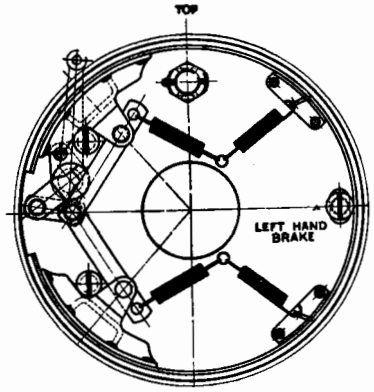
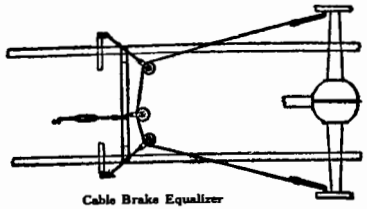



Warford Brake

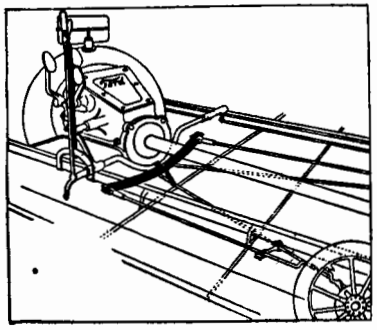
without the need of removing the clevis pin. Thus the brake rods can be very easily adjusted with the fingers, without taking the brake rods apart. A projection on the edge of the nut engages a slot in the clevis and is held by a spring, so that car vibration will not affect the



Cable Brake Equalizer

adjustment. Much the same locking arrangement is used on the adjusting nuts of the Ford transmission bands.

Another type of equalizer for the Ford rear hub brakes consists of a cross bar, which is attached to the middle of the controller shaft. Then the front ends of the two brake rods are connected to the outer ends of this equalizer bar. The result is that the equalizer bar acts in practically the same manner as the familiar whiffletree of a wagon, the two brake rods being attached in place of the two horses. The ends of the equalizer bar are steadied by two coil springs, not shown in the cut.



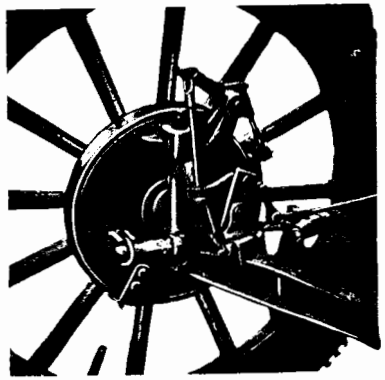
Cross Bar Equalizer

In the cable brake system, steel wire cable passes over two specially designed equalizing pulleys, and automatically equalizes the two rear hub brakes. A third pulley acts on the middle of the cable and this third pulley is attached to the foot brake, so that the application of the foot brake also applies the rear hub brakes at the same time.

**FOUR WHEEL BRAKES FOR FORDS**

A most interesting development to Ford owners, is the McNerny Four Wheel Brakes for Ford cars, which have been perfected, and patented by Clyde J. McNeray, well known inventor, and are sold by the McNerny Products Corporation of San Francisco, California. The superior advantage of four wheel brakes has been thoroughly demonstrated, and long recognized by many of the leading automotive engineers of the country and approved by them. They have been adopted as standard equipment by a large number of the manufacturers of the standard higher class and expensive cars.

The McNerny four wheel brake equipment is of the external contracting type, and consists of 4—10" steel drums—front and rear wheels, with 1-¼ inch brake-bands, and best standard linings, which give approxi-



mately 145 square inches of braking surface, and provides the driver at all times with a simple, positive, and efficient mode of control.

The McNerny brakes are connected from the foot pedal, by means of a rod to the equalizer mounted on the drive shaft housing, having a compound lever action which gives an easy and responsive pedal action; requiring very little pressure to operate. The Ford transmission brake is loosened so that it is inoperative, and the emergency brake is retained in tact.

Equalization is provided between the two front wheels and between the two rear wheels; also between the front and rear units. Direct center pull over the steering knuckle pins makes it impossible for one wheel to grab, or bind in turning corners, or on sharp curves.

