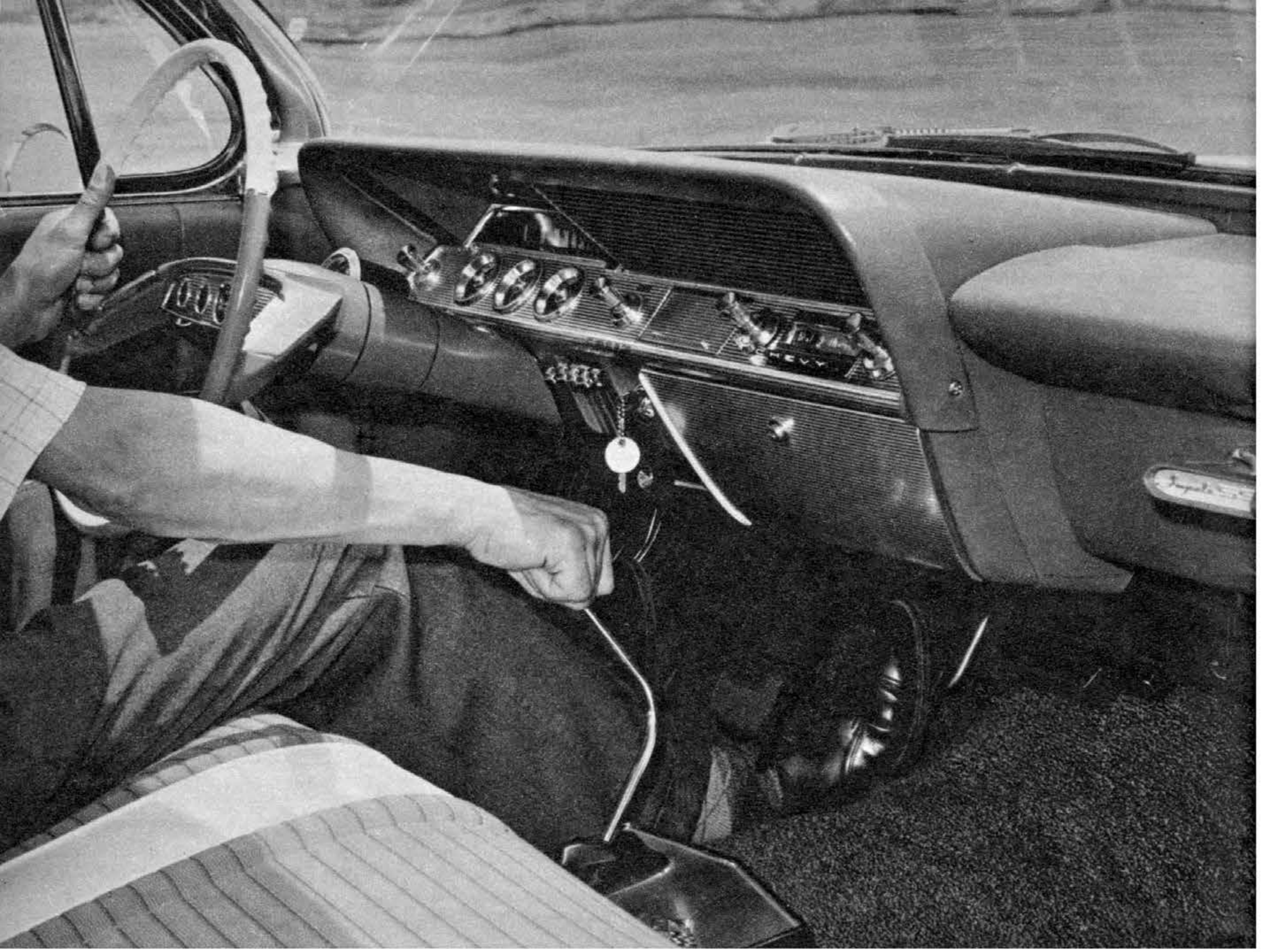


THE DRIVE TRAIN

WE HAVE gone on at some length in the first portion of this book about increasing engine performance. And, when we first begin to engage in hot rodding activities, that glamorous looking multi-carbureted, chromed and painted, big bore stroker is all we can focus on. Then, after we blow up a clutch, de-fang a gear or uncouple the driveshaft in a gratuitous display of power, it usually sinks in that the drive line is not infinitely overstressed.

Modern motorcar engineering allows for all sorts of idiocies on the part of the owner. Most components are built to take several times normal weight, torque, pounding, heat, cold, and so on. If it were not so, we could never engage in rodding as a pastime; it would be far too costly. However, this surplus of strength extends only so far, and we have advanced so much in engine development that we are running ahead of the rest of the chassis, so to speak, and have completely used up the margin of error in most of the car's other components.

The path of power from flywheel to the ground is made up of a number of links in a chain, of which none must be conspicuously weaker than the others. Clutch, transmission, universal joints, drive shaft, differential, rear axles, wheels and tires assume the task of overcoming the inertia of the automobile in response to energy created at the crankshaft. Inertia is a product of weight and rolling resistance; it is the inclination of a car to sit still rather than to move (and you realize how strong this inclination is after you have tried to push a stalled car by hand). The strength required from the links in our chain is directly proportional to the power which goes into it and the inertial resistance it meets.

In the not too distant past, a simple three-speed Ford gearbox with Lincoln Zephyr gears would contain and distribute all the power our hottest engines could develop, considering the chassis they were mounted in.

Today such a box in the driveline of a really hot car would make a sound like a skillet of popping corn. If you raise horsepower at one end or weight at the other, something in the middle has to give. Now, weight has not come up as much as horsepower, of course, but the *effective* weight (as an easy way to visualize it) has been enormously increased by more efficient tires.

We could cram a lot of horsepower through our old Zephyr gears, even if the transmission was mounted in a nine-passenger limousine, if the back wheels were sitting in a puddle of oil. But, put some 10-inch wide slicks on those wheels and set them on a dry strip. Then what happens?

Correct. Popcorn.

The tires must, however, in the final analysis, be the weakest link in our chain. They are expendable. The rest of the system, with the exception of the clutch, is expensively replaceable, and, besides, when it has been expended you don't move!

There are, to be sure, other considerations than mere strength. We will deal with them in due course. But, first, let's see what we have to work with in the Chevrolet.

THE AUTOMATIC TRANSMISSION

Powerglide, Chevrolet's trade name for its automatic transmission which has been in use since 1950, is not actually one of those components which manufacturers have unwittingly bestowed on an eager group of power enthusiasts. It is an extremely serviceable box for normal on-the-road uses . . . which is exactly what it was intended to be . . . but it is not one of the easily-modified parts that can be made to serve another purpose.

The Heavy-Duty Powerglide, available in 1961 with the 348 engine, and carried forward with the 409 in 1963, is a beefed-up version of the regular unit having a welded converter cover and higher friction clutch discs, which is about as far as you can go toward making it into a piece of racing equipment.

In its design, the Powerglide becomes self-limiting at a lower level than, say the General Motors Hydramatic, because it is a torque converter attached to a two-speed planetary transmission, rather than a multiple-speed transmission with a fluid clutch as the Hydramatic is. A torque converter *multiplies* the engine torque in the same way a conventional gear set does. A fluid clutch merely *transmits* torque, as a conventional dry disc clutch does. Here is the rub, as far as gross amounts of horsepower and high speed are concerned, since the torque converter is at its maximum of performance at stall speed; multiplying torque at a ratio of 2.1-to-1 or up to 2.6-to-1, depending on the unit.

This multiplication drops off as engine speed (and vehicle speed) rises, until it reaches 1-to-1. At this point, in the Powerglide, the torque converter begins to act like a Hydramatic fluid coupling because the pumps and valves which control the action of the stators and turbine so dictate. Otherwise the engine would be free to race and the car would proceed sluggishly inasmuch as the efficiency curve of a torque converter looks like an inverted "U". The faster it turns, past a given point, the less effective it is.

This factor prevents the torque converter from being used alone and causes it to require a supplementary gearbox which can be used to change ratios while the converter is in the fluid clutch stage. Because of the converter's ability to multiply torque to an appreciable extent, fewer gear ratios are needed than would be the case with a conventional transmission. Hence the Powerglide has only two forward gears, Low and High.

In the current boxes, Low ratios are: 1.76-to-1 in the cars with the biggest engines, 1.82 in the rest. Stall speed multiplication is 2.1-to-1 in the converters attached to V8s and is increased to 2.5 in the unit for the Chevy II. It is up to 2.6 in the Corvair. All High ratios are 1-to-1.

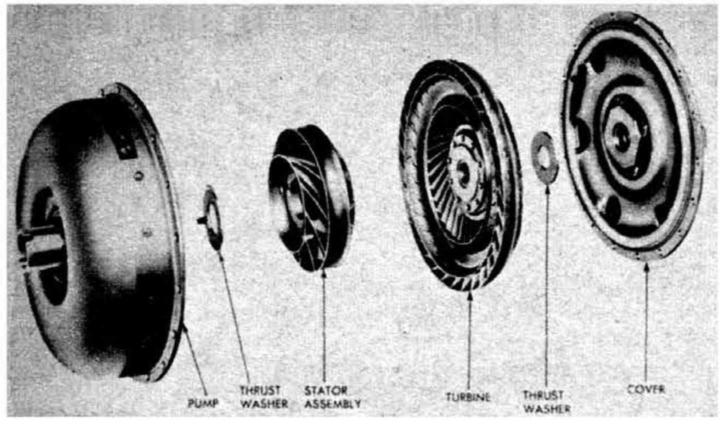
When we proceed a little further into gearing theory you will see how these compromise ratios affect performance. Meanwhile, a look at the unit is in order so that we can understand what demands not to make on it.

Strangely enough, the Powerglide has a resemblance to the first automatic transmission ever invented. This adjunct to motoring dates back to 1904 when the Sturtevant brothers of Boston, Mass., utilized such a device in a car made by their concern. It was a two-speed gearbox operated by friction clutches which responded to centrifugal weights. One clutch engaged a set of double reduction gears, the other, which came into play at higher engine speed, locked the driveshaft into direct coupling with the engine. Substitute the fluid coupling of the torque converter and hydraulic pressure for the centrifugal weights and you have the effect of the modern automatic. Instead of spur gears, as the Sturtevant used, the Powerglide uses a planetary gear set. But, still, all gears are in mesh and changes of ratio are accomplished by locking or releasing gear sets.

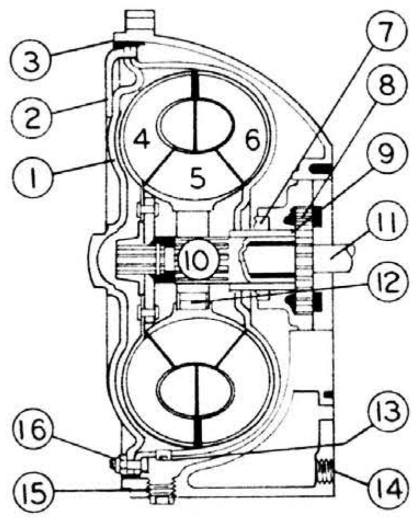
The speed at which these ratio changes occur is determined by the governor which is geared to the output shaft. It either directs hydraulic pressure to the Low band servo or releases it for direct drive. A manual control can override the governor on the upshift, that is, when the selector is in L from the start, but a downshift cannot occur until pressure drops sufficiently, regardless of where the selector is placed. In the 1963 327 engine cars with 250 horsepower, the maximum upshift speed is 62 mph and maximum kickdown speed is 58. In the 300-bhp engine, the speeds are 62 and 60 respectively.

You can alter these shift points by changing the governor weights and springs, but it is not in the realm of the neophyte mechanic. This is the sort of thing best left to a specialist who has the tools and know-how to effect alterations without dire consequences. In changing the shift points, however, we still cannot escape the fact that the Powerglide still has only two gears: Low, variable from 3.82 to 1.82, and High at 1.00, with quite a spread between the ratios. If we consider that 3.82 is the effective Low, that 1.82 corresponds to Second in a conventional transmission and 1.00 relates to High, we still have an unhealthy jump. The Second gear ratio in the Chevy 3-speed is 1.53 and it is regarded by many as being too distantly removed from High.

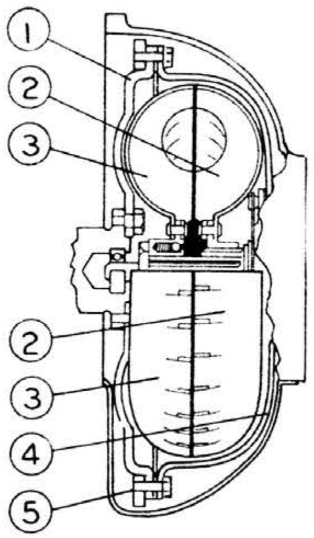
A second consideration is that the Powerglide is more prone to failure under extremes of usage than the Hydramatic. Any torque converter has a stator, to direct the fluid flow between the pump and the turbine. To reduce weight,



Exploded view of Chevrolet Powerglide reveals components. Heavy Duty Powerglide is distinguished by welded housing.



The torque converter consists of: 1) Cover, 2) Flywheel, 3) Housing, 4) Turbine, 5) Stator, 6) Impeller, 7) Oil seal, 8) Oil pump, 9) Impeller Hub, 10) Reactor shaft, 11) Input shaft, 12) Stator shaft, 13) Converter drain plug, 14) Gearbox drain plug, 15) Bell housing drain plug, 16) Retaining bolts to cover.



The components of a hydraulic coupling are: 1) Flywheel assembly, 2) Drive torus, 3) Driven torus, 4) Torus cover, 5) Cover retaining bolts. Power is transmitted by torus, not multiplied.

these parts are made of aluminum. The Hydramatic employs steel in the corresponding rotating members. Again, the shear action of the fluid and the torque increase in the members acts exactly like a slipped clutch; heat builds up, which increases pressure. Thus we have a condition of pre-disposed over-stress.

This is not to say that the Powerglide is not an adequate transmission; far from it. Because of its smooth action and generally trouble-free reputation, it is fine for most uses. However, this will explain why it is not found in much-modified cars, whereas the Hydramatic is becoming extremely well thought of even for the hottest machines.

If you are going to modify your Powerglide Chevrolet for ultra-high output and rpm, then a switch to either a Hydramatic or a conventional gearbox is in order. If you are going stick to the Powerglide to run S/A class, then the welded converter type, rather than the riveted type, is mandatory. These are identifiable by the letter W added to the serial number: C206DO. "Beefed" or improved automatics are allowed in this class as long as the unit corresponds to that which is used in the particular year and model. Most of the beefing in this case can be accomplished by substituting the latest clutch drive and reaction plates.

FLYWHEEL AND CLUTCH

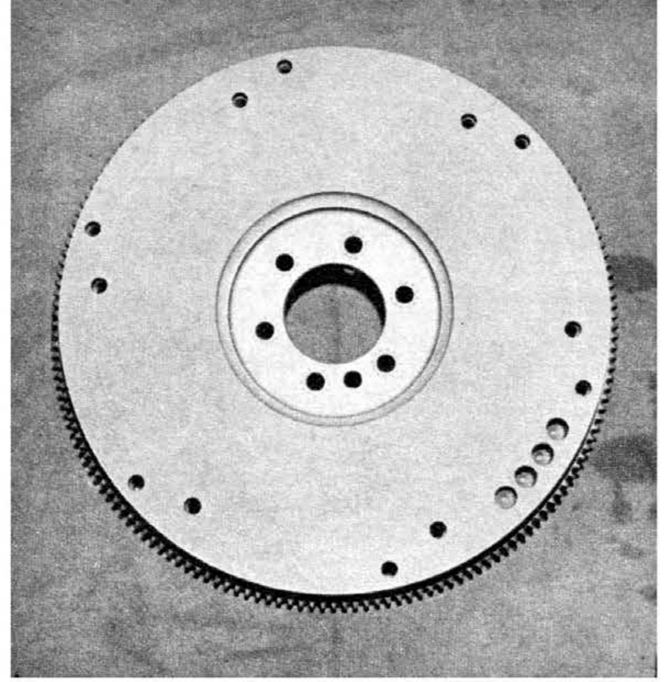
If we are going to drop the faithful Powerglide in favor of a conventional transmission, or if we have a gearbox and intend to use it briskly behind a hopped up engine, two ingredients may become necessary . . . in line with our original premise that no link in our chain should be disproportionately weak in relation to the others: (A) a stout flywheel, and (B) a rugged clutch.

