flat-tappet versions for the Ford 289. Crower Cams and Equipment grinds each cam from solid steel billets. They install in stock camshaft journals so that no block machining is necessary. Camshaft only is $300, the complete roller cam and kit $450.

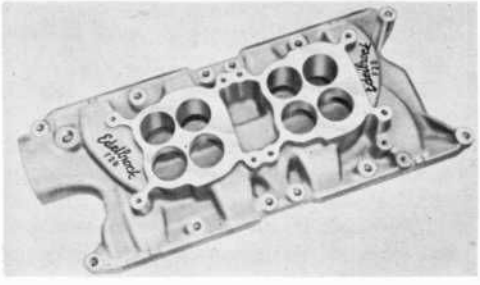
Complete cam-tappet-valve-cylinder head service is offered by Crane Engineering Co. *Crane's Patented Roller Tappets* have been tested and proven for nearly five years under the high rpm of drag racing conditions. Their exclusive alignment bar mechanism requires no machine work to install – they drop right into the stock tappet holes. Standard length pushrods are also used to maintain correct pushrod/rocker arm geometry. A set of eight pairs lists for $140. Crane's cams run the gamut from the H-260 Hydraulic Road & Drag grind to the maximum competition *Ramsonic Hyper Flo Roller* which lifts valves 0.587 in. The hydraulic cams list at $85, or $177 for a complete kit with 16 special lifters, springs, retainers and seals; the roller tappet grinds are $120 list, or $342 for the complete works with rollers, springs,



DUAL quad by Offenhauser.

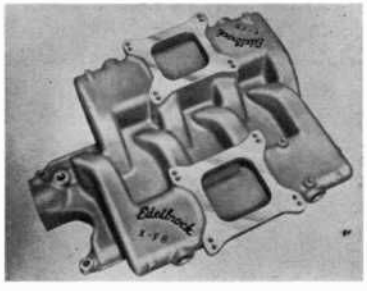
RAM inductors by Offenhauser.

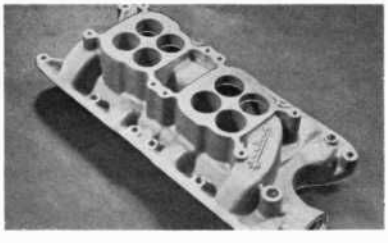




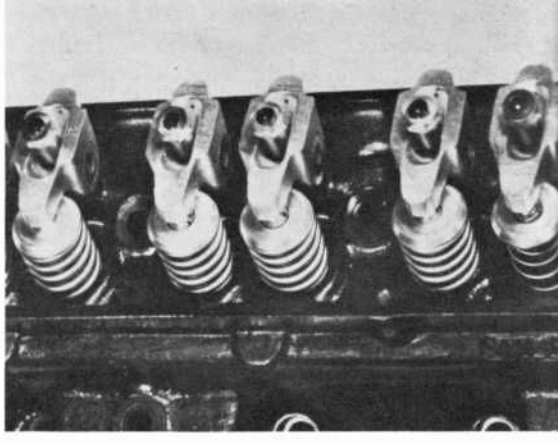
EDELBROCK's dual quad.

X-F8 is a top performer.

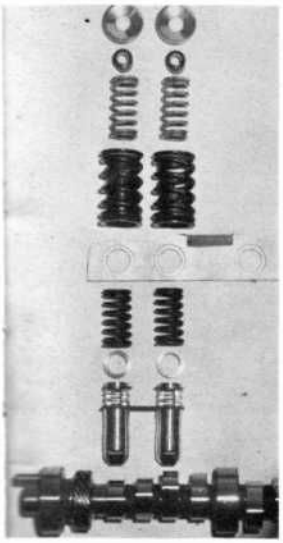


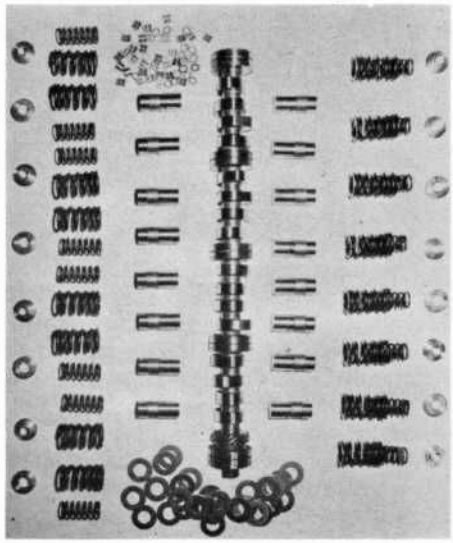


PEGASUS by Weiand mounts two quads.

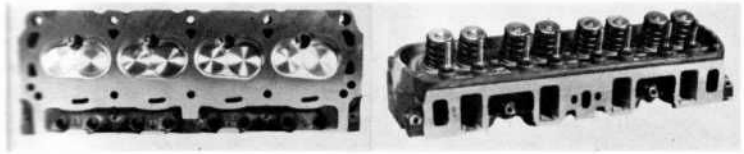


THOMAS rockers for high rpm.

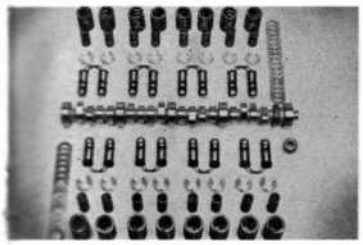


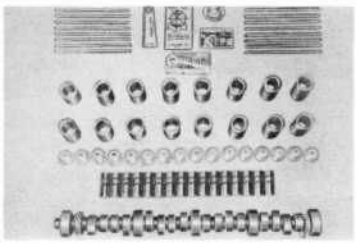


RAMSONIC roller kit. CROWER's Imperial flat-tappet kit.

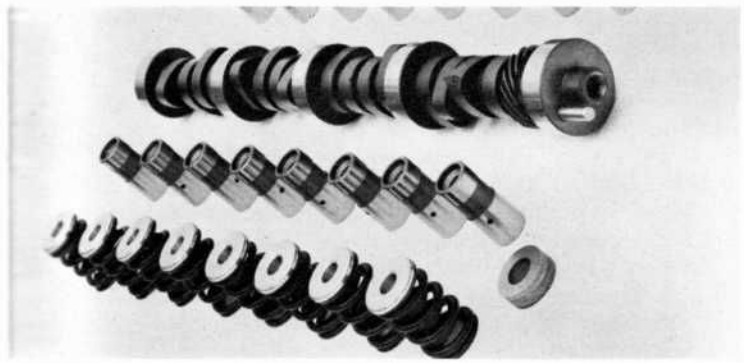


SUPER Port Flow treatment for Mustang heads by Crane.



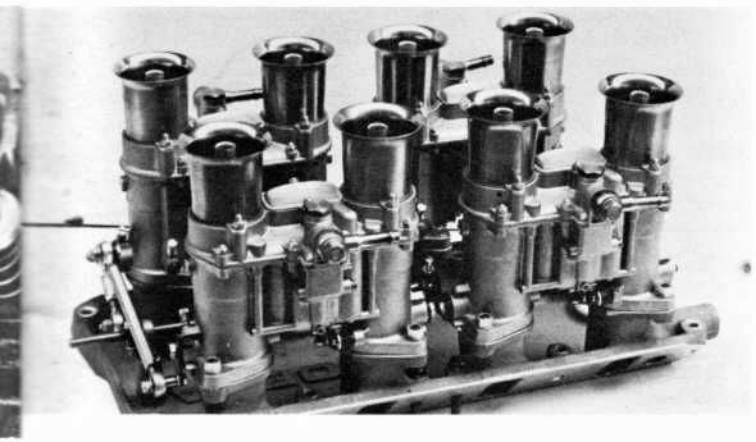


POTVIN's Eliminator kit. ISKY hydro cam package.



REVMASTER 101-M cam and kit from Racer Brown.

WEBER carburetors on Cobra manifold; Shelby-American.



etc. Crane's roller tip-needle bearing aluminum rocker arms are half the weight of stock arms and are invaluable for high rpm use. The roller tip rotates on needle bearings to eliminate friction and valve guide wear. The needle-bearing fulcrum also reduces friction and permits continuous engine operation at 10,000 rpm, according to Crane. The *Super Port Flow Cylinder Heads* for the Mustang 289 are said to add 60 bhp to a 271-bhp high performance engine, or 30 bhp to the Cobra-equipped version. Crane recontours ports and combustion chambers (59-60 cc) for $150 per pair, grinds and locates valve seats properly to fit Crane's 1.625-in. exhaust and 1.9375-in. intake valves, or puts together a set of heads completely equipped for roller-tappet use at $304.89 (exchange).

Engle Racing Cams are noted for their dragstrip performance and the No. 324 grind is claimed to produce 35 bhp more than the stock 271-bhp cam with no other changes. Engle's flat tappet profiles are ground on new cast billets; roller tappet cams are ground on steel billets. The flat tappet cams, in five grinds from 268° to 288° duration, are $70; the rollers, 288° to 316°, are $280. Lifter kits are extra.

Hydraulic racing cams and coordinated valve gear assemblies from *Iskenderian Camshafts* feature Isky's exclusive anti-pump-up hydraulic racing tappets. Even hydraulic cams produce 7000 rpm in Mustang V-8s, but Isky's flat-tappet Polydyne cams will swing upward to 9000 rpm. Price for the hydro cam is $85, with $80 additional for the lifters and spring kit.

Magnesium or aluminum *Rocker Arms* from Thomas Automotive for the 221-260-289 Ford have case-hardened tips in each end and individual rocker shafts designed to let the rockers move freely for positive valve action at high rpm. The tilting position common with stock rockers is eliminated, along with its attendant valve guide wear. Each kit includes 16 rocker arms, shafts, locknuts and set-screws; in magnesium, $100; in aluminum $90 – from speed shops and speed equipment dealers such as Offenhauser, Edelbrock, Ansen, Honest Charley, Bell, California Speed-Sport, and others.

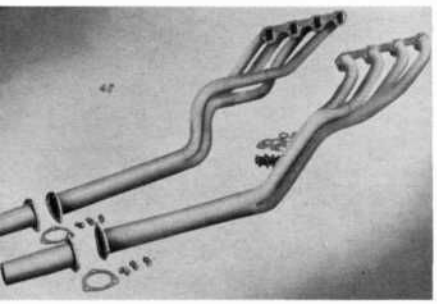
Free-breathing exercises for the Mustang are guided by Douglass Muffler Mfg. Co., makers of the *Deeptone Mufflers* and *Dyno-Tuned Headers*. The quickest way of boosting the Mustang's kick is with Douglass' Double-Inch straight-through muffler which directly replaces the stock component. In either steel-pack or 'glass-pack, it is $18.45. A better-yet system is the equalized dual set which includes all the necessary pipe and hardware to convert the stock single-tube system to duals and a pair of slash-cut chrome tailpipe tips. Maximum performance principles are applied to the header kit which utilizes 180° scavenging for minimum flow restriction and maximum sonic ram effect. The $139.95 kit includes all bolts, gaskets and tapered flange connectors.

More horsepower at the rear wheels is guaranteed with the *Headers by Doug* 260-289 assembly. The complete kit, $170, includes headers, clamps, brackets, 'glass-packed mufflers and tailpipes with chromed tips; headers alone are $110.

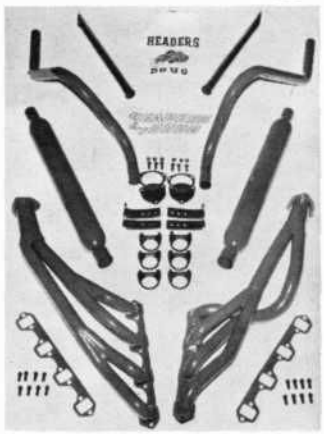
Jahns Pistons for Mustang Sixes and Eights come in standard or high compression and standard or oversize bore (recommended oversize is no more than 0.06 in. for the 289 V-8). Jahns grooves piston pin holes for lock-rings and furnishes the lock-rings so that the pins can be full-floating. The tops of these pistons have large machined reliefs to eliminate valve interference when high-lift cams are used. A set of eight flattop 8.7 or 10.5:1 pistons is $86.40; the 11:1s are $89.60.

Made from special high-tensile aluminum alloy with carefully contoured deflector designs to increase compression ratios to 12.6:1 without impairing engine breathing, the *Forged Racing Piston* from JE Engineering lists at $104 per set. In forged alloy, they are $147.50. Large valve cuts

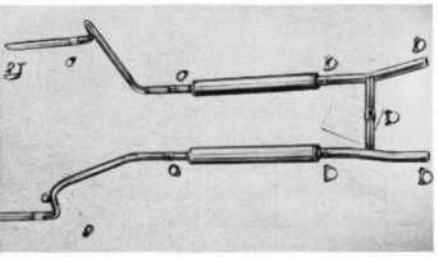
The Custom Mustang



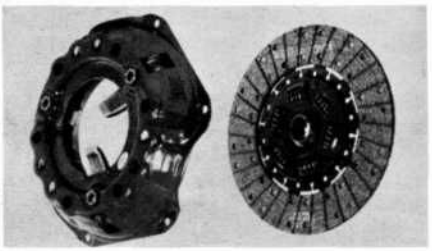
DYNO-Tuned Headers by Douglass.



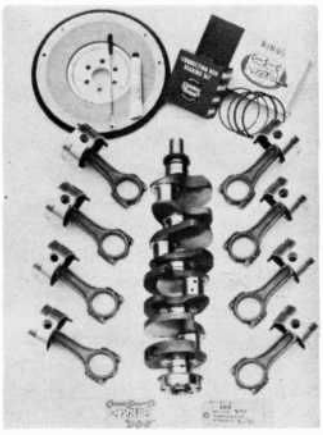
DOUG's Headers for the 289 V-8.



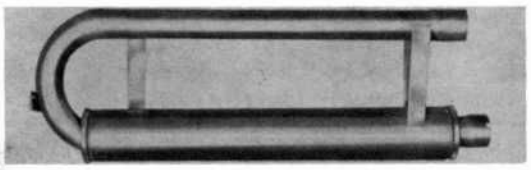
DEEPTONE equalized duals.



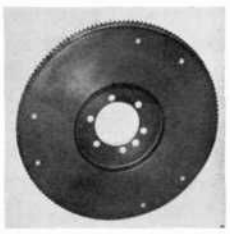
MASTER TORQUE clutch and disc.



MULE kit from the Crankshaft Co.



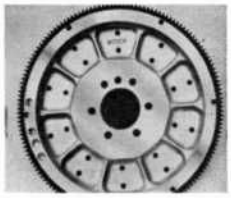
DOUBLE-inch by Douglass is quick tune-up.



WILCAP's steel flywheel.

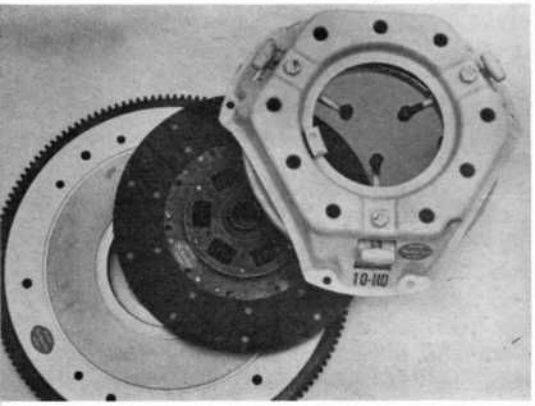
JE forged piston; 8.7 and 11:1 Jahns pistons.

FLYWHEEL, clutch and plate by Schiefer.



FORGED Weber 'wheel.

SCHIEFER's Magneto.



permit use of half-inch lift cams and special slipper skirt designs are available upon request. JE balances forged pistons to within 5 gr.

Crankshaft Co. of Los Angeles has long been the leader in the big-inch department; Crankshaft's strokers are used in racing cars around the world. CSC makes a 0.30 in. stroker *Mule Kit* for the 289 Mustang V-8 that increases displacement to 319 cu. in., before boring. The kit includes special forged pistons, forged chrome-moly 4340 steel rods, lightweight, super-strong taper pins, special connecting rod bearings and a forged aluminum flywheel. CSC also makes and markets the forged pistons and rods separately.

Guaranteed blow-up proof, Mustang flywheel, pressure plate and clutch disc assemblies from Schiefer Manufacturing are literally the choice of champions. *Schiefer Pressure Plates* are made up from super-light aluminum forgings finished with Schiefer's copper-steel facing. Specially heat-treated yokes, screws, release levers and bushings are added into a dimensionally perfect, carefully constructed unit. The *Schiefer Clutches* may be ordered with either riveted or bonded disc; riveted discs are more suitable for street use where smooth clutch engagement is desirable while the bonded discs are better for all-out competition. Schiefer forged aluminum flywheels cost $86 for the Mustang. They replace the stock unit and are fitted with steel starter ring gears. Clutches list at $26, the pressure plates at $70.

Weber Tool Co. makes two flywheels for Mustang V-8s, one in forged aluminum that sells for $81.95 and one in steel that lists for $97.50. Both the *Weber Forged Aluminum Flywheel* and steel flywheel have starter ring gears.

The *Wilcap Steel Flywheels* for the popular Ford engines are designed to withstand extremely high rpm and drag-racing type abuse. Extensively lab and dyno-tested, the Wilcap wheels are guaranteed and cost $49.95.

All *Master Torque Racing Clutches* have new parts and are carefully balanced. A Long-type pressure plate for the Mustang V-8 is $35, a bonded-facing clutch disc $22.95. Master Torque also has a forged steel flywheel at $89, which is practically a must for drag racing use.

Roto-Faze Ignitions are necessary equipment for high rpm use as their ball-bearing shafts and dual points give optimum, consistent ignition at more than 9000 rpm. In a dynamometer test, a 289 Ford reached only 7000 rpm before the points in the factory distributor began to bounce; substitution of a Roto-Faze SRS unit not only produced more horsepower at 7000 rpm, but allowed the engine to turn up to 8700 rpm where the pushrods failed, thus ending the test. A single coil, parallel point unit, the SRS lists for $120.

The new *Spalding Flamethrower* ignition system reflects the high standard of quality and engineering necessary to insure consistently superior performance. The distributor cam is wear-proof, self-lubricating, sintered iron. Ball bearings surround the main shaft and special ventilated breaker points (two sets) are used. Flamethrowers show considerably increased voltage output over all other types, according to Spalding. The unit lists at $108; a mechanical tachometer drive is $12 extra.

Mallory Electric Corp. makes five good ignition systems for Mustangers, application depending upon usage of the vehicle. The *Mallory Photo-Cell Breakerless Ignition* completely eliminates the usual contact points. Instead, a silicon photo-electric cell triggers the switching, receiving light impulses from a GE computer lamp. A rotating shutter wheel replaces the cam in the ignition distributor. When it interrupts the light source from the photo-cell, the coil is triggered (through a transistor ignition amplifier) and current sent to the spark plug. Mallory claims far superior timing and longevity with this system, and furnishes it complete with precision distributor, heat sink and transistor circuit, coil and ballast resistor for $145. Mallory's *Rev-Pol* system ($69.95) is also designed primarily for high-perform-

ance engines. It uses a 4-lobe cam with dual circuit breakers in conjunction with a dual primary, epoxy-molded transformer. It provides more than adequate voltage in all rpm ranges, without point float. The *Double-Life* distributor is $49.95, also uses the 4-lobe cam and dual circuit-breakers, and has been proved superior over all standard systems. For maximum performance, the *Mallory Mini-Mag* magneto fits the Mustang V-8 without modification and can operate up to 10,000 rpm. Low-cost modification of original equipment may be accomplished with Mallory's *Micro-Electric Conversion Kit* which adapts dual circuit-breakers, electric advance switch and heavy-duty condenser to the stock distributor. It lists for $15.

Full magneto operation for ultimate performance is guaranteed by a *Vertex Magneto* from Ronco Corp. The magneto's chief advantage, Ronco says, is that its voltage output curve rises at nearly the same rate as the engine's horsepower/rpm curve, although the Vertex voltage increases without increasing the volt-ampere draw across the breaker points. A unique cam-actuated automatic advance mechanism completely eliminates spring and vacuum fluctuations to give steady, flawless performance. The kit installs without modification to the engine.

Another fine performing product from those clutch/flywheel makers at Schiefer Manufacturing is the *Schiefer Magneto.* At $150 for the magneto and $37.50 for the adaptor, it delivers maximum voltage from starter cranking speeds to infinite rpm regardless of engine compression or supercharging characteristics. It has large heavy-duty ball bearings, extra-size magnets and carries a one-year guarantee.

Better performance for the stock ignition system is offered by the *Go-12ER Coil* from P&D Manufacturing Co. At 5000 rpm, it provides approximately 25,000 v. to spark plugs, compared to 9-10,000 v. from the normal system. List is $26 and it installs without modifications.

Positive ignition under any condition is provided by *Electronic Magneto* from Judson Research and Manufacturing Co. A complete and integrated electronic ignition system that results in improved performance and better fuel mileage, faster starting and better top speed, the Judson unit installs by transferring three wires from the present ignition coil and adding a ground wire. Installation of this $49.50 unit can be done in 20 min. or less.

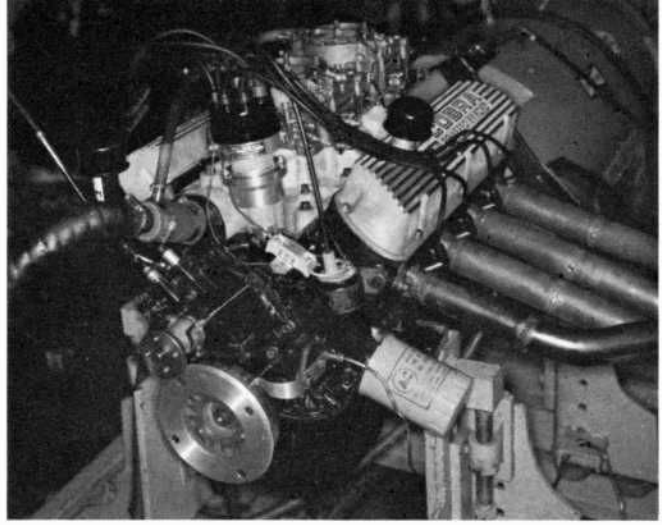
The *Thunderbolt Mark 10* "Energy Transfer Ignition System" from Delta Products Inc. can be purchased in either kit ($34.95) or complete ($49.50) form. It uses the standard coil and installs without rewiring, or can be reconverted to standard operation in less than 10 min.

Instant cold-weather starting, extended spark plug and ignition point life, and up to 10% fuel savings are claimed for the *Jet-Fire Transistor Ignition* from RPM Distributors. The unit mounts under the dash for cooler operation and has plug-in transistors. The cost is $39.95 and the unit is guaranteed three years.

To establish new standards of sure-fire performance, Autotronics Inc. has developed a new *Super Sports S/S Transistor Ignition System.* The system is designed so that none of the original system need be removed before installation; in fact, it requires only the moving of two wires between systems to change over. The $50 cost includes a Bosch high-energy coil, a ballast resistor and wiring harness with solderless connectors.

The Prestolite *Transigniter 250,* with its distinctively styled die-cast aluminum heat sink, offers far greater ignition system longevity, without service attention, than does a normal Mustang system. In addition, it improves starting, eliminates rough idle and irregular timing, and maintains optimum fuel economy. The 12-v. negative ground model for the Mustang costs $61.50.

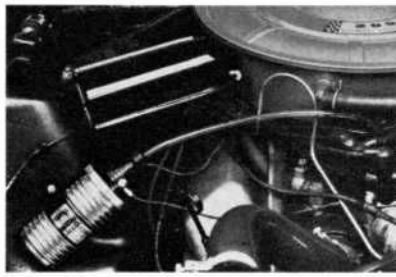
Transfire Division's transistorized voltage regulators are said to give improved regulation (thus keeping the battery



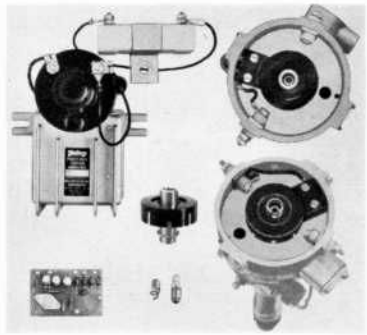
ROTO-FAZE ignition proved itself on dyno.

VERTEX unit.

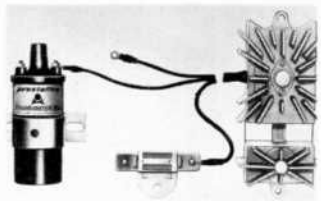
SPALDING's mag.



GO-12ER high output coil.



MALLORY Photo-cell breakerless and Micro-Electric kit.



PRESTOLITE Transigniter 250.

SUPER Sports.

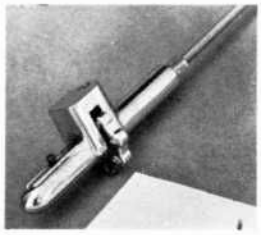
TRANSFIRE unit.

SWITCHABLE RPM system.

JUDSON mag.

DELTA Mark 10.

AUTO-Timer adjuster.



TRANS-Dapt dual oil filters in place.

fully charged) and eliminate regulator replacement. The hybrid type is $12.95, a solid-state all-electronic type is $14.95. The *Transfire Transistor Ignition* system is available in either heavy-duty 30-kv grade or Special Service 40 kv, with either one or two transistors. The TS-1 shown is $74.95, has 40-kv capacity with one extra-high voltage transistor and T400 coil. Other models start at $35.95.

A useful little gadget for drivers encountering varying fuel grades, car loads and altitude changes is the Engine Accessories Co.'s *Auto-Timer*. It fits under the dash and permits the driver to dial-select distributor advance while driving along. It is $6.95.