The construction of the operating mechanism of the McNerny front wheel brake is such, that when the brake is in operation it automatically reinforces the front axle.

The installation of the equipment is very simple, and can be made by any mechanic in a few hours; there are no extras to buy, and it requires no machining or drilling to install.



Oct. 1923

# Four Wheel — Brakes The Newest Automotive Idea—Applied to Fords

## A Discussion of This Braking Method and a Review of Front Wheel Brakes for the Ford Car

BY MURRAY FAHNESTOCK

*FRONT WHEEL BRAKES* were the subject of an interesting discussion at a summer meeting of the Society of Automotive Engineers, and it was soon evident that such brakes were receiving the very serious consideration of practically all the engineers in the automotive industry. In our opinion, when some of the cars get front wheel brakes—the rest of the cars will be practically forced to fit them. When the car ahead stops quickly, one must either stop quickly—or run into the car ahead. But running into the car ahead means paying for the damages to both one's own car and to the car ahead, which is not a pleasant proposition.

*FRONT wheel brakes are coming!*

*On many other-than-Ford cars they are already here. The announcement of front wheel brakes, as one of the outstanding features of the new Packard single eight and on the latest Rickenbacker and Buick cars, shows the trend of enginering design, and indicates future probabilities.*

*Only the Ford Motor Company knows when —if ever—front wheel brakes will be fitted to Ford cars as factory equipment. Probably not we hazard the guess, until the design of the entire Ford car is radically changed. However, it is now possible to buy front wheel brakes for Fords. This article describes these brakes and their principles.*

An incident will illustrate this. On a recent tour, the writer examined a Duesenberg (fitted with front wheel brakes) in front of the hotel where we stopped for lunch. That afternoon, we saw the same Duesenberg ahead of us and, knowing that the Duesenberg had front wheel brakes and better control than we had, we trailed it over a winding road for several miles, watchfully waiting for an opportunity to slip by.

In the meantime, one of the Fords (passed by the Duesenberg) seemed to consider this as a challenge, and chased right along as fast as it could go, keeping only about a hundred feet in back of the larger car..

Being timid by nature and knowing that the Duesenberg had front wheel brakes, we decided to give them both sea-room, and dropped back far enough for safe stopping.

On rounding a turn of the road, we saw an old type Buick car skid violently and, to avoid the Buick, the Duesenberg came to a quick but smooth stop, without a trace of skidding, even though the road was slightly wet from a light rain. But the Ford was too close and, when the driver applied the brakes, the Ford skidded halfway around, and the rear of the Ford struck the Duesenberg with a crash.

Even though the Ford was only slightly damaged, a dented body panel in the Duesenberg may cost the driver of the Ford a repair bill over a hundred dollars. The lesson being, give strange cars sufficient room to stop in half the distance you can stop your own car, or else fit your car with front wheel brakes.

Many of us still speak of a gasoline automobile as a *touring* car because we do not realize the number of automobiles that make 90 per cent of their mileage within city limits, or on roads which have almost as much traffic as city streets. Such utility work means that the car is almost always in traffic, where quick and accurate car control is of vital importance for, in utility work, the car is most used at those times and places where traffic is heaviest.

Rapid acceleration makes a car pleasant to drive—but is relatively unimportant as a factory of safety. While rapid acceleration must depend on quick and effective non-skid brakes for safety on the other 999 occasions.

The general adoption and proven utility of front and rear bumpers proves that there is still much lacking in the precision control of automobiles in traffic. The majority of cars have brakes that will slide the rear wheels, which proves that the limit in rear wheel braking is being approached.