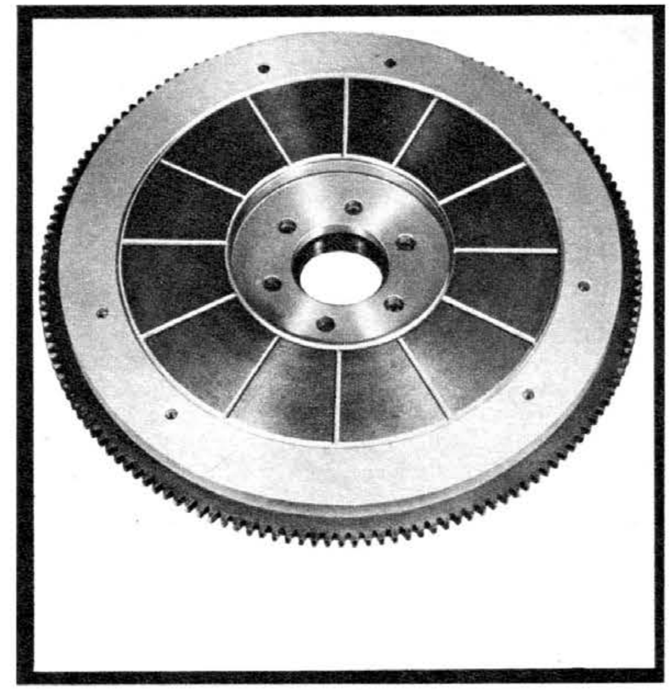
In the past, emphasis was placed on chopping the flywheel to rid it of excessive weight and, thus, permit the engine to accelerate more rapidly. It has now been recognized that this can be carried to ridiculous lengths and that the dangers inherent in reducing flywheel strength far outweigh the gain in acceleration, particularly in the case of a big engine. In fact, the inertia of a heavy flywheel is used by many all-out dragsters to help keep engine rpm up as they leave the line. The important aspect today is safety.

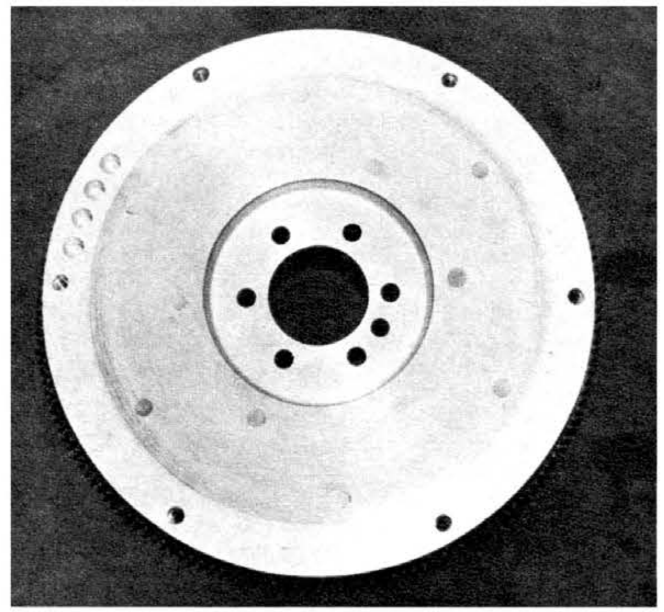
It is dubious that you will extract enough horsepower from your Stock class or street machine to disintegrate a flywheel under normal conditions, but since the NHRA requires a scattershield on all stick shift Chevys (and other big V8's) some experience from the past indicates that either flywheel or clutch *can* come unglued in any of these classes. If you are going to abide the stock flywheel, have it balanced alone and in unit with the clutch. If the surface is not perfect have a cut taken off it or have it surface ground. It should have zero run out relative to the centerline.

Excessive lightening is not permitted by NHRA in Stock classes and is not advised, anyway. Replace with a proprietory flywheel of either steel or aluminum treated for wear resistance, if you are going to abandon the unit as it comes from the factory.

A number of such units are available. The Schiefer bronze-faced aluminum type is one, the Sanfordized aluminum type





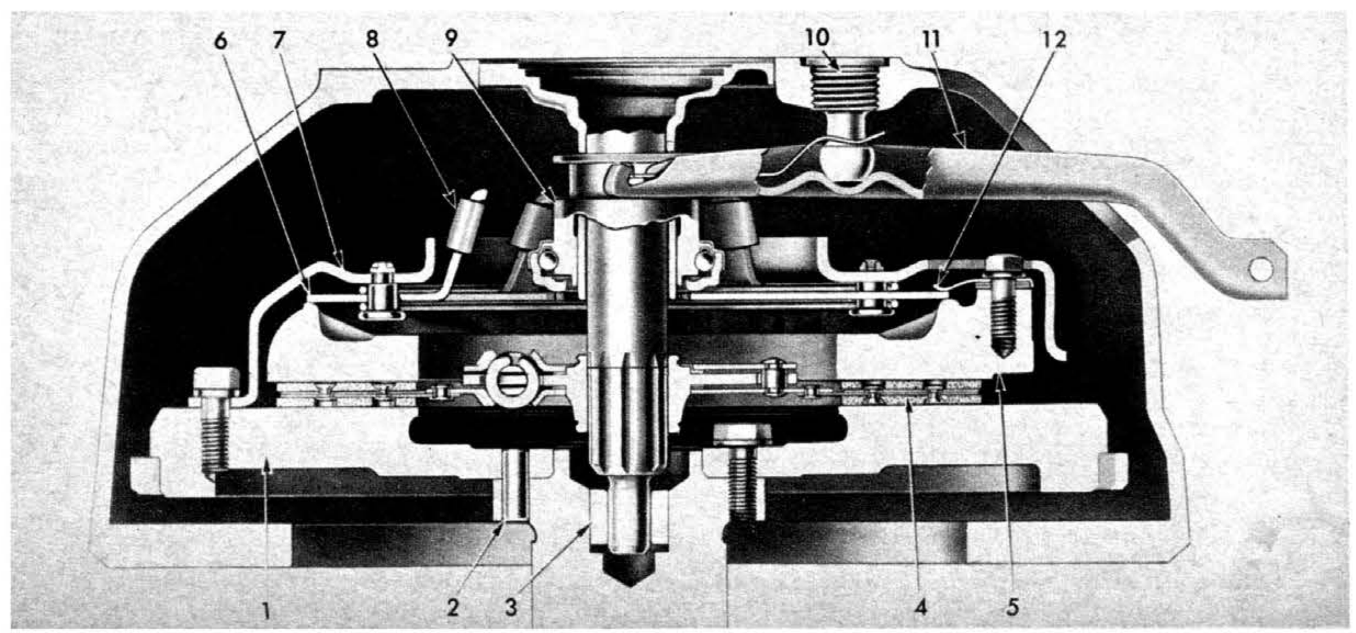


ABOVE LEFT: Lightweight aluminum flywheel made by McGurk Engineering has driving surface toughened by Sanfordizing.

ABOVE: Schiefer flywheel, also aluminum, relies on surface coating of bronze. Grooves speed up heat dissipation.

LEFT: Alternate method of improving aluminum flywheel is to rivet steel plate into machined recess. Unit is balanced.

BELOW: Chevrolet Heavy Duty clutch used on several models utilizes governor weights (8) to increase pressure plate thrust.



distributed by Frank McGurk is another. Still a third type is that offered by Weber Equipment Co. wherein a steel facing is incorporated into an aluminum disc. Aluminum is not used so much for lightness in these flywheels, which are intended for street and strip applications, but for heat dissipation. Heat is the enemy of metal, lowering its strength, and, together with centrifugal force, is the cause of flywheel and clutch disintegration. Steel plate, naturally, can absorb both more heat and centrifugal force than can the ordinary cast wheel and it is generally used in the awful dragsters.

If your interest is primarily in good road performance and occasional drag strip runs, you can make do in the clutch department with the optional heavy duty Chevy components, for passenger cars and trucks. Otherwise it is a sound idea to invest in a good re-built clutch designed for competition.

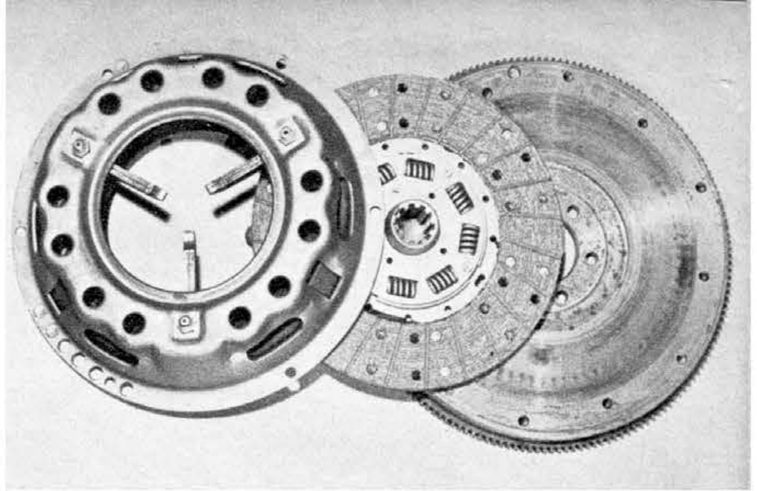
The clutch, like most components in an automobile, is a compromise. It should be light in weight and have low mass in order that it can be released with little pressure and at a rapid rate, yet it must be strong enough to absorb high input, withstand extremes of friction and engage the flywheel solidly. Stock clutches are only engineered to withstand the abuse delivered by the average careless driver without increasing pedal pressure to an uncomfortable point. This pressure on the release mechanism and, consequently, the thrust exerted against the flywheel is generally the rating by which we identify a heavy-duty clutch. But, it is not the only criterion. So let's eyeball the whole assembly.

Two sub-assemblies make up the dry-plate unit: (A) The driven plate, or disc, which is a thin metal plate, faced with friction material, having an internally-splined hub mating with the transmission input shaft; (B) The pressure plate and cover which are bolted to and rotate with the flywheel. Between the cover and the pressure plate are springs, which hold the disc against the flywheel when engaged, and retractor fingers, which remove spring pressure to disengage the disc. It is plain to see that increasing spring pressure will, indeed, hold the friction disc against the flywheel with greater force and thus make it more able to transmit power without slippage. But, if this pressure is increased, what of the pressure plate and the cover which must bear the load . . . not to mention the bolts which hold it to the flywheel, the fingers and even the release bearing which motivates the fingers?

The composition of the friction material itself and the quality of the plate to which it is bonded are also important.

So. Don't be misled and buy a "beefed clutch" which is mostly bull.

One advantage of the factory heavy-duty clutch (such as that which is used with the current high-performance 327 and 409 Chevy engines) for the driver who must use his car for



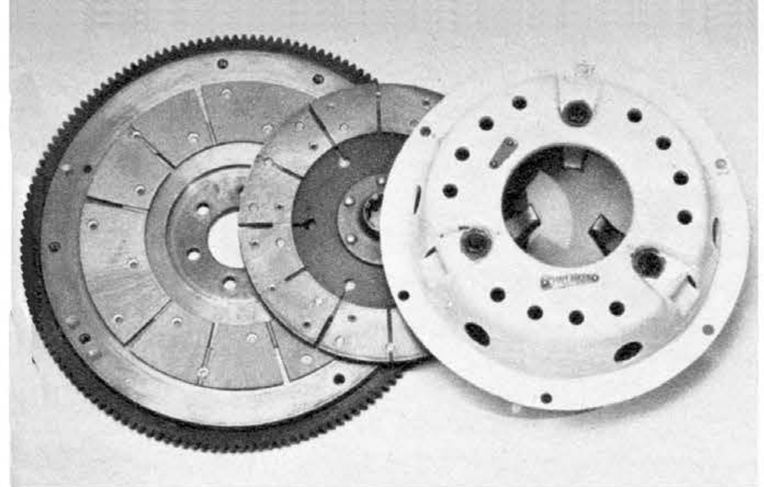
Chevy clutch assembly consists of clutch cover with pressure plate, driven disc or plate, flywheel. All can be improved on.

daily transportation is that it is centrifugally assisted. This design allows relatively light springs to be used between the cover and pressure plate, with consequent easy pedal at low speeds, as in traffic driving. The centrifugal weights apply extra pressure, as speed goes up, to compensate for the lighter springs. Such a clutch is stiff at high speed and becomes as difficult to disengage as one with heavy springs, but no more so. These are 10½-inch diameter disc clutches. In 1962, they were available with the 380 and 409 horsepower 409 engine, listed as "Borg & Beck" units. Nominal pressure from the coil springs and centrifugal assist was 2100 to 2380 psi. In the 1963 models, they are referred to as Chevrolet parts and have either diaphragm springs or coil springs. The diaphragm spring type exerts 2300 to 2600 psi pressure and the coil spring model 2020 to 2300 psi. With these more rugged units, a "premium grade" friction material is used in driven disc facings from the factory.

Note that these clutches differ from the 1961 HD semi-centrifugal type fitted to 230 hp 283 engines and the 348 cubic inchers which were diaphragm type and with 1575-1725 psi and 1725-1875 psi ratings.

An optional clutch for dual purpose applications which has been much used is the 11-inch Chevrolet truck pressure plate and disc assembly, part nos. 3758681 for the pressure plate, 3758678 for the disc. With the 1963 327 model, however, the new flywheel is too small to accept this assembly.

Corvettes employed a Borg & Beck coil spring clutch assembly with coil springs rated at about 1600 psi initial, up until 1962 when they were also fitted with the Borg & Beck centrifugally assisted type of the 409, but using a 10-inch disc instead of the 10½-inch. For 1963, they come with Chevrolet



High performance flywheel-clutch assembly includes faced flywheel, non-cushioned driven disc, heavy cover, pressure plate.

diaphragm spring type, still centrifugally assisted, and developing up to 2600 psi pressure.

So far this clutch has not been received with great enthusiasm by Corvette road racing experts, and because of the smaller flywheel, it offers some problems in adaptation.

The Borg & Beck Corvette clutch has always enjoyed a good reputation but many road race-prepared cars utilize an alternate disc facing, such as Velvetouch, to extend clutch life under competition conditions. Any proprietary clutch disc will have industrial grade lining which will be more suitable to hard usage than the normal factory friction material; the choice is a matter of individual preference. Both the metallic and non-metallic type have their advocates, with about equal success. But, it goes without saying, that for any off-the-street use, a superior grade of friction material is called for.

The disc itself can be improved upon for a true competition clutch . . . one which does not necessarily have to serve a dual purpose, or where the owner is willing to put up with an all-in-or-all-out engagement . . . by making it a solid affair, eliminating the reaction springs which cushion the engagement in the normal plate. These are best avoided by the weekend warrior, frankly, but a revised pressure plate, as found in the better "beefed" clutches is good insurance for any competitor.

There are several approaches to the pressure plate problem, but the Chevy owner is fortunate that the major manufacturers of this equipment have concentrated on the Borg & Beck type clutch in the past few years, whereas a few seasons ago everything was built around the Long clutch used in Ford products. Frank McGurk, who specializes in Chevy modification equipment, offers a cast pressure plate made from 4130 cast steel which is normalized to eliminate internal stresses, machined, then heat treated to give a tensile strength of 165,000 pounds. Weber Equipment Co. favors a malleable iron alloy for this component, and has demonstrated that the plate can withstand extremes of temperature and distortion without failure. Other builders use aluminum or steel plate for this most important piece, but all are striving for a product which will endure the intense heat generated during the moments of slippage.

Another factor entering into the pressure plate problem is the uneven application of force due to spring location. Springs cannot be spaced equidistantly around the plate because of the location of retractor toggles. The more conscientious manufacturers try to equalize pressures by using slightly weaker springs where they are closest together. Spring pressures, incidentally, of more than 3,000 psi are not practical, nor desirable, becoming too difficult to control and making cover strength marginal. If more solid plate-flywheel contact is mandatory, such as in the one-gear-only dragsters, a multiple-disc arrangement is used where a floater plate is interposed between two discs, thus doubling the contact area.

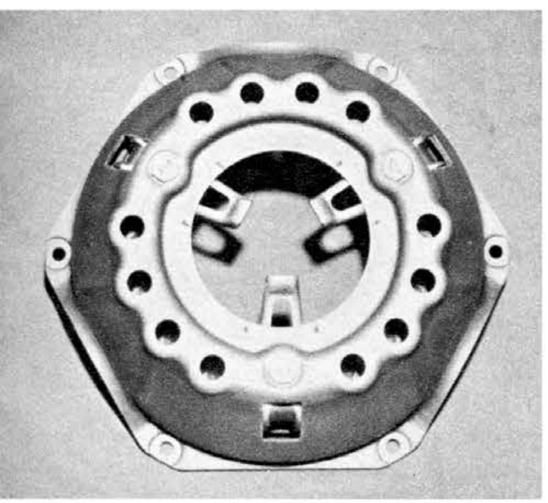
But, keep in mind, as you improve the clutch for drag racing there must still be some "slip" here. The application of power to the rear wheels cannot be instantaneous and it is necessary to hit a delicate balance between slip at the clutch and spinning the wheels during a full power start. You will have more control over the car with less tire slip, naturally, but run more risk of overheating and destroying the clutch. In preparing your Chevy for competition, do a little comparison shopping before you buy and select a high quality clutch assembly, then wrap it in an NHRA-approved scattershield.