A *Trans-Dapt Dual Oil Filter* for the Mustang assures longer trouble-free performance and proper oil lubrication. The cover is attractively finned to complement the engine compartment.

Segal Automotive Products has a ball-bearing *Replacement Throttle Linkage* for the Mustang that does away with sticky, interfering parts of an old foot-throttle linkage and gives the driver smooth, positive control of the accelerator.

Miscellaneous

How to make a Mustang sound like a Maserati? Simple. Install a set of *Maserati Electric Pneumatic Air Horns* from Racing Safety Equipment. Three trumpets give either simultaneous or musical blasts by use of a control cable. At $54.50, they are complete with high-volume compressor, relay, air lines, hardware and instruction sheet. RSE also offers an enamel-and-leather keyfob for the Mustang owner at $1.50, and embroidered Mustang jacket patches at $1.

Jacket patches for Mustang owners at MG Mitten Inc. are authentic, embroidered replicas of the car's emblem and sell for $1 each.

There are even *Mustang Spectaculars* (sunglasses) for the enthusiast. These $22.50 items are available at Vilém B. Haan in men's or women's styles, and the choice of tint is green, gray or bronze. Haan also markets a Mustang keyfob, at $1.50, and an emblemized ignition key in either gold-plated sterling or sterling silver for $8.25.

The *Lite-Minder* by Alsynco will sound an audible warning the moment you shut off the engine – if you've left either parking or driving lights on. The unit utilizes a transistorized circuit and turns off when lights are turned off; it installs without drilling and requires only three connections; $14.50.

An auxiliary ignition system, tester and starter, the *Kwik-Start* from RPM Distributors provides emergency starting power for stalled or balky vehicles; $19.95.

Designed to keep the car's interior clean and tidy, the *Sport-Vac* from Car-Vac Industries Ltd. costs only $29.95 and operates off the vehicle's 12-v. electrical system; it simply plugs into the lighter and the owner slicks away dust, dirt and sand. Works in boats and airplanes, too, and can be used for pumping up air mattresses.

Providing a new concept in automotive-born sound, the trunk-mounted *Stereo-Verb Kit* with 6 x 9 in. speaker operates from a single, dash-mounted control. Easily installed, the complete unit is $39.95 from Gibbs Special Products.

A. R. Fisher Products has added a *Clock-Type Tire Tester* to its list of fine MotoMeter instruments. $3.95, it registers pressures from 10-60 psi and has its own leather carrying pouch.

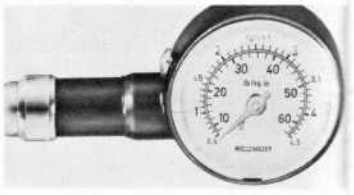
A brand-new *Automotive Torque Wrench* that covers every Mustang application can be ordered from New Britain Machine Co. (New Britain, Conn.) or auto parts jobbers for $36.43. With a range between 10 and 250 ft.-lb., it is one of the most accurate torque-limiting wrenches currently available, according to its manufacturer, Jo-Line Tools.

Good treatment for the High Performance, or any other, Mustang should include *D-A Speed-Sport Oil* in its crankcase. Its manufacturers say that the oil's exceptionally high film strength means protective lubrication of all oiled surfaces under even the most severe conditions and that it is stable at high temperatures and will not foam. It is available in 10, 20, 30, 40 and 50 Grades SAE.

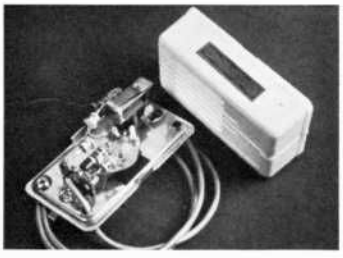
GOLD-plated key from Vilem Haan.

SPORT-VAC plugs into lighter.

JACKET patch by MG Mitten.

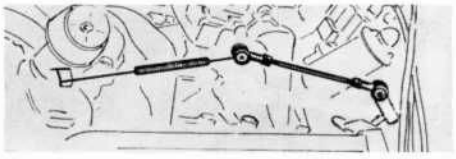


CLOCK-type tire gauge; Fisher.



LITE-Minder stops battery woes.

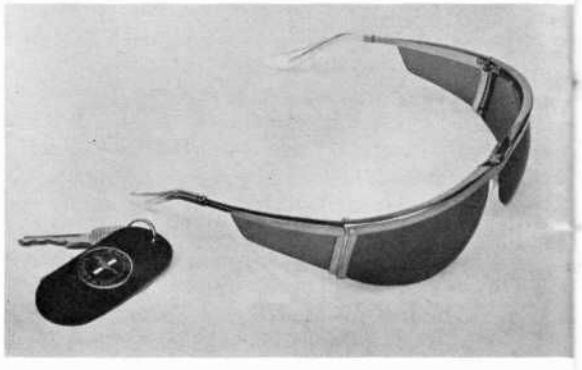
KWIK-Start from RPM Distributors.



BALL-bearing throttle linkage.

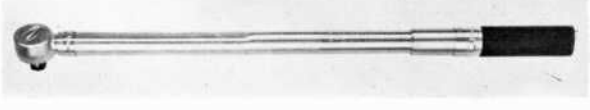
RACING Safety's Mustang keyfob.

D-A Speed-Sport oil is engine protection.



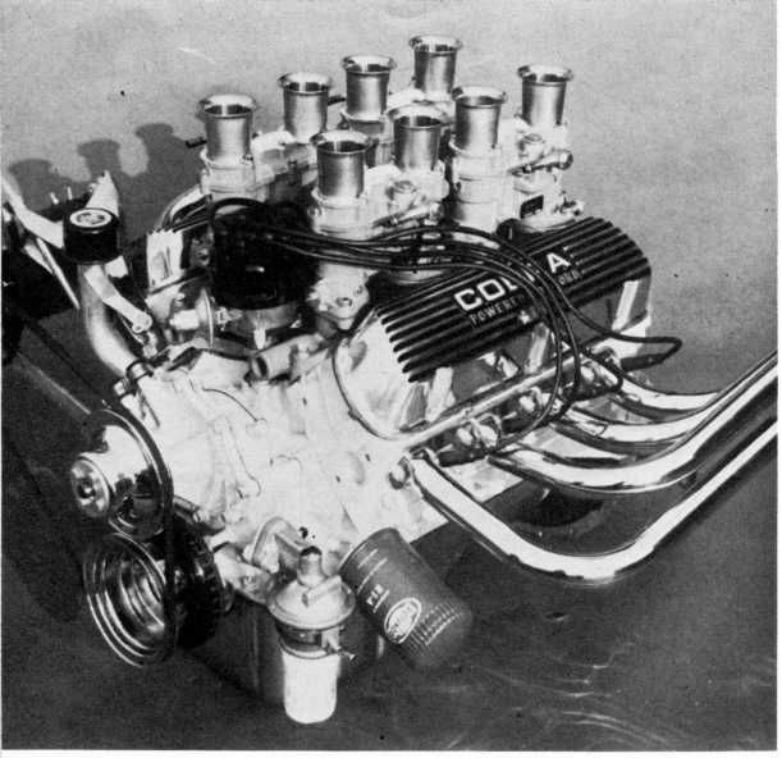
MUSTANG "Spectaculars" and key fob from Haan.

TW-55 Torque wrench from New Britain Machine.



Where to Buy 'em!

Airguide Instrument Co., 2210 Wabansia Ave., Chicago, Ill.
Air Lift Co., 2330 W. Main St., Lansing, Mich.
Alsynco, 171 S. Main St., Natick, Mass. 01762
Amco Division, American Carry-Products Co., 13148 Raymer St., N. Hollywood, Calif.
American Racing Equipment, 480 Potrero Ave., San Francisco, Calif. 94110
Ansen Automotive Engineering, 13715 S. Western Ave., Gardena, Calif.
Astro Enterprises, 120 W. 157th St., Gardena, Calif.
Atlas Auto Products, 4330 Brooklyn Ave., Los Angeles, Calif.
Autotronics Inc., 43 Woodland Dr., Woodcliff Lake, N. J.
Bell Auto Parts, 3663 E. Gage Ave., Bell, Calif.
Berry Plasti/Glass, 2460 Lemon Ave., Long Beach, Calif.
California Speed-Sport Shop, 295 Jersey Ave., New Brunswick, N. J.
Canell Co., 61 S. State St., Hackensack, N. J.
Car-Vac Industries Ltd., 444 Dunsmuir St., Vancouver 3, B.C., Canada
Crane Engineering Co., PO Box 175, Hallandale, Fla. 33009
Crankshaft Co., 1422 S. Main St., Los Angeles, Calif.
Crower Cams & Equip. Co., 3333 Main St., Chula Vista 21, Calif.
Customs by Grotz, 300 Kenny Ave., Ridley Park, Pa.
D-A Lubricant Co., 1332 W. 29th St., Indianapolis, Ind.
Delta Products Inc., PO Box 974, Grand Junction, Colo.
Dixson Inc., PO Box 1701, Grand Junction, Colo. 81502
Douglass Muffler Mfg. Co., 5636 Shull St., Bell Gardens, Calif.
Drag-Fast Sales Inc., 7417 4th Ave. S, Seattle, Wash. 98108
Dragmaster Co., 2725 State St., Carlsbad, Calif.
Dunlop Tire & Rubber Corp., PO Box 2011, Buffalo 5, N. Y.
Eaton Mfg. Co., 100 Erieview Plaza, Cleveland, Ohio 44114
Edelbrock Equipment Co., 4921 W. Jefferson Blvd., Los Angeles, Calif. 90016
EELCO, PO Box 4095, Inglewood, Calif.
Efpe Co., 5530 Dickerson Ave., Detroit, Mich. 48213
Engine Accessories Co., Los Angeles, Calif. 90022
Engle Racing Cams, 1621 12th St., Santa Monica, Calif.
A. R. Fisher Products Corp., 20-10 44th Dr., Long Island City 1, N. Y.
Firestone Tire & Rubber Co., 1200 Firestone Pkwy., Akron, Ohio 44317
Gibbs Special Products Corp., PO Box 471, Janesville, Wis.
Goodyear Tire & Rubber Co., Akron, Ohio 44317
Grant Industries Inc., 241 N. Westmoreland Ave., Los Angeles, Calif. 90004
Vilém B. Haan Inc., 10305-07 Santa Monica Blvd., W. Los Angeles, Calif. 90025
Headers by Doug, 5533 E. Whittier Blvd., Los Angeles, Calif. 90022
Hellwig Products Corp., 6231 San Fernando Rd., Glendale, Calif.
Andy Hotton Enterprises, 475 Main St., Belleville, Mich.
Hurst Performance Products, Glenside, Pa.
Imperial Motor Products Ltd., 24 Michigan Rd., Bellerose, N. Y. 11426
Ed Iskenderian, 607 N. Inglewood Ave., Inglewood, Calif.
Jahns Quality Pistons Inc., 2662 Lacy St., Los Angeles, Calif.
JE Engineering Corp., 930 Monterey Pass Rd., Monterey Park, Calif.
Jo-Line Tools Inc., 8442 Otis St., South Gate, Calif.
Judson Research & Mfg. Co., Conshohocken, Pa.
Koni—Kensington Products Corp., 240 W. 60th St., New York, N. Y. 10023.
Mallory Electric Corp., 12416 Cloverdale Ave., Detroit, Mich. 48204.
deMarcellus, Knowlton & Associates, 704 N. State St., Chicago, Ill. 60610
Master Torque Clutch Co., 2700 Lincoln Blvd., Santa Monica, Calif.
Michelin Tire Corp., PO Box 217, Woodside 77, N. Y.
Miles Instrument Co., 1431 Underwood Ave., Milwaukee, Wis. 53213
MG Mitten Inc., 1163 E. Green St., Pasadena, Calif.
Monroe Auto Equipment Co., Monroe, Mich.
Moon Equipment Co., 10820 S. Norwalk Blvd., Santa Fe Springs, Calif.
Motor Wheel Corp., Lansing, Mich. 48914
Mustang Accessories Co., 1216-20 W. Bristol St., Elkhart, Ind. 46518
Offenhauser Sales Corp., 5300 Alhambra Ave., Los Angeles, Calif. 90032
P&D Mfg. Co. Inc., Long Island City, N. Y. 11105
Potvin Equipment Co., 111 E. Wilhelmina, Anaheim, Calif.
Prestolite Co., PO Box 931, Toledo, Ohio
Products d'Elegance, 3639 San Fernando Rd., Glendale, Calif.
Racer Brown Inc., 108 W. Florence Ave., Inglewood, Calif.
Racing Safety Equipment Inc., PO Box 314, Floral Park, L. I., N. Y.
Rallye Engineering, PO Box 143, Utica, Mich. 48087
Robbins Auto Top Co., 1453 Lincoln Blvd., Santa Monica, Calif. 90401
Ronco Corporation, Blue Bell, Pa.
Roto-Faze Ignitions, 1152 E. 65th St., Inglewood, Calif.
RPM Distributors Inc., Dept. 217, Roxbury, Mass.
Schiefer Mfg. Co., 508 Monterey Pass Rd., Monterey Park, Calif.
Segal Automotive Products, PO Box 46091, Los Angeles, Calif. 90046
Service Spring Co., Box 638, Indianapolis, Ind. 46206
Shelby-American Inc. (Cars), 6501 W. Imperial Highway, Los Angeles, Calif.
Spalding Products, 1617 S. Myrtle Ave., Monrovia, Calif. 91016
Supreme Specialties, 17402 Woodingham Dr., Detroit 21, Mich.
Teleflex Inc., North Wales, Pa.
Thomas Automotive Products, 8816 S. Crocket St., Los Angeles, Calif.
Traction-Master, 2917 W. Olympic Blvd., Los Angeles, Calif. 90006
Trans-Dapt of Calif., Box 4157, Compton, Calif.
Transfire, W. F. Palmer Electronics Laboratories, Carlisle, Mass.
U. S. Rubber Co., Rockefeller Center, 1230 Ave. of the Americas, New York, N. Y. 10020
VDO Instruments, 9500 Woodward Ave., Detroit 2, Mich.
Weber Carburetors (Shelby-American Inc.), 1042 Princeton Dr., Venice, Calif.
Weber Tool Co., 310 S. Center St., Santa Ana, Calif.
Weiand Power & Racing Equip., 2737 San Fernando Rd., Los Angeles, Calif. 90065
Weiler Products Co., Box 2525, Huntington, W. Va.
Wheel Centre Co., 199 Mayhew Way, Walnut Creek, Calif.
Wheel Corp. of America, Sales Div., 110 W. Ocean, Long Beach, Calif. 90802
Wilcap Co., 2930 Sepulveda Blvd., Torrance, Calif.



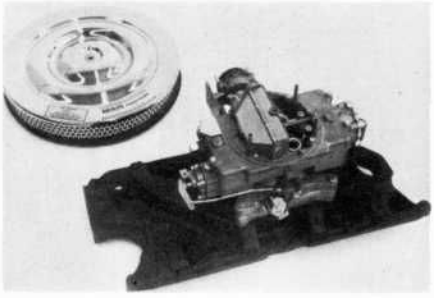
COBRA KITS FOR T

The basic Mustang V-8 is a natural for power-increasing modifications because it's designed for high volumetric efficiency and has the advantages of low piston speeds from its short-stroke compactness. The strength and rigidity of the original 221-cu. in., 140-bhp design has allowed increases to 271-bhp from 289 cu. in. without change in the engine's basic dimensions. And there's more available, through the utilization of the Ford dealer-offered Cobra Kits.

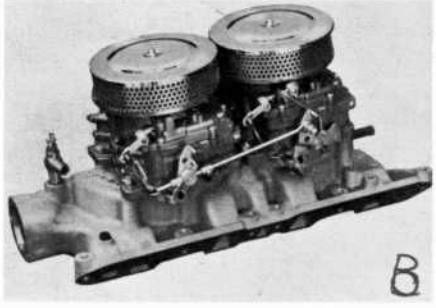
In addition to parts that deliver better performance (see table), there are items for safety – personal and car, too. The high-carbon, cast-steel scatter shield is designed to provide increased protection against clutch or flywheel failure at high rpm; the increased capacity of the competition oil pan provides an extra safety margin for proper lubrication of a high-performance engine.

Dress-up components are also offered. Parts may be ordered through Ford dealers, or through Parts & Service Marketing, Ford Division, Ford Motor Co., Dearborn, Mich. A very helpful book, *Ford High Performance* (Vol. 65 PSM 59) is available at dealers or from the above address.

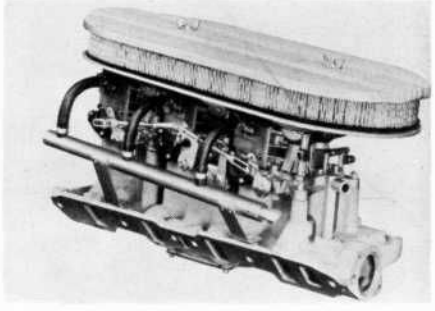
SINGLE 4-barrel carburetor, manifold, air cleaner, gaskets and hardware come in kits to fit both 260 and 289 V-8s, add performance over the 2-barrel carburetor and manifold, even without other changes. Complete kit is $122.60; Part No. C40Z-6B068-D fits '62-64 221-260-289 V-8s; No. C5ZZ-6B068-A fits '65 260-289s.



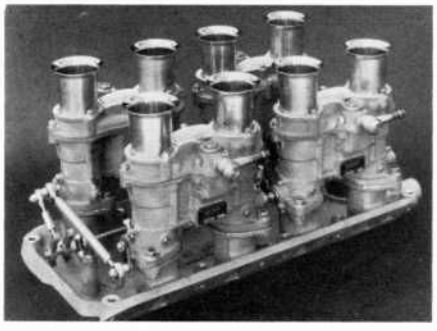
TRIPLE 2-barrel carburetors can really boost horsepower when used with the engine performance and distributor kits. This kit has three carburetors on a cast-aluminum manifold and a special air cleaner. Mechanical linkage (kit, $8.50) permits one-or-all operation. C4DZ-6B068-A fits 260 Mustangs; C4DZ-6B068-B fits the 289 Mustangs. $210.



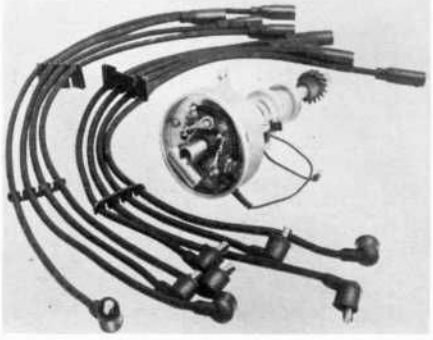
DUAL 4-barrel kit contains two of the carburetors used in single 4V kit, plus cast-aluminum intake manifold, two air cleaners and Cobra Medallions. Secondary barrels of these carburetors are velocity-flow operated for maximum performance. Kit No. C40Z-6B068-E fits '62-65 221-260-289s; cost is $245.



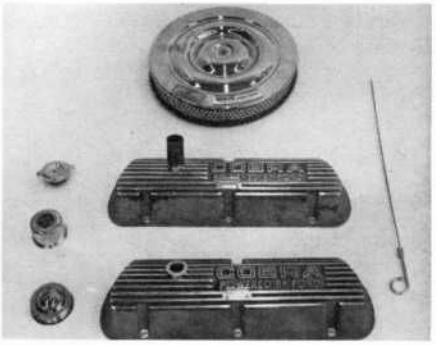
ULTIMATE in carburetion is the four 2V Weber system as used on racing Cobras. Best used for off-the-road, all-out competition Mustangs, it includes manifold, four Weber carburetors, water and fuel manifolds. Throttle linkage kit is $56.96 extra; manifold kit C50Z-6B068-A fits all 221, 260 and 289 V-8s.



DRESS-UP kit for the Mustang engine includes finned, polished aluminum valve covers; chromed dipstick, radiator cap, master cylinder cap, oil filler cap, air cleaner cover and filter. C40Z-6980-A is $78.35. Valve covers alone come with chromed bolts and washers, and are $42 per pair (C40Z-6A547-A).

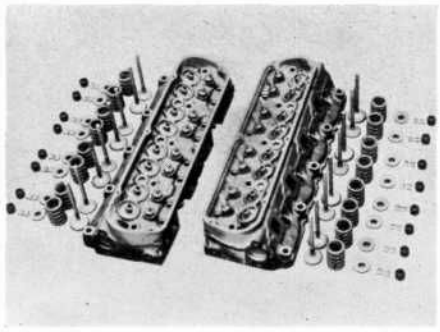


DISTRIBUTOR kit has heavy-duty wiring and distributor with dual points, centrifugal spark advance for high-speed operation. Part No. C4DZ-12050-A fits all Mustang V-8s. Price is $49.80. Separate solid core spark plug wire kit is $8.50 (kit No. A9AZ-12259-D), but should be used with Radio Interference Suppression Kit (C4AZ-18827-A, $8.10) for best radio operation.



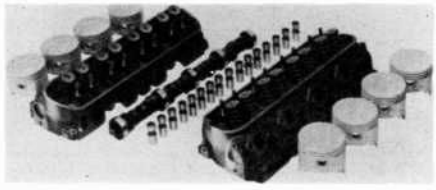
HE MUSTANG

HEAD and valve kit features threaded-in rocker arm studs, spring seat ridges, 1.665-in. intake, 1.445-in. exhaust aluminized valves. Heads, complete, are $224.25 (C40Z-6C056-A) and fit all 221-260-289 V-8s.

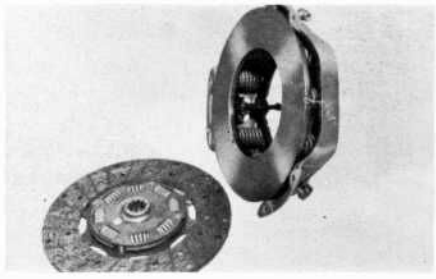


PERFORMANCE kit for all Mustang V-8s has eight matched pistons with heads notched for valve clearance, high-lift cam and solid lifters, heavy-duty cylinder heads and valve equipment; rocker arm studs are screwed-in, and oil-control valve seals are included. The 260 kit is C40Z-6A4044-B, the 289 kit is C40Z-6A4044-C; either costs $345.25.

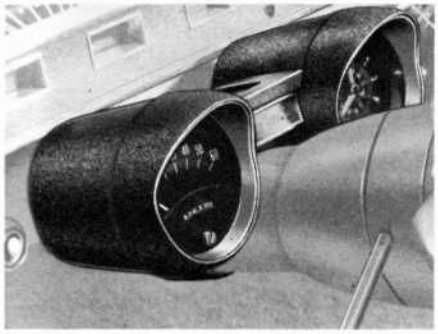
CAST-aluminum oil pan increases capacity to 6½ qt., has exterior cooling fins to keep oil cooler under prolonged hot operation. C40Z-6675A, $80.80.



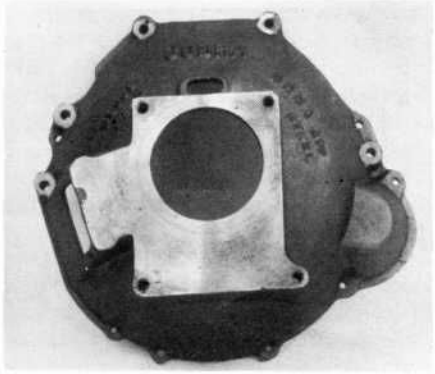
CLUTCH kit has heavy-duty disc and pressure plate. Construction of both the plate and the disc virtually eliminates slipping and provides maximum performance under all conditions. Part No. C30Z-7A537-A fits both 260 and 289 Mustangs; $51.45.



SCATTER shield bell housing is made of high-carbon cast steel to give extra protection for occupants and car at high engine speeds. It replaces the cast aluminum cover and costs $106.75; part No. C40Z-6394-A.



RALLY Pac is a twin-pod instrument cluster which mounts on the steering column. Includes 6000 or 8000 rpm (6 or 8 cyl.) tachometer and precision clock. C5ZZ-10B960-C is $75.95. Ford dealers also offer a full line of Rotunda tachometers, in 3- or 4-in. faces, and 0-6000, 0-8000 or 0-9000 rpm dials. Prices range from $31.75 to $60.



HORSEPOWER AT RPM A 260 CID	HORSEPOWER AT RPM B 289 CID (4-V)	Heavy duty Distributor spark plug leads	Autolite BF-32 spark plugs	Emission valve plugged	Cobra Cam Kit	Compound valve springs	Cobra Cylinder Head Kit	Reworked 4-V heads: ported, enlarged comb. chambers	Steel shim cyl. head gaskets	289 4-V High Performance Exh. Manifolds	Competition (tubing) exh. headers	4-V (1-4V) Induction Kit	8-V (2-4V) Induction Kit	6-V (3-2V) Induction Kit	8-V (4-2V) Weber Kit	Generator disconnected	PEAK (lbs.-ft.) TORQUE AT RPM A 260 CID	PEAK (lbs.-ft.) TORQUE AT RPM B 289 CID (4-V)
141 at 4500	232 at 5500		B									B				AB	227 at 2500	282 at 4000
(STOCK RATING)																	(STOCK RATING)	
145 at 4500	242 at 6000	AB	AB	AB								B				AB	228 at 2500	289 at 3500
161 at 5000	247 at 5500	AB	AB	AB	A	A			B			B				AB	217 at 3000	295 at 3500
	249 at 5500	B	B	B					B		B	B				B	228 at 4000	296 at 3500
205 at 5500	276 at 6000	AB	AB	AB	A	A			B		AB		B	A		AB	232 at 3500	285 at 4000
220 at 5500	286 at 6500	AB	AB	AB	A	A		B	B		AB	AB				AB	228 at 3500	286 at 4500
211 at 5500	314 at 6500	AB	AB	AB	A		A	B	B		AB			A		AB	230 at 4000	286 at 4500
207 at 6000	345 at 6500	AB	A	AB	A		A	B	B	A	B			A	B	AB	232 at 3500	286 at 4500
213 at 6000		A	A	A	A		A				A			A		A	230 at 3500	313 at 5000
222 at 5500		A	A	A	A	A					A	A					240 at 4000	
225 at 5500		A	A	A	A		A				A	A					244 at 4000	

The 289 4V engine used Autolite type BTF-1 spark plugs up to 276 bhp; higher readings were obtained using type BF-603.
(These figures were obtained from actual dynamometer test programs by Shelby-American Inc. for Ford Motor Co.)