One of the reasons that has hindered the development of front wheel brakes is their greater complication, due to the fact that the front wheels are pivoted and the brake linkage must

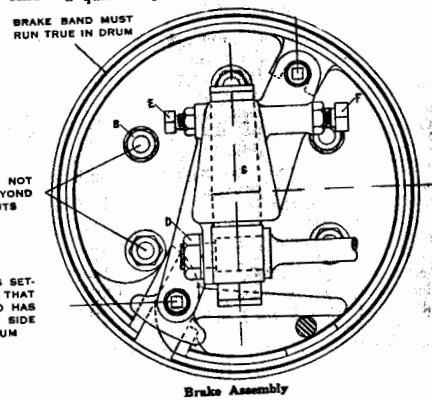
be so arranged as to allow for this. But complication is a minor factor, if better results are thereby secured. A sun-dial is a simple thing—yet most people prefer an Ingersoll. When two-cylinder cars were first introduced, nearly everyone said that they were "Too complicated." And they said the same thing about the four, six, and eight-cylinder cars. But we find that the 8-cylinder Lincoln car is not too complicated to be reliable.

Marcel Guillelmon, of the Renault Motor Car Company, estimated that 75 per cent of French cars, of 100-horse power or over, are fitted wth front wheel brakes. Such brakes are an almost imperative necessity for use on French roads, as "speed limits" do not exist in France, and the usual custom is to drive as fast as the car will go—but the penalties are severe to those who cause accidents.

L. H. Pomeroy, an English automobile engineer, estimated that almost the same percentage of English automobiles, especially in the larger sizes, would be equipped with front wheel brakes this year.

Among the foreign cars now fitted with front wheel brakes are: Renault, Isotta-Fraschini, Delage, Voisin, Minerva, Elizalde, Delaunay-Belleville, Hotchkiss, Microe & Dunamis, De Dion, Excelsior, Hispano-Suiza, Hurta, Peugot, Berliet and the Sizaire-Berwick.

At the summer meeting of the Society of Automotive Engineers, Marcel Guillelmon would drive his Renault thundering down Ocean Drive Avenue at over 60 miles an hour, and then suddenly apply the four wheel brakes. All the passengers would simultaneously rise from the seats, as if making obeisance to the laws of inertia, and four streaks of ground off rubber on the asphalt would show the distance required to stop the car. An actual speed of 60 miles an hour in faster than most people realize, and it is necessary to grind some rubber off the tires to make a quick stop when travelling at that speed.




**Brake Assembly**

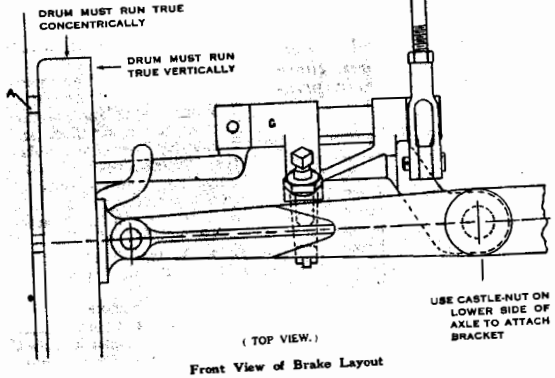
To many of the engineers, however, the performance of the Isotta-Fraschini was even more impressive for, even at high speeds, it would stop smoothly and easily without apparent effort on the part of either car or driver and without sliding the wheels.

### Time in the Affairs of——

There is a time in the affairs of ideas—as well as in the affairs of men. Sometimes great ideas are brought out too soon. Then they seem to languish for a time, until the world catches up to these outposts of civilization. Many years ago (in 1913 or so if memory serves aright) the Morton front wheel brakes were first described in this magazine.

At that time there was little traffic on the roads, and the *need* for front wheel brakes was far less imperative than it is now. Also, no other cars had front wheel brakes, and so they seemed to be an unnecessary complication at that time. Before the war began people were more interested in getting cars to go—than in getting them to stop. About this time, electric starting and lighting systems were being generally introduced on automobiles and, eventually, on Fords.

Now electric starting certainly added complications to the car. Yet the electric starting and lighting systems have come into almost universal use on even the most inexpensive cars. Because the public has been educated up to these standards and demands them.