BELL HOUSINGS AND SCATTER SHIELDS

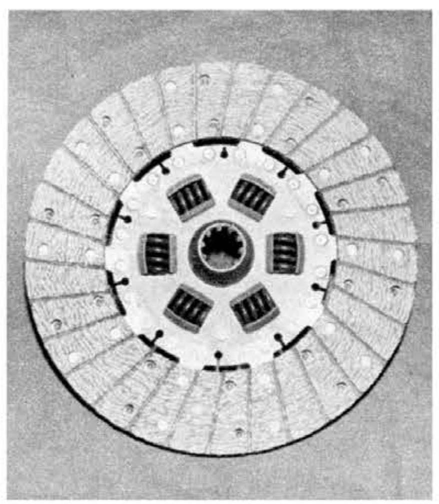
The late Chevrolet bell housings of cast aluminum have ample strength to double as scattershields and are NHRA-approved. Other, cast iron, types must be surrounded by a 360° shield made of ¼-inch steel plate securely mounted to the frame and so made as to completely cover the bell housing to a point one inch ahead of the flywheel and one inch behind the pressure plate and clutch. Such a protective device is marketed by several firms, one being Moon Equipment Co., whose two-piece, bolt-together unit for Chevrolets is easily installed.

The scattershield can be omitted if the bell housing is fabricated of or cast in steel of appropriate thickness as several competition housings or adapters are.

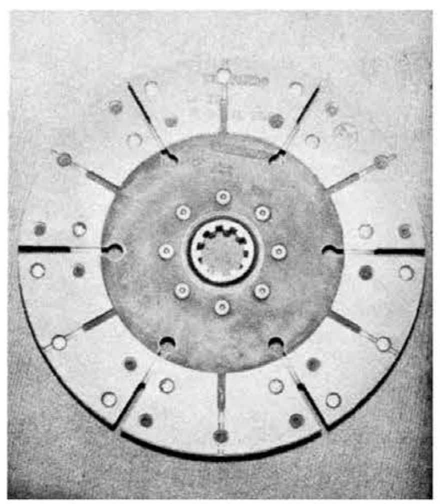
An engine support strap, of steel plate or aircraft cable,



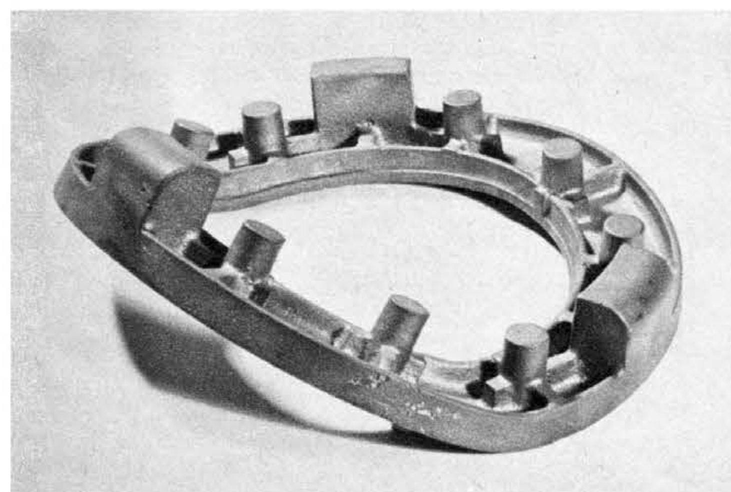
Beefed clutch cover should have stronger release levers as well as stiffer springs.

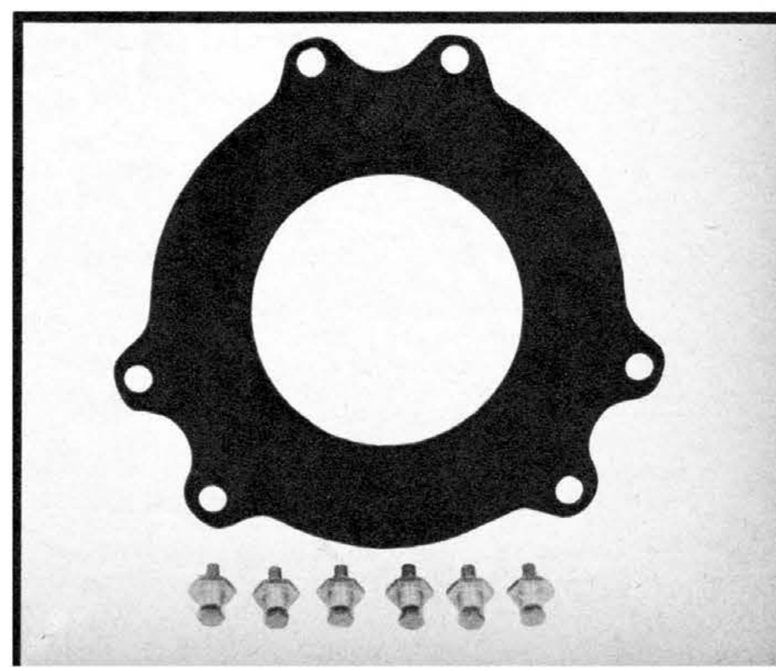


Industrial grade (heavy duty) facing on disc a must for even casual drag racing.

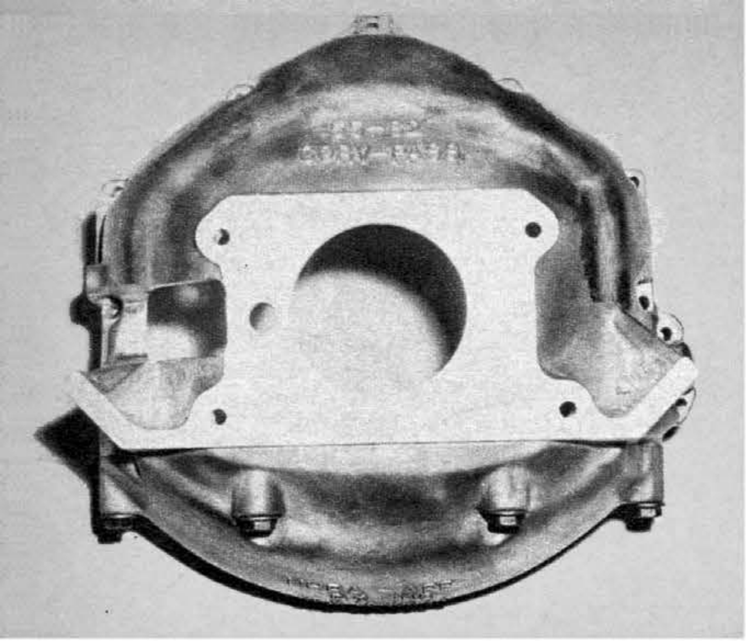


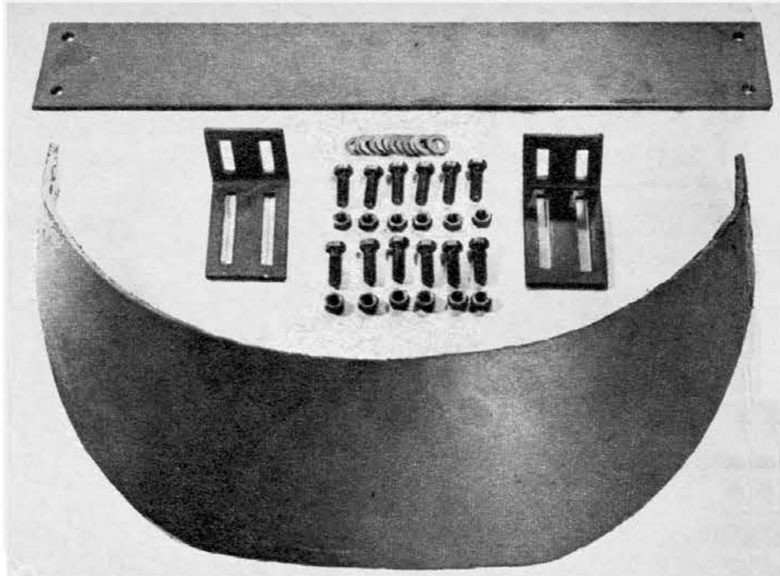
Dragging-only disc has no cushioning springs around center, is not for street.

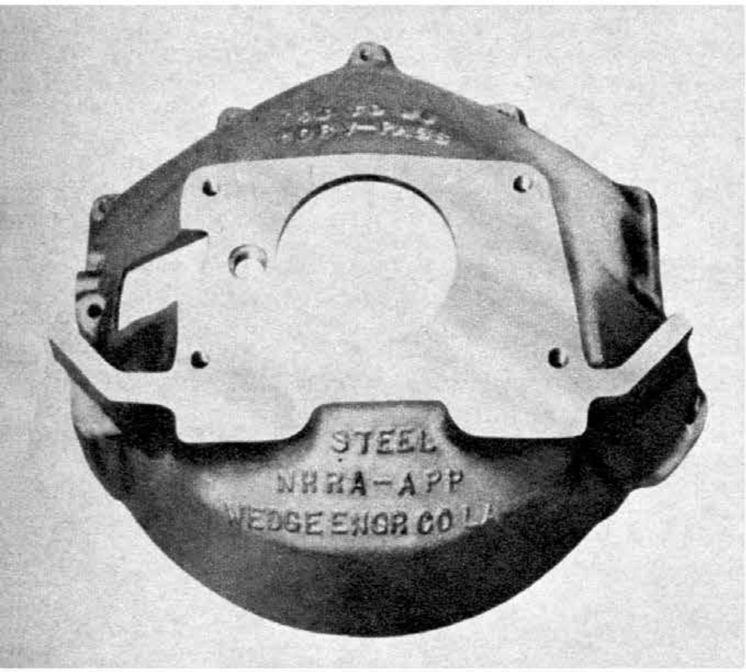


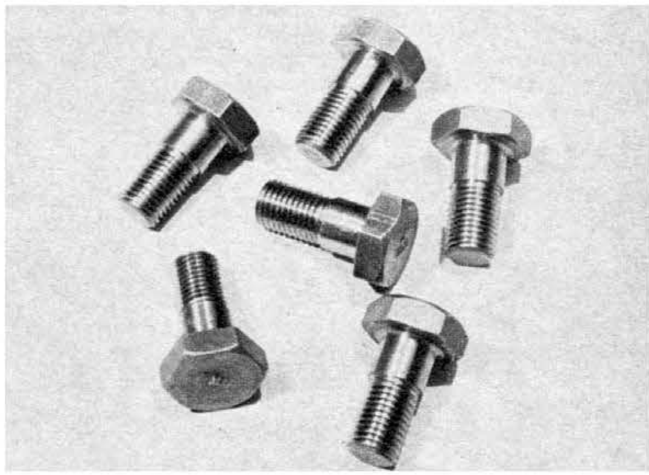


ABOVE: Malleable iron pressure plate in "blow-up-proof" clutch can warp harmlessly. RIGHT: Steel floater plate, bolts.









TOP LEFT: Chevy aluminum bell housing meets NHRA requirements for safety, can be used without scattershield in its events. TOP: Bolt-around scattershield is popular Moon Equipment Co. item. Full 360-degree enclosure of bell housing is NHRA ruling. LEFT: Combination scattershield-transmission adapter of cast steel satisfies safety requirements, makes neat installation. ABOVE: High tensile steel cap screws are used in clutch-flywheel assembly. Heat generated at clutch causes failure.

must be used in competition cars under the rear of the engine to prevent its dropping out of the car in case of bell housing blow up, according to NHRA regulations. This, and a safety strap under the drive shaft on non-torque tube drive cars is good, common sense precaution.

Which brings us to the debatable topic of:

GEARBOXES

In order to differentiate them from automatic transmissions, let's call the transmissions in our Chevy automobiles "gearboxes." This will pinpoint the discussion; namely the size and effect of the cogs therein.

A performance handbook such as this dedicated to one make is not the proper place for a full fledged discussion of gear theory, but insofar as we can bring it down to Chevy parts, a little analysis of the why of picking gear ratios or what to do with the ones you have seems to be in order.

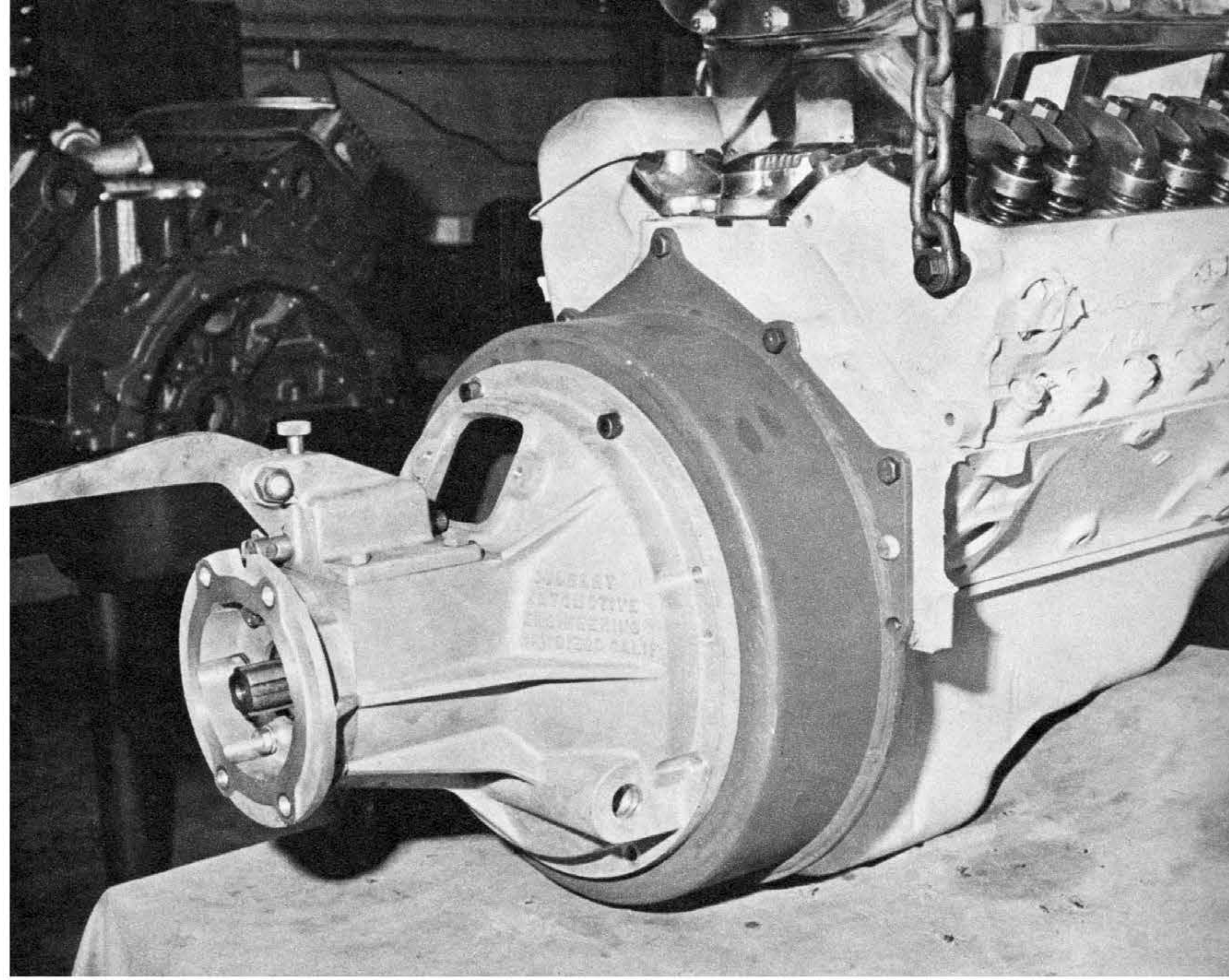
The first suggestion I can make is to either brush up on your math or procure a "dream wheel" which relates overall gear ratios to miles per hour and engine rpm because there are a staggering number of possibilities and conditions. And, one of the most effective visual aids in plotting against time and speed is a graph such as those you see reproduced here which give the theoretical road speed for any rpm in any gear. Being limited to Chevy gear ratios, as far as most of our clientele is concerned, makes construction of one graph for each rear end ratio and gearset not too onerous, but since we learn best by doing, I'll give you the facts and you can roll your own.