TAMING THE WILD MUSTANG

BY STEVE WILDER

Successful as the Mustang is on the sales front, no auto expert worth his beans can claim that its chassis is exquisite. In fact, with its 55/45 weight distribution (the ratio varies considerably with optional equipment – this is for the writer's car) and a softly leaf-sprung rear axle that is quite heavy in relation to the weight it carries, the Mustang is the quintessence of what's generally wrong with American cars: It's a nose-heavy blunderbuss with teen-age rear suspension (one that loves to dance, especially the twist) and too-slow steering. The corollary to nose-heaviness is tail-lightness. The Mustang's particular problem is that the same large engine that makes it nose-heavy develops buckets of torque which dictates a strong and therefore heavy rear axle. In technical terms, the sprung/unsprung weight ratio is terrible at the rear. And Detroit's traditional means of coping with this familiar phenomenon is to use very soft springs so that at least the occasional bump can be absorbed unnoticed. It's a fine solution for tar strips but lousy for cornering on cobblestones. Excessive body lean uses up the available upward wheel movement at what a sporting motorist considers mild cornering forces or lateral "G" loadings. If you hit a bump heeled over, the suspension immediately bottoms out, the tire loses its already tenuous grip and the Mustang jumps to the side like a frisky colt.

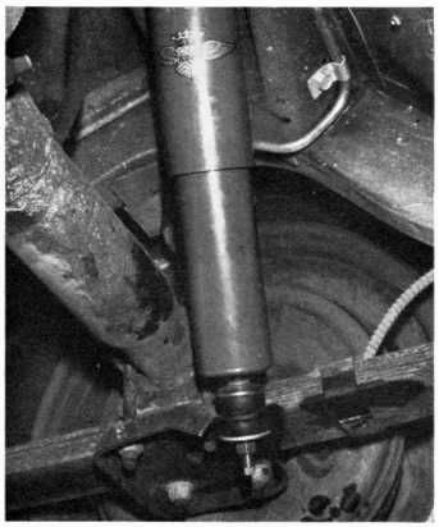
Since I eke out a living under the guise of auto expert, I must make it clear that I was aware of all this when my wife and I bought our Mustang in June of last year. On the other hand, the Ford people have created something quite exciting in the Mustang despite its fundamentally crude basis.

And, after a decade-plus of MGs, Porsches, Aston Martins and finally a sham-caned Mini-Minor estate wagon (our Long Island "estate" is not much larger) we both find it a delight to have non-enthusiast friends exclaim over our car without asking us to explain it.

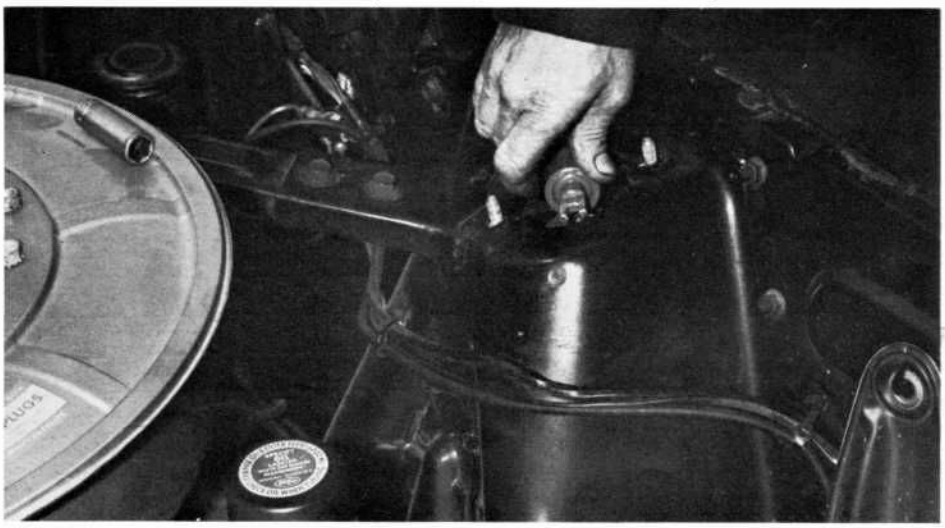
Our Mustang, right or wrong, is a yellow convertible. It came with the "soft" 289-cu. in. engine, automatic transmission (have you gone crosstown in Manhattan lately?), the trim stripe (it's cheaper than taking off that piece of chrome flashing), padded visors, 2-speed wiper and a windshield washer. Nothing else. Hardly the option-laden package the dealers love – some of them chortle about retailing Mustangs at over $4000 – but a nice reasonable imitation of a *pur sang* sports car that's no worse than a lot of famous British machines that cost more, brag more, go slower and break faster.

Our first disappointment was that whoever punches the IBM cards forgot to open the little rectangular holes for the Sport Handling Package and back-up lights. The latter we can live without but the standard super-soft springing and damping and the slow steering were hard to take; but not as hard as waiting a month for another Mustang.

REAR KONI shock absorbers are adjusted by turning lower mounting bolt extension.



UPPER SHOCKS can be adjusted from under the engine hood. The unit is loosened, compressed fully, turned one-half turn, tightened.



What to do? Something, of course. I had already bought wide, wide 15 x 5.5 rims from a friendly neighborhood Ford dealer (part number C1AZ-1007A, $8.50 each and they fit Volvos, too) and a set of Pirelli Cinturato braced tread tires. These were installed within 50 miles so as to get a good take-off price on the original tires and wheels. (Anybody want hubcaps?) These Italian radial-ply tires really make a change in any car's handling. Because they develop the necessary side forces for steering corrections or cornering maneuvers at smaller slip angles than do conventional bias-ply tires, a car so equipped requires drastically less steering wheel movement for a given maneuver. In effect, they are a rubber quick-steering kit. They also improve the steering system by giving the driver better road feel.

We drove the car a lot in this configuration – as purchased but with wide rims and Pirellis – and found it very pleasant, much more so than ordinary Mustangs. The ride was remarkably comfortable for such a light car but clearly underdamped. With adult passengers in back, the rear axle bottomed easily and often on bumpy roads. We had that typical problem of the muffler clamp hitting the right spring, too, but swinging it around for clearance solved only part of the problem. And the Ford dealers were not very anxious to install the bits and pieces of the handling kit, in fact they kept helpfully suggesting that we just sell our car and buy a new one!

We gave that some thought but the answer became clear when I attended a test session at Bridgehampton Raceway organized by Kensington Products, the importers of the Dutch-made Koni shock absorbers used on all Ferraris, Shelby's Cobras and the occasional Porsche. Their test was to measure the improvement Konis could provide, if any, in Walt Hansgen's lap times in a Mustang hardtop fitted with the now-obsolete 164-bhp, 260-cu. in. engine, 3-speed stick shift, a radio and, just to keep things sensible at racing speeds on the winding turns that thread across Long Island's sand dunes, a set of 7-in. wide 15-in. rims and Dunlop racing tires. Comparing the best laps, the improvement due to Koni shocks was a good 1.8 sec. That's a lot for changing only one item, especially in a car that by racing standards is overweight and underpowered. Then came the grapevine message that Ken Miles was choosing Koni over Armstrong for Shelby's Mustang GT-350. I got the hint – and a set of Koni shocks.

Let me tell you what a change they make. I pulled out of Henri Weber's Amoco station in Bayside (with a name like that, he just *has* to do good work) and trundled East on Northern Boulevard. Like all New York City streets, it's no gem. And to my surprise and joy the Mustang was no longer plodding tipsily over the irregularities as if in styrofoam-filled overshoes. Sure, I could feel the bumps – thump-bump and they were past – but the car was still level. If I squint my eyes a bit, it feels just like a Ferrari.

A certain amount of this small displacement stiffness is peculiar to new Konis; the piston rod seal takes a while to run in. It didn't take anything like the 500 miles Kensington Products suggests for this to happen and our Mustang now is comfortable riding enough that passengers remain unaware of any change. But come an interesting corner and I can turn on a little tiger without losing contact with the tarmac. Stiffer shocks despite standard springs give good protection against "crash-through" or bottoming-out of the suspension. Incidentally, of the four shocks taken off, two were unserviceable by even the crude test of compressing by hand. That was at 6000 miles or so. The Ford dealer replaced them under warranty graciously but confusedly, since neither the new nor the old ones were or had to be attached to our car.

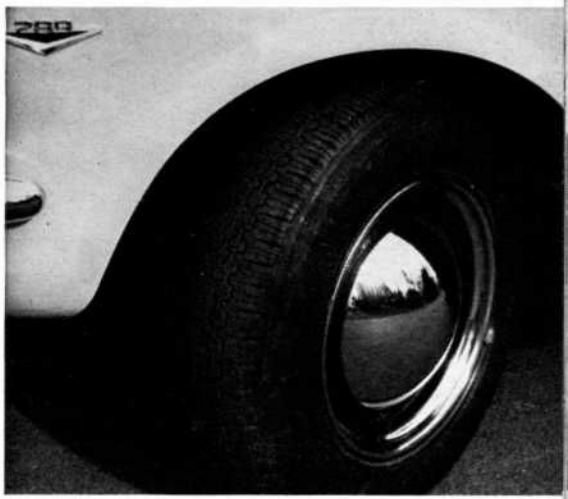
You can tell by this point that I'm not an engine nut. Our 289, in fact, insists on idling roughly and delivers mileage as low as 13.5 but the dealer doesn't solve it and we hardly care, what with Gulftane at 27.9¢. What we are interested in is handling and I'm sure some of you will be quick to point out we bit off a mighty large bite when we bought a Mustang. And you're right. But at $3146 list, delivered to New York, it was and is a tempting beginning.

After the Koni shock absorbers were installed, I had Art Riley (of Volvo fame) install a pair of Traction Masters. Traction Masters are tubular radius rods that can be used on virtually any car with a rear axle wherein leaf springs do the suspending and both lateral and longitudinal locating. One bracket is clamped to the axle housing by the U-bolts, the other must be welded to the frame directly beneath the front spring eye. Their purpose is to keep the axle housing from rotating back and forth – normally a common problem under hard acceleration which leads immediately to wheel hop (judder). They achieve this by effectively providing a parallelogram linkage: The TM rod and the front half of the leaf spring being parallel and of equal length, they limit the axle housing to vertical movement in a slight arc with no rotation whatever. That's in theory, anyway. In practice, of course, things are different, though not much. The problem with Traction Masters is that they are mounted so close to the spring – in order not to eat up all the ground clearance – that their useful effect is minimized. Mine were installed while we were still treating the Konis gently and I can't help but wonder if the TMs add very much on their own. Whatever the reasons, the family Mustang now is quite a stable (pun!) platform on the lousy roads that abound in this blighted area.

To augment the above handling aids, I fell back on Ye Olde New Englande 98¢ Traction Kitte, available at hard-

TRACTION MASTER arms mount beneath leaf springs and provide improved rear axle control. Forward bracket must be welded in place.

PIRELLI CINTURATO tires, in 165-15 size, trim rings and Baby Moons complete wheelwear.



ware stores and lumber yards nationwide. Namely, a big bag of sand. This is a very tidy trick, especially if you check your bag for leaks before paying for it. The bag lies flat on the trunk floor, on the Mustang you can slip it under the spare tire to conserve luggage space – or you can plop it into the right rear fender well to maximize its effect on the one wheel that's first to lift during acceleration. Either place, it's well behind the rear axle which means it actually lightens the load on the front wheels. My slide-ruling indicates that just one 80-lb. bag changed this Mustang's weight distribution from 55/45 to 53/47. Of course, it also raised the weight 80 lb. Keeping the gas tank full is also useful, but perhaps the best trick (I haven't gotten around to it yet) is to move the battery to the trunk, protecting the luggage from it with a rustproof plastic box of the sort you can find at marine hardware stores. You should be sure to use 6-v. (larger diameter) cable from it to the starter so that the extra length won't cause too much of a voltage drop.

Of course, shifting all this weight to the rear makes it still easier for the rear suspension to bottom out – and that was already a fault to begin with. The reason the situation is no worse than when we started is largely a credit to the Koni shock absorbers. Their strong damping thoroughly eliminates excessive wheel travel over the everyday sort of bumps that cause crash-through on ordinary Mustangs. Re-arching the rear springs would be sensible, but I'm content to leave things as they are for now. I'm glad now I don't have the stiffer (20%) springs of the handling kit and my Koni shocks are better than the heavy-duty items offered by Ford. That's not what I thought when I ordered the car, but I've given it more thought now. Stiffer springs, like stiffer anti-roll bars (stabilizers), do reduce body roll but they also make it harder for the tires to follow irregularities in the pavement. Zora Duntov, speaking once about pre-Sting Ray Corvette's racing suspension, said that stiff suspensions were fine for airport circuits or Le Mans, but if he were to race at the Nurburg Ring or Targa Florio he would be sure to select the standard "boulevard" springs. (But not the shock absorbers!)

One item I would like to change is the tires. Not the brand or type. The size. I went the cheap route on my Cinturatos, picking the 165-15 since it is roughly equivalent to anything from a 5.90 to a 6.40-15, and Ford at one time talked of offering a 5.50/5.90-15 sports tire as an option. Even checking out load ratings with Pirelli made it sound like the right size, with 24 psi front, 20 rear, being adequate for touring. But on the wide rims I selected (Pirelli spokesmen think 4.5 is wide enough for the 165), the tires looked too flat by far at such low pressures. So I've been running them at 29 psi or so all around, sometimes 32 in front. I'd rather have the much more expensive 185s or at least the 175s and run them softer. Better ride and perhaps better road-holding over bumps.

Enough technical talk. Externally, I did some dimestore customizing to rather good effect. The grim black wheels – Henry's at it again – were treated to some very ordinary trim rings and Baby Moons. My neighbors look askance since these are locally very much a symbol of the high-school motoring set, but I think their smooth roundness really suits the Mustang's lines far better than the complicated designs that Ford offers. I have discovered the hard way that the Baby Moons should be kept well waxed.

If I had buckets of money, I'd look into mag wheels. Not so much for their appearance though, but for what I presume is their light weight. Why don't the advertisers ever mention this? At the risk of repeating myself, the problem is to reduce unsprung weight. This is true on any car but it's especially pertinent on cars like the Mustang.

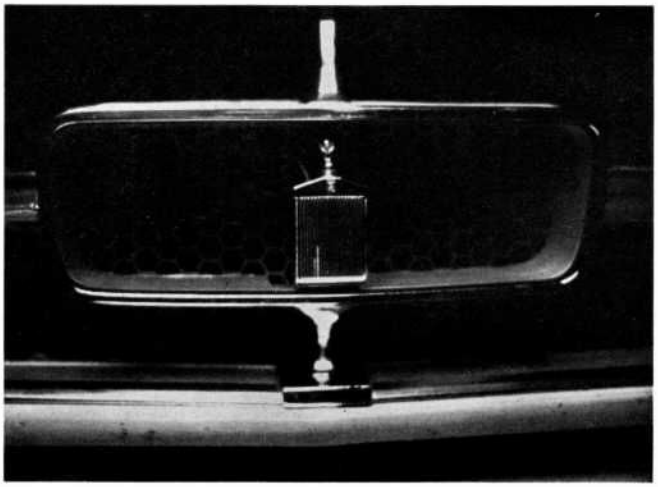
A short friend neatly solved his forward visibility problems with his Mustang by placing 1.5-in. wooden blocks under the seat tracks. I tried it, and it's a better seat height.

Our Mustang has a black interior and I can't remember offhand whether all other Mustangs have black dash padding, too. While it does a rather good job of killing reflections in the windshield, I found the shiny windshield wipers very distracting. Another 98¢ bought an aerosol can of flat black paint and, while my technique would make the enamel shrivel at a professional paint shop, all I did was take the arms right off, remove the rubber blades and spray away. No pickling, no sanding. Of course, it'll chip off eventually, but for now I am at least free of distracting dazzle. I'd like to recommend this trick. The paint I had left was sprayed in the fender wells and on the underbody to kill the odd glints of unwanted lightness in those areas.

Oh, yes, one other appearance device. When my brother-in-law gave me a paperweight for Christmas that is a 3-in. miniature of the famous R-R grille, complete with a tiny Flying Lady, what else was there to do but mount it on our Mustang where the horse had been? It was easy to install, I just used old coat hanger wire and some sheet metal screws, picking up the horse's mounting holes in the grille bar. And like Rolls-Royce owners who remove the Lady when they park in unsavory areas, I do, too. Of course, in this case the upper surface of the header tank comes off with her, but after all, a gentleman wouldn't leave a lady unescorted, would he?

SIMPLE TREATMENT reduces glare off windshield wiper arms. A can of flat black paint spray, 5 min. work and – no dazzle.

ONE OWNER'S custom touch: A miniature Rolls-Royce radiator in place of the horse.



MUSTANGS SCORED their first international competitive success late in 1964 when Peter Procter (in front) and Peter Harper won the touring class of the Tour de France. Procter finished the 10-day grind without incurring a penalty point.

MUSTANGS FOR MONTE CARLO

BY JOSEPH LOWREY

In 1936 and again in 1938, the *Rallye Monte Carlo* was won outright by a V-8 Ford. When the light Mustang appeared on the scene in 1964, the chances of Ford repeating those old victories appeared higher than for many years past – but chance was the important word.

Monte Carlo, the little principality under the cliffs of France's Mediterranean coast, has gambling as the centerpiece of its tourist industry and the Monte Carlo Rally is very much a gamble on the hour-to-hour uncertainties of winter weather in mountain districts. It takes a very good car with a very good crew to win, but many a good car with a good crew gets put out of the running; this can be a result of picking a starting point from which the route becomes blocked by snow (as happened to the lavishly-backed Falcons in January, 1963), or of being at the unlucky end of the hours-long column of cars on the route's final stage onto which all of the rally routes eventually converge.

Four Mustangs were among the 237 cars which set off on the 1965 Monte Carlo Rally and unhappily none of them were among the 22 cars which reached the finish within the very tight time limits. Only two of the Mustangs had been regarded as really serious challengers for outright victory; Bo Ljungfeldt of Sweden (who placed second in the 1964 Rally with a Falcon Sprint) started from Stockholm in a car prepared in England by Alan Mann Racing Ltd. with Ford backing, Henri Greder of France went from Paris in a car prepared on similar lines by Ford of France. Ljungfeldt, driving the car in which Peter Harper had finished second (behind teammate Peter Procter) in the Touring Category of the Tour de France a few months earlier, had a tire go flat on him suddenly on the Col du Granier and was thrown into a snowdrift. Greder got almost to Monte Carlo and then

WORKSHOP SCENE is at Alan Mann Racing Ltd., just outside the old Brooklands track in England. Mann's group prepared the Monte cars.

LEAVING ONE of the numerous control points along the Rally Monte Carlo route, a Mustang has its Marchal auxiliary lights covered for protection.

Monte Mustangs

was put out by breakage of a front suspension wishbone.

Whereas smaller-engined cars are often very highly tuned indeed to gain rally-winning performance, Alan Mann has no problem in getting enough power from the Mustang. His mechanics have concentrated on developing the chassis, so that full use can be made of the available power on the narrow, rough, winding and slippery roads which rally competitors must cover at the highest possible speeds. Engines of the 289 cu. in./271 bhp "High Performance" specification are assembled by Holman & Moody with its regular camshaft and exhaust headers, and have proved utterly reliable. One 4-barrel Holley carburetor is preferred, for performance unimpaired by the wash-out during hard cornering which can afflict some dual carburetor systems. Nobody seems to mind how much noise a rally car makes, so two short exhaust systems with slight silencing are planned to discharge sideways ahead of the rear wheels, road clearance beneath the car's well-armored underside being improved by placing the pipes close to the floor, disregarding how much heat gets into the bodywork.

With only moderate tuning, the Mustang engine is flexible and not unduly fussy about gear ratios. A 4-speed stick-shift transmission is used with normal rather than extra-close ratios. The sturdy rear axle is equipped with a No-Spin differential in which dogs give a brutally positive lock-up, and a high 1st gear ratio provides the power to spin both rear wheels when the driver wants to slide the car's tail around a hairpin turn on dry pavement. For the Monte Carlo Rally a 4.5:1 axle ratio was chosen, giving around 105-110 mph at 6000 rpm, according to the tires in use, whereas for the Tour de France, which involved fast racing circuits, a 3.5:1 axle providing 135 mph or so had been fitted. The Monte Carlo gearing made it easy for the driver to sustain high rpm, so even for a mid-winter rally the oversize radiator option was fitted, with an oil filter and cooler alongside it to keep down the temperature of the SAE 30-grade Castrol lubricant.

Whenever possible Alan Mann Racing Ltd. likes to build up its own cars from unpainted body shells, so that it can check every structural detail, apply seam welding where the mechanics suspect that the normal spot-welding may lack

REAR END of the well-equipped rally Mustang shows a pair of studded tires, already mounted on wheels for quick-changing.

SERIOUS COMPETITORS in the Monte have almost as many kinds of tires as golfers do clubs — to suit the varied road and weather conditions.

strength or stiffness, and weld in additional reinforcement wherever bad roads and a modified suspension are liable to impose heavy loads. This was not originally possible on the Mustangs, which reached England as complete cars, and during the Tour de France some quite major frame welding was undertaken in spare minutes outside time checks; by the time they started out for Monte Carlo (weighing some 2650 lb. at the curb, fully equipped but with almost empty fuel tanks) the cars should have been strong enough to face any stress except an encounter with a major obstacle hidden in the snow. Points which have especially needed reinforcement are the frame just behind the front suspension, and the rear suspension crossmember.

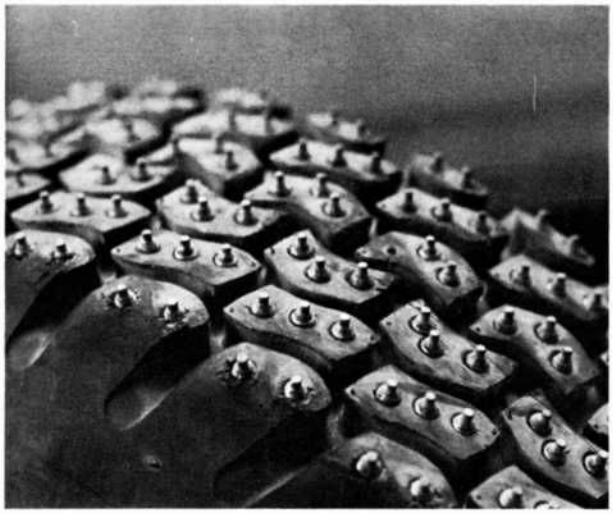
Suspension settings for the competition Mustangs have been evolved in Europe by trial-and-error, and involve extra-stiff coil springs at the front, rear half-elliptic springs with very strong check leaves to control axle wind-up and a track bar from the right side of the frame to the rear axle. Long-travel Aeon hollow rubber buffers check rear axle movement before the usual small rubber bump stops are touched. Strut-pattern shock absorbers have been tailored for the job in England by Armstrong, and have click-stop external bleed valve adjusters which permit final quick adjustment of front and rear suspension damping for best road-holding.

The quickest available Mustang steering option gives lock-to-lock in 3.73 turns, and with tire inflation pressures around 35 psi, the car is light to handle. To eliminate the flywheel effect of the deeply-dished production steering wheel, the column is lengthened to take a small-diameter wheel with lightweight wood rim, this making skid control quicker and easier.

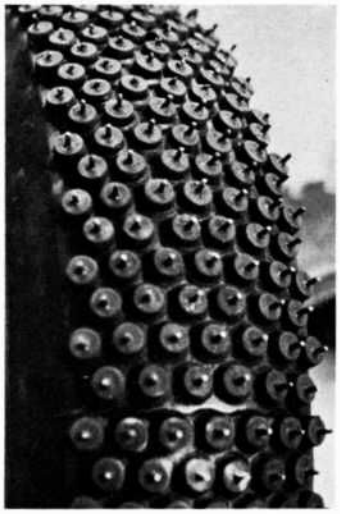
Braking is by caliper discs at the front and by drums at the rear, the latter being normal Mustang units with sectional metallic linings which last through several rallies. Because development engineers are close at hand, British-made Girling front brakes and a vacuum servo of the same make (with a vacuum reservoir) are fitted in preference to the Mustang's normal Kelsey-Hayes disc brakes. Renewal of the Ferodo disc brake pads is a very quick job and as a matter of routine was done at two-thirds distance in preparation for the extra-tough final stages of the Monte Carlo Rally. To make room for the brake servo and vacuum cylinder, the normal-size Autolite 12-v. battery is moved to an alternative position beneath the rear seat, where its weight helps traction.

For a winter event such as the Monte Carlo Rally it is essential to have the right tires for each important section of the route, and mobile service teams change wheels for factory-backed drivers according to whether there is dry pavement, rain, hard ice, thick or thin layers of wet or freez-

GRIP FOR icy patches on an otherwise dry road is provided by this tire.



FIRESTONE Super Sports/All Traction proved to be most versatile when equipped with Scason studs.



FINNISH recaps with wire spikes were used for most extreme conditions.

ing snow ahead. Nine different kinds of tires were taken in service vans to points on the route, mounted on 15-in. wheels of 7-in. rim width, and no commercial contract with any one tiremaker was allowed to inhibit choice of the best obtainable equipment.