**Front View of Brake Layout**



### Installing Morton Brakes

1. It is highly important that the brake drums run true. To ensure their doing so *vertically*, see tbat all mud and grease is cleaned off the wheel at the point where the spokes enter the flange, so that the projections "A" on the outside of drum, fit accurately against the spokes. Before finally tightening the special nuts "B" which secure the drum to the wheel, it is advisable to assemble the wheels temporarily on the axle and revolve them, to ascertain that the drums run concentrically true. A light tap from a wood mallet on the outside of the drum may be required, in the same manner as when "chucking" an article in a lathe. When the drums are true, the special nuts "B" should be securely tightened by means of a standard ⅜ inch socket wrench. Flange bolts must not project beyond the face of the nuts.

2. The anchor casting "C" is best assembled on the spindle body (steering knuckle) by removing the wheel and spindle body (intact) from the axle. Insert the brake band in position in the drum, then place the anchor casting on the spindle body. Insert the spindle arm in position and set the nut "D" medium tight. Adjust the anchor casting by means of the set-screw "E" so that the brake band operates true inside the brake drum. Then fix the set-screw "F" and the nut "D" securely.

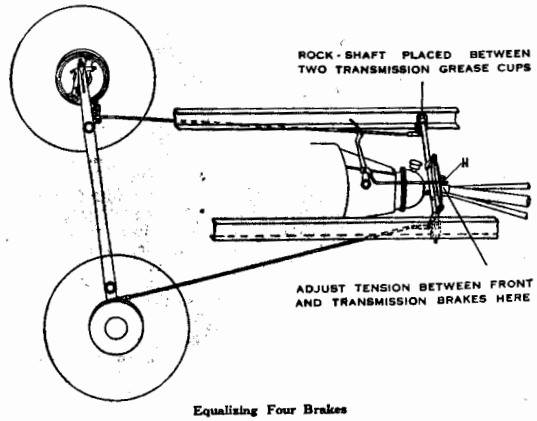
3. The axle bracket "G" is secured by means of the set-screws provided, and the front spring perch nut (castle nut on lower side of axle).

4. The general plan of assembly will be readily seen on referring to the diagram herewith. The adjustment, between the existing transmission brake and the front wheel brakes, (both the transmission and front brakes operating 50-50 at the same time) is regulated by the nut "H" on the brake pedal rod. Only sufficient adjustment should be given to ensure non-skidding and absence of "chattering." This is best ascertained by actual road test.

Adjust the set screws, at top and bottom of anchor brackets, so that the brake bands have 1-16 inch side play in the drums.

### Operating Instructions

When operating the brake, best results are obtained by applying pressure to the brake pedal and again partly releasing, repeating the operation rapidly. This will prove more efficient than if a steady pressure be applied. (This also tends to reduce wear of transmission brake lining, by allowing the oil a chance to get between drum and lining, and prevent burnings and charring which, rather than actual wear, is the cause of most Ford brake failures).




**Equalizing Four Brakes**

Owing to the light construction of the Ford front axle system, it is in a great many instances supported by the addition of extra radius rods running from the rear end of crank case to lower side of axle. (This applies to Ford axles having the old-style front radius rods, fitted to the spring perches above the axle.) When installing Morton front wheel brakes, it is advisable to use these auxiliary radius rods. Fix these radius rods after installing the axle brackets "G."

It is estimated that any good mechanic can install a set of these front wheel brakes in less than two hours, without drilling any holes or otherwise altering any part of the car. Adjustment can be made in a few minutes, to give more braking effort on either front or rear wheel brakes as desired.

### Safety Front Wheel Brakes

The Safety front wheel brakes are made for attachment to Ford cars now in use. The spindle bolt is replaced by a special spindle body bolt of extra length. The upper end of this special spindle body bolt is extended to nearly the top of the brake drum, where it supports the brake anchor. The brake band is of the internal type with the anchor at the top and the operating cam at the bottom.

The operating cam is a cylindrical piece with rounded ends. The center of the cylinder is directly under the center of the spindle body bolt, so that the front wheels can be turned without changing the relation of the cam and brake band. This allows the brake to be used with the same certainty when turning a corner as on the straight-away.