The formula for turning engine rpm into theoretical mph is this:

$$\frac{RPM \times W}{GR \times 168} = MPH$$

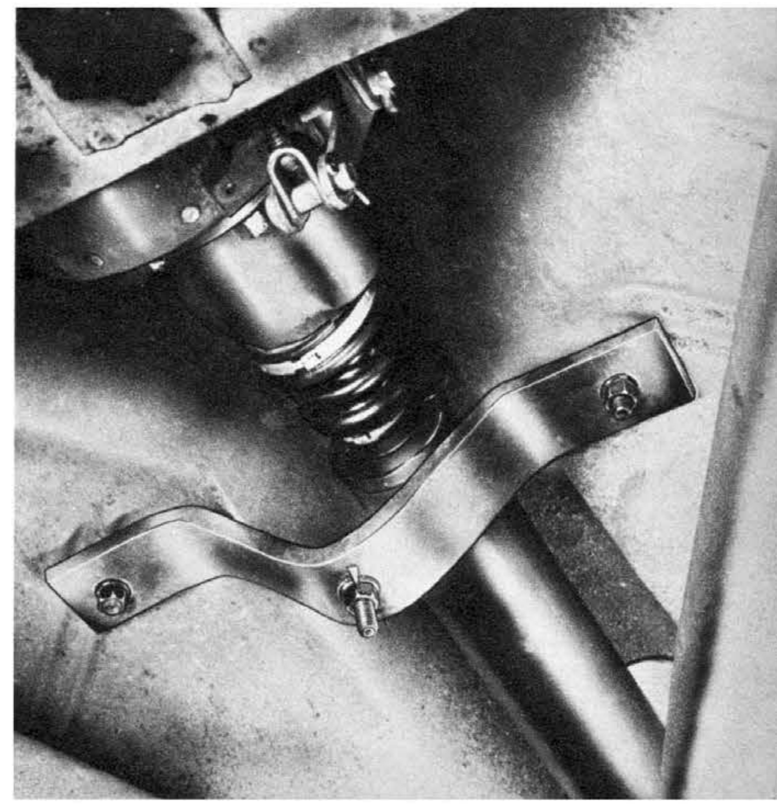
In this formula RPM = Engine speed
W = Tire/wheel radius
GR = Overall gear ratio

W is the distance measured from the center of the rear axle to the ground with the tire inflated to nominal pressure and GR is obtained by multiplying the gear ratio of the particular cog in the gearbox by the rear end ratio (168 is a constant). For example: First in the optional four-speed Chevy box is 2.20-to-1. With a 4.11 rear end, the overall gear ratio (GR in our formula) would be 9.042-to-1. For practical purposes we round it off to 9.04. Let's plug this figure into the formula and work a sample problem.



ABOVE: Competition-only use sometimes demands elimination of transmission entirely. In-and-out box used for dirt track racing couples engine to rear axle where gear changes are made.

Steel strap bolted to underpan of car is added safety precaution in competition. In case of universal joint failure drive shaft cannot drop to ground.

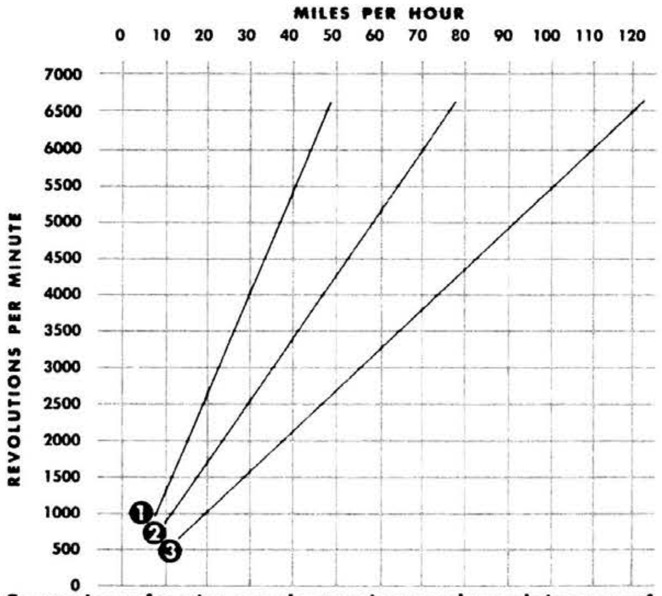


Assuming that we have a 7.60 × 15 mounted on the rear, the distance from the center of the rear axle to the ground will be close to 14 inches, depending on tire and inflation, and we want to know how fast we'll be traveling at peak engine speed, say 6,000, when a shift is in order, then the formula looks like this:

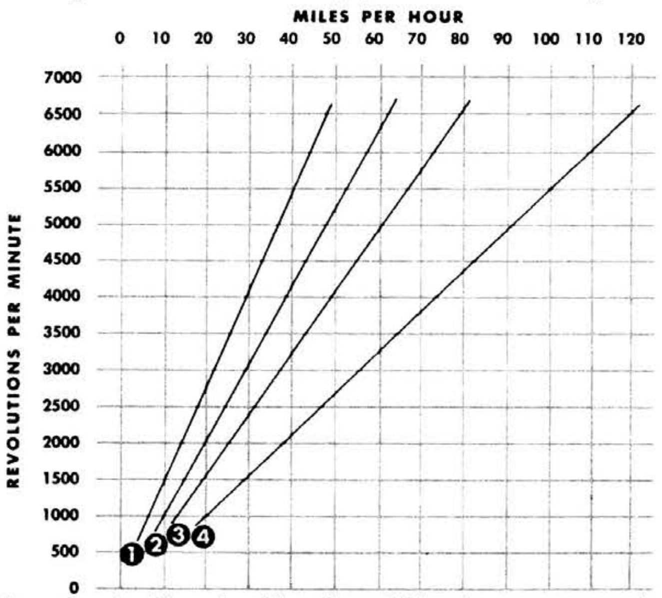
$$\frac{6{,}000 \times 14}{9.04 \times 168} = MPH$$

Worked out, by using all fingers and toes, we arrive at an answer of 55 mph.

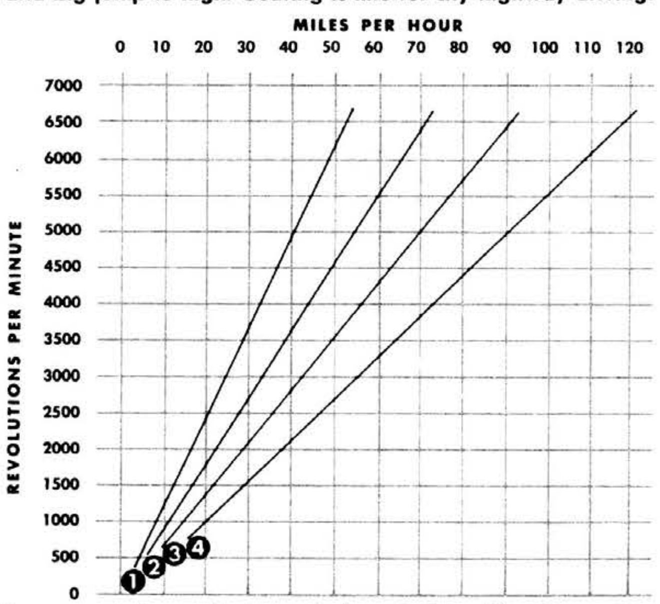
Now, these speeds in themselves, when we determine them, are not of so much importance as their relative placement on a chart such as is advocated here. When plotted on a graph, the spreads between gear ratios assume their true relationship which is geometrical rather than arithmetical. In other words, where there may be 500 rpm difference between First and Second at 20 mph, the spread jumps to 1500 rpm at 50 mph. This is extremely important to the performance minded individual since the output of an engine is not constant but follows a curve and the necessity for staying within the range of maximum power is obvious.



Comparison of engine speeds at various road speeds in gears of three-speed box shows wide gaps between various gears.



Four speed wide-ratio offers three fairly close gear spreads and big jump to high. Gearing is fine for city-highway driving.



Four speed close-ratio transmission, stock on Corvette, option on passenger cars, has smallest jumps between adjacent gears.

To plot the relative positions of the gears in your particular unit, you don't need to work the formula for each 1,000 rpm, even. Run it out for 1,000 rpm, make a dot on the graph paper at that point, then repeat substituting the maximum rpm you expect from the engine and draw a line between the two points. If you want to check, work the formula for an interim rpm, say 3,000 and see if the dot falls on the line. It should, since the progression is in a straight line.

You can use this formula to select the proper gear ratio in the box or the rear end, or to choose the correct tire for existing conditions. Or, suppose you know that it will take 100 mph at the timing light to beat your nearest rival. Using the formula you can compute how tight you'll have to wind your engine or which rear end ratio you should use with the tires you have mounted, and so on.

The use of graphs can help you select the proper shift point, too, but here we will use them mainly to illustrate the different Chevy gearboxes and final drive ratios.

Let's look at charts I, II and III.

I represents the conventional three-speed box with 2.47-to-1 Low, 1.53-to-1 Second and 1-1 High used in conjunction with a 4.56 differential, 9.50 × 14 tires.

II is the so-called "wide ratio" four-speed box, with 2.54, 1.92, 1.51, and 1-1 gearing, keeping the 4.56 and 9.50 tire combination.

III represents the close ratio gear sets, all other conditions remaining constant. These gears are 2.20, 1.66, 1.31 and 1-1 and are available as a set from your Chevy dealer or as an optional transmission with some models.

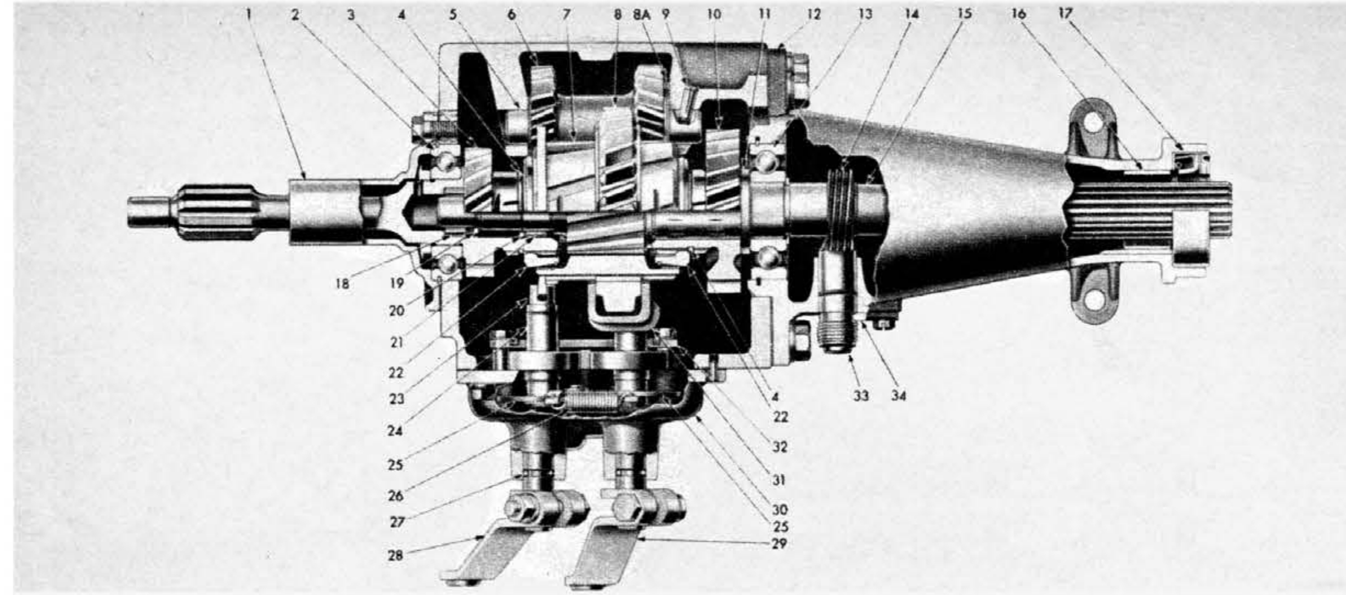
Now. Observe the advantage of the close ratio four-speed over the other two boxes when it comes to keeping engine rpm constantly in a narrow power band.

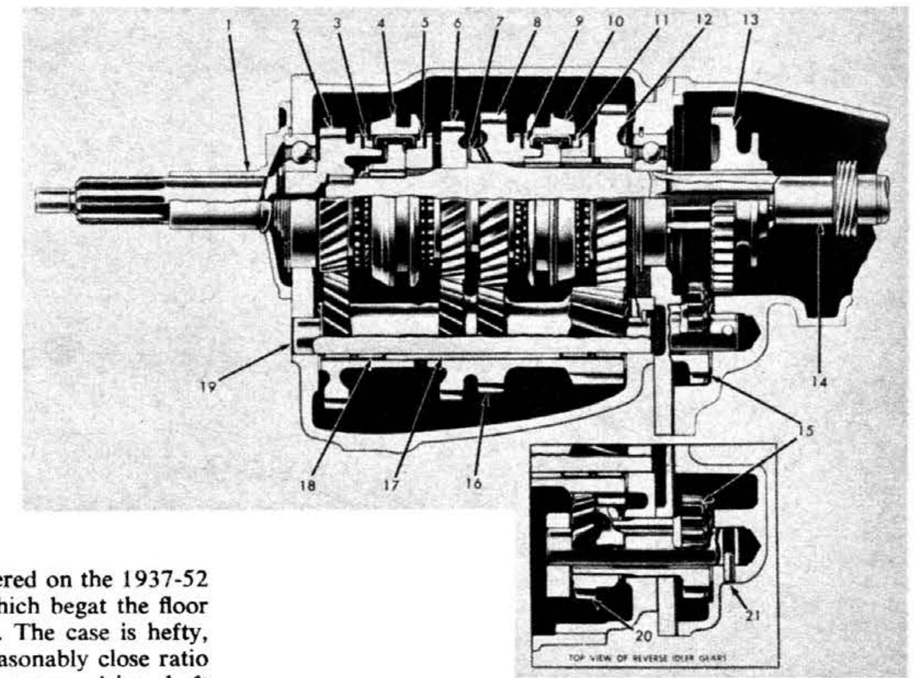
If we select 6,000 rpm as our shift point, with the change from First to Second in the three-speed, rpm drops to about 3,800. With the wide-ratio box it drops to a little over 4,500 and about the same in the close-ratio model. From Second to High is approximately the same drop in the three-speed and that's it. With the normal four-speed and the close ratio this shift drops engine rpm to about 4,750, but in the change to Fourth from Third, the close ratio box keeps rpm up to 4,550 but the wide-spread allows it to sag to right at 4,000.

With the highly-tuned smaller Chevy engine, the maximum power curve barely covers a 1,500 rpm spread. So, for road racing, let's say, the three-speed and the wide spread four-speed boxes are impractical since they drop us right out of our working range. The bigger mills having much more torque developed at lower rpm, have a correspondingly larger spread and it is possible to get away with only a three-speed box for drags. Some drivers contend that the time wasted in shifting to fourth speed can be more than the time needed to bring engine rpm up with the three-speed. However, the leading SS competitors use and endorse the four-speed close ratio box.

You'll still find lots of three-speed units in use throughout the other drag classes where the four-speed boxes either are not part of the new car package or where a whopping amount of power is developed. This proceeds inversely until at the peak of the performance category a simple in-and-out dog clutch is used and no gear changing at all takes place. The cost of a four-speed on the used equipment market is still about like the price of the same unit when ordered as an option with the car (in most localities), so you can weigh the advantages against the cost, if you are contemplating a switch, by observing what the competition is using. Making a chart of your present gearing set up is a preliminary which should be followed by a graph of the horsepower output of your particular engine as determined by chassis dynamometer or engine dyno. The broader the power spectrum, the less need you have for multiple gear changes.

What three-speed box should you choose? Most of the


Cutaway illustration of standard Chevrolet three-speed side-shift gearbox reveals essential sturdiness of unit. Three-speed is favored by many drag race enthusiasts because of strength of gears and change mechanism. Big engines in light chassis do not require multiplicity of gear changes and many drivers feel that time spent in third gear change is not advantageous.



Four speed Chevrolet box was developed by Chevy engineers for Corvette, manufactured by Borg Warner. Part of secret of success is that unit was originally a husky three-speed. Reverse (13) was removed from main case and put into tailshaft housing to make room for fourth gear. Case for this box is now Aluminum. Available in most of Chevy line, acceptance of four-speed has resulted in similar box becoming available on many other cars.

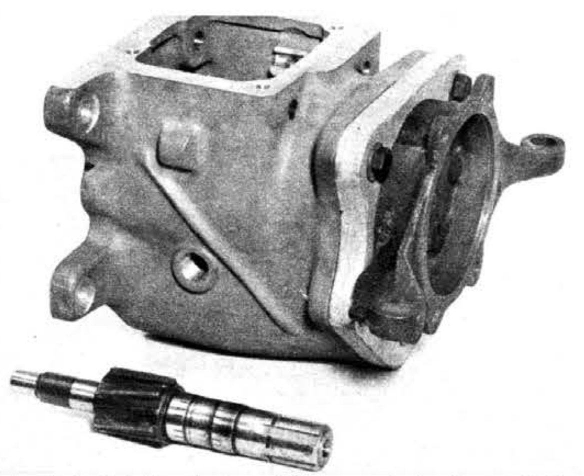
action in the hotter classes has been centered on the 1937-52 Cadillac-La Salle unit. This is the one which begat the floor shift craze and it is a tough one to beat. The case is hefty, the stock gears are rugged and have a reasonably close ratio relationship: 2.39, 1.53 and 1.00. It is an open drive shaft type, so there is a certain amount of work needed to mate it to a torque tube drive. Also, it requires an adapter in order to match a Chev engine. But it will take brute torque.