Dry road equipment for the fast stages (not needed in the 1965 event, as a blizzard coincided with the departure of competitors on the final high-speed journey through the mountains!) would have been Dunlop R6 road racing tires. Similar tires with rings of pressed-in steel studs around their inner and outer edges were available to cope with ice patches on otherwise dry roads. At the opposite extreme, recapped tires from Finland designed for deep snow were entirely covered with wire spikes so long and sharp that it looked dangerous to do a wheel-change without wearing heavy gloves! In the event much use was made of Firestone 7.10/7.60-15 Super Sports/All Traction tires, with 800 Swedish Scason mushroom-ended carbide-tipped steel studs pressed into blind holes which had been drilled in each tire tread; these hard-rubber tires gave over 1000 miles life in tough Rally conditions and kept the studs (up to three per block of the tread pattern) in place even at 110 mph.

At the back of the Mustang, a fuel tank of 26.5 gal. (U. S.) capacity bulges up through the trunk floor. For the Monte, two spare wheels were clamped down flat above the gas tank, while for the Tour de France in September only one spare wheel had been carried, and there was then room for an auxiliary 10-gal. tank in the right rear fender, feeding the main tank through an SU electrical pump.

Most of the vital stages of the Monte Carlo Rally had to be covered flat-out in the dark, so eight Marchal driving lamps were fitted to each car and used simultaneously on the speed tests. Two central spotlamps provided very long-range illumination for sections of straight road and were aimed rather high; the two headlamps were set with their beams slightly low and splayed outwards, to illuminate the way over humps or rough slight curves, two lamps with very wide spreading beams helped on hairpin corners and two cornering lamps aimed 30-35° to the side were mounted under the ends of the front bumper.

All these lamps had the 12-v., 55-watt quartz-iodine bulbs from the Philips plant at Eindhoven which have now become universal rally equipment in Europe, and a high-capacity Autolite alternator driven by a single belt kept them burning brightly.

No great weight of complex equipment was used on the Mustangs and, as their tactics were "win or bust," such things as snow shovels were jettisoned on approach to the final stages. Two reclining-backrest bucket seats by Restall were installed, so that the navigator could sleep whenever he was not busy and the driver could rest when he reached a control with time in hand. The windshield washer had a 2-gal. reservoir, and if almost-undiluted solvent or brine solution did not de-ice the glass, the rear end of the hood could be wedged open with a block of wood. An instrument panel in front of the strip speedometer carried a Sun tachometer, an oil pressure gauge and a coolant thermometer, other instruments used in preliminary testing being thought useless during the actual rally. For the navigator there was a Halda Speed Pilot to show time gained or lost on schedule, a Halda Tripmaster distance indicator and an elapsed-time clock.

Sheer performance plus sufficiently good road-holding let the Mustangs of Peter Procter and Peter Harper win their half of the 1964's Tour de France with almost contemptuous-looking ease. 1965's Monte Carlo Rally was a much tougher nut to crack, as it requires large-engined cars to go faster than small-engined cars to beat a handicap formula. This would have been hard work in good weather, but in conditions of fresh snow it looked almost impossible. What a pity that a tire fault and a broken suspension wishbone prevented the two really top-line Mustang drivers from showing what they could do!

BO LJUNGFELDT demonstrates tail-out sliding technique used to get around a snow-packed corner. Monte must be driven at maximum speeds.

PHOTOS: JOSEPH LOWREY, HENRY MANNEY, FORD MOTOR CO.

THE SNAKECHARMER AND THE COBRA

Carroll Shelby's Magic Flute

BY JIM WRIGHT

It would be difficult, if not downright impossible, to try to put together a Mustang handbook without including mention of the Shelby-American operation. If not because of its recently introduced Mustang GT-350, then because of the part it has played in developing Ford's Fairlane V-8 engine to the point where it's one of the most reliable and respected powerplants in the racing world. If those aren't reasons enough, then we'll mention the operation simply because it's a darned good success story; one that the automotive world hasn't seen the likes of in a long, long time.

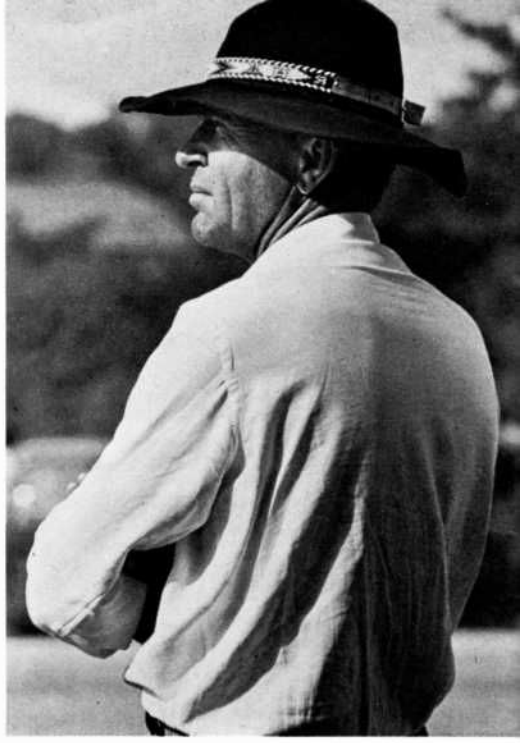
Five years ago Carroll Shelby was an ex-chicken farmer just turned ex-race car driver. Imposing credentials which, along with 15¢, were good for a short beer at any joint in town. We aren't sure about the reasons Carroll had for getting out of a sure-fire thing like the chicken business, but he got out of race cars on the advice of a friend – his doctor. A periodic check had turned up a slight heart condition. Nothing really serious you understand, but please don't climb into any more race cars.

Since the demand for ex-race car drivers (to say nothing of ex-chicken farmers) has always been somewhat slight, Shelby had to look around for something else to do.

The first thing he did was form Shelby Enterprises, a rather loose-knit organization consisting of Carroll himself, the desk space he was renting from speed equipment maker Dean Moon, and a telephone answering service. Those were the tangible assets.

Not so tangible was the idea Shelby had about building an American sports car. This was a thing that had been kicking around in the back of his mind for a number of years and something he had a lot of faith in. Shelby felt that there was a ready market in this country for a car that combined the power and reliability of an American engine with the fine styling and finished look of an expensive European sports car.

So have a lot of other people. The idea isn't exactly an original one. It seems that since back in the early Fifties there's always been *someone* making announcements that *he* was going to do just that. But no one ever did. Lack of funds was the usual excuse. Shelby had the same problem and it didn't look as though he was going to get any further with his project than the others had with theirs. Not being blessed with funds meant that he needed somebody with a bankroll and the foresight to match. Financiers aren't exactly noted for opening their pocketbooks to every ex-chicken farming, ex-race-car-driving Texan who comes down the pike with a far-out idea and a fast line of chatter – a fact Carroll quickly discovered.



CAREER OF Carroll Shelby spans more than a dozen years of racing on several continents. Upper far right: Shelby in a 4.5 Ferrari placed 2nd at Ft. Pierce; Upper right: On his way to win the Times GP at Riverside in '60.

ALICE BIXLER

In the meantime, Ol' Shel was keeping himself in walking-around money with the operation of the Shelby School for High Performance Driving. It was also about this time that he made a deal to sell Goodyear racing tires. At least he didn't have to worry about standing in the unemployment lines.

Not easily swayed by success, however small, Carroll never lost sight of his original goal, The American Sports Car. To keep the idea alive he sent a steady barrage of letters to various automobile manufacturers in search of backing. When business took him to the Detroit area he tried to see them personally. More often than not he found himself cooling his heels in an outer office while the executives beat a hasty retreat through the back door.

Then, late in 1961, two dissimilar announcements were made to the automotive world. To the unpracticed eye the events were totally unrelated. But not to Ol' Shel. In true Shelby fashion he put two and two together, came up with six, and has been way ahead of the game ever since.

The first announcement came out of England. The AC Carriage works decided that it could no longer produce the AC Bristol sports car because its engine supplier, Bristol Aircraft Co., had discontinued making engines.

The other came out of Dearborn, Mich., where Ford en-

WHEN SHELBY put two and two together in '62, he came up with the original Cobra. It combined a light but potent American engine in a swift, roadable English chassis.

STRICTLY A 2-passenger vehicle, the Cobra had traditional sports car driving characteristics.

BILL NORCROSS

FRANK W. TREMBLEY

LEO P. CUMMINGS

LOUIS KLEMANTASKI

gineers had finished working the bugs out of a brand-new V-8 engine and had put it into production. Some revolutionary new casting techniques had been developed which allowed the block and heads of the new V-8 to be cast with much thinner walls, making it an extremely lightweight unit.

Shelby contacted both AC and Ford, proposing that he develop the AC chassis and body and the new Ford engine into a new sports car. Don Frey, now Ford Division General Manager, but then in the special vehicles division, along with his assistant Ray Geddes and the operators of AC, agreed that this might make an interesting mating. They approved the construction of a prototype.

At long last Shelby was generating the kind of interest for which he had been looking. He went to England and supervised the modifications necessary to allow the AC chassis to accept the 260-cu. in. version of the Fairlane engine. The results were personally checked out by Shelby at a nearby test track. When he was finally satisfied, the car was shipped back to the U. S. where a few final modifications were made at Dean Moon's shop in Santa Fe Springs, Calif.

Now came the critical period. Ford liked the car but wasn't about to get too deeply involved until it found out what the public would think about it. Shelby took the Cobra — this is the name he had been calling it long before it ever became a reality — to all of his many auto journalist friends and let each of them test drive it. All were impressed.

During this period a second Cobra was built. This was a racing model and it made its debut at Riverside Raceway in a 3-hour GT race in October, 1962. Driven by Billy Krause, the Cobra was way out in front of the nearest Sting Ray when it retired with a broken half-shaft. The spectators were impressed, as were the many GM executives who just happened to be there.

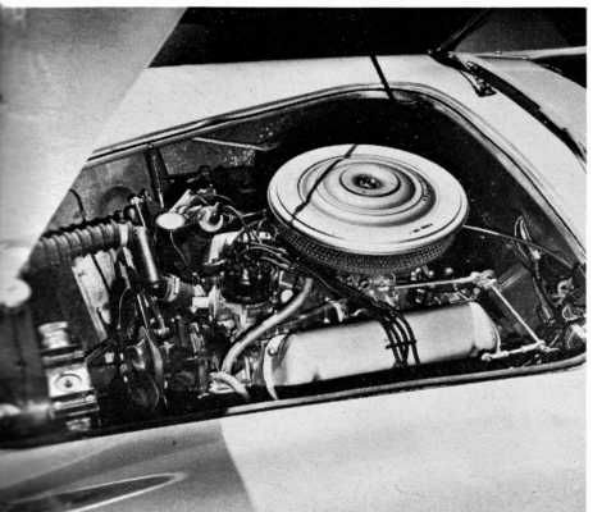
Carroll wrested the prototype Cobra away from the journalists long enough to give it a glittering gold-yellow paint job and ship it off to the 1963 New York Auto Show. More favorable impressions, this time accompanied by orders, along with *cash* deposits for similar models. This enabled Shelby to order more chassis from AC and more 260 engines from Ford. But, for the time being, the final assembly was still being handled in the back room at Moon Equipment Company.

A sales curve had been established and it was going up. And right along with it went Shelby's credit rating. Most important, the Cobra image fit in with Ford's plans for an extensive performance program. Ford offered financial backing. On the strength of this, Shelby was able to negotiate for the purchase of the Reventlow Automobile Inc. facilities in Venice, Calif. Lance Reventlow was another of those who wanted to build The American Sports Car. While a great deal more successful than others, his Scarab sports car, built wholly in the U. S., was far too expensive to be a production vehicle.

The Shelby operation moved into its new quarters and was christened Shelby-American. Shelby Enterprises was retained and consisted of the driving school, which was being run by Pete Brock, and the Goodyear racing tire distributorship, which was and is operated by Paul Anfang.

FIRST COBRA engine was a 260-cu. in. V-8 well worked over by Dean Moon and associates.

EARLY TRACK tests at Riverside Raceway revealed some amazing performance characteristics; 0-100 in 10.8 sec., top speed over 150 mph, fine handling.



ROAD & TRACK PHOTOS

The Snakecharmer

With capital at his command, Shelby really began to move. He hired the best talent available. Phil Remington, recognized as one of the country's leading race car engineers, became the chief engineer. Ken Miles, a leading West Coast sports car driver and a builder, became head of what was soon to be the busiest competition department in the world.

It wasn't long before S-A outgrew the original RAI facilities and expanded its operation into a complex of buildings across the street. This gave three times the room. The original building still housed the main offices, the engine and dynamometer shops, and the competition department.

Early in 1963 the competition department swung into action. The racing team, headed up by Miles as No. 1 driver and featuring such stars as Dave MacDonald and Bob Bondurant, won most of the races it entered that year, losing only a few. Early in the game it became apparent that the 260-in. engine was just a bit small and it was necessary to develop a larger version. This was the 289. Constant work with the engine saw its power output rise from the original 271 horses in its factory stock form to 380 in the all-out, Weber-carburetored version. Engine mechanical failures were unheard of.

The 1963 season ended with the United States Road Racing Championship going to Shelby – 111 points vs. 28 points for second-place Ferrari. On the international circuit Ferrari still had things pretty much his own way, but he knew he was in for trouble in the near future.

Long before the '63 season ended, Shelby began making plans for 1964. Pete Brock, who had been running the driving school, was given a new title: Director of Special Projects. As such he began working on a new Cobra: An aerodynamic coupe that could compete with the Ferraris on the longer, faster European circuits. The reason for designing a coupe was that under the class rules they weren't allowed any engine or chassis changes. So, the only way to go faster was to come up with a shape that could slip through the air with less resistance.

In December, '63, the coupe was still practically in the drawing board stage and Brock, chief engineer Remington and Miles found they had a crash program on their hands if one was going to be ready for the first points race of the international season: The Daytona Continental in February. It took a long succession of 24-hour days, but they did it. Brock's design had been checked out by scientists from Ford's Aeronutronics Division and, with a few changes, had been pronounced fit. In testing, the coupe was 15 mph faster than the roadster down the backstretch at Riverside.

In practice for the big 12-hour Continental, the coupe was faster than everything, even the prototype Ferrari driven by Pedro Rodriguez. During the first eight hours of the race it led most of the way. Drivers Dave MacDonald and Bob Holbert reported it was the fastest, most comfortable car they had driven. But just as dusk fell disaster struck. A rear axle coolant pump broke and the rear end began overheating. The coupe pitted and during the refueling operation, fuel splashed on the red-hot differential and exploded into flames. These were quickly doused but the combined delay of the fire and the rear axle problem knocked them out of a chance for an overall win. The coupe did finish fourth overall and first in GT class, ending a long string of GT victories for Ferrari.

The Shelby team was jubilant, but this wasn't to be its year. It finished second to Ferrari in the Targa Florio, was defeated at Spa in Belgium and at the Nurburgring in Germany. At the 24 Hours of Le Mans, drivers Dan Gurney and Bob Bondurant finished fourth behind three Ferrari prototypes but won the GT class and the points that go with it. They lost again at Reims, but Bondurant won the Frieburg Hillclimb. When the season ended Shelby had come within a sharp fang of beating Ferrari.

At home Shelby faired better. The U. S. Road Racing

FROM SHORT, slow production line to a van-transported racing team, the Shelby-American Cobra has proved a phenomenon. Racing efforts of Ken Miles and others helped win Shelby the '63 and '64 U. S. Road Racing Championships.

ALICE BIXLER

Championship was again his by a wide margin. The Cobras were unbeatable and 1-2-3 finishes were commonplace.

The current year, 1965, promises to be one of the biggest yet in the short, sweet history of Shelby-American. Production of the 289 Cobra has been phased out and has been replaced with the Cobra 427. This is an all-new (under the skin) car featuring fully adjustable independent suspension and Ford's big 427-cu. in. V-8. It will again be offered in either street or competition form.

The introduction of the Mustang GT-350, which will be produced by S-A, has again forced the company to seek larger facilities. The new place is located on the south edge of the Los Angeles International Airport and used to house North American Aviation's Sabreliner shops. This makes it handy for commuting. All Shelby has to do is hop into one of his two light planes, which are hangared on the premises, taxi about a half-mile to the main airport runway and take off like a big bird. The complex has 96,000 square feet of usable space and is situated on a 12.5-acre concrete-surfaced site that is almost large enough to contain a road-racing course. Initial plans call for a combined Mustang-Cobra production of 125 cars a month with a potential of 500.

At the beginning of 1965 Ford turned its Ford GT-40 coupe project over to Shelby. These fabulous cars, possibly among the most expensive racing machines ever built, had shown great promise since their introduction at Le Mans last year, but had never really delivered. In their first race under Shelby-American care, the Daytona Continental, they finished first, third and fourth overall. The venerable Cobra Daytona coupe finished second overall to pick up the important GT class points that count toward the Manufacturer's World Championship.

In the second race of the season, the 12 hours of Sebring, S-A again beat Ferrari but finished second overall to Jim Hall's Chaparral (still first in prototype class). The Daytona coupe finished fourth overall and again first in GT class.

Right now the Old Texan is sitting mighty tall in the saddle. Cobra sales continue to grow and it looks as if there will be a big demand for the Mustang GT-350. In addition to the cars, Shelby-American also does a big business in the Cobra engine dress-up and hop-up kits.

Over at Shelby Enterprises, the driving school under the direction of Pete Brock and John Timanus, is heavily booked for the coming year, and the tire distributorship will probably gross around $400,000 this year.

But Shelby, while he might be getting slightly rich, is getting neither fat nor complacent. It was a tough fight getting the operation out of Dean Moon's back room, and it'll be just as tough keeping it where it is.

The rumors about what's going to happen in the future are already flying hot and heavy. Italian racing car builder deTomaso has just finished a brand-new, radically different prototype Cobra. Nobody is admitting anything, but this could either be S-A's next race car, or it could be the '66 Cobra, because there is a rumor that the '66 will be completely different. It's also a safe bet that with the exception of the bare frame, the 1966 Cobra will be completely assembled at the California plant. Also just around the corner is an open version of the Ford GT-40 coupe. With just a little more engine than the pushrod 289, this might be a quick answer to Jim Hall's Chaparral.

Then again, if the whole thing goes up in a puff of smoke, a fellow sure could cram a lot of chickens into one of those big old ex-Sabreliner hangars.

SHELBY ORGANIZATION has gained such fame as a competition specialist that it will campaign these vehicles for Ford Motor Co. Clockwise, they are the Mustang 350-GT, the Ford GT and the 427-cu. in. Ford-powered Cobra.

FANGS FOR THE 289

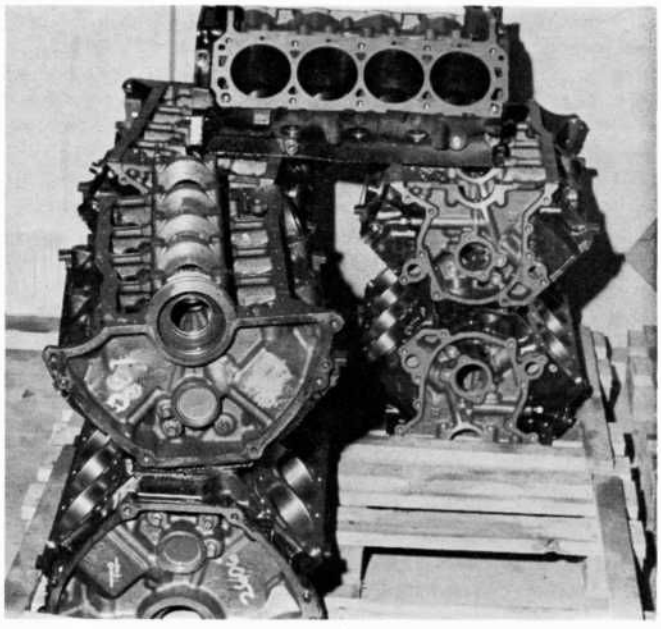
BY JIM WRIGHT

Three years ago Ford introduced a new V-8 engine to go along with its new Fairlane car. It was immediately accepted for what it was: Just another passenger car engine, albeit an interesting one, mainly because new manufacturing and foundry techniques had kept its weight about 100 lb. lighter than any comparable V-8 then on the market. Today it's America's No. 1 racing engine. What happened? In a word – Cobra.

The original engine had a bore and stroke of 3.50 and 2.87 in., displaced 221 cu. in., and was rated 145 bhp at 4400 rpm. As a factory option it was offered with 260 cu. in. and 164 bhp at 4400 rpm. This was accomplished by increasing the bore to 3.80 inches.

This is where it was in 1962 when Carroll Shelby decided it was just the engine for his new Cobra sports car. He added a hot cam, solid lifters and a 4-barrel carburetor, put everything together carefully and came up with about 225 bhp at 5500 rpm. It did a good job of hauling the street version Cobra around but was a lot less than was needed on the race track.

Shelby, his engineers, and the Ford engineers got together, kicked a few figures around and came to one firm conclusion: The first thing that had to be done was find a few more cubic inches. There was only one problem – the production blocks were already bored as much as was physically possible to get the 260 cu. in. At this stage of the game any thought of increasing the 2.87-in. stroke was discounted as being too expensive a process for what was thought to be a limited production run. The solution, which was more expensive than boring, but less expensive than stroking, was to rearrange the cores when the blocks were being cast to allow for bigger cylinder bores. As it was, the centerline to centerline bore centers were only 4.38 in. apart. They decided that with luck they could safely go for a 4-in. hole. Allowing another 0.005 in. for clearance meant that there would be only 0.375 in. left to form the cylinder walls and allow a small space for water circulation between them. So far there hasn't been a single case of a collapsed cylinder wall, but if you own a 289 – don't try to bore it. Neither should you try to bore a 260 engine out to 289. Doesn't work.



A STACK of blocks ready for the Cobra treatment; S-A considers them raw castings in need of a lot of personal refinement.

The 289 can be stroked up to 325 cu. in., which is something else that Shelby has been experimenting with on the Cobra engines. But they've been running into problems with rod and piston angularity that aren't conducive to long, reliable engine life.

With the cubic inch problem licked, Shelby and Ford turned their attention to the heads. The valves were enlarged and the combustion chambers were re-shaped slightly to un-shroud the valves and to allow higher compression ratios. Breathing was also improved through bigger ports and a solid lifter cam.

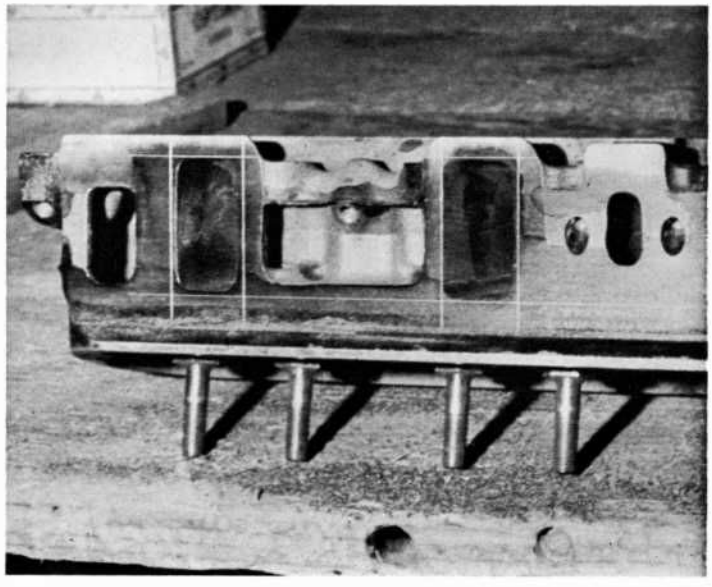
Reliability was added with specially forged piston, rods and crankshaft and screw-in rocker arm studs.

They added a 4-barrel carburetor and special exhaust manifolds. In its resulting "high performance" form the 289-cu. in. engine was now putting out a rather healthy 271 bhp at 6000 rpm.

Ford was satisfied with the 271 rating. It was as far as its engineers wanted to take an engine that would be in

CYLINDER HEADS require the most time and effort. Here an operator uses an electric grinder to rout out and reshape ports.

SCRIBE MARKS around the intake ports indicate optimum shape and enlargement, serve as guide for the grinder operator.



regular production and offered to average customers. This version has subsequently become a very popular factory option for the Fairlane and Mustang cars.

As far as Shelby-American was concerned, the 271-bhp version would be just about right for the street Cobras and a darned good starting point for the competition conversions. By the time S-A got through with its racing development work, the 289 was pumping out as much as 375-380 reliable horsepower at 7000 rpm.

Until the recent introduction of the Cobra 427, the 289/271 engine remained the standard Cobra engine. Right now, S-A still builds about three versions of the 289 engine. The first is rated 306 bhp at 6000 rpm and is the standard engine in the Mustang GT-350. The competition version for the GT-350 is rated 350 bhp at 6500 rpm. At the top of the heap is the 380-bhp engine which is still used in the Cobra Daytona coupes and the Ford GT-40 prototype race cars.

An important point to remember here is that the Shelby people could probably squeeze even more power out of the engine, but only at a sacrifice in reliability. But their type of racing demands engines that will "live" a long time. So far they do.

Regardless of its use, every engine that S-A builds starts out as a basic 289/271 which it buys fully assembled from Ford. With the exception of the standard GT-350 engine, all of Shelby's engines receive the same basic modifications. The differences in power output between them depends on carburetion, camshaft and amount of head modifications that are allowed under various racing organization rules.

There really isn't any great secret about how the Shelby-American shop goes about getting both the power and reliability out of these engines. Basically it follows the same methods that most serious hot rodders have followed for years. S-A does a lot of experimentation, chooses the right modifications and then puts everything together with precision and plenty of tender loving care.