The cam is operated by a shaft, to which it is attached, and a lever. The two levers are connected by means of a cable, through equalizing pulleys to the main brake shaft, which is operated

by the foot pedal. The brake cam and shaft are supported by brackets, which are bolted to the front axle, requiring only two holes to be drilled at each end. The brake shown in the cut is attached to a Timken axle, but the same principles are used for brakes applied to Ford axles.

**Special Front Wheel Brake Axle**

One of the larger makers of front axles is now working on a special front axle for Ford cars, in which the front wheel brakes will be a special feature of the axle. No cuts are as yet available of the front axle for Fords, but it will probably be made along the same general lines as the special front wheel brake axle shown in the cut. A lighter construction and changes in the steering connections and spring perches will be made in order to use as many Ford wearing parts as possible.

Since the use of front wheel brakes will place a twisting or torsional stress on the front axle, it is probable that the axle will have wider webs than the usual Ford front axle. And some special provision may be made for a stronger radius rod

**Motion Front Wheel Brake**

construction, to absorb the shocks when the front wheel brakes are used. It is evident, when front wheel brakes are used, that the impact of the front wheels against bumps will be greater than when the wheels are free to roll over the bumps.

**Reduces Skidding**

One of the most important advantages of the four wheel brakes is the almost total elimination of skidding which they afford. "What is a skid?"

Isn't it the attempt, when the brakes are applied, of the rear wheels to put themselves at the front part of the car? The reason being that it is the rear wheels which carry the brakes.

Now isn't it a simple idea to put the wheels, on which the brakes are applied, at the front of the car to begin with? Then there will be no attempt of the brakes-fitted wheels to swing to the front. Because—why, they are already there!

This fine idea can easily be proven by anyone in a few moments. Take a toy automobile and tie the rear wheels so that they will slide. Start this toy automobile down a board, and you will notice that, even though started down-hill straight, the rear of the car will swing around and the toy car will reach the bottom of the hill rear end first. Try the same stunt with the rear wheels free to roll and the front wheels tied—and the toy car slides down hill in a sedate and orderly manner, without skidding at all.

"What is skidding?" It is a partial or complete *locking* of the wbeels and, when a wheel is locked against rotation, it is in effect no longer a wheel, and so slides with equal facility in any direction. It is only while actually rolling, that wheels have that sense-of-direction which is necessary for the control of a car.

In actual practice, however, we do not depend on front wheel brakes alone, for good rear wheel brakes are already available and might as well be used. Also, it is evident that a car can stop almost twice as quickly with *both* front and rear wheel brakes, as with either set alone.

Of course, front wheel brakes must not be used to lock the front wheels, as that would tend to cause a front wheel skid. And while front wheel skids are rare, the helpless feeling that such loss of car control occasions will not allow such skids to be forgotten easily.

On many of the cars equipped with four wheel brakes, the adjustment (between front and rear brakes) is so made that the front wheel brakes exert 40 per cent of the braking action, and the rear wheels 60 per cent. As a matter of fact, when the brakes are applied, the weight of the car tends to slide forward, so that this is automatically taken care of.

The fear of skidding is the shadow that haunts the minds of many drivers but, with the danger of skidding practically removed by the fitting of front wheel brakes, driving will tend to become a greater all year pleasure. For driving a car is not really a pleasure to sensible people, unless it is also safe.

With the dangers of skidding eliminated, it will not be necessary to use chains on the tires to prevent skidding and give increased braking effect. And, as everyone knows, the use of tire chains seems to about double the wear and tear on the tires. Of course, there are times when, if the chains are really needed, they may reduce the tire wear by reducing slipping and sliding. But if we can eliminate the need for tire chains, then the wear of the tires will certainly be reduced.

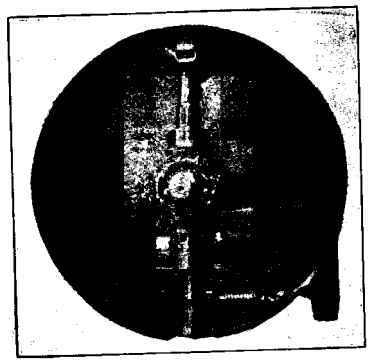
*There are a number of ways to stop any car—eventually. But it is sometimes highly important that a stop be made at a very definite place in very sudden time. There is an element of sport in wondering if your car is going to stop just when and where you want it to; but there's a lot of satisfaction and safety in knowing that it is. Four-wheel brakes help you to know.*

Those who used pedal bicycles, fitted with a brake acting on the front tire, will remember the total absence of skidding of such bicycles. When coaster brakes came into use, however, skidding became more general, because of the braking effect being applied to the rear wheels.