Here is an example which brings us back to the original premise. The Cadillac was a heavy car and its engine developed a couple of hundred horsepower, so if you insert the box into an automobile weighing half as much, it is reasonable to assume that you could couple it to a much stouter engine. On the other hand you must exercise care in going the other direction . . . such as installing an older Chevrolet unit which has top-mounted gear selector. There are several gear sets available for these elderly models, and the gears themselves are strong, but the case and the top plate are not the last word.

However, in this era of conversions, even this has been taken care of. Offenhauser Equipment Co. sells an X-shift box which is an aluminum duplicate of the 1937 and later Chevy three-speed top shifter. It weighs 10 pounds less and is 50% stronger than the original. The bolt pattern mates with the bell housing of any 1955-1962 Chevy and it takes just a few parts, available at your friendly dealer's, to make a switch. In addition, the choice of either wide or close ratios makes it attractive. The nominal gear set with 2.47 Low and 1.53 Second, can be replaced by either a 2.94 Low and 1.68 Second or a 2.21/1.32 pair . . . which are roughly equivalent to First and Third in the close ratio four-speed.

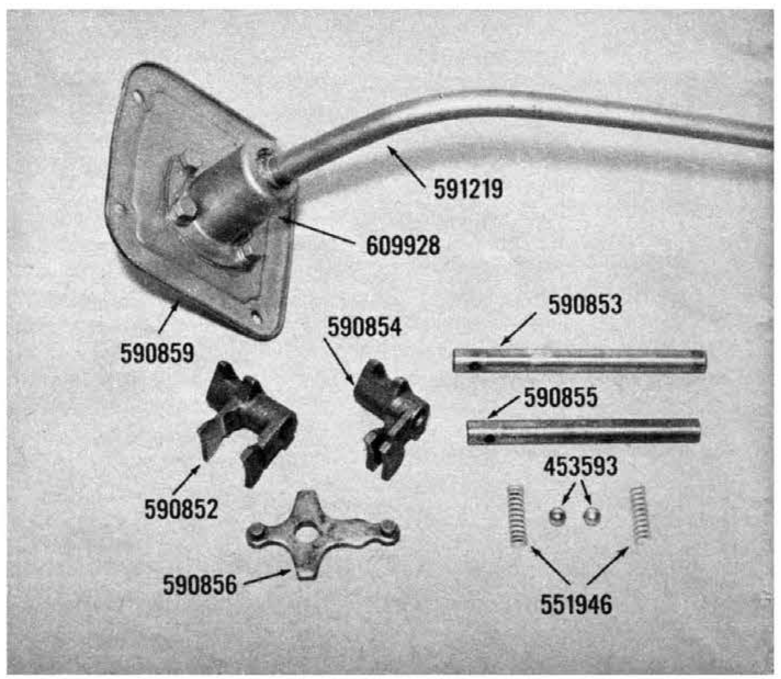
This box is also handy if you are swapping a Chevy engine into some other chassis since it takes only the simplest adapters to fit it to a variety of drive shafts.

Among production line components advantageous to high performance minded enthusiasts is aluminum transmission case.



Suddenly it's 1937! Sturdy floor shift transmission is now being cast in aluminum. Unit is offered by Offenhauser Equipment.

RIGHT: Chevrolet parts needed to complete top shifter are few, inexpensive. Late gears are used.



Suppose you are not primarily interested in drag strip competition, but have a solid street machine with a surfeit of power, what box then? A four-speed is most convenient on the road, since the final gear ratio can be selected with an eye to high speed cruising. This is an overdrive effect, more or less, if you pick the wide ratio gear set. Using a 3.36 rear end, you can cruise at the legal 70 mph limit on many expressways with the engine merely ticking over in the 3,000 rpm range. Third becomes a good passing or around town gear and the 2.54 Low is enough to get you well started at any stop light. Low is also synchromesh in these boxes, so you can drop into it at any point while moving slowly.

As to overdrive transmissions, they are the least promoted but one of the best features of Chevrolet cars. For an extra $107 at the time of purchase (in most areas), you can have a three-speed box which becomes a four-speed at the touch of a lever. The two-speed planetary overdrive unit is mounted to the tailshaft of the conventional gearbox and can be kicked in to reduce engine speed by about 30% at any point above 27 mph, either manually or automatically, via solenoid and governor control.

Although these units are not listed with optional equipment for the 327 and larger engines, they will withstand considerable horsepower. Not up to a hot 409, I'm afraid, but, in a light car, they seem perfectly satisfactory for street use. This is not a dragstrip tool, be assured, although the extra gear ratio looks tempting. But, it is a big help if you want to run a low final drive ratio for acceleration and still get some economy.

If you aren't too much given to gear changing, then probably one of the re-worked Hydramatics would be the answer. We'll come to them presently, but first, let's examine the current phenomenon:

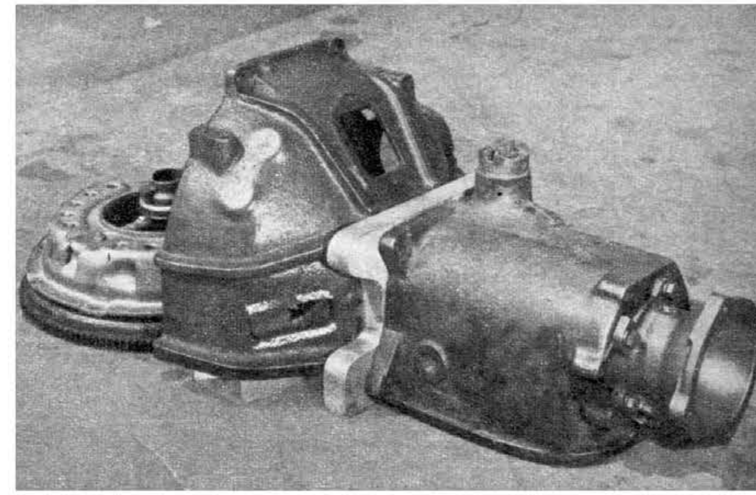
STICK SHIFT

Apparently no self-respecting hot rodder would be caught dead today without a floor-mounted stick shift. This fad has gone so far that at least one company is offering a floor shift for the Powerglide . . . which is about as utilitarian as mammary glands on a male hog . . . but aside from the "follow-the-leader" aspect, there is good reason for getting the control away from the steering column. Assuming that you have gears to shift, of course.

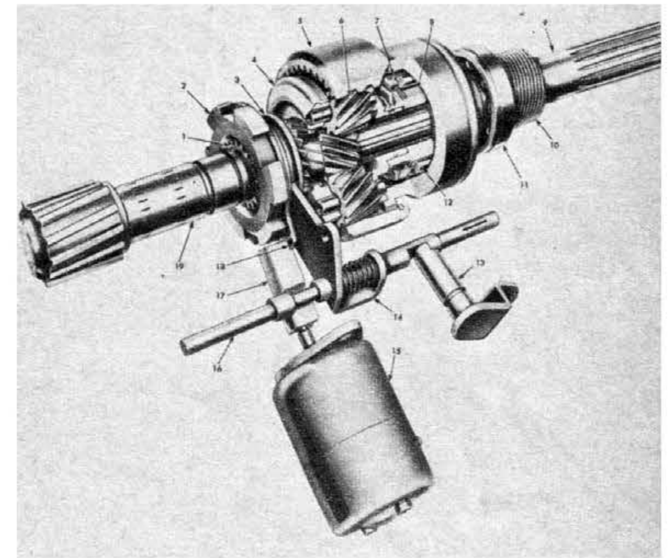
The time lost in gear changing is lost solely because the engine is disconnected from the wheels and is not urging the car onward. The lessening of this time has a beneficial effect on acceleration, to be sure. And, while it can never be lowered to zero because of the physical motion involved, the present crop of stick shift accessories has certainly reduced the split second to a tiny splinter. The secret is in shortening the linkage and eliminating unnecessary motion in the shifting lever. That the steering column-mounted monkey motion is glacial or snail-like in its action is easy to see, but when the SS hot dogs remove the factory floor shift and install a proprietary gear change lever, then you begin to realize what strides have been made in this department.

As with most accessory items, these adapters come in a variety of price brackets. If your principal aim is to operate on the street and highway, one of the "economy" models will serve well enough. If you are bound for the dragstrip, invest in one of the better built, more accurate types.

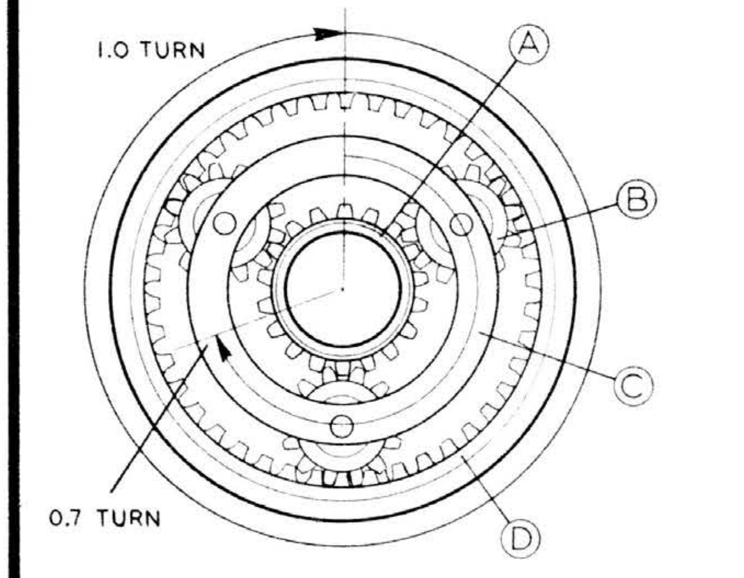
The floor shift adapter kits are generally of two types: H shift pattern, the normal disposition of Reverse, Low, Second and High around Neutral, and Straight Line, which, as the name implies, disposes the relationship in a single plane which is supposed to allow faster changes. One kit, the Hurst, can be changed from one pattern to the other by the removal or insertion of a locating pin. Shift rapidity is probably not



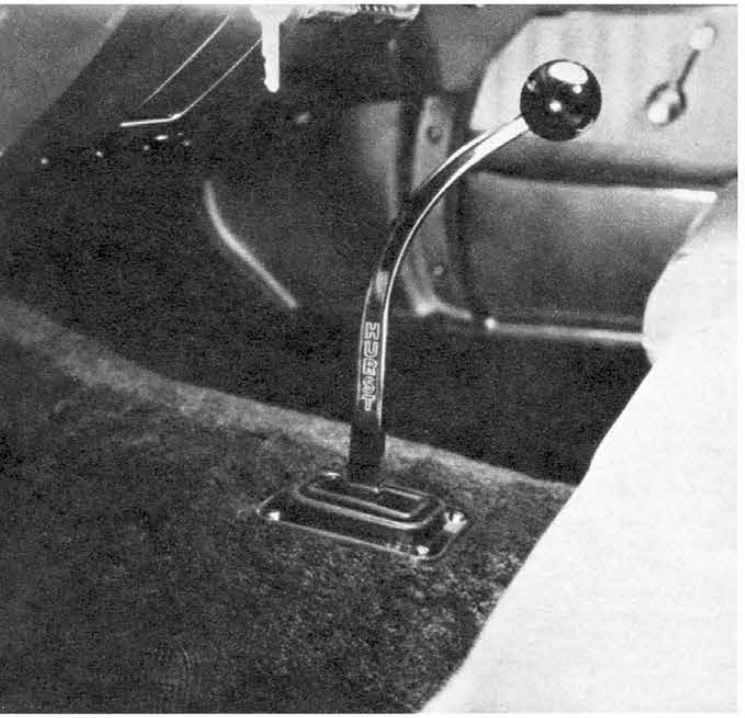
Cadillac-LaSalle gearbox has been choice swap for rodders. Scarcity of such boxes has led to X Shifter and similar units.

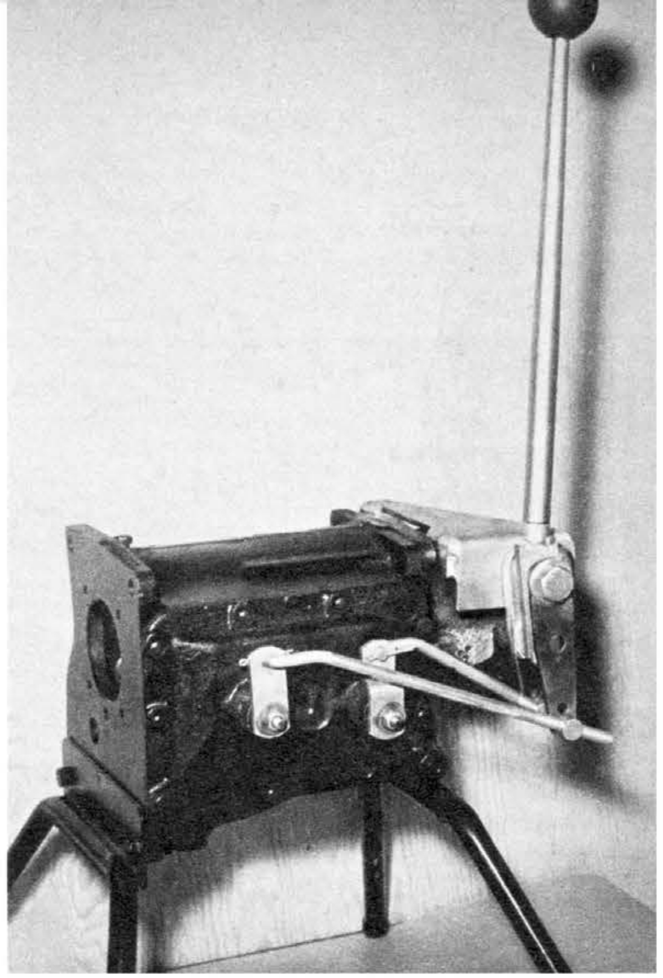


Chev overdrive unit seems overlooked but offers many advantages. Solenoid-controlled planetary box gives 20% overdrive.



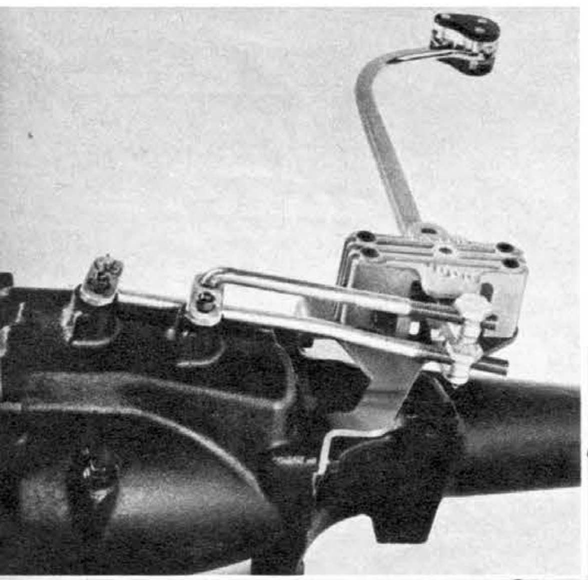
Simple planetary gearset in overdrive provides two ratios by controlling movement of Sun gear (A), Planets (B) and Ring gear (D). Action of locking device is either automatic or manual.

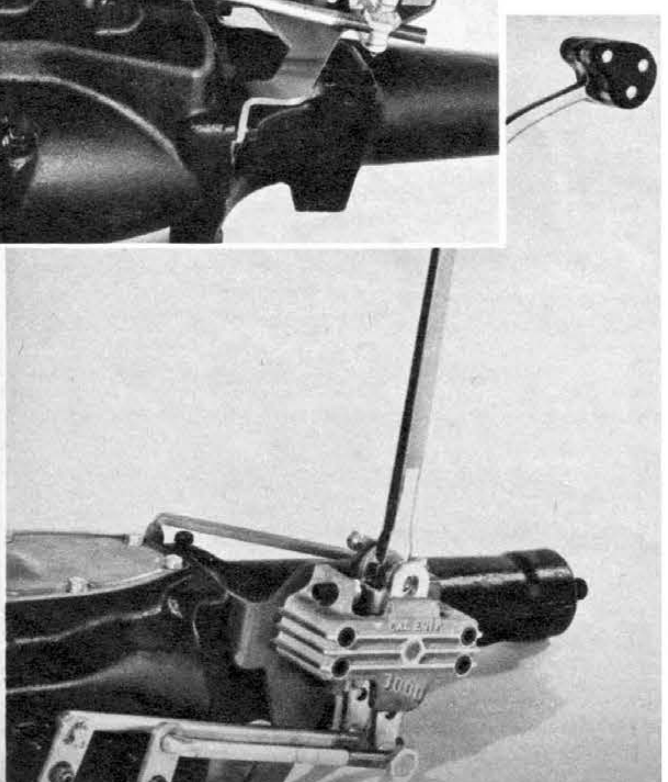




ABOVE: Floor shift installations are attractive as well as useful. Hurst unit shift lever is designed to withstand force.