The lowest rated, 306-bhp engine receives the least amount of work. In fact, those 35 bhp extra are strictly the "bolt-on" kind. All S-A does is replace the standard intake manifold and specially developed Holley 4-barrel carburetor. The cast-iron exhaust headers and stock exhaust system is replaced with fabricated tube-type headers and a straight-through muffler system. The horsepower increase comes from the improved breathing abilities afforded by the low-restriction intake manifold, high-capacity carburetor and low-restriction exhaust system.

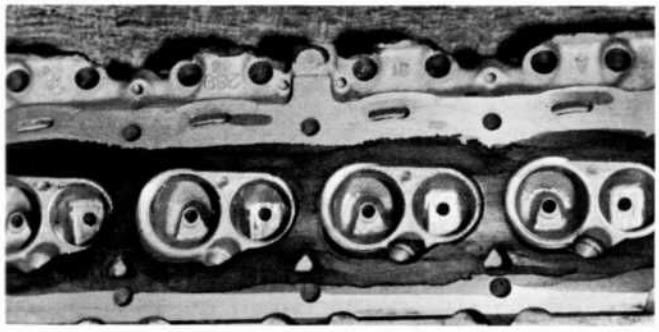
The higher output engine modifications are a little more involved. Each racing engine turned out by S-A has had between 36 and 50 hours of detailed attention lavished on it by one of the highly specialized S-A engine men. This doesn't count the time involved in outside operations such as balancing, or porting the heads.

To begin with, each engine is completely disassembled and all rods, pistons, pins, etc., are identified with respect to cylinder location and engine number.

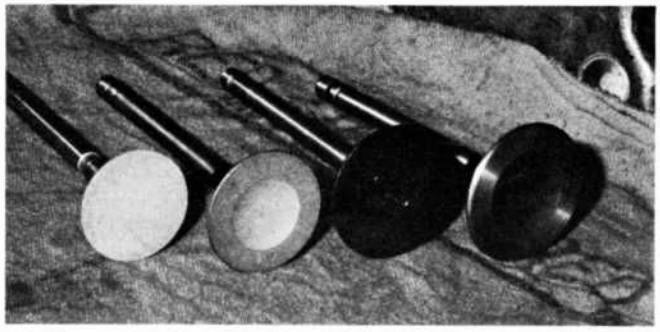
All parts are then either Magnafluxed or X-rayed to make sure that they don't contain *any* imperfections. This has always been done outside but just recently S-A purchased its own equipment to speed up the job.

The cylinder block is degreased and the cylinder bores are honed to obtain a cross-hatch pattern that will allow the piston rings to seat more quickly. Standard factory piston-to-wall clearances are retained. The soft plugs which seal the open ends of the block's internal oil passages are removed

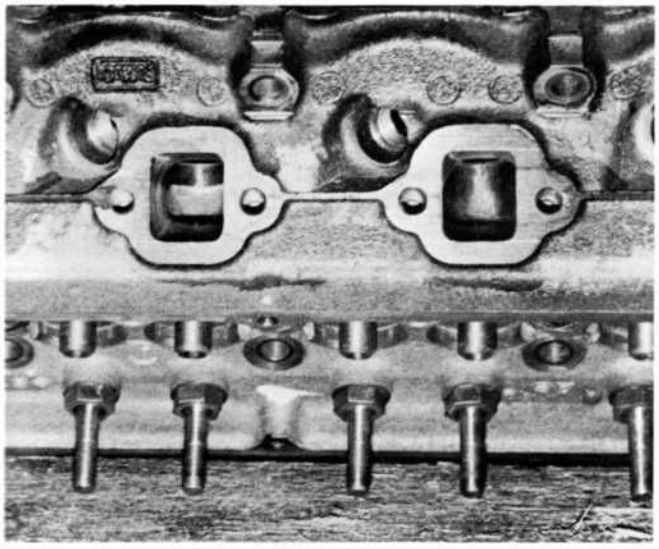
COMBUSTION CHAMBER also receives machine-shop treatment. Area around valves is flycut to relieve shrouding by walls.



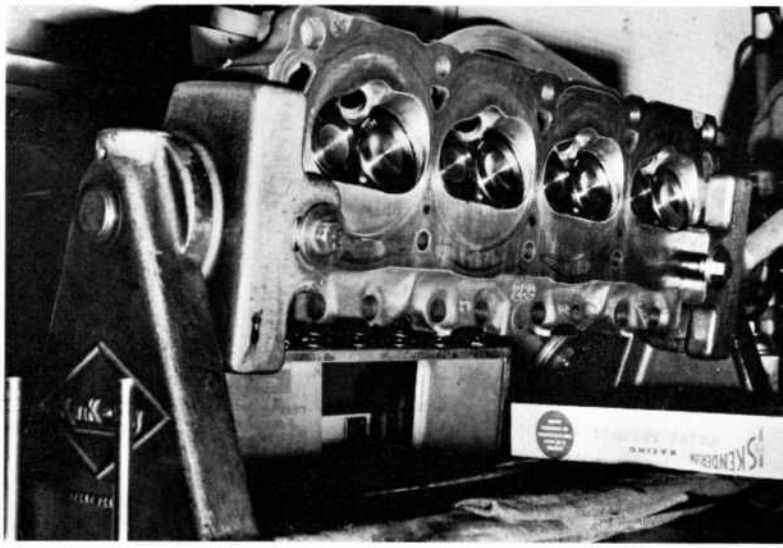
COMPARISON OF stock valves (left) and polished, larger Thompson Products valves used in Cobra-ized heads.



EXHAUST PORTS also are enlarged and polished, again to scribed marks. Porting and polishing improve gas flow.



FINAL ASSEMBLY of heads and valves is done in this fixture. Special valve springs and retainers are also installed.

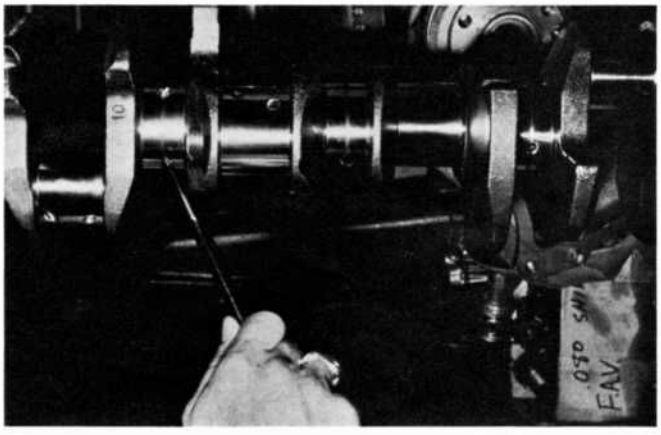


FANGS

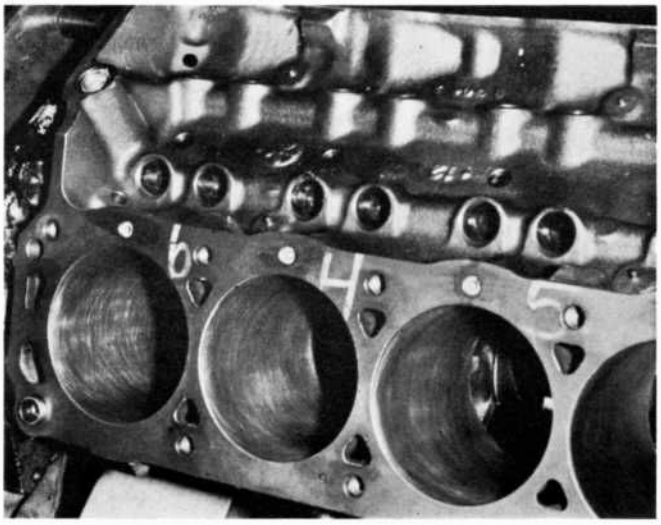
and the openings are tapped to accept pipe plugs. This prevents them from ever blowing out or leaking under pressure. The eight small water outlet holes located just above each cylinder bore are also drilled to accept pipe plugs. There aren't any cylinder head bolts in this area and by plugging the water holes a potential source of blown gaskets and water leakage is eliminated. This has the further effect of forcing the coolant flow to the back of the block and helps eliminate the possibility of "hot spots" forming around any of the cylinders. The corresponding banana-shaped holes in the heads are also welded up since they no longer have to pass any coolant. The main coolant flow is now through the front of the block to the rear, up into the rear of the heads and then forward to the front of the intake manifold, and through the outlet back to the radiator. A stock water pump is used.

After Magnafluxing, the crankshaft main bearing journals are grooved to increase the oil flow to the rod bearings. The "eyebrows" in the tops of the pistons are flycut a little deeper to allow the added valve clearance needed with the higher lift camshaft that will be installed. Deck clearance – the distance from the top of the piston to the top of the block surface – is controlled and matched from cylinder to cylinder by removing material from the top of the piston as needed. The crank bearing surfaces are polished and then the complete assembly, including rods, pistons, flywheel and crankshaft damper, is sent out for balancing. Incidentally, the crankshaft damper has been marked in one degree increments around its periphery to aid in the degreeing of the camshaft and ignition timing.

CRANKSHAFT MAIN bearing journals are grooved to increase oil flow to rod bearings; all bearing surfaces are polished.



CYLINDER BORES are honed to a cross-hatch pattern to allow quicker seating of piston rings. Stock clearances are used.



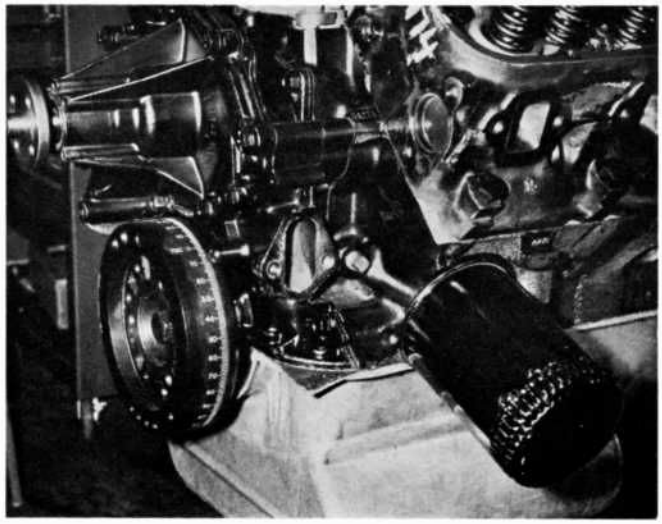
Before the heads are sent out for porting and polishing they receive several modifications at Shelby's shop The area around the valves in the combustion chambers is flycut on a milling machine to de-shroud the valves and insure that the flow around them isn't restricted. Until just recently it was necessary to enlarge the valve throats in the heads to accept larger valves but now the production-line 271s are using the same 1.875-in. intake and 1.60-in. exhaust valves as the competition engines. But a 70° reamer is still used to remove enough material in this area to narrow the valve seats and move them toward the outer edge of the valve.

The heads are then usually sent to Roger's Porting Service to have the ports enlarged and polished and the combustion chambers smoothed and polished. If the engine is destined for drag racing the work is limited to matching the ports to the manifold. This is all that is allowed under NHRA rules. After this work is completed, the banana-shaped water passages previously mentioned are welded up and the heads are milled 0.05 in. This eliminates any warpage that might have occurred during the welding process and also brings the combustion chamber volumes down to approximately 44-45 cc.

The heads are returned to S-A for their final rework, which consists of cutting down both ends of the valve guides, grinding valve seats, fitting valves and springs. The guides are cut for two reasons: To reduce the restriction on the end that extends into the valve pocket; and to allow the installation of Perfect Circle VS-24 valve stem seals. Intake seats are cut to 30° but the 45° exhausts are retained. Intake seat widths are 0.03 in. wide and exhausts are 0.04 in. Polished Thompson Products intake and exhaust valves replace the standard valves. The standard valve springs and flat-wire dampers are replaced by special compound springs. Spring pressures are checked out at both seat height and open height before installation to make sure that all the springs are equal. The installed heights are then carefully checked and, if necessary, shims are used to bring them to the correct, specified height. Special aluminum spring retainers replace the standard steel retainers. Milling the head leaves a sharp edge around the combustion chambers so a sharp steel scraper is used to break and slightly round this edge to remove a potential cause of pre-ignition.

While this head work is taking place, other engine components are also being modified. The standard 289/271 dual-point, centrifugal advance distributor gets stiffer advance

DEGREE-MARKED crankshaft damper is used to pinpoint cam and ignition timing. Extra-large oil pan is for competition use.



springs and the advance curve is recalibrated. The standard distributor contains 18 to 21.5° of advance, which with a 12° BTC initial setting, gives a total of 30-31.5°. The reworked distributor contains 26° and runs with a 10° initial setting, giving a total of 36°. The standard advance curve feeds it in gradually until it is all in at 5000 rpm. The recalibrated curve feeds it in earlier all the way up.

A steel shim, 0.2 in. thick, is placed behind the oil pressure relief spring to increase oil pressure by 10 psi. The oil pump pick-up tube has a stiffening web welded to it to prevent vibration and subsequent breakage.

Adequate crankcase breathing is ensured by the addition of a breather cap to the right-side valve cover. The breather cap tube is baffled to prevent any oil loss through it under racing pressures.

Two different types of oil pans are used, depending on what car the engine is for. Cobra and Ford GT-40 coupes get a reworked fabricated steel pan with a 12-qt. capacity. Swinging-gate type baffling is installed in the bottom of the pan. The baffle surrounds the oil pump pick-up tube and ensures that no matter what forces are working on the oil in the pan, there will always be an adequate supply available to the pickup, eliminating the possibility of oil starvation. A cast-aluminum pan is used on the GT-350 engines. This pan also contains a gate-type baffle, but has only a 6.5 qt. capacity.

The standard Ford, forged-steel flywheel is retained. The mounting bolt relief in the center of the wheel is slant-drilled back to the engine side of the flywheel so that if any oil should work past the rear main bearing oil seal into this area, it will drain to the rear of the flywheel instead of onto the face, thus preventing clutch slippage.

Clutch pressure plate and disc are Ford heavy-duty units. The plate is a semi-centrifugal type giving increased pressures at higher rpm. The cast-steel bell housing is made for S-A by Wedge Engineering. It is NHRA-approved and eliminates the need for a scatter shield. It gives complete 360° protection.

During final assembly, both rod and main bearings are plasti-gauged to ensure that clearances are to specifications – 0.002 to 0.0025-in. straight through – with the latter being the favored figure. Rod bearings bolts are torqued to 50 ft.-lb. and mains are torqued to 75 ft.-lb.

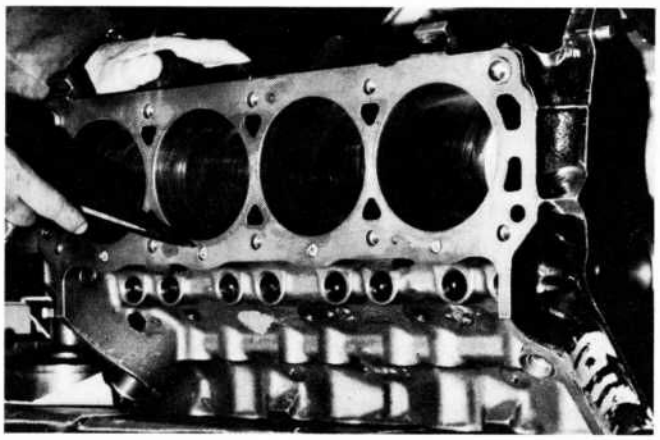
Various camshafts have been tried and S-A is constantly running tests in this area. Right now it is using one that has 37.5-78-77.5-35 timing giving 295.5° duration, 72.5° overlap and 0.5 in. lift. The standard lifters are replaced with Johnson lifters, which have a slightly different oil collar design to prevent over-oiling of the rocker arms. Before installation, the camshaft is coated with molybdenum disulfide to prevent scuffing or galling during the initial engine fire-up.

Thin steel head gaskets are used and the heads are torqued to 75 ft.-lb., while making sure that the proper tightening sequence is observed.

Cam timing is checked out by installing the No. 1 cylinder lifter, pushrod and rocker arm. A dial indicator is mounted over the No. 1 piston to locate exact top dead center and then the valve timing is checked using the degree-marked crankshaft damper. They try to set the cam right on the money – no advance and no retard. However, if the cam happens to be off 2-3° in either direction, this is noted on the permanent record that is kept on each engine and all future adjustments will take this into account.

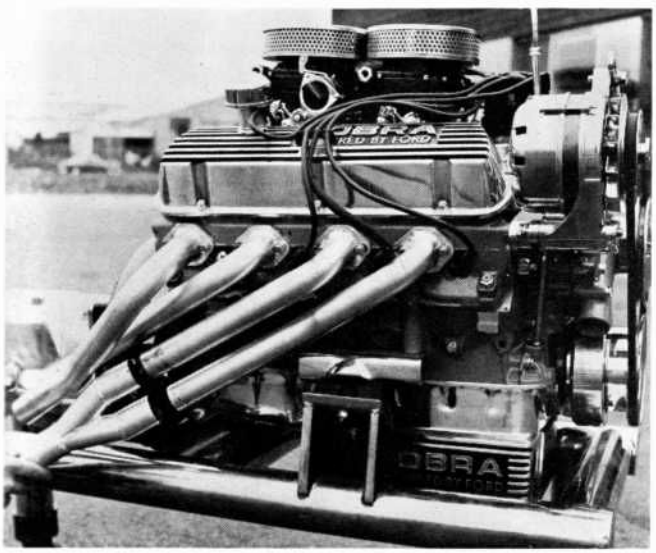
When the proper carburetion setup has been bolted on, the finished engine is installed in the dynamometer for break-in and a power check. If the output isn't up to specifications, they'll find out why and correct it.

That's all there is to it. Nothing that the average guy with a shop and a fat bankroll couldn't duplicate!

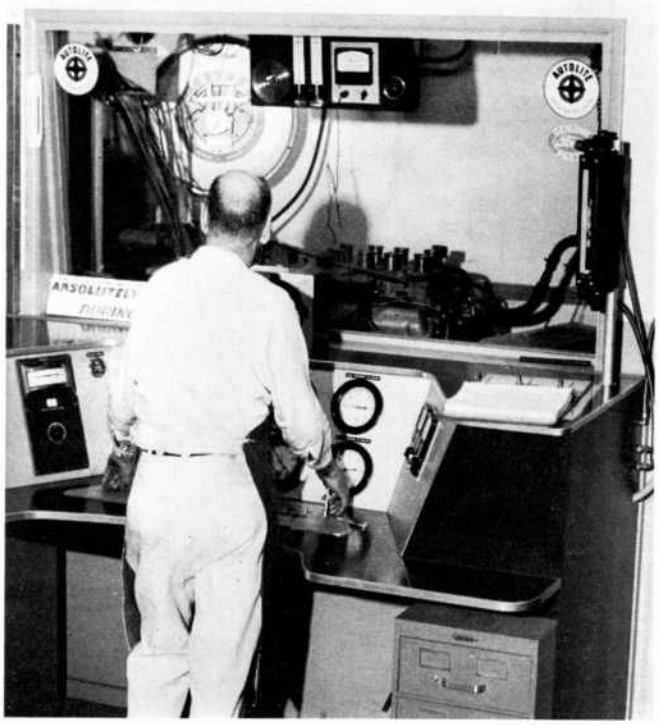


PENCIL POINTS to pipe plugs tapped into cylinder-block water outlets to eliminate possible source of head gasket leakage and trouble.

SHOW ENGINE displays headers used on all Cobra engines, other Cobra dress-up items, and 2 x 4 carburetion.



DYNAMOMETER TUNING is essential step in preparing S-A Cobra engines. If power-check isn't up to par, engine is rejected.



THE GT-350 MUSTANGS

The Shelby Touch Transforms the Car

BY JIM WRIGHT

There's a good chance future automotive historians and buffs alike will look back on the present day Cobras and Mustang GT-350s and equate them with the same names that we revere today: Mercer, Mercedes, Duesenberg, Alfa – or you name it. And for the same reasons: The cars look good, they go fast and they're constantly proving their mettle on the automotive battlefields of the world. In short, they are cars of character.

Shelby-American's latest offering – the Mustang GT-350 is one of the most exciting cars to hit the enthusiast's market in a long time. The modifications that have transformed it from production car to *gran turismo* embody much of the vast savvy and experience that Shelby's crew of designers, engineers, builders and racers have gained through long, hard years of building and preparing and racing high performance machinery in all the far corners of the world. The GT-350 appears to offer everything that one expects from a high performance machine and at a much more reasonable price than one is used to paying.

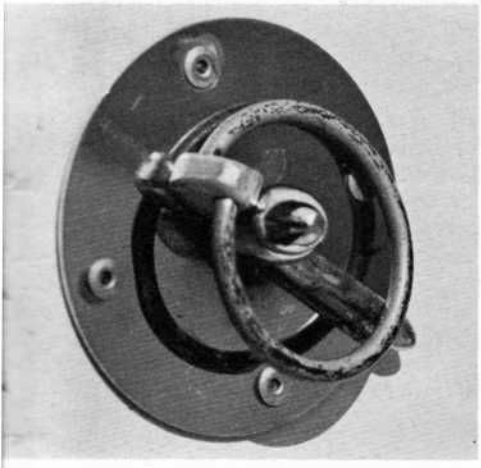
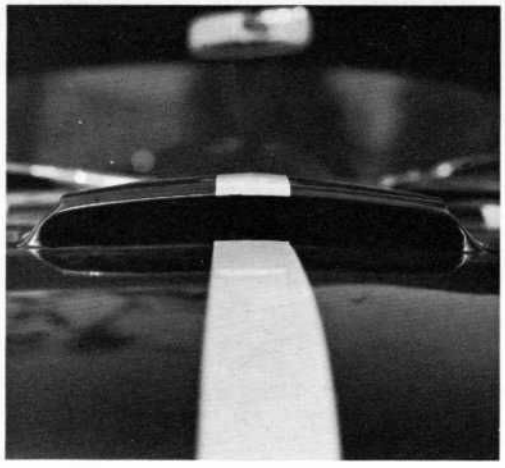
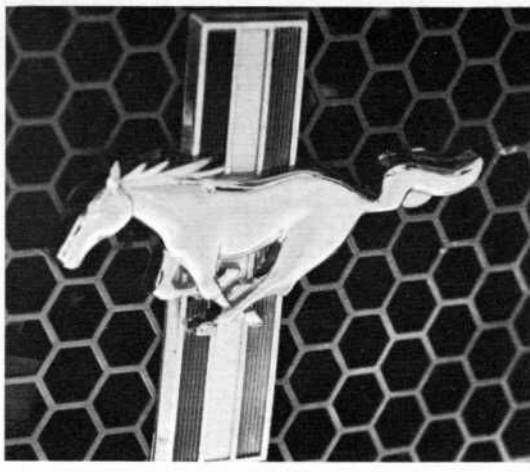
In a way, the GT-350 is more than just an exciting car. Since S-A functions in part as a kind of research and development arm of Ford's special vehicles department, the GT-350 is also an important step in the development of a car that's going to be around for a long time to come: the production Mustang. On the surface, it takes quite a few modifications to transform a stock Mustang into a thoroughbred GT-350. Closer inspection reveals that all the various component modifications and engineering could very easily be programed into the standard factory assembly line. So it's not at all unlikely that today's custom-built GT-350 might well be tomorrow's production-line high-performance Mustang.

The competition version of the GT-350 is showing great promise that it will make its name as familiar in the winner's circle as the Cobra has. Immediately after its February introduction a competition GT-350 was entered in the annual Southern Polar Prix at Green Valley Raceway in Texas. Running in B Production class, the car scored an impressive first-time-out victory. At Pomona, Calif., a month later, the car again scored a class win and ran third overall behind a Cobra and a Sting Ray in the big-bore production race. In the first Sports Car Club of America race of the year (Tucson, Ariz.) offering national points, the car decisively whipped a well-prepared E-Jag as it again won its class.

In the Texas race the car was driven by Ken Miles, Shelby's competition manager and the man largely responsible for the development of the GT-350's suspension. In the other two races the car was driven by Jerry Titus, popular West Coast automotive editor and race driver. Miles, who might be a little biased (understandably so), says that the GT-350 is one of the easiest handling race cars he's ever driven. Titus, who isn't at all biased, says just about the same thing. He feels that the car has all the power that it'll need to stay in front of SCCA Class B competition and that the suspension does a good job of transmitting the power to the ground. Both drivers agree that the GT-350's biggest assets are: (1) It's a completely predictable car that always lets the

SPECIAL CAP on cast-alloy wheel hubs carries the Carroll Shelby insignia, identifying car as GT-350.

PHOTOS: PAUL E. HANSEN, DEAN BATCHELOR, CARLYLE BLACKWELL, JIM WRIGHT

MORE SPECIAL touches are the pin-locks for the hood, the air scoop that scoops, and a small Mustang emblem on a blank grille.

driver know what's happening in advance; (2) It is a forgiving car that will make up for a lot of mistakes on the driver's part. Since both Miles and Titus are considered to be among the top sports car drivers in the country, those are pretty meaningful endorsements.

The biggest question concerning the GT-350 and the one that we most often hear from standard Mustang owners and potential GT-350 buyers is, "What makes the car so different from the standard Mustang?" The next most-asked question is, "Is it worth the added cost?"

Both questions can best be answered by casting an analytical eye at the product.

In appearance, the GT-350 still retains much of the original Mustang flair although there have been enough changes made to give it an identity of its own.

First off, all non-functional exterior trim is removed, leaving an extremely clean, uncluttered design. At the front the gunmetal anodized, stamped aluminum honeycomb grill insert is retained but the heavy crossbars, along with the large Mustang emblem, have been removed. A small Mustang tri-color medallion is carried, off-center to the left, on the grille insert.