### For Racing Fords

Strange as it may seem, four wheel brakes were first developed for racing use over European roads; where ability to slow down for turns in the road is almost as important as engine power and ability to pick up speed, after the turn has been passed. Far racing on the Indianapolis Speedway, where the cars roll on and on at a nearly uniform high speed, four wheel brakes would be superfluous. And it is possible that they would not be particularly valuable for racing on mile dirt tracks. But, for half-mile dirt track racing, it would be interesting to see the idea tried out—though driver would have to radically alter his present methods of driving—in that skidding around the turns would be eliminated. We would be glad to hear the results obtained by our readers with front wheel brakes in dirt track racing.

For general *road* racing use, where there are many bends in the road, it is probable that front wheel brakes would be of considerable advantage towards winning the race. For such racing use, we suggest the use of the special front radius rods, as shown for use on Fronty-Fords, as the strains of racing car use are very severe.



Safety Front Wheel Brake

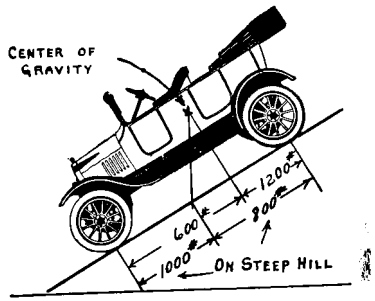
### Greater Front Axle Load

Charles L. Sheppy, chief engineer of the Pierce-Arrow Motor Car Company, stated that the following items should have serious consideration when applying four wheel brakes to the average car.

The front axle should be designed to withstand the torque due to the use of front wheel brakes. (The special front wheel brakes axle being designed for Fords will allow for this. In the case of the Morton brakes, it seems probable that not over 25 per cent of the braking effort will be applied through the front wheel brakes, and the Ford front axle system should be amply strong to take care of this.)

Front springs should be stronger to carry the extra load, and amply provided with rebound clips. In some experiments conducted on Pierce-Arrow cars, it was found that a transfer of weight, from rear to front axles of nearly 30 per cent, was sometimes attained, amounting, in the case of the Pierce-Arrow car, to 1,775 pounds on a 30 per cent grade. (We can furnish names of makers of special, extra heavy front springs for Fords, if the need for stronger front springs is felt.)

With the transference of weight to the front wheels, it is our opinion that the old-style Ford ball-bearings in the front wheels might not prove




Weight Transference on Hills

altogether satisfactory. And as the front wheel roller bearings are so much better, and are now standard equipment on all Ford cars; we suggest that old-style Fords have the roller bearings fitted, before the front wheel brakes are attached. Another reason for using the roller bearings is that they hold the front wheels more accurately and with less play and wabble. This makes it possible to secure and maintain a more accurate adjustment of the front wheel brakes.

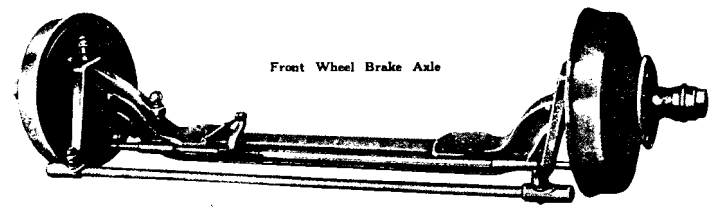
In the Pierce-Arrow experiments, it was found possible to stop a 6,000 pound car in 70 feet, using rear wheel brakes only, when travelling at 30 miles an hour. With four wheel brakes, this was cut exactly in half—stopping being attained in 35 feet. At a speed of 50 miles an hour, the rear wheel brakes stopped the car in 175 feet, while only 90 feet was required with brakes on all four wheels.