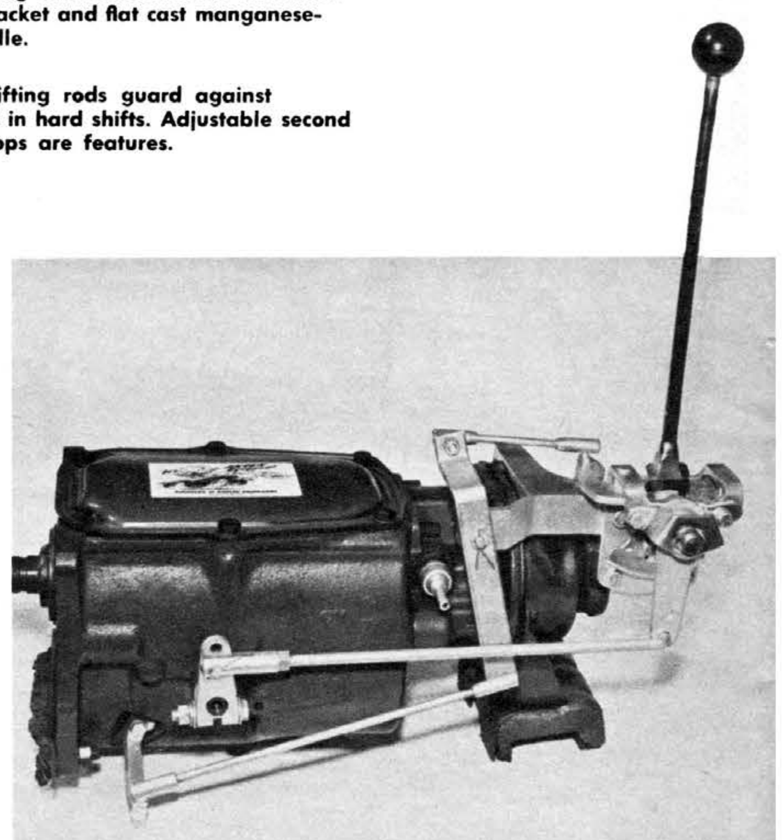
RIGHT: Ansen Automotive Posi-Shift was one of first floor-shift adapters to be placed on market. Finished unit is rugged.



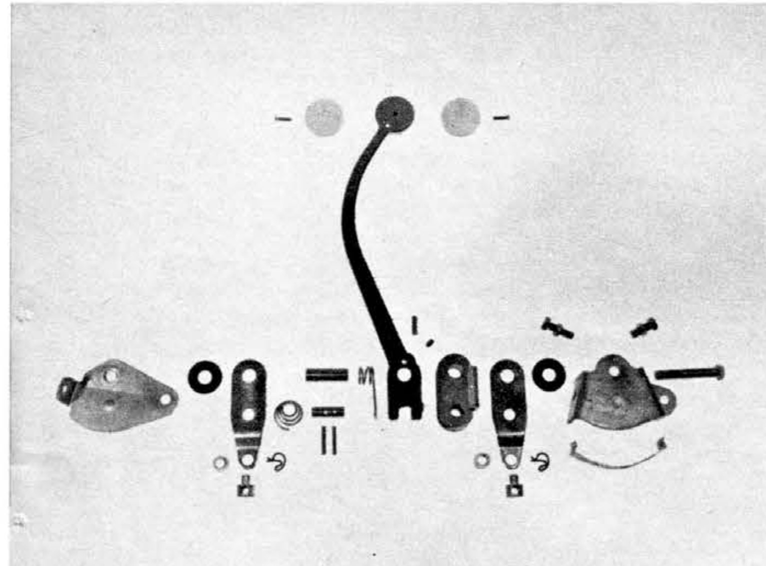


Cal Equip Drag Fast 7000 has cast aluminum mounting bracket and flat cast manganese-bronze handle.

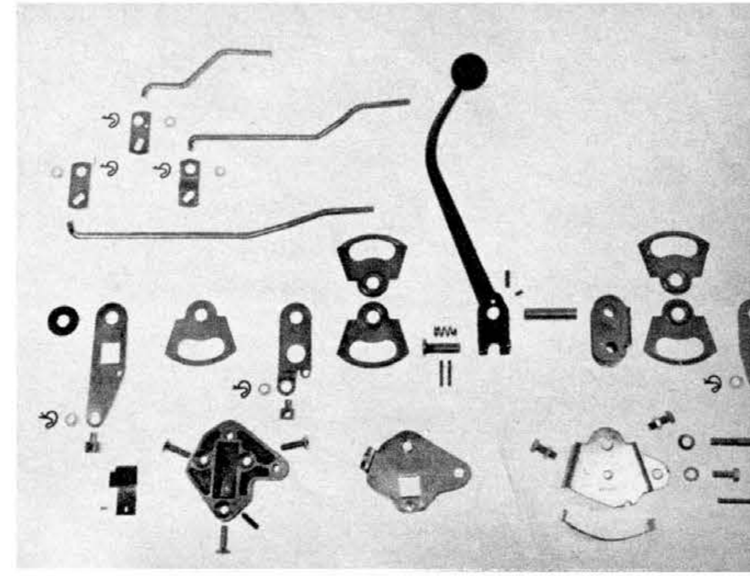
Half-inch shifting rods guard against bent linkage in hard shifts. Adjustable second and high stops are features.



Unavailability of Cadillac-LaSalle transmissions has brought older Buick box out of hiding. Ansen floor shift tops this one.



Floor shift conversions are precision-made, incorporate many parts. This is Hurst's three-speed model, shown without links.



Only currently available proprietary shifter for four-speed boxes is Hurst's. Drivers replace factory linkage seeking speed.

so much a function of the pattern as it is of the box itself, the gear spread and design of its synchromesh. (A gear change in a four-speed will be quicker than that in a three-speed, for example, because the synchronizers have less load.) So this disposition is a matter of personal taste.

The qualities to look for include size and strength of the shifting control rods, rigidity of the mounting brackets and the method of adjusting gear stops. Extras, such as Nylon bushings at wear points, "trigger" action and spring loading to aid First-to-Second shifts or locked-out Reverse, are to be expected on the specialized models.

Here are the salient features of a few of the newer units:

Ansen Automotive's Standard Economy model is of very simple design with two flat steel shifting arms and a flame-cut flat steel handle all mounted on a common pin extending from the transmission bracket. The arms are welded to steel bushings in such a manner that they angle apart at the bottom. A dowel pin in the bottom of the shift lever engages a slot in one or the other of the arms to operate links to the transmission. A husky spring from the bracket to the shift lever creates the needed load to distinguish between Low-Reverse and Second-High in the H-pattern design. This unit is simple and cheap and should work well in a car for every-day street use, but other models are more suited for drags and the required speed shifts.

The medium priced unit is called the Posi-Shift Junior and is a straight-line shifter. In this unit, the shift lever and a spring-loaded firing pin are in a U-shaped carrier with the shifter arm on either side. All moving parts pivot on a single ⅝-inch bolt which screws into the mounting bracket. The round shift lever is threaded on the bottom end to screw into the rest of the unit and a locknut is provided to keep it locked in place. With this particular arrangement, once the stick is positioned in the car, a few tacks with an arc welder would be a more suitable means of locking it in place than with the locknut.

To engage Low gear, the lever is pulled to the left and back, then when the stick is released, it snaps to the right in the Second-high line of shift. As the stick is shoved forward in this line, the spring-loaded firing pin snaps from the Low-Reverse arm into the Second-High arm as the Neutral position is passed.

Hurst's new three-speed is quite similar to his original model except that an adjustable stop has been added for High gear and a dust cover added on the bottom. The model has such features as the straight-line or H-pattern shifts with the removal or insertion of a small pin, adjustable handle position, Second gearstop adjustment and the flame-cut steel handle. Shift arms which bolt to the transmission have been redesigned so that straight shifting rods are used, and these straight rods plus stops for both Second and High should prevent rod flexing.

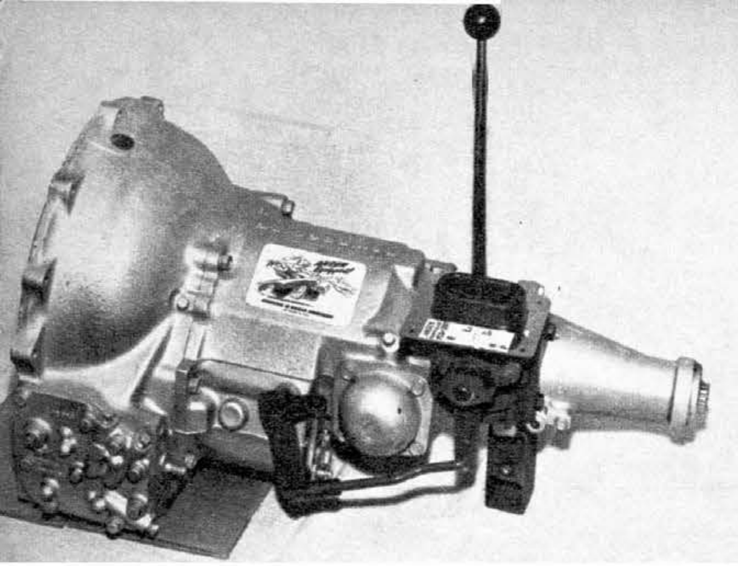
Hurst's four-speed resembles the three-speed somewhat in appearance, but is wider due to the need for an extra shifting arm and related pieces. Adjustable stops are fitted for the four forward gears, the handle has a side adjustment of approximately two inches, and a dust cover affords protection to the working mechanism. Alignment holes through the three shift arms and shifter housing permit the whole unit to be aligned with a ¼-inch pin.

A spring within the aluminum adapter plate provides a reverse lock-out so that extra pressure must be applied to move the lever to the left far enough to engage reverse gear. Unlike shifting rods for three-speed kits, rods for the four-speed are not straight. They must be routed around the speedometer takeoff gear and reverse lever boss on the tail-housing so all three links have bends. Heat-treated chrome moly is used here.

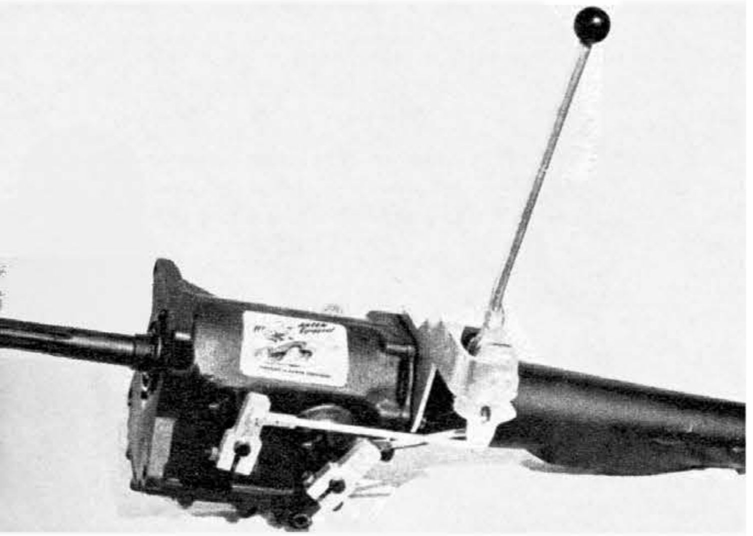
California Equipment's Drag Fast 7000 has a husky cast aluminum housing for the moving parts and a flat beam handle cast from manganese bronze and guaranteed unbreakable. Both Second and High gear adjustable stops are incorporated in the heat-treated casting and a third adjustable screw permits pressure to be applied to the side of the Second-High arm. This last adjustment permits the driver to adjust a "drag" on the levers which is helpful in stopping the Low-Reverse lever in Neutral on high rpm speed shifts. A firing pin which engages the shifting arms is loaded by a 27-pound spring. The lever is loaded with a 47-pound spring to help force the handle to the right so that the Second gear lever can be picked up on fast shifts.

Drag Fast shifters use ½-inch shift rods with no bending bends. Jam nuts and lock washers clamp the links securely in the rod ends after proper length adjustment.

The Shift Master handle moves a pair of flat rails which have driving lugs to move the shifting arms. The effect of this action is to reverse the direction of motion, permitting the transmission shift arms to be mounted in the stock down-ward position instead of the top where floorboard clearance could present a problem. The motion from sliding rail to link



Even the Powerglide can be shifted from floor position in line with latest fad to remove shift lever from steering column.



Economy model conversions are recommended for pleasure driving rather than competition use. Linkage is lighter, less sturdy.

is doubled by pivot placement permitting a very short travel if desired. A second set of holes in the transmission arms allows the driver to select a longer lever travel. Shift Master uses a pair of springs on their unit; one acts as a Reverse lock-out and helps stop the Low-Reverse rail in Neutral when making a fast shift from Low gear to Second; the other has less tension and acts on the Second-High sliding rail to prevent rattles when the lever is in High gear position.

Others on the market incorporate similar features, but the principal aim of all the specialized types is to help eliminate missed gear changes under the stress of competition. That these positive action mechanisms are a definite aid to a skilled driver can be discerned by the fact that my friend Hayden Profitt, "Mr. Stock Eliminator" at the 1962 Nationals, has not missed a shift in something like 6,000 times in competitive runs, which he feels would not be possible if he had been stuck with the normal stock shift linkage.

If gear changing fails to excite you, but you hunger after rapid acceleration, perhaps you should install a representative:

BEEFED HYDRAMATIC

The Hydramatic, GM type, that is, as noted earlier, is a unique automatic as far as U. S. production cars are concerned. All other self-shifters employ a torque converter ahead of the planetary gearbox. It uses a fluid coupling which does not have the inverted "U" shaped efficiency curve of the torque converter, nor does the coupling engage in torque multiplication. Thus there is less strain on this component. Consequently, when modified to withstand greater loads and to act in direct response to the driver's wishes, rather than being fully automatic, the Hydro becomes an extremely efficient transmission for either competition or dual-purpose use.

Two of the leading suppliers of re-worked Hydros are B & M Automotive of Van Nuys, Calif., and Hydro Motive Transmission Specialties of Chicago. Both concerns sell hundreds of units annually for Chevrolet installation, reporting that such conversions are among the most popular.

Although pre-1959 Chevrolet pickup trucks used Hydramatic in many cases, and this unit is available over-the-counter, it is not recommended as a direct replacement because of its rough, light throttle shifting. The re-built Hydros are engineered to give smooth, well modulated, shifts as well as strength to withstand up to 600 bhp and 8,500 rpm. And, frankly, it takes a well-coordinated driver with lots of experience to beat one of these babies through the gears.

Three types of beefed Hydros are in general use; two-speed, three-speed and four-speed. Hydro Motive offers the three as separate models called "Hydro Two", "Hydro Three" and "Hydro Four". B & M's "Hydro Stick" is a four-speed which can be under complete manual control or fully automatic.

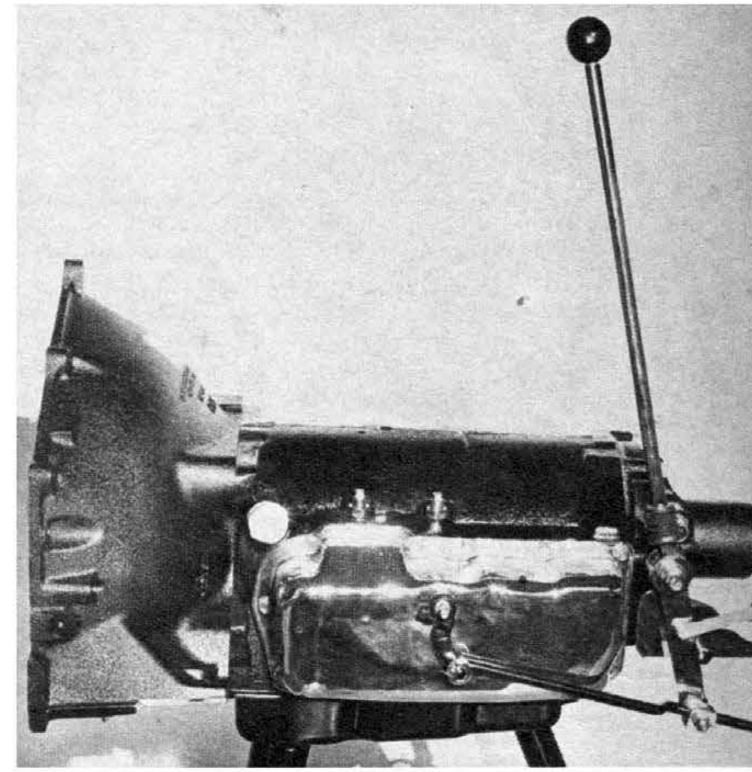
Taking up the "Hydro Stick" first, for Chevy installation, it is based on a 1954-1956 Olds, 1955-1956 Pontiac or 1955-1956 Cadillac transmission which has been modified in several important particulars. At the front, the torus members are altered by reshaping the vanes to change the stall speed according to the prospective use of the machine. For Chevrolets reworked to deliver their output at very high rpm, the fluid coupling will permit slippage up to 2,500 rpm, for example. For big engines with lots of low rpm torque, the deep vanes of the unit are retained. Maximum efficiency is attained by optimum placement of the torus pairs.