One of the GT-350 design goals was to come up with a lighter car. By various means they've chopped about 200 lb. out of the car. The standard hood has been replaced by a fiberglass unit. A functional air scoop, molded into the center of the hood, supplies fresh, cool air to the carburetor. Standard hood hinges and springs are retained but the locking mechanism has been replaced by competition-type locking studs with safety pins. These are located at each forward corner of the hood. They allow a weight saving and also provide a positive method of keeping the hood down while traveling on rough roads and at high speeds.

Several interior modifications have been made to provide greater driver comfort and convenience. In keeping with the car's high-performance, dual-purpose character, there is room for only the driver and one passenger. The standard, folding rear seat has been replaced by a fiberglass shelf which mounts the spare tire and also provides luggage space (as well as saving a few pounds of weight). The spare is covered with a fitted vinyl cover which adds a finished touch.

Greater driver comfort is provided by the use of a wood-rimmed, competition steering wheel with aluminum spokes. This wheel has a smaller diameter than the standard Mustang wheel and also is formed with less "dish." This moves it about 2 in. closer to the dash and provides just that much more elbow room. This feature, combined with the fore and aft adjustment of the individual bucket seat, will give just about any size driver the leg and elbow room necessary to maintain precise and absolute control over the car. The bucket seats are well-shaped to provide a high degree of comfort and support. The padding is on the firm side and has a "just right" feel that will be appreciated on long trips.

Standard Mustang instruments are retained but are backed up by a tachometer and oil pressure gauge. The added instruments are carried in their own fiberglass pod which is

FINISHED IN WHITE with a pair of wide blue racing stripes and the triple-stripe trim on the rocker panel, the GT-350 looks fast and purposeful just parked along the roadside.

GT-350 Mustangs

mounted in the valley in the center of the top of the dashboard. They are angled slightly toward the driver to make them easier to read. A dash-mounted toggled switch operates the horn.

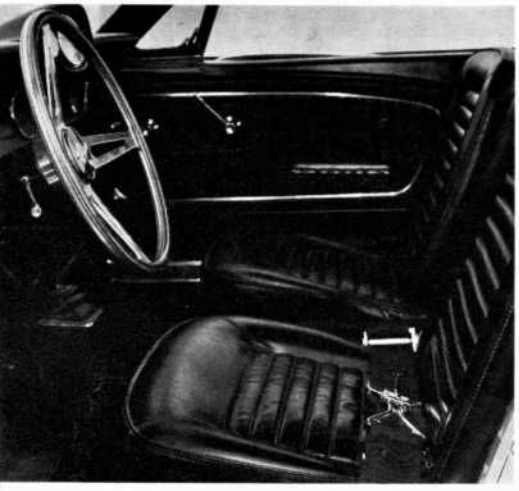
Heavy-duty, 3-in. wide nylon seat belts are installed. These are quick release competition units and are fully approved by all racing organizations. The belts are swivel mounted to heavy-duty eye-bolts.

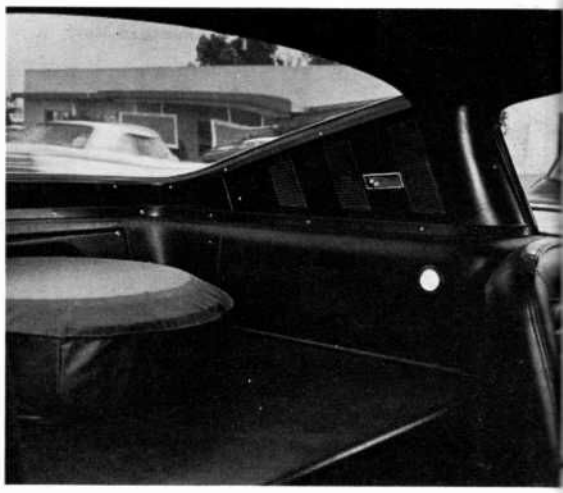
In a later chapter we'll outline the engine modifications that are a part of this package. Other power-train modifications include the use of a Warner T-10, 4-speed, manual transmission, safety-strapped driveshaft and beefed-up rear axle with a self-locking differential.

The Warner gearbox was chosen because it has an aluminum case which makes it much lighter than the Ford-built 4-speed, and because of the availability of special ratios. The transmission is a close-ratio type with a 2.36:1 first gear, 1.62 second, 1.20 third and direct fourth.

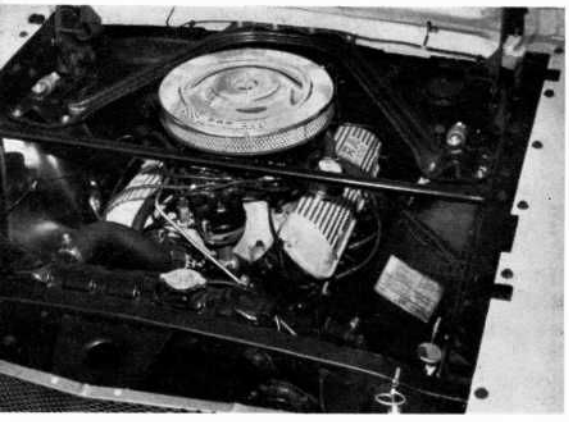
A standard 2.75-in. diameter, high performance propeller shaft is used. S-A adds a strap-metal safety loop, located at the forward end of the shaft, to prevent the shaft from dropping to the ground in case of U-joint or shaft failure.

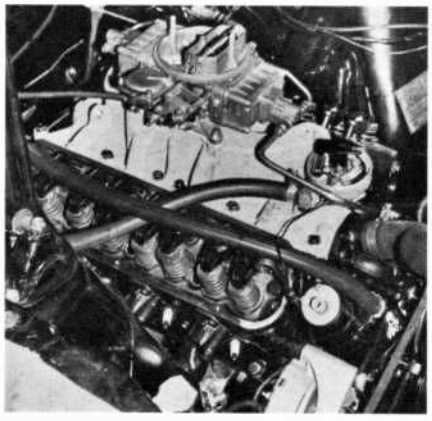
The rear axle assembly carries special axles and bearings and should be able to stand up to just about anything a GT-

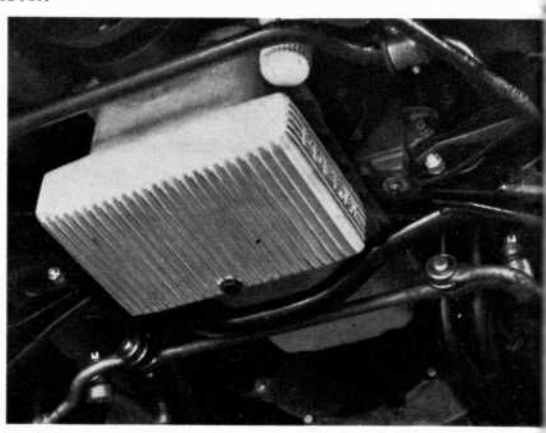




INTERIOR TREATMENT of "street" GT-350 includes 3-in. wide safety belts, wood-rimmed steering wheel, electric tachometer and oil pressure gauge in pod atop dash, and back seat replaced by fiberglass cover.

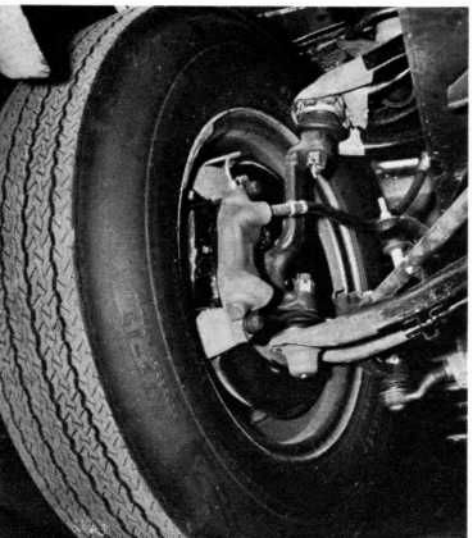


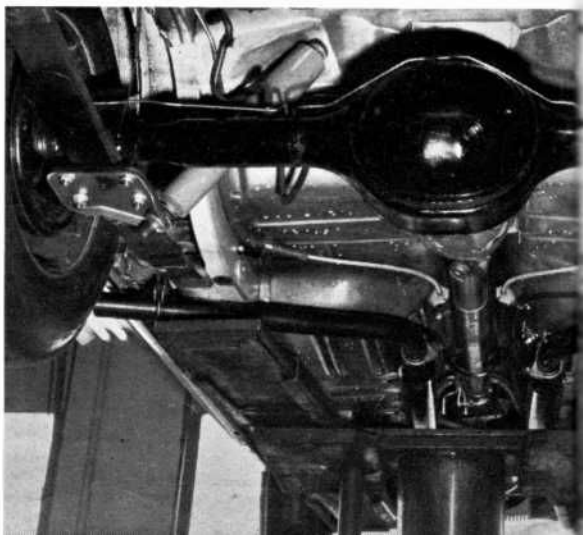




NORMAL GT-350 engine has horsepower increased by bolt-on treatment, such as the high-riser intake manifold. Valve covers are for show. Competition oil pan, however, has added capacity for better cooling.

FRONT DISCS are standard Mustang items; upper arm mounting points are lowered; rear axle is fitted with Konis.

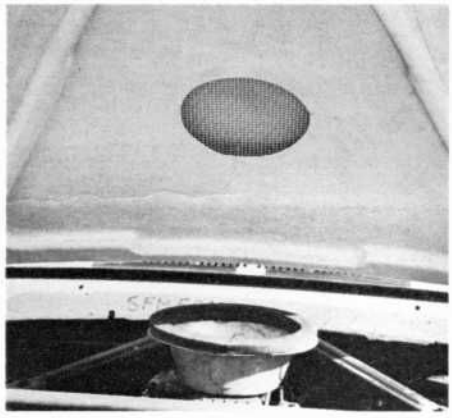


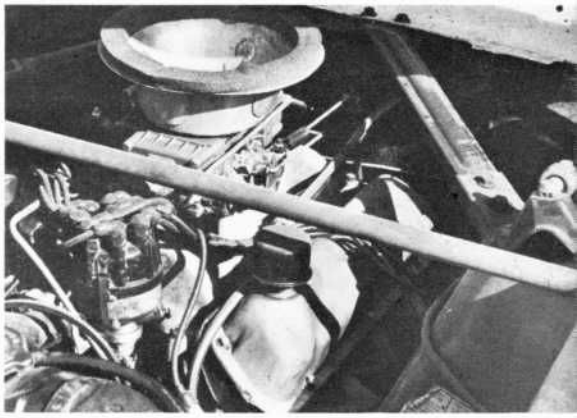


350 owner can hand it. The standard ratio is 3.89:1. Optional gear sets include ratios of 3.70, 4.11 and 4.33:1. The locking differential is standard equipment. Shelby's choice here is an excellent one: Detroit Automotive Products' "NoSPIN" unit. This one costs more than the average locking differential, but because of its positive engagement features and superior quality it will keep on doing its job after the average unit has failed.

Front wheel disc brakes are standard equipment on the GT-350 and work in conjunction with drums at the rear. The discs are identical to standard Mustang units except that they use a very special heavy-duty lining material that was developed for grand prix racing. At the rear, big 10-in. diameter by 2.5 in. wide cast-iron drums are fitted with metallic linings. The combination provides a high level of fade-

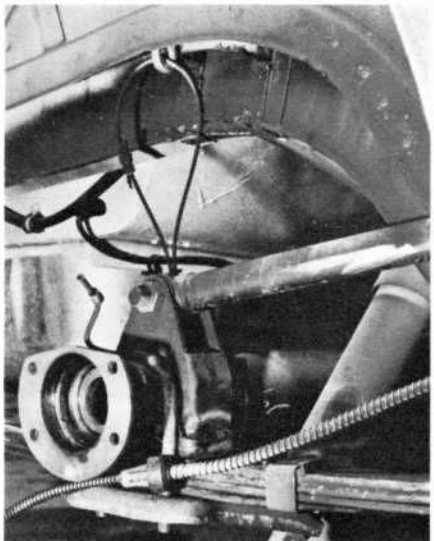
COMPETITION VERSION is much more stark; real bucket seats replace Detroit types; hefty roll bar is optional, but fully-instrumented dash is part of the race-ready package. All frills are removed.





HUGE HEADERS are used with the racing-prepared engines. Hole in hood matches up with air horn atop the carburetor to give pressurized flow of cool air. Street engines have stock air cleaner; racing engines, air horns.

CONTROL ARMS are added to rear, extend forward into car body. Wider, segmented brakes are substituted for stock units.



GT-350 Mustangs

proof braking power that is more than a match for the car's speed potential.

The most important and significant modifications are found in the chassis and suspension. Here Shelby's design goal was to obtain increased front and rear cornering power and stability to provide the GT-350 with a crisper handling feel along with quicker response characteristics. This obviously had to be accomplished without destroying the reputation that the original Mustang had gained as the car that had predictable handling characteristics.

On paper, the necessary modifications look pretty simple, but actually they represent untold hours of computation, experimentation and test driving. At the front, it was found that only one major physical alteration would be required to produce the desired results. This was the relocation of the inner pivots of the upper control arms. To do this they simply drilled two new mounting holes exactly 1 in. below the original ones. This resulted in changing two design parameters: (1) The camber change that takes place in the front wheels as they move through their travel limits from jounce to rebound has been increased from the standard 0° per in. of travel to 0.6° per in. of travel around design height; (2) The front roll center height has been raised from 2.6 in. to 4.9 in. above ground level.

By increasing the camber change they've decreased the amount that the front wheels will lean with body roll during cornering by 30% (0.7° per degree of body roll vs. the standard 1° per degree of body roll). This means the front wheels remain more nearly perpendicular to the ground during cornering, thereby improving their cornering power and bite while at the same time reducing the tendency for the front end to plow.

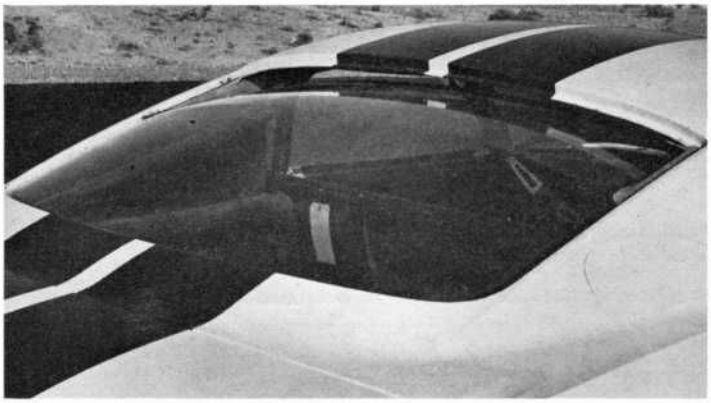
Raising the front roll center height re-established the basic understeer balance by slightly increasing the front end portion of the total weight shift under cornering, thereby automatically decreasing, by an equal amount, the rear axle weight shift. The improved front wheel attitude made this possible without re-introducing the tendency for the front end to plow. Raising the front roll center height also had the effect of reducing body roll by 8%. A further increase in roll stiffness was gained by increasing the diameter of the front anti-roll bar from 0.84 to 1.00 in.

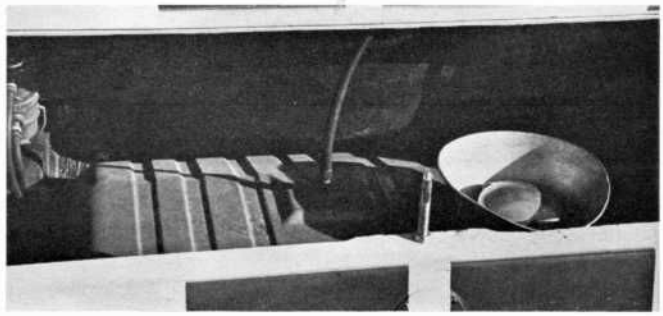
Steering system modifications have resulted in quicker, more precise steering that is fairly light at all speeds. The standard Pitman and idler arms were replaced by specially forged, longer units that reduce the overall steering ratio from the 21:1 offered in the factory high-performance Mustang package down to 19:1. This reduces the between-lock steering wheel turns from 3.73 down to 3.5.

The added power of the GT-350 engine meant that a more positive way of locating the rear axle was needed, so a set of sturdy torque reaction arms is used to take the torque and braking loads and provide increased lateral stability. Extensive testing proved that the location of the torque arms was critical insofar as their ability to effectively eliminate spring wind-up was concerned. The best location was found to be directly over, and in line with, the spring and extending from the centerline of each axle forward to a point directly in line with and over the front pivot of the spring, thus forming a parallelogram. To accomplish this it was necessary to cut a hole in the frame section to allow the arms to extend into the rear quarter-panel area. Steel brackets are welded to the axle housing and inside the rear quarters. The torque arms are fabricated from 1 in. diameter, heavy-wall steel tubing with forged steel, rubber bushed ends. Rubber boots are fitted to the forward end of each arm to seal their entry holes and keep dirt and water from entering the quarter-panel areas.

As is the practice in current race car suspension design, spring rates are kept fairly low (95 lb./in. front and 110 lb./in. rear – same as the factory Mustang handling package) with a strong emphasis placed on good shock absorber control. Here again S-A has disregarded cost in favor of quality and performance and has chosen what most experts agree are the best shock absorbers available: Konis. These

LIGHTER, PLASTIC windows are used side and rear on competition GT-350. The rear window is modified to act as air vent. Battery of street GT-350 is installed in trunk; competition car has huge fuel tank and funnel to prevent sloshing.





Dutch-built dampers enjoy a world-wide reputation for performance and reliability and are fully and easily adjustable for changing road conditions. Interestingly enough, it is only the choice of shock control settings that separates the street GT-350 suspension from that of the competition GT-350.

Another change that's done much for improved handling is the use of wide-base (6-in. rims) 15-in. diameter wheels along with a specially developed tire. These tires are made by Goodyear and called "Blue Dots." They are a low profile, nylon tire (7.75-15) featuring a rounded shoulder. In testing, they have been run 120 min. at 120 mph and 20 min. at 130 mph.

To provide a little better front to rear weight distribution, the battery had been relocated in the right rear corner of the luggage compartment.

At the present the only color combinations available are white exteriors and black interiors. The white exteriors are set off with blue stripes along each rocker panel and, as a dealer-added option, broad blue racing stripes running from hood to trunk.

That's about the extent of the modification it takes to convert a stock Mustang into a GT-350. To turn a stock GT-350 into an all-out competition car requires most of those already mentioned, plus just a few more. The really important difference is in the engine – which we've already described in preceding chapter.

The next biggest change is a further reduction in weight. Approximately 300 lb. more have been eliminated, bringing the competition version down to 2500 lb., ready-to-race. This was accomplished by using more fiberglass (bumpers, front under grille panel) and replacing side and rear window glass with plastic. The rear window is also designed to act as a vent to exhaust the interior of the car. This is necessary because the side "gill" vents have been eliminated and covered over by aluminum, and the doors have been gutted of window actuating mechanisms.

The interior has also been gutted as far as the rules will allow. No carpeting or sound deadening materials are used. The driver's seat is replaced with a lightweight fiberglass bucket that would almost provide a secure seat without the use of seat belts.

Other interior changes include a full set of instruments and a fire extinguisher. An approved roll-bar is available as an option, or the buyer can install his own.

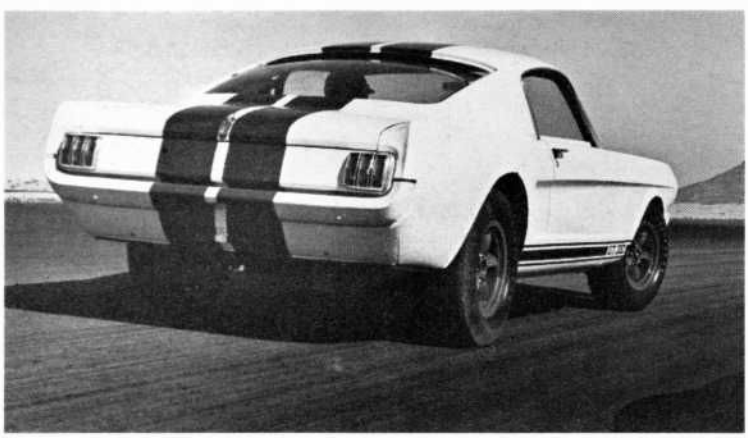
A larger capacity radiator is used and an oil radiator, mounted low in front of the water radiator, is standard equipment. As a tribute to the standard GT-350 suspension, it is identical to the race version's. As we have said, the only difference is in the choice of shock absorber settings. Wheels and tires are another story. The competition car uses alloy wheel – 15 in. diameter, but with 7 in. wide rims. Tires are Goodyear's Sports Car Specials.

Brakes also remain stock, but with added cooling provisions. At the front the rubber dirt shields on the calipers are removed because they can melt under the heat of competition. The metal shields protecting the discs are also removed for increased cooling. Ducting of direct fresh, cool air to the discs is a part of the competition package. At the rear, the stock backing plates are liberally drilled and fitted with air cooling ducts. Standard GT-350 front and rear brake linings are retained.

A larger, 37-gal. gas tank is provided, and by a rather simple expedient at that. The stock Mustang gas tank is formed in two halves that are bolted together. The top half is flat and actually forms the floor of the luggage compartment while the bottom half is the part that has the volume. Shelby-American takes two bottom halves and bolts them together to get the increased capacity. A large diameter opening with a quick release cap and built-in funnel provide for fast refueling.

The street version GT-350 carries a $4500 price tag, while the race car goes for $6000. Both prices are quite a bit more than you have to pay for a factory Mustang, even one with the high-performance package. The buyer who wants to get something that's head and shoulders above anything else he can buy in this particular class will find the first price not at all high. And as for the second, where else can you buy a fully, and professionally, prepared race car for anywhere near that? If you didn't want to buy either you could probably get together enough of the parts to rework a stock Mustang, but you'd probably end up spending more than their price to equal either of them.

A STACK of raw, empty Mustangs awaits the S-A touch. The finished product comes out ready to tackle anything. The competition car has extra-wide radiator opening for better cooling, and an oil cooler for the engine.



MUSTANGS ON THE DRAGSTRIP

Look What's Replacing the Deuce And the T-Bone in the Hearts of The Youthful Car Enthusiasts

When Ford Motor Company unveiled that new addition to its passenger car line – the performance-minded Mustang – it was an immediate sensation and within a year was the fourth most popular model in the country.

Now, design engineers at FoMoCo may have presented the Mustang as an all-new motoring concept, meeting the requirements of an expanding young, young-at-heart and performance-oriented market, but to the avid hot rodder, the appearance of this showroom sensation was just a continuation of a cycle that started in the mid-1920s. Not only was the 1925-27 Model T roadster the most popular thing on the road in its time, it was later to become the standard for the automotive enthusiasts of the next generation who were enthralled by a desire for speed and power. Engine conversions, performance equipment and body modifications turned Henry Ford's pride and joy into the first hod rods. The basic design was both so popular and functional that today T bodies are even being reproduced in fiberglass.

Ford scored another impressive victory with its classic 1932 roadster – known throughout the automotive performance world as a "deuce." No other identification is required. With back-up support from the equally popular 1934 Ford, the second generation of hot rodders took this line to heart with even more affection than shown for the "T." Not only has the '32 and '34 Ford been subjected to every type of racing and performance application imaginable, but the models are also the backbone of the custom car field.

Next in line was the 1940 Ford, another hot rod classic. The sleek lines of this beauty channeled it more toward the "show" than "go" applications, but it must also be included on the list of great production victories by Ford in the hot rod field. Several subsequent models made minor splashes among the high performance fraternity during the next few years, but none came up to the purist qualifications until the introduction of the Mustang. And with production figures reaching an all-time high for the car, things are looking really bright for tomorrow's hot rodders, as well as today's participants.

There is no doubt that in the future the Mustang will occupy a respected spot alongside the '27 T, '32 roadster, '34 coupe and '40 coupe in the history of hot rodding, but it is also smack in the middle of the action right now. In fact, an off-the-showroom Mustang will run circles around the hottest "deuce" to hit the streets in the hey-day of street-type hot rodding.

This power and performance augmentation of the classic design makes the Mustang a natural for the nation's organized dragstrips, a fact readily established by both stock and

modified versions. When the first load of Mustangs was let out of the FoMoCo corral, the hottest thing in the Ford line was the lightweight Thunderbolt sedan powered by a 427-cu. in. V-8 high-riser engine. No sooner had this new little beauty been unlimbered than drag racers across the country began to gaze under the hood to see if there was room for the big engine. It was quickly established that this installation was a simple process.

About the same time, the word came out that a single overhead cam 427 was on tap for the 1965 racing season. Although this engine was banned by the round-and-round racers, it found an immediate home on the nation's quarter-mile dragstrips – and this meant under the modified hood of a Mustang. A combination of design appeal and performance advantage selected the 2+2 fastback model as the builders' choice for a drag racing contender. With a ready-to-race weight of slightly over the 3200-lb. minimum, the sohc 427 adaptation was a natural for the wild and woolly A/Factory Experimental class. Ford unveiled the sohc hemi-Mustangs at the 1965 Winternationals Drag Race Championships in Pomona, Calif., and the cars lived up to their advance publicity by winning the coveted Factory Stock Eliminator title. Bill Lawton was at the controls of the Tasca Ford entry that won the event in 10.92 sec. and 128.20 mph, but he was surrounded by other Mustangs enroute.

While the big-engined A/FX Mustangs are the glamor cars of the crew, there are several other slots down the performance ladder where the little horse fits in nicely and competitively. In fact, with four engines and three transmissions available in the fastback, hardtop and convertible models, you can get a Mustang that qualifies to race in nine different National Hot Rod Association (NHRA) stock classes, in addition to the A/FX versions – and a possible new challenger is in the mill. Although all of them aren't obvious winners, there are sufficient classes within the average racer's reach to meet any competitive desires.