Aside from emergency traffic stops, brakes are most needed when descending hills. This is obvious but, when a car is descending steep grades, the center of gravity of the car moves forward, and more nearly over the front axle. This transference of weight, from the rear to the front axle, decreases the effectiveness of the rear wheel brakes, so that the rear wheels slid and skid easily, thus increasing the wear and tear on the tires.



In order to more clearly illustrate the way in which the weight of a car is transferred, from the front to the rear wheels, by the directly downward pull of gravitation, we have illustrated a Ford car (with an approximate weight of say 1,800 pounds) on a very steep hill. Let us say that, on a level road, the weight distribution is about 600 pounds on the front wheels and 1200 pounds on the rear wheels (the exact figures are immaterial).

But if we place the same car on a steep grade,



Front Wheel Brake Axle

then the center of gravity (with a line drawn directly downward) changes the proportions between the front and rear axles and, instead of having most of the weight on the rear wheels, we may have most of the weight on the front wheels, and an increase of weight on the front wheels of from 600 to 1000 pounds.

This is one reason why front wheels are so effective, because the front wheels are pressed more tightly against the ground, both by gravitation and inertia forces, just at those times when such pressure is most needed for effective braking effect.

### Possible Disadvantages

Among the possible disadvantages of front wheel brakes, we might mention the greater complication and need of adjustment. If the Ford is used for commercial use (not fleet use), and never given any attention until something actually breaks; then it is possible that the greater complication and need of adjustment of front wheel brakes might be a disadvantage. But such Ford abusers do not read our magazine, and we believe that the average reader of this magazine would be fully competent to make any front wheel brake adjustments as might he needed.

Since the braking wear, when front and rear wheel brakes are used, is distributed over four wheels and four brakes, instead of only through the rear wheels; it seems probable that this would result in a considerable reduction in wear and tear in both the transmission brake lining, and in the differential gears and rear axle parts, so that these parts should not require as frequent adjusting as when only rear hub brakes were used. Also, the wear and tear on tires should be greatly reduced by distributing the sliding of tires which tears the rubber and causes cuts to appear.

The transference of weight, and the need for stiffer front springs, when front wheel brakes are severely used; might mean less easy riding qualities of the front end of the car. But this fitting of shock absorbers or rebound snubbers.

As a matter of fact, by only using the front wheel brakes for about 25 per cent of the braking effect, the need for stronger front springs, extra heavy radius rods and other precautions could probably be more than overcome by the would be eliminated. Yet, by eliminating chattering and reducing skidding, the car performance would be greatly improved.

The possibility of the front wheel brakes causing additional wear of the spindle body bushings is very slight. This could be more than overcome by applying some special form of lubricating system to these spindle body bushings. Such wear is far more the result of lack of lubrication or ingress of grit; rather than the result of the additional pressure on the bushings, which would only be present when the front wheel brakes were in actual use.

The additional unsprung weight would have some effect on the riding qualities of the car. That is why front wheel brakes should be made as small and light as is consistent with proper strength and braking ability. By using front wheel brakes that are not quite as powerful as the rear wheel brakes, sufficient braking effect can be secured with the minimum of weight.

(The subject of rear hub brakes will probably be considered in detail in a future issue of this magazine.)

## Brake Rods Anti-Rattler

After a little driving, there is often a rattle at the front ends of the hub brake pull rods, where they connect to the controller shaft under the floor boards. This annoying rattle can be completely and permanently removed by using two coil springs from Ford brake shoes, No. 2570B, listing at 3 cents each, if you wish to buy them. This is seldom necessary, as there are always old brake shoes around, but cleaning the muck off old springs is worth the cost of new springs.

If there is not a cotter pin already there, put one in the hole in the rear bolt of each controller shaft bracket and spread the ends of the cotter pin well. Hook one end of the brake shoe coil spring in the eye of the cotter pin and the other end into the fork of the hub brake pull rod. It will be necessary to enlarge the hook in the end of the spring slightly with the aid of a pair of pliers.