Control valves which regulate the gear selection and the speed of engagement are boosted to an operating pressure of 185 psi (upped from a normal of 70 to 90 psi), which provides snap action, and the clutch discs are replaced by special high-friction types. Whereas the ordinary Hydramatic clutch facings are capable of withstanding an honest 200 bhp, at the most, B & M's replacement discs have been tested up to 400 bhp and 750 bhp in the two grades used. The lower-rated grade is a non-metallic material, the higher grade is semi-metallic. Both are the exclusive development of B & M and available only in one of their units.

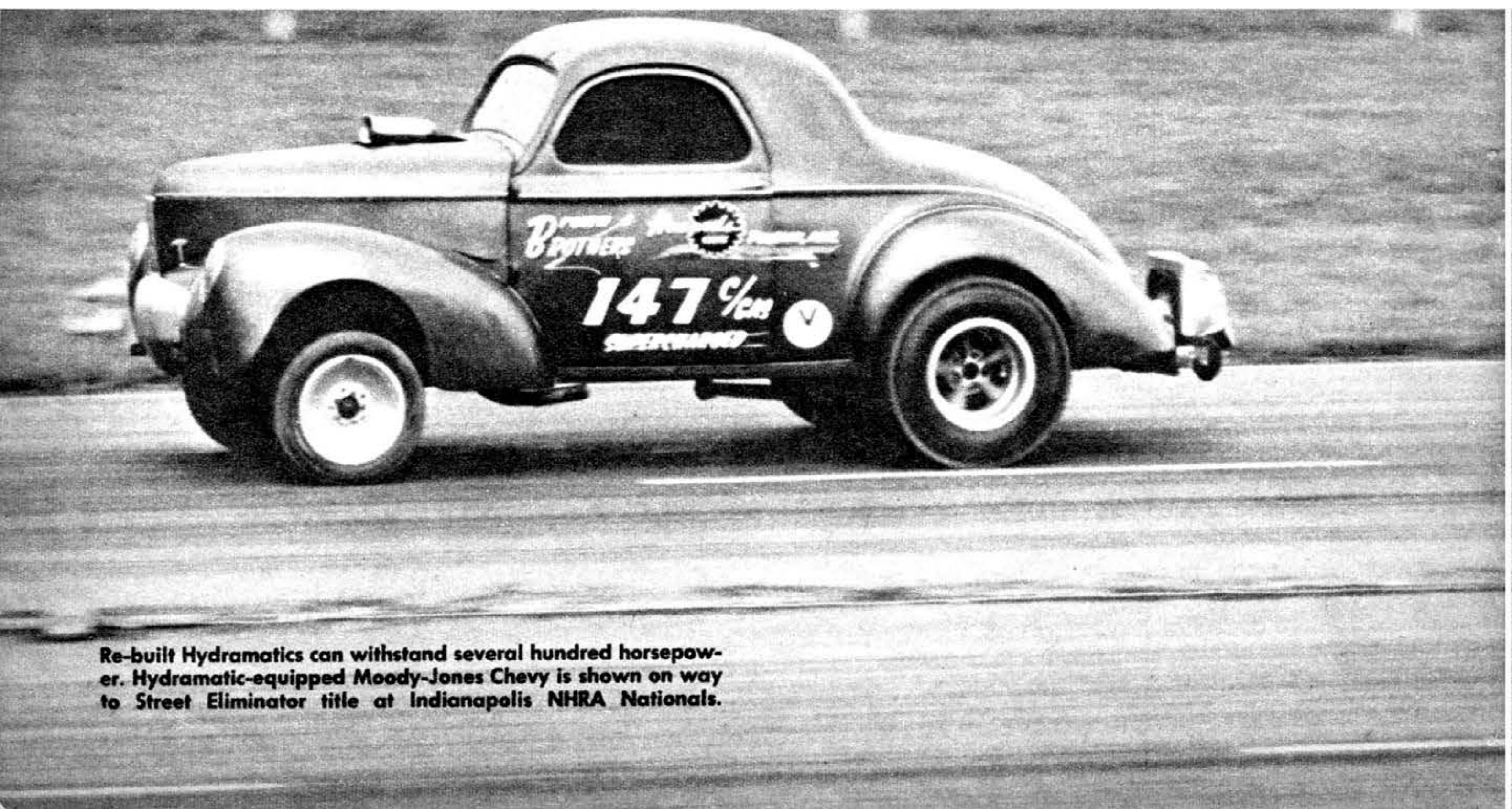
B & M offers three models and their ordering system suggests that the customer give them full particulars on the engine, chassis, vehicle weight, rear axle ratio and intended primary use when placing an order. The "Unblown" type is recommended for limited horsepower vehicles mainly for street use weighing 3,500 pounds or less. "Unblown Competition" is the designation for a unit to be coupled behind an unblown engine in a car of 3,500 to 4,500 pounds. "Blown" model has no horsepower limitation nor weight limitation.

Each of the "Hydro Stick" boxes can be shifted progressively from First through Fourth through column shift or floor shift control. If the control is placed in Fourth position, the transmission will start in First and progress automatically through the gears. If placed in Third it will progress to that gear only, and so on.

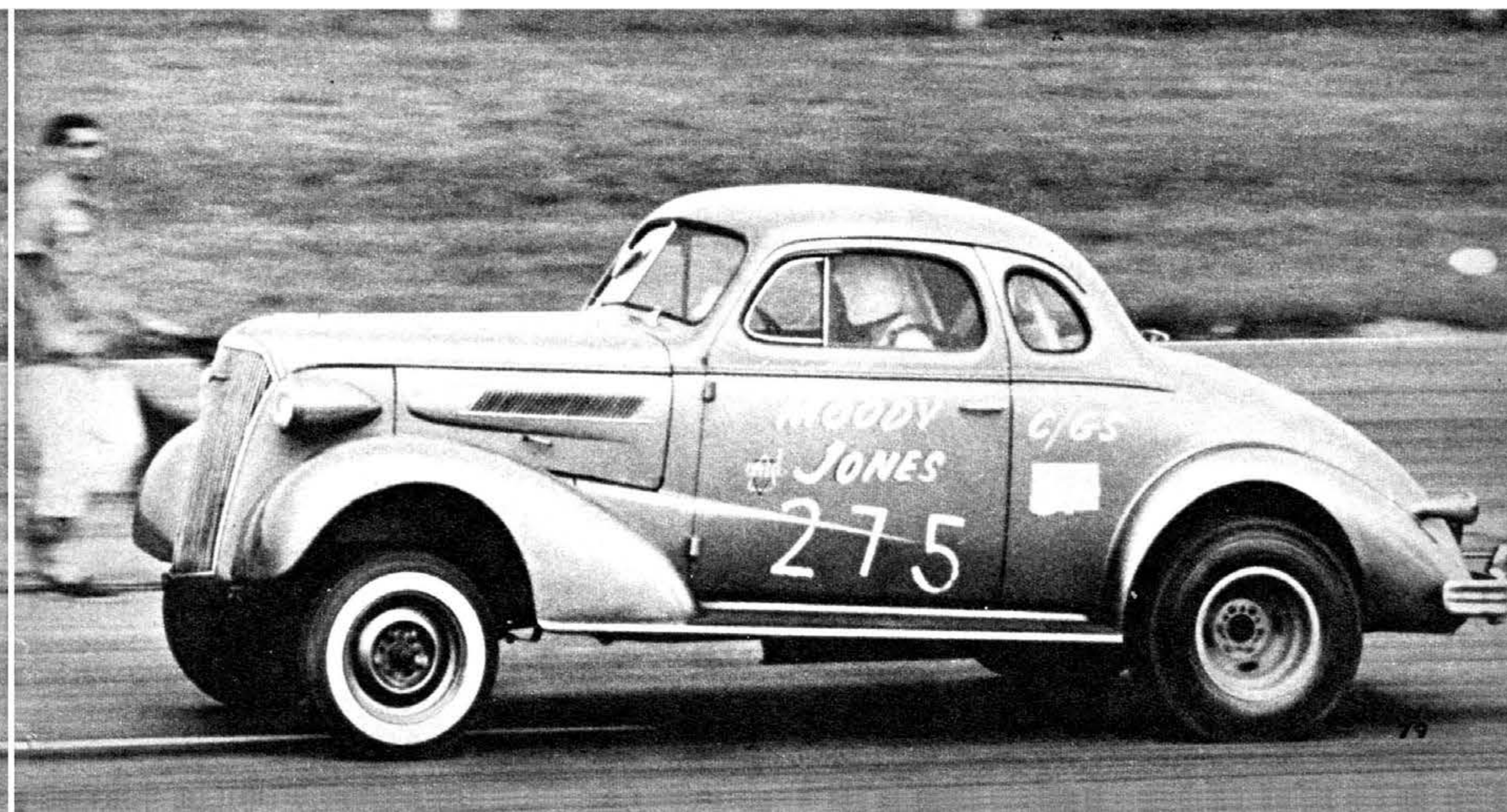
For installation in the non-blown category, the Chevy owner needs to procure bell housing, torus cover, torus members, flywheel, starter, solenoid and dust shields common to Hydramatic-equipped V8 pickup trucks. B & M can supply the rear mount adapters and instructions for various chassis

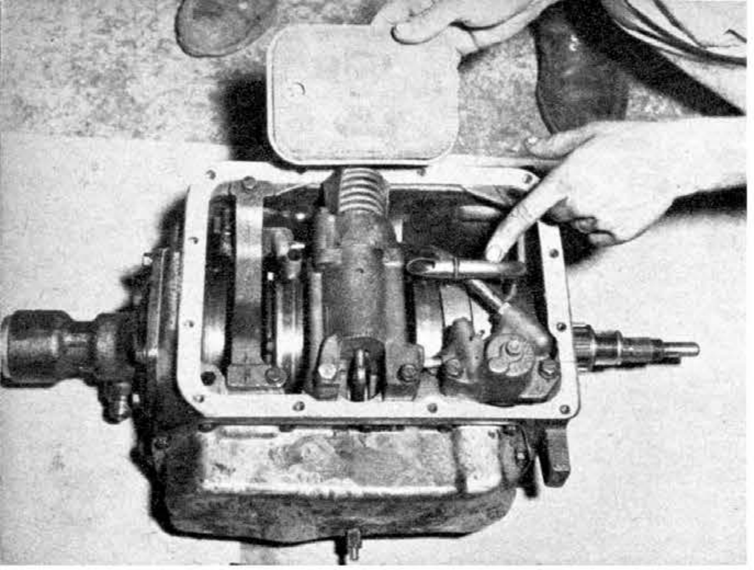


Automatic transmission, in form of General Motors Hydramatic, is now in wide use for competition. B & M re-worked is shown.



Re-built Hydramatics can withstand several hundred horsepower. Hydramatic-equipped Moody-Jones Chevy is shown on way to Street Eliminator title at Indianapolis NHRA Nationals.



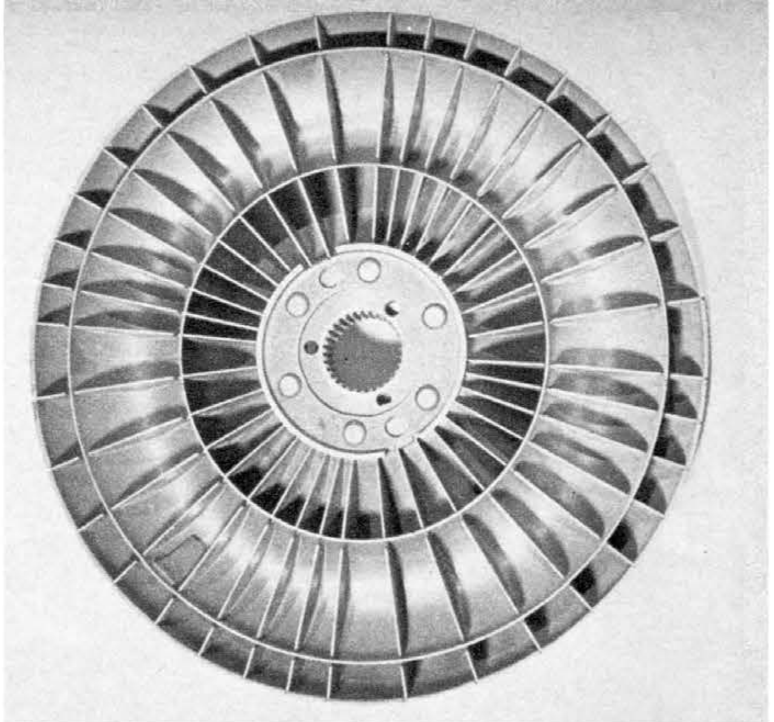


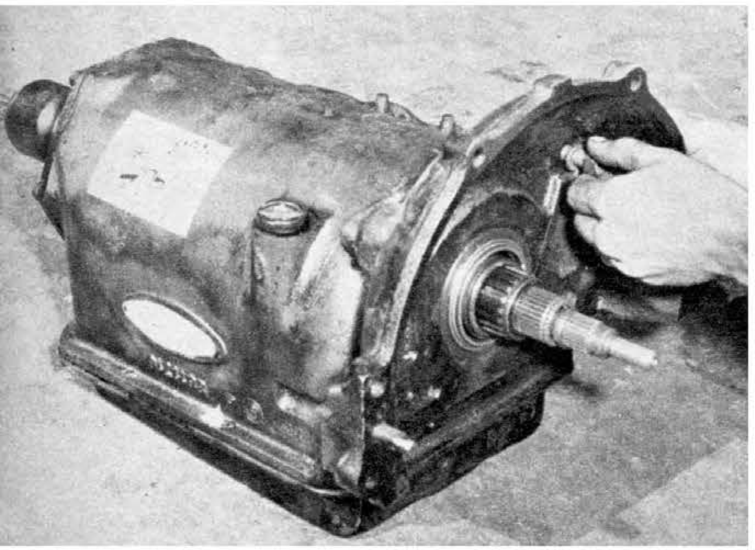
ABOVE: Inherent strength of Hydramatic is one of reasons it is choice over other automatics for re-building for competition.

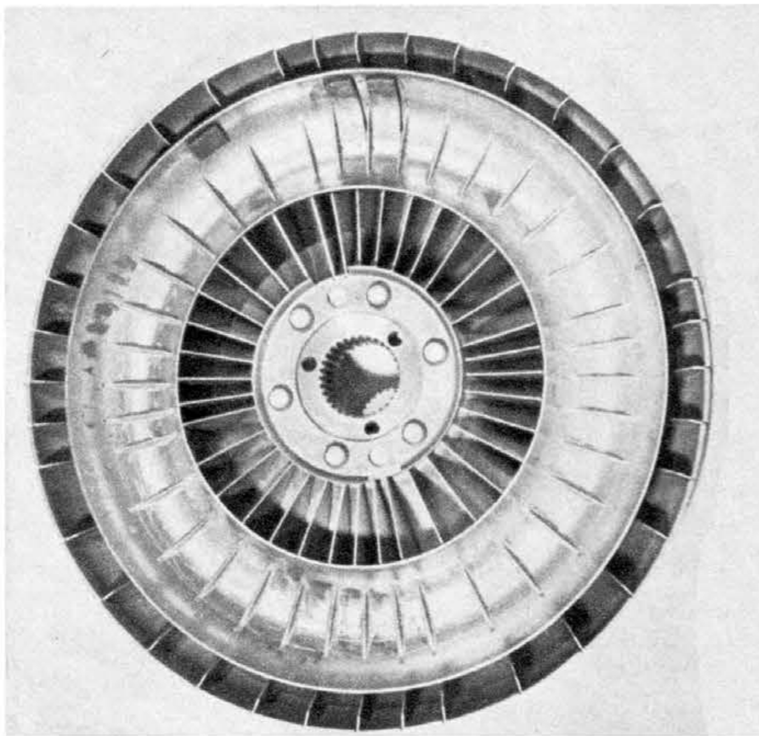
Hydramatic fluid coupling is essentially a liquid clutch, not a torque converter, making it more efficient at speed. Stock driving torus is shown above, right.

BELOW RIGHT: Altered driving torus of high-performance Hydramatic includes modified vanes to increase stall speed.

Adapting Hydramatic to Chevrolet engine is done with Chevy and a few GM parts. Hydramatic was used in Chevy trucks.







installations, as well as linkage. For adaptation to the 409 and other engines with Powerglide and Turboglide crankshafts, either a pilot bushing adapter or some flywheel machining is required. Altogether, however, the switch to a Hydro is not difficult nor excessively costly when it is considered that some B & M clients report they have lowered e.t. in the quarter by as much as a full second over their conventional transmission. An average of .25 second less should be expected by the average driver, according to B & M. These units are also guaranteed for 4,000 miles or 90 days against anything and for a period of one year against faulty materials or workmanship.