Drag racing's trial and error engineering has improved upon the Winternationals A/FX performances to the point where 10.70 sec., 131.00 mph, runs are now routine. Let's trace the improvements and changes the top runners have made to see what makes the cowpony so quick and fast.

Naturally, the big push comes from the single overhead cam 427-cu. in. Ford engine, which surprised a lot of people by quietly dropping into the Mustang engine compartment with a minimum of effort – once the way had been cleared.

Research and construction on the original prototype of the drag racing A/FX Mustang was completed at Andy Hotton's Dearborn Steel Tubing, a swinging speed emporium operating under a *nom de plume*. When the Mustang was delivered to the shop it was only partially assembled and without an engine. With this as a start, the project began.

In the past, the spring towers have been chopped or flattened when the wedge-head 427 was installed in a smaller Ford or Comet, but they were removed completely from the Mustang. The extra wide overhead cam engine needs full use of the vacated space and the openings that remained in the engine compartment served to bring in additional cooling air. But, with the removal of the heavy, space-consuming

WINTERNATIONALS CHAMPION Bill Lawton demonstrates a "wheelie" with his potent A/FX Mustang. Although a time-waster in competition, the wheelie makes good exhibition stuff. Added weight in trunk, low tire pressure make it possible.

DRAGSTRIP

spring towers and coils, the engineers were faced with the necessity of designing a new front suspension system.

Calling upon their background in drag racing geometry, the Ford engineers assigned the suspension job to a simple leaf spring set-up which serves as a torsion bar. Using the lower control arm from the heavy-duty Mustang option for the disc brake equipped cars, the engineers ran the leaf spring-torsion bar from this control arm forward to a mounting attachment at the front of the frame. This simple arrangement does several jobs. It prevents the lower control arm from making any front to back movement, supplies the torsion reaction when the lower control arm swings, and gives stability along with saving weight.

ANOTHER COMPETITOR in Winternationals battle was Gas Ronda in this A/FX Mustang. Fiberglass front end, plastic windows keep weight down.

One of the major advantages of the leaf spring-torsion bar is the saving in space and lack of conflict with other chassis and engine components. In order to gain the safety and reliability desired with a conventional torsion bar, the engineers found they would have had to install a long unit with its accompanying mounting hardware. With the leaf spring, mounting became a very minor task of locking it down to a flat area, using the leaf spring as a torsion bar, but not letting it bend. A bracket which swivels on the chassis holds the front of the leaf spring, which has a nylon bushing and bolt tying it to the lower control arm.

Pre-loading of the chassis for straightaway drag racing is accomplished simply by placing shims under the leaf spring. Not only did this arrangement save space and weight, but it is also proving to be very easy to adjust for various strips and traction conditions.

Removal of the conventional spring towers and coils also required considerable beefing of the metalwork on the front end since most of the lateral cross bracing was also taken out.

Another major relocation project in the A/Factory Experimental Mustangs was made in the steering department. The entire steering gear was mounted outside the frame area in order to give clearance to the tuned exhaust headers and clutch linkage.

The front crossmember is stock and the unique quarter-elliptic design of the leaf spring-torsion bar permits the body to rise from 3-6 in. without pulling up the front wheels. Wheelstands are the "in" thing this season with the exhibition cars, but they don't contribute a thing toward winning races. Uplocking shock absorbers provide the additional control

Ford's sohc 427 V-8

Ford's single overhead cam 427 engine remarkably has been adapted from existing production components. Normally, new overhead-cam cylinder heads and the camshaft-drive system would require practically a brand new engine with relatively few components adaptable from the previous wedge-head pushrod design.

The ohv 427 cylinder block, crankshaft, rods, bearings and oil pump are used as is. The only difference is that an oil line must be tapped into the back of the block for oil drainage from the heads and a small boss is being cast on all 427 blocks to allow for this. Otherwise, the parts are identical. The new heads mount to the original block stud locations and use former water passage holes. The front housing for the chain drive to the overhead cams is formed by placing a large stamped plate over the front of the block, to act as the back cover for the chain drive, and then bolting a cast-aluminum front cover over this plate. This gives a complete oil-tight chain housing without changing the original block casting. The distributor stays in its original position behind the chain housing. The water pump bolts to the front of the front cover and is belt-driven.

The chain drive to the overhead cam is most interesting. The whole job is done by simple two-row roller-type chain, similar to bicycle chain, rather than the more usual inverted tooth "silent-type" chain. A roller chain has rolling bushings over the pins, which serve to reduce the rubbing speed the same as floating bearings in an engine. The Ford application is apparently an easy one. The primary chain drives from a crankshaft sprocket up to the original camshaft axis at the usual 2:1 reduction. This sprocket turns a short dummy camshaft, that spans just two bearings, with a gear to drive the distributor and oil pump. (Solid shells are put in the three rearward cam bearings to seal the oil flow.) Then on the front of this sprocket is another sprocket that drives the 6-ft. long secondary chain that follows a kind of T-shaped routing – up over two idlers and around the cam drive sprockets, then straight across the top. The right idler is adjustable by a self-locking set screw to adjust chain tension. Whipping is prevented where the chain passes across the top by a 20-in. long steel guide with nylon rubbing surfaces. There is another, shorter, guide below the left idler for further damping.

The new cylinder heads have the single overhead camshafts running right down their center with the valves inclined at an included angle of 80° and operated through rocker arms that pivot on shafts on each side of the head. This gives a beautiful hemispherical combustion chamber, with minimum area/volume ratio, short flame travel and a minimum of shrouding around the edges of the valves. The spark plug is offset lengthwise from the center of the chamber and is reached by inserting a gasketed tube down through the heads (like the Chrysler hemi engines).

The same head casting can be used for either bank by milling off the front cam bearing boss on the left head (which leaves the left cam with five bearings and the right cam with six). This isn't as bad as it sounds. The left cam (and cylinder bank) is farther forward, hence the overhang from bearing to sprocket is reasonable. On the other hand, the right side has considerable overhang, hence two bearings are necessary. The rocker arms are nodular iron castings and have roller cam followers on needle bearings.

Cam gear lubrication is through the camshaft and through the rocker shafts with feed passages to each cam bearing and rocker arm. Camshafts can be indexed by vernier gradua-

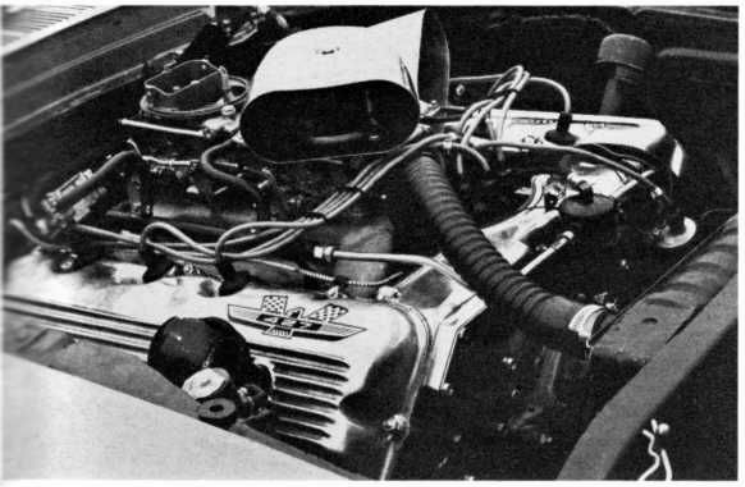
needed, with most of the cars running a 60-40 or 70-30 setup instead of the more conventional 90-10 used so successfully last year with the bigger cars.

When it comes to exhibition runs, however, the little Mustang has also proven to be a real challenger to the others in the field. Generous applications of ballast in the trunk and low tire pressures will put the front emblem in orbit, but most of the effort has been directed toward "go" instead of "show" and in that area the Mustang is almost unbeatable.

Back in the rear of the Mustang, Galaxie gear carrier and axles are housed in the stock Mustang case, but the 4.86:1 ratio is strictly for the dragstrips. The rear traction bars are almost identical to the '64 Thunderbolt versions, except for

HUGE SOHC 427 V-8 is nearly a squeeze fit into the Mustang's engine compartment. Elimination of spring towers makes it possible.

DRAGON SNAKE is Shelby-American's drag-racing version of the Cobra. It has made many championship runs and rules the roost in sports class.



PHOTOS: MARVIN LYONS, D. A. O'CONNOR, D. SHATTUCK, CHAN BUSH, FORD MOTOR CO.

the incorporation of an adjustable front mounting bracket. Tests by Ford engineers indicate that too much nose-up or nose-down attitude unnecessarily increases air drag and this feature of the traction bars permits each car to be adjusted to the individual driver's style. The traction bars are a boxed design and are welded to the rear axle housings.

Naturally, the battery is relocated over the right rear slick for better weight distribution and is of the 75-lb. maximum weight style. The rear end has been narrowed and moved 2 in. forward to permit the installation of the big 10-in. slicks. This operation also required minor reshaping of the wheel openings.

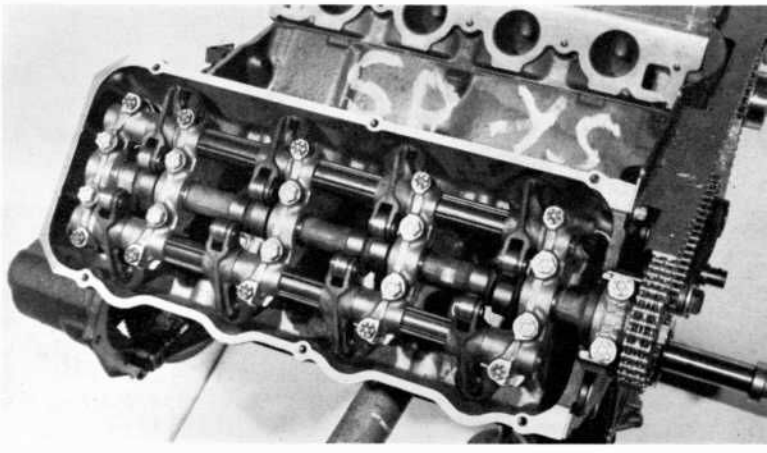
Very functional spot disc brakes were installed on the front of the Mustang, with heavy-duty drums on the back. These discs are more than adequate for the 130-mph runs.

With the running gear installed, the next mission was the installation of the overhead cam 427 engine. This powerplant is what turns the cowpony into a wild horse. With

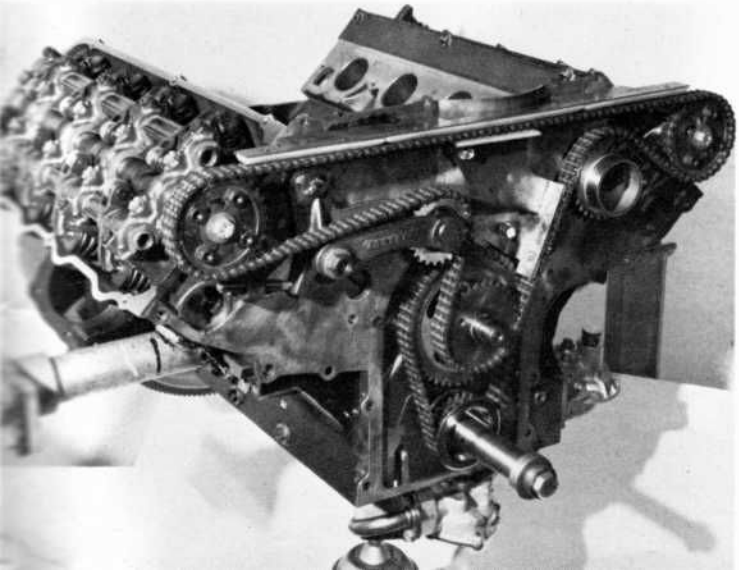
tions on the front of the cam and adjacent bearing cap.

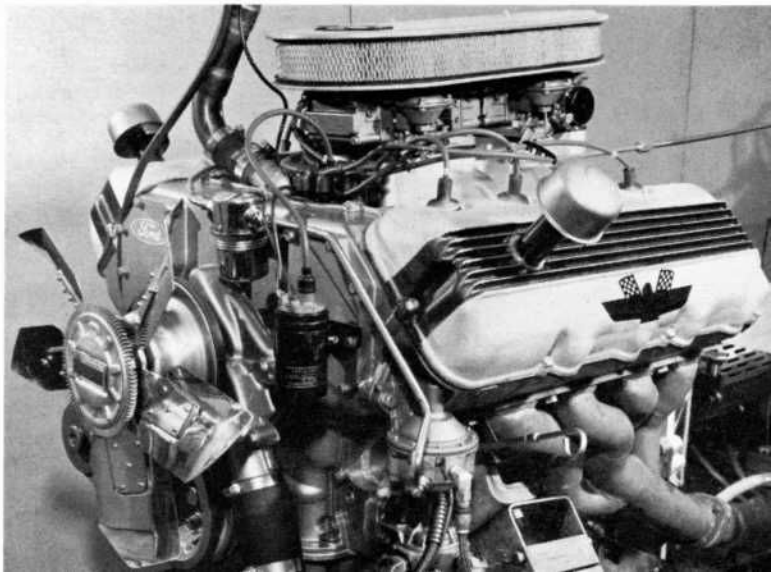
The valve and port specifications on the new sohc engine are really exciting. Intake valves have 2.25 in. head diameters, exhaust 1.9 in. Valves are the same type hollow-stem, flexible-head units that are used with the "7000 rpm kit" for the 427 pushrod engine. These weigh only a fraction of what conventional valves of this size would weigh and Ford engineers feel that with a valve spring tension of 375 lb. at the open position this engine should be capable of 8500-9000 rpm without destructive valve float.

You can just about stick your arm through the intake ports. These are round instead of the usual rectangular ports on Ford engines. Ford engineer Norm Faustyn says the circular



DRIVE-CHAIN for the overhead cams measures 6 ft. in length, runs over two idlers and between nylon whip-dampers. Rocker shafts parallel camshaft. At right, complete engine on a test dynamometer.





DRAGSTRIP

plenty of factory installed horsepower already available, nothing else is needed in this area to give the driver an abundance of pulling power for the entire quarter-mile distance.

Even with all of this modification to the running gear and engine compartment, the A/FX Mustang retains a stock appearance right up to the hood. There the image deviates. Instead of the stock Mustang unit, the FX'ers are equipped with a unit similar in design to the bubble-top hood used last year. Naturally it is fiberglass, as are most of the other front end components and doors in this weight-saving maneuver.

Inside the driver's compartment, there is the proven four-on-the-floor Ford transmission, and conventional racing tachometer, oil pressure gauge and related instruments.

That takes care of the big stallion of the herd, but what about the others?

There are plenty of ponies there, too. One of the most popular classes for the Mustang is F/Stock, where the very popular 289/4-speed campaigns. This class gives you plenty of speed, with the big winners topping the 100 mph mark, but still enables you to drive your bomb back and forth to work. Naturally, most of the difference between a winner and an also-ran in stock classes is driver ability and technical know-how.

Tests indicate that the 2+2 fastback shape gives a slight advantage in airflow, but the bigger rear window also adds some 50 lb. of weight. Fortunately, it is near the back where it counts, not hurts.

The first thing necessary for any Mustang, as well as any car heading for the dragstrip, is the installation of traction bars to prevent wheel hop and rear-end wind-up. These are mandatory if you are going to get all the power available to the ground. There are several proven units on the market and all are easily installed on the Mustang.

Next in line if you are going the all-out route in search of every potential horsepower is the addition of a balanced ex-

HOOD scoops on the A/FX cars have vents in back to let in cool air for carburetors. Oil pressure gauge shows through screen.

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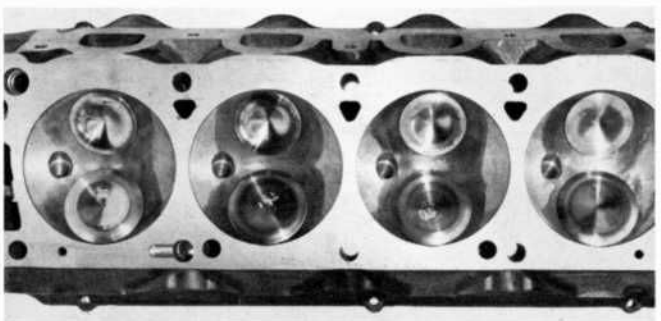
cross-section is ideal for any flow passage, because it gives the minimum surface area per square inch of flow area for minimum skin friction, and the entire cross-section can be utilized for flow area. Current intake ports have a diameter of 2.1 in. for an area of 3.44 sq. in. where the '64 427 pushrod engine had 2.44 sq. in. of port area.

Breathing and performance characteristics are phenomenal. The air flow per cubic inch of displacement is much higher than with the 427 pushrod engine in even its most sophisticated versions. Power development has only just started and already it exceeds 600 bhp at 7000 rpm with 12:1 compression and a single 4-barrel carburetor. Maximum torque runs more than 500 lb.-ft. in the 4000-5000 range.

Current prototype engines are using 0.55 in. valve lift and 328° duration compared with 0.50 in. lift and 324° for the 427 pushrod engines. This timing, plus the additional breathing efficiency, has put the power peak up about 400 rpm, or from 6800 rpm for the high-riser to about 7200 on the sohc.

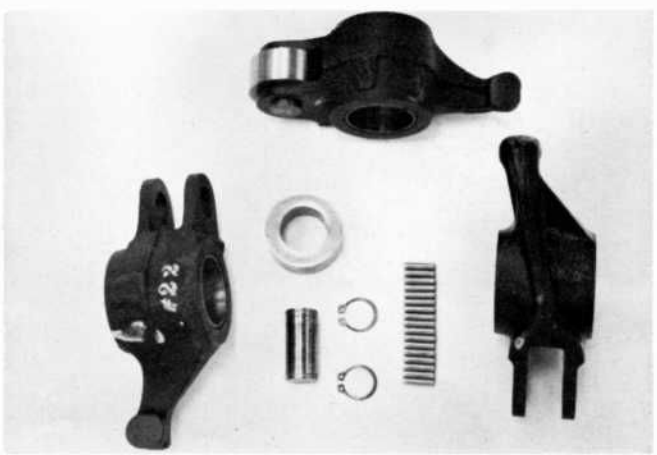
COMBUSTION CHAMBER of the sohc Ford comes out a perfect hemispherical shape — best for high performance work. At right, the roller rockers which ride on camshaft. Rollers run on tiny needle bearings to cut friction.

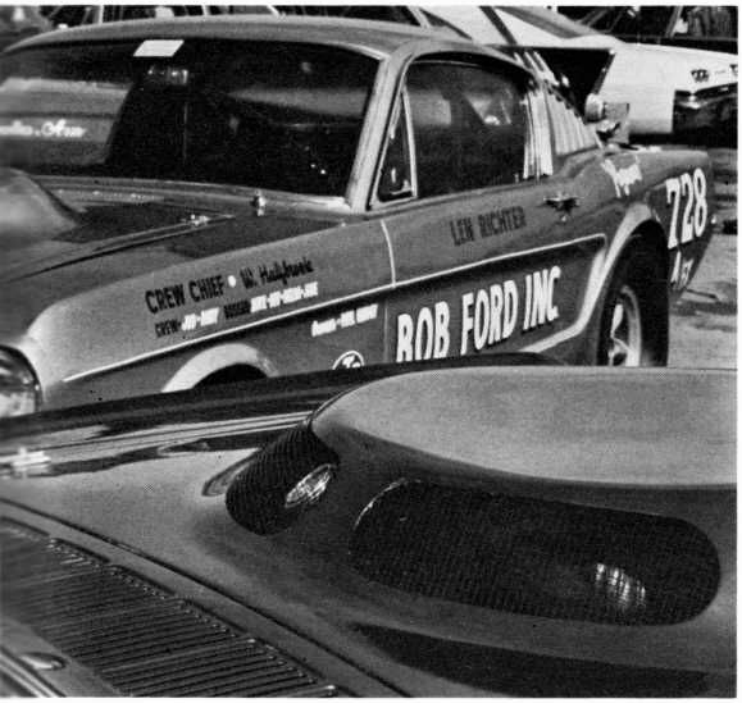


How high can the new sohc Ford turn? Faustyn was cagey. He admitted they had not had it above 7500 rpm on Ford dynamometers because of fear of breaking something in the dyno room (dynos are much more expensive than engines). But he feels there would be no distress in the valve gear at 8500 or 9000 rpm.

How about the important matter of engine weight? Admittedly, the new sohc 427 is about 100 lb. heavier than last year's pushrod 427. The bare head castings weigh 72 lb. for the sohc, compared with 39 lb., and then there's the extra weight of the chain cam drive, double rocker shafts and brackets and front chain housing. The complete sohc engine, with all accessories but without flywheel or the heavy cast-iron exhaust headers, weighs 697 lb. with single 4-barrel carburetor. The pushrod 427 weighs just under 600 lb. in this trim.

— Roger Huntington





haust header system. Here again, there are dozens of top manufacturers in every area and an individual's personal choice will probably be the deciding factor.

After mounting a set of "cheater" slicks on the rear of your cowpony, you're ready to do battle. From then on you play around with the timing, try out different cam settings and find the right shift points.

The next step upward in Mustang racing is high performance power equipment and the starting place here is spelled Carroll Shelby and the Cobra. Although most of the major speed equipment manufacturers now offer a full line of "goodies" for the Mustang, the people at Shelby-American Inc., were the first to really pull some horsepower out of the 260-289 Fairlane engine.

With a big assist from both Ford engineering and marketing, Shelby has developed a full line of high performance equipment (see page 62) for the Mustang that is available through your friendly neighborhood Ford dealer.

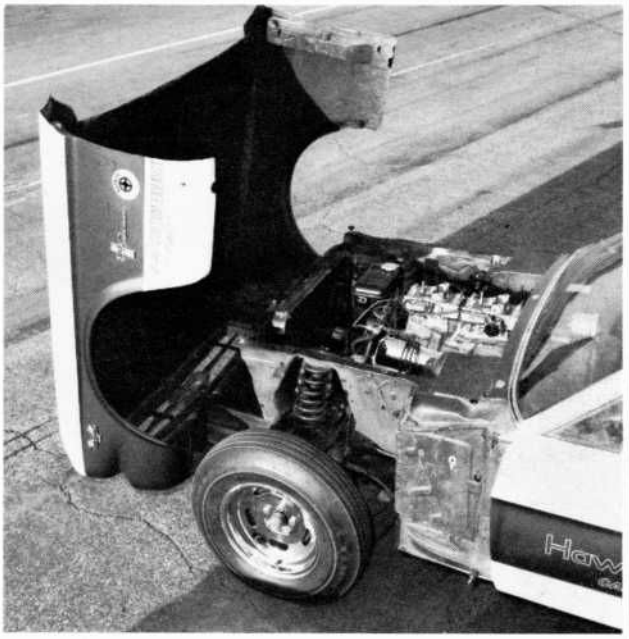
First stop enroute to the all-out Mustang is the installation of a Cobra distributor. It's stock legal and will give a hot, dependable spark up to 7000 rpm – in addition to about five more horses. The unit consists of dual points, centrifugal advance calibrated for performance rpm and solid wire spark plug leads.

The 271-bhp High Performance engine comes stock with a solid-lifter cam which keeps you legal, but if you are dropping out of the stock classes it will give you at least 20 more horses when used with compound valve springs.

At this point, it is time to bring another Mustang option into the discussion – one that could really stand the drag racing fraternity on its ear in the sports car classes. Shelby-American took the sales-booming 2+2 and gave it the full Cobra treatment from front to back. The production model is known as the GT-350 and this Shelby Super Sports should really give the B/Sports ranks an overhaul if it meets the technical paperwork requirements.

Shelby took over the Mustang with everything going against him in his announced intention of making it into a winning sports car. Turning out the required 100 units to qualify it as a sports car was no real problem. Actually, making it into a handling road race machine wasn't either when we consider the vast talents brought together under the Shelby roof.

And just as the Shelby-conceived and produced Cobra shook up the drag racing world when it appeared in "Dragon



One of the first 427-powered Mustangs was put together by Oaklawn, Ill., dragster driver Ron Pellegrini and custom car specialist Johnny Malik. Their "Quarter-Horse," followed the format of a Fairlane Thunderbolt they had successfully compaigned. Front-end sheetmetal was replaced with all-of-a-piece fiberglass for easy engine access, and windows replaced with lighter weight Plexiglass; the result of such a diet was a 2900-lb. car. In installing the 427 cu. in. ohv V-8, they put it far enough back into the firewall to eliminate interference with the front spring towers and far enough to gain some rearward weight bias. Both 4.89 and 5.21 gears were used with 10.00-15 slicks; results were 10.90 sec. and 130.16 mph in the quarter-mile.

DRAGSTRIP

Snake" configuration, the GT-350 should do the same thing when the Shelby Super Sports hits the quarter-mile to campaign in Corvette country.

First move in preparing the Mustang for a sports car identification was removal of weight – the same task that faces any drag racer. This was accomplished by the removal of the rear seats, relocation of the spare tire and battery – the battery in the trunk over the right rear wheel and the spare tire where the rear seats formerly resided – and installation of a lightweight fiberglass hood. All sound-deadening and undercoating were eliminated along with considerable weight. Even the small rear vents were blocked off, as the mechanism weighs 14 lb. each!

The front seats were replaced by very light, but still functional 'glass units. A simple grille screen not only changes the appearance but saves more poundage.

After the weight-reducing diet, the racing suspension, additional front-end bracing and no-spin rear end setups were added. The 325-bhp 289 Cobra engine and 4-speed transmission completed the package for a drag racing winner.