Hydro Motive's "Hydro-Four" is similar to the box just described and makes use of all-new, special friction material clutch discs, and so on, which distinguish these transmissions from those whose valve pressure has merely been raised. Max Phillips of Hydro Motive says that this box was especially designed with the Chevrolet owner in mind inasmuch as the smaller displacement engines need a lot of gears, yet the owner may want to drop a 409 into his car at any time! This unit will suit both purposes since it is good up to 500 lb./ft. of torque.

For the enthusiast who is starting out with a 348 or a 409, which have ponderous torque, the "Hydro-Three" in this line is recommended. It is also suited to husky competition machines weighing between 1,800 and 2,500 pounds and those powered by blown engines of 450 hp or more. Two gear ratio combinations are offered: 2.63 First, 1.45 Second and 1.00 Third, or, 2.55, 1.55 and 1.00. It comes with all adapters, linkage and accessories.

Installation of Hydramatic in Chevy requires grease rack or lift and hydraulic jack, is comparable to refitting of gearbox.

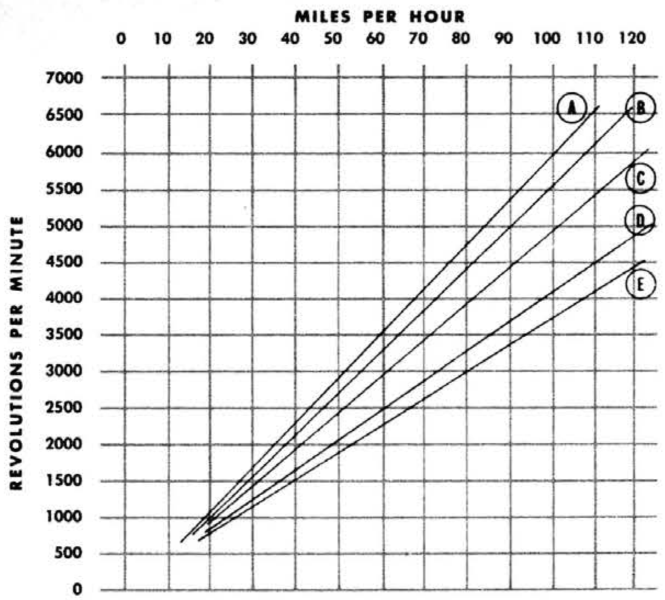
Hydramatic flywheel differs from type used with conventional clutch. Chevy pickup truck part is most commonly used. Correct bolt torque is necessary.

This firm's "Hydro Two" is a custom built unit manufactured to the buyer's specifications and intended for applications such as dragsters, light weight altereds, competition coupes and modified roadsters. It can be as short as 16¼ inches and weighs only 125 pounds. Stall speed from 2,000 to 4,000 rpm can be specified and a choice of either 1.45 or 1.55 starting gear is offered. This stout box can be hooked to anything automotive, according to the manufacturers.

Hydro Motive also issues a 90-day full guarantee and a three-year warranty with its equipment.

THE REAR END

A discussion of final drive gear ratios involves us, once again, with formulae and math . . . not particularly because we are impressed with man's ability to calculate, but mainly because a little time spent on one end of a pencil often saves much time, money and confusion later. The hassle of chang-



ing gears in the stock car is one of the less pleasant pastimes I can think of, and short of substituting the third member straight across is not even interesting after the umpteenth time.

Actually, hardly anybody proceeds on theory in this department. There are a limited number of gear ratios available, you have a general idea of what everybody else is doing and most any amount of free advice is available from bystanders at any given minute. However, to plan for action, it doesn't hurt to understand why all these other experts arrived at the gear combination they advocate.

So, let's set up our happy graph again.

This chart represents a selection of five Chevrolet ring-and-pinion combinations available in the 1963 model, supposing it to be the 409 set up with 9.50 X 14 tires (the maximum, for all practical purposes). In High gear, the speeds attained with each ratio (theoretically) are plotted in relation to engine rpm.

As you can see, a 4.89 set will deliver approximately 100 mph at 6,000 rpm, whereas the 3.08 will permit this speed at a mere 3,700.

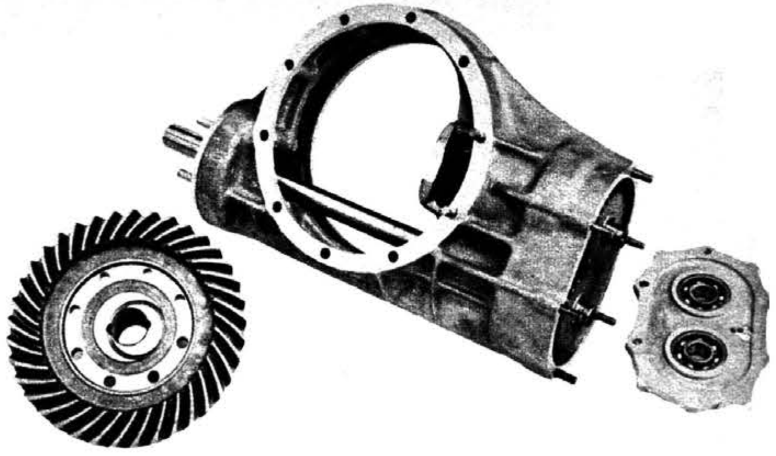
"Wowee!", you say. "I'll slip a set of 3.08 cogs in my Impala and charge through the timing lights at like a Hundred and Plenty!"

Not so, Clyde. You might charge off across the salt flats at Bonneville for several miles and get up to terminal velocity, but not in your back alley. Torque multiplication rears its ugly head.

Depending on tires and conditions, a final drive ratio of somewhere between 10-to-1 and 15-to-1 is going to be necessary to spin the wheels on the average sedan. This will provide the torque multiplication required to make things happen at low rpm where engine torque and horsepower are down. Two factors combine to change this requirement: The hp/weight ratio and tractive efficiency of the tire/suspension combination. As you can see, a small diameter wheel and tire with narrow tread/surface contact will require less torque to break it loose than a monster slick, thus a lower torque multiplication from the same engine, which means a lower numerical ratio.

This is elementary, but it is surprising how many railbirds speak wisely of rear end gears with scant consideration of the tire or chassis. Believe me, a simple change of *brands* of tires can make more difference in many instances than a switch of gears. So the problem is moved rapidly from theory to practice when acceleration is involved.

Another facet is also in the realm of practice: How fast



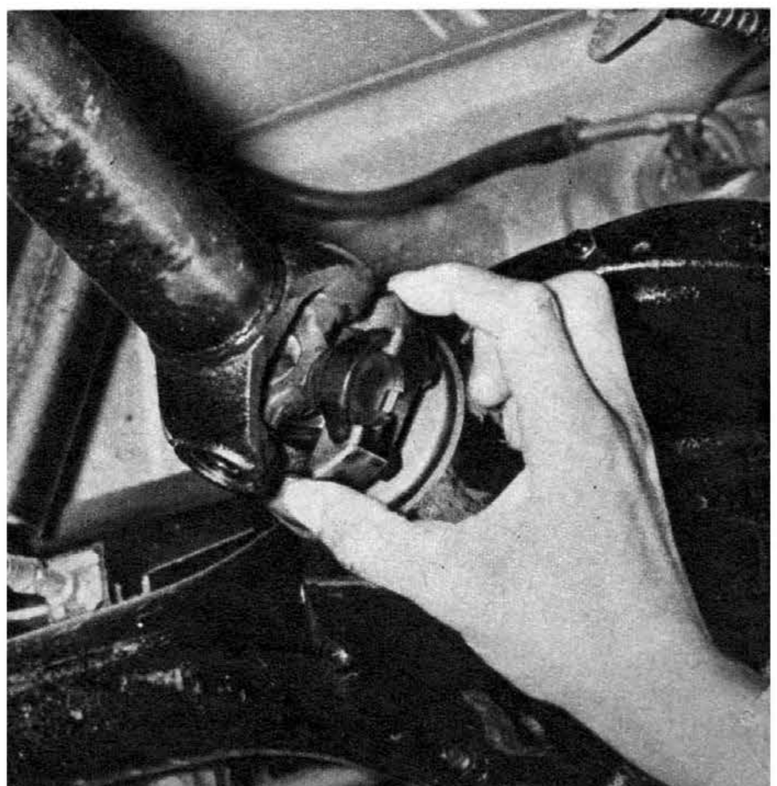
ABOVE: Quick change center section is used in place of regular third member. Gear ratio change is effected at back of housing.

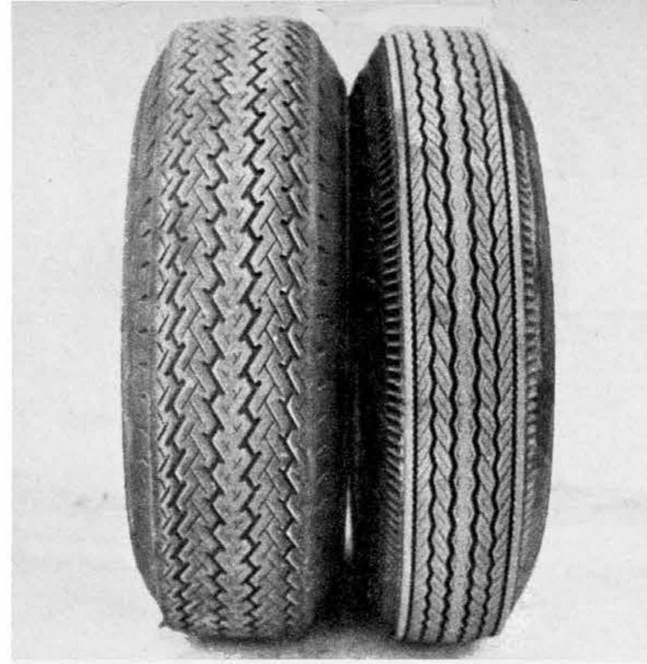
LEFT: Results of changing final drive ratios in terms of engine speed at given mph: (A) 3.08 (B) 3.36 (C) 4.11 (D) 4.56 (E) 4.89.

do you want to be travelling at a given point? And, most important in drag racing: At what elapsed time?

If it was merely a matter of getting underway we'd pick the optimum ratio for torque multiplication in low gear, slip the clutch, spin the tires and use all that multiplied power to get off the line. But 1320 feet away we want to have attained a maximum speed several times that which can be realized in first gear without bursting the engine, so we must consider the final ratio in direct drive. And, by leafing back to the gearbox ratio charts, we can visualize the steps in between.

It is true that terminal velocity and elapsed time are not in direct proportion, but top speed is an indicator. In road racing, cars are geared directly to peak out at a given speed on a straight stretch. Knowing from past performance what the fastest car's top speed was on this stretch, the handlers calculate what will be necessary to meet or exceed it and gear accordingly, relying on the gearbox to provide necessary ratios for turns and slower portions of the circuit. The same is true at Indianapolis. So, if you are serious about class contention, and know the peaking speed of the engine, pick a gear and tire combination which will place you in the top bracket of the class, according to trap speed, at about 300





to 400 rpm over the peaking rpm. Then, see if it falls within the 10-to-1 up to 15-to-1 first gear category.

Here, for example is where the idea of using the 3.08 cogs in the Impala with a close ratio gearbox falls down. Simple arithmetic says that 2.20 X 3.08 is far short of 10.

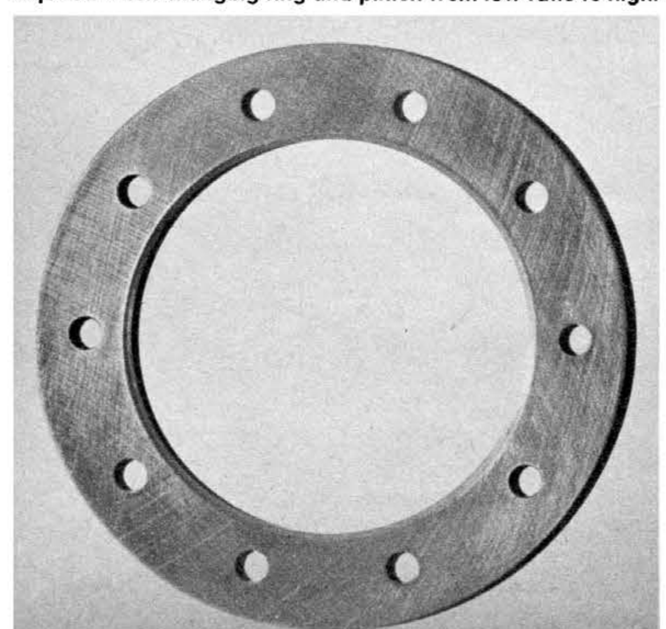
At the other extreme, 4.89 X 2.20 is about 10.7, which does fall into the bracket, and this gear set is used by many SS competitors. You have to turn about 6,700 rpm to get into the 112 mph range, but, when traction is good, this combination is needed to keep from bogging down on the starting line. Hayden Proffitt is turning about 6,400 to 6,500 rpm at the light with his 409 using 4.56 gears and running 9.50 X 14 Caslar recaps, which are real sticky.

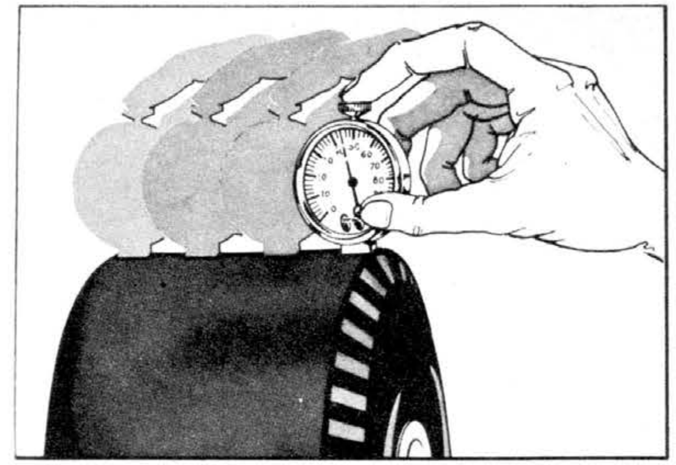
But suppose you have a 1960 Bel Air with a 283 engine weighing in at 3530 pounds and rated at 170 horsepower . . . an I/S class competitor, let's say. Your power to weight ratio is over 20-to-1, whereas the 409 Impala mentioned above has a ratio of something like 8-to-1. Are you going to run the same gears and tires? Highly unlikely if you want to get to the end of the strip before they shut down for the night.

To get off the line at the same rate as the Impala you'd have to have a low gear total reduction of about 23.5-to-1 and with this gear you'd be taching pretty close to 15,000 rpm if you wanted to go through the traps at the same speed as

LEFT: Hefty size of universal joint in 409 Impala SS points up stress imposed on this component under full throttle operation.

BELOW: Rear housing spacer, precision machined from steel, is required when changing ring and pinion from low ratio to high.





ABOVE: Durometer, rubber hardness tester is handy gadget for competitors; "stickiness" of tread often depends on hardness.

LEFT: Difference tire switch can make in final drive ratio, bite is illustrated in comparison photo of 7.60 X 15, 7.50 X 14.

Brother Proffitt. Neither seems too practical, so let's see what the opposition is doing.

80 mph looks about right here, and the 283 170 hp model is supposed to peak at 4,200 rpm, so let's call it 4,500.

Plugging these figures into our formula

$$\frac{RPM \times W}{MPH \times 168} = GR$$

and assuming a 13-inch radius for our wheel and tire, we emerge with

$$\frac{4{,}500 \times 13}{80 \times 168} = 4.35.$$

We don't happen to have a 4.35 ratio, but the 4.56 is closer than 4.11 and it also keeps us at 11.60 for Low which is within our optimum range. And, if we want to do 80, we'll have to crank the mill up a little more, say to 4,800 or so. In fact, with such an adverse power to weight ratio, to get well at the starting flag, it may be necessary to go to 4.98's and twist it even tighter.

You say, "Why not go for smaller tires?"

You could, but there are advantages to big gears and big tires. Both are apt to last longer and suffer less distress. Pull the biggest you can.

Positraction, anyone?

Of course. The Chevy self-locking unit is one of the best and it is really worth the price of admission when it comes to competition . . . or, for that matter, in highway driving where adverse weather conditions are encountered.

One thing to remember; use only the recommended lubricant with the Positraction: GM part no. 3758791. And, for maximum effectiveness, stack the clutch plates in the *alternate* position. A reference to the cutaway drawing will make this disposition clear. The clutch plates should be arranged with an internally splined friction disc against the differential case, then an externally tanged plate, the Belville plate, if used, and another tanged plate.

Incidentally, it is not necessary to change the entire carrier assembly in switching a Positraction gear ratio. A handy machined plate spacer is available from speed shops, such as Moon Equipment Co., to permit merely the installation of an alternate ring and pinion. This requires the use of longer capscrews which are available at the Chevy dealership in your neighborhood.

So. With this information clouding your mind, don't forget Finagle's Law, Part IX, which you probably did not study in High School Physics: "Take all the advice you can get. Then find out for yourself." ■