Inside the engine of the Shelby Super Sport GT-350 are all the Cobra goodies that are also available for the 260-289 engines.

Tracing this item for item, with cross-reference to comparable components from other independent manufacturers, will produce a real charger for 1965-styled "knights."

Cams have always been the most discussed item on the speed equipment roster. Here you "pays your money and takes your choice," depending on what you want in final performance. You've really got to go to beat the Cobra cam with solid lifters for street operations, but all-out drag racing applications may dictate any one of a dozen quality roller tappett sticks now on the market for the Mustang.

In the area of intake manifolds and induction systems, the market is again saturated. Shelby alone has four different units, ranging from a single 4-barrel, through a 3x2 set-up, to dual fours. Probably the best overall unit of the bunch for the average Mustanger is the single 4-barrel which gives performance plus on the strip and livable driving mileage.

You've got to take a long look at the tri-power set-up, however, if you've got the bucks in your Levis. For the $210 price-tag, and with the right cam action, your Mustang begins to really prance.

For the average Mustang rider, the Weber induction kit, featuring four 2-barrel Webers, is strictly something to dream about. But if your dreams ever come true, you've got a real power package for the strip.

By the time you've advanced this far in your Mustang training and development program, you've undoubtedly installed an approved type scatter-shield bell housing over a blow-up proof clutch. These units are strictly "smart" as well as being 100% legal stock class equipment. Here again, Schiefer, Weber, Shelby and others offer real clutch and flywheel units, while RC Industries, Ansen, Shelby and others can supply approved safety housings.

Moving through the engine, you can either buy your High Performance heads from Shelby for your Mustang, or you can have any one of the highly competent machine shops do their versions, which will give you varying degrees of improved efficiency.

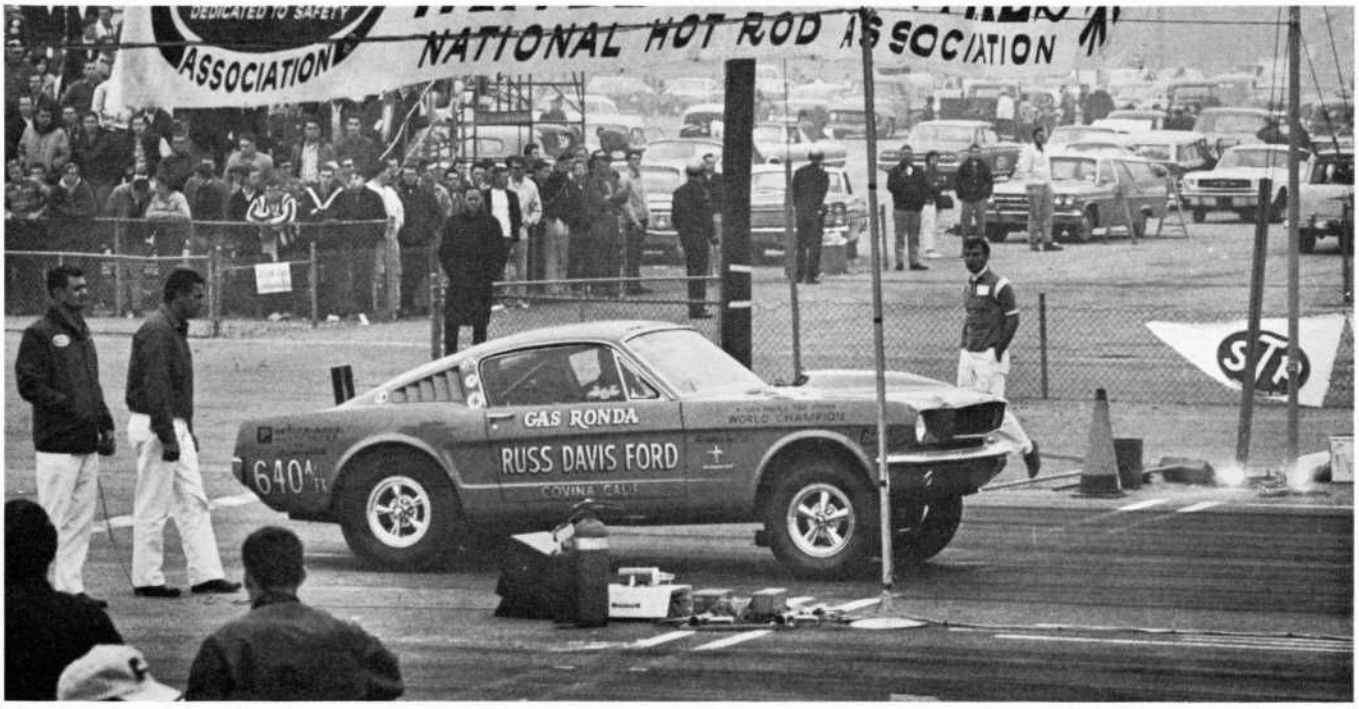
Paralleling all of these performance components is the most complete line of "dress-up" goodies ever presented for any individual model car. Even the factory is climbing onto the chrome and polish bandwagon with the introduction of the "GT Kit."

And wheels . . . wheels . . . wheels . . . and more wheels for the Mustang. My personal choice, although I haven't settled on a definite pick, comes down to either the specials for Shelby from Cragar, Cragar and Hurst . . . in alphabetical order.

Up to now we've been strictly bolting on and adding, but you've got to get inside to really make the Mustang a championship bronc. Here again, Shelby sets the pace and everyone else makes a major contribution in the area of stroker kits, special pistons, roller cams. If you go this route start out with the 289 block. The 260 just can't stand the success, although everything fits.

At the top of the heap is the "blueprinted," full-house Mustang. The heap will be formed by fallen opponents and trophy "gold." For the drag racing and drive-in fraternity, this is definitely the "Year of the Mustang."

MUSTANG FASTBACK 2+2 coupe is a natural for the sohc V-8 and the A/FX class. But Mustangs are eligible for nine NHRA stock car classes, too.



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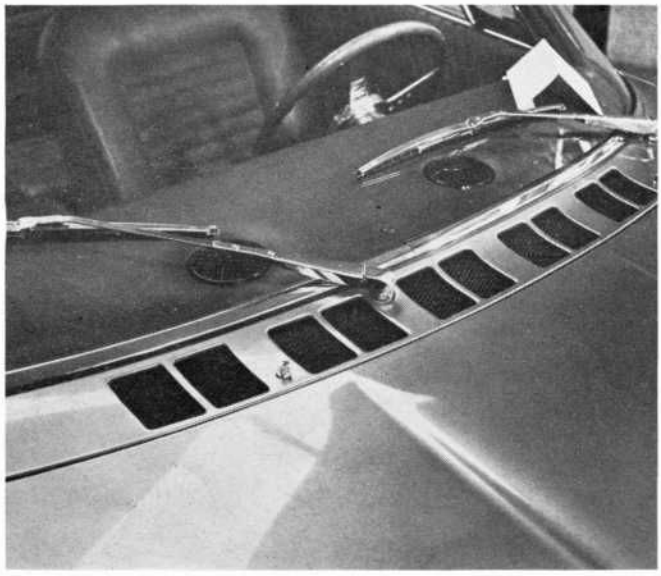


CARROZZERIA MUSTANG

An Italian Coachbuilder Produces a Shapely Colt

The first Italian-styled American car since World War II to make its international debut at the New York International Automobile Show was this Bertone-designed Ford Mustang 2+2 fastback. Flown to New York by Alitalia Airlines the day after it was completed, the car was commissioned by the magazine *Automobile Quarterly* and built by Carrozzeria Bertone.

The Bertone-styled Mustang set the stage for an all-new Italian car design exhibit to be co-sponsored by Alitalia and *Automobile Quarterly* for the 1966 New York automobile show. It is the hope of the Quarterly's publisher, L. Scott Bailey, to reverse the practice of introducing new car designs in European shows and to bring to America first some of the outstanding cars designed and built by European coachmakers.

Carrozzeria Bertone, a styling and coachbuilding firm established in Turin, Italy, in 1912, is well known as a designer for Fiat, Alfa Romeo, Lancia, Iso, Simca and BMW automobiles. The Bertone Mustang, however, is the firm's first design on a Ford car.

Bertone's approach to designing an Italian version of the Mustang has been to reduce the overall square Mustang shape to an aerodynamic line in order to increase stability and speed. This has been accomplished without any engineering changes. No alterations were made to the main sup-

FRESH-AIR intake is screened to keep out larger debris; rear seat (below) folds flat to form extended luggage area.

NIPPED OFF in Continental fashion, the Mustang's tail was slightly shortened. Small window panes between rear pillars slide open electrically.

PHOTOS: DEAN BATCHELOR, BERTONE

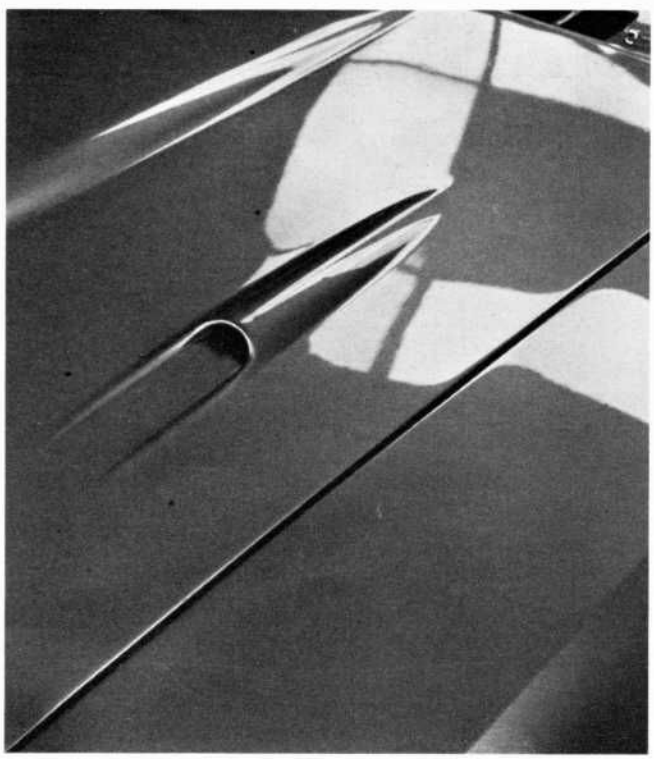
ITALIAN-STYLED "mag-type" wheels are cast in a magnesium alloy. Pirelli Cinturato tires, 195-14, are mounted on the 6L x 14 rims.

porting structures with the exception of a newly designed radiator that reduces frontal area. Although the Bertone car is shorter and lower than the standard Mustang, the passenger space and overall visibility have been increased.

The two rear windows are retractable, an unusual feature in the modern GT and fastback styles. The front end is aerodynamically clean, with hidden headlights electrically rotated into position. Cooling vents for the front wheel brakes are styled into the side panels. The Bertone Mustang body is turquoise, with roof and rocker panels in metallic silver. The interior is in tobacco tan leather.

Specifications: Overall width, 68.6 in.; overall height, 49.1 in.; overall length, 158.3 in.; panel instrumentation by Borletti. Wheels, 6L x 14 electron by Campagnoli; tires 195-14 Pirelli Cinturato.

HEADLIGHTS ARE hidden in rotating outer grille sections. Machine gun blisters are stylists' tricks to cover upper shock absorber mountings.



A STYLIST'S MUSTANG

Thoughts-on-Paper for a Future Line-Up

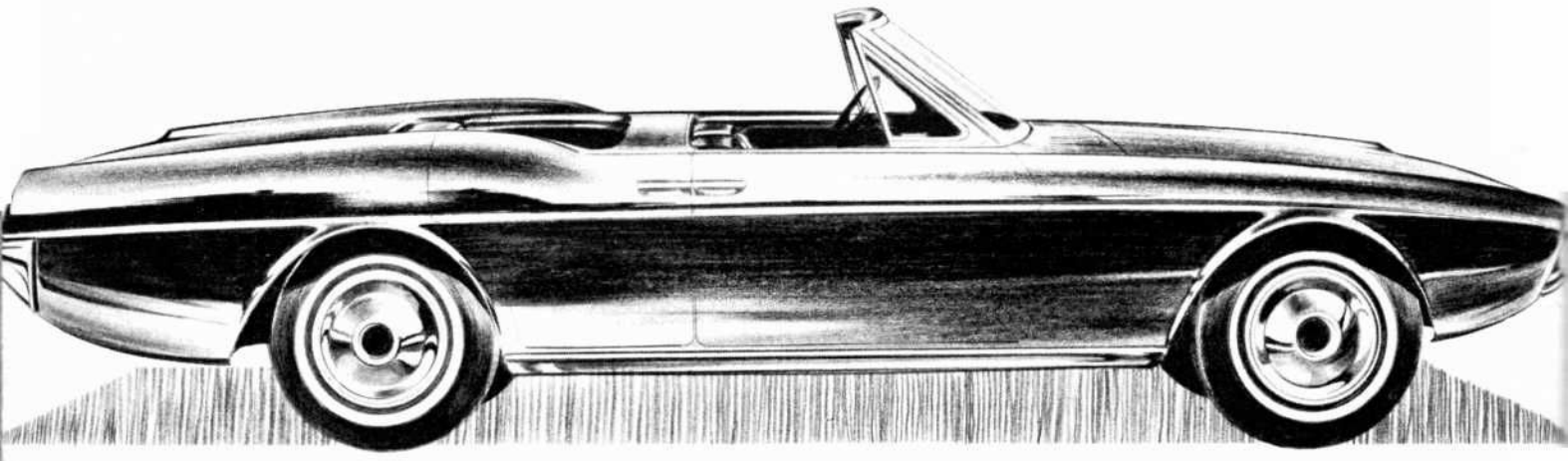
DESIGN AND TEXT BY GENE GARFINKLE

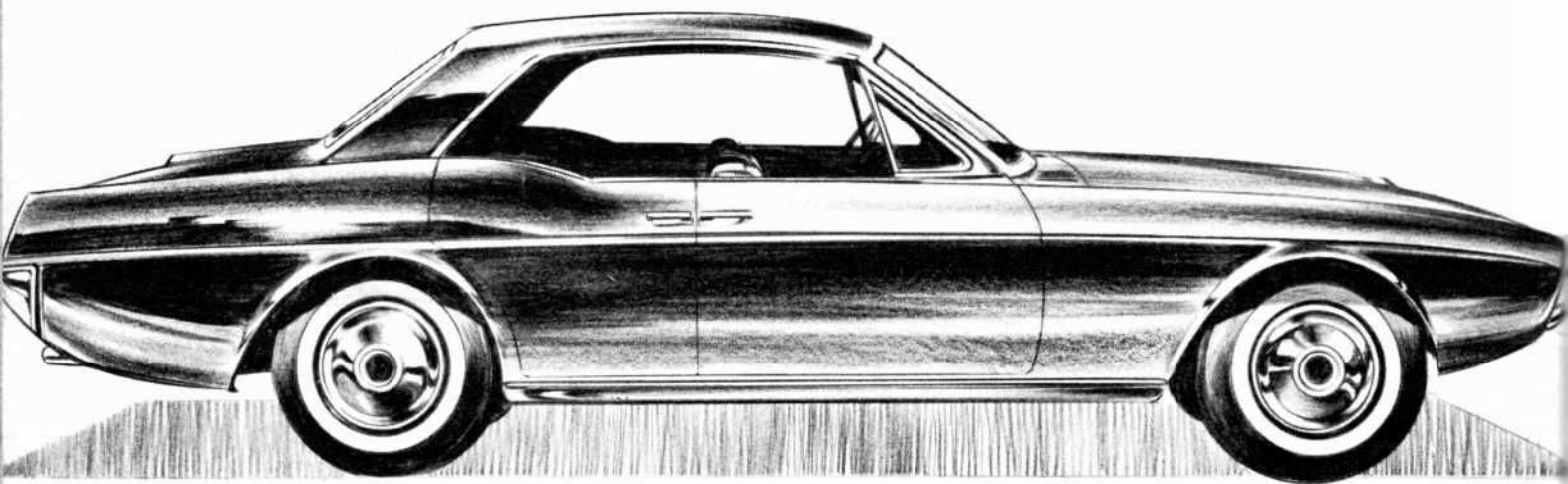
The Mustang's impact on the domestic automotive scene has demonstrated very convincingly that the market for this type of car, demanded by the enthusiast, is not necessarily limited to just the enthusiast. It has shown also that the so-called limited-market vehicle, if properly promoted and merchandised, can have an extremely large market.

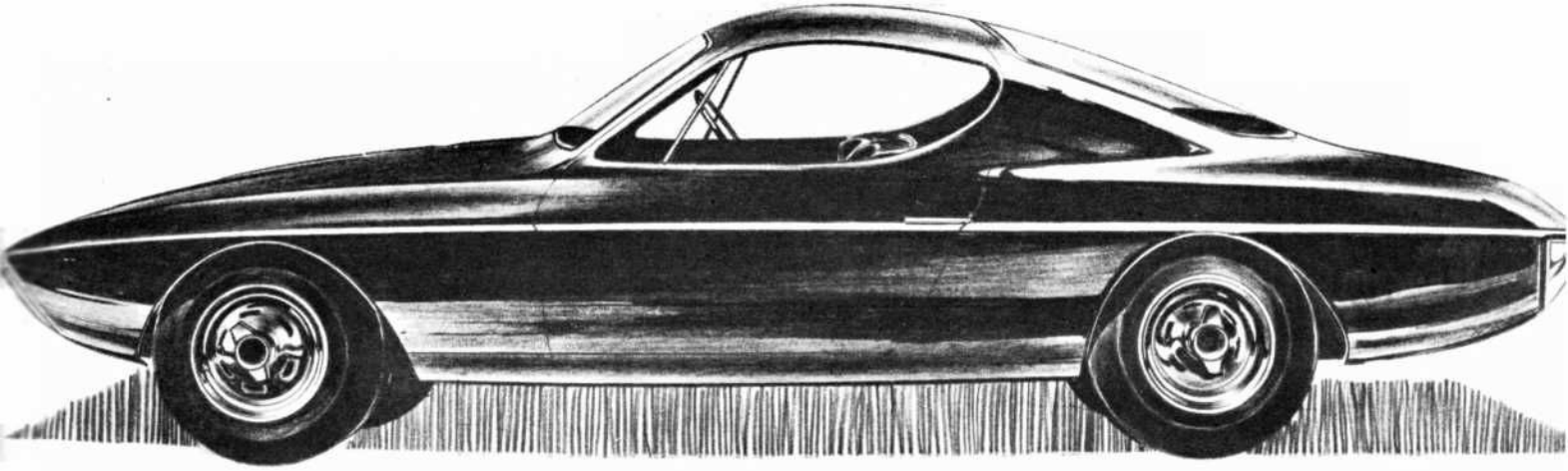
In reality, the Mustang offers no more (and in some instances a bit less) to the buyer than other compact semi-sports types offered in the last few years – with two significant exceptions: It represents itself as a unique, separate package, distinct in form from the rest of the Ford line and, as opposed to the compacts of 1960-64 with which it compares in size and price, it offers an image of performance and distinction without displaying the negative aspects of economy or size.

The Mustang has achieved its success with only two models, the hardtop and convertible; but in the fall of 1965 added a fastback variation. It has, and Ford evidently intends to maintain, its exclusive image as a sports or sporting type of car. However, a more complete line of cars *could* be created to take advantage of the available tooling and running gear and of the very potent image that the Mustang has developed. It is so logical and feasible, we wonder if Ford Motor Co. might not already have something similar under way?

The group of cars shown here is not intended to be an extension of the current Mustang line, but rather to draw from those components and qualities and establish a new series with further distinction of its own. As the Mustang offers within its current options and running gear framework all that is necessary to found a series of production cars,







the basic specifications and dimensions of the Mustang would be unchanged. Changes in the exterior sheet metal and interior styling are carried only far enough to give this series a separate identity.

The 4-door sedan is a close-coupled, pillarless hardtop, which follows along the long hood/short deck proportions of the Mustang and maintains, as do the rest of the series, some flavor of the Lincoln Continental.

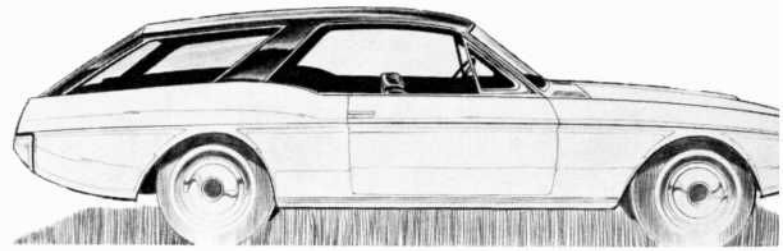
The 4-door convertible sedan, with its separated passenger compartments, lends a classic character and has a functional value. As the 4-door configuration eliminates the need for folding front seats, lounge-type seating may be used front and rear and the cowl behind the front seat could restore the structural rigidity normally lost in a convertible.

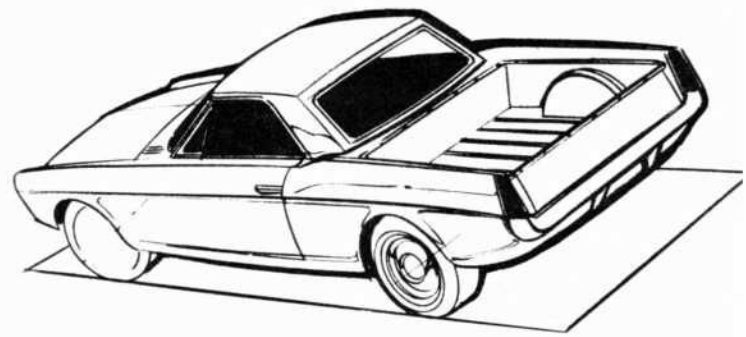
The station wagon is the application again of the Mustang's visually exciting proportions to a familiar body style; shown is a 2-door version.

The Ranchero-type pickup is in reality more of a throwback to a body style lost with the Ford Model A, the roadster/pickup. The appeal of this sort of car is enchanced by the removable hardtop, which is capable of being stowed in the pickup bed, and with top off and tonneau in place, it has all the attributes of a contemporary roadster.

As the Mustang's very rigid and self-contained platform chassis makes an ideal base for the coachbuilders' art, the inclusion in the line of a limited series all-out GT cars is also quite feasible, as illustrated by the 2+2 sketch.

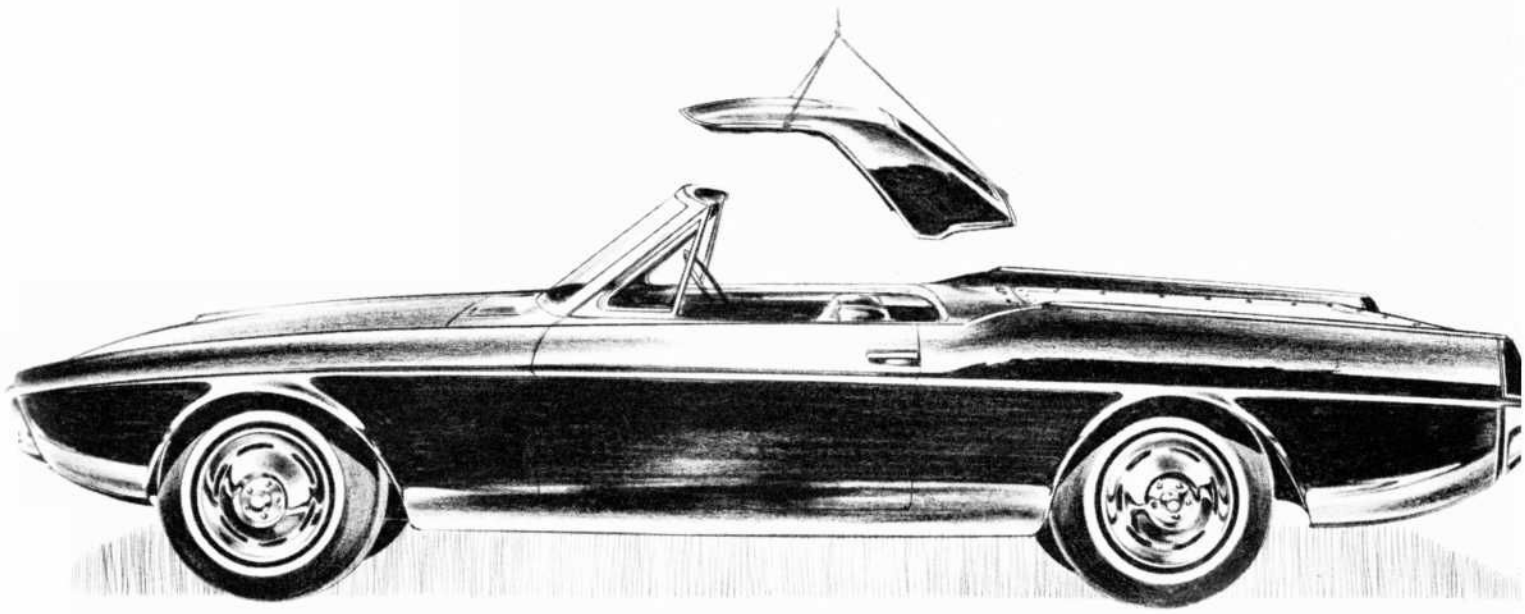
Are these for sale? No. The models shown in the accompanying illustrations are merely one stylist's studies of what could be done within an existing framework.





VARIATIONS ON a 4-door theme appear on facing page, show how a pillarless formal sedan and convertible sedan might appear in the proposed Mustang of the future. Top, on this page, is a close-coupled GT coupe, much on the order of the current GT-350. Below it are a 2-door station wagon and its allied styles — a short-bed sedan-pickup and, best of all, a roadster/pickup!

(OVERLEAF — All the Mustangs by Ford; Mustang I, II, production and GT-350.)



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