## SERVICE BULLETIN No. 3-37

# INSTALLING NEW GENERATOR BRUSHES

The installation of new generator brushes is a simple matter in itself, yet a certain procedure must be followed in order to get a 100% satisfactory job.

Before the brushes are installed, the armature should be inspected and tested for:

1. Shorts and grounds. A growler with a test lamp should be used for this purpose.

2. The commutator should be turned down to a true round and the insulation between the segments undercut.

3. The commutator segments should be tried for looseness due to shrinkage of insulation between segments.

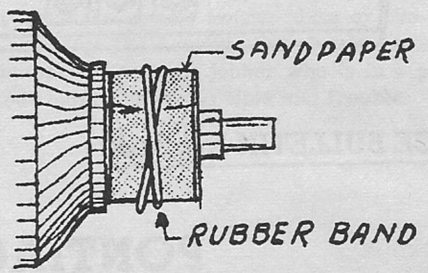
After this is done the proper brushes should be procured and installed. In connection with this we cannot caution you too strongly against picking brushes for size only. There are any number of brushes that look exactly alike, as, for instance, E-35 and E-39, yet cannot be substituted for each other, as each type of brush is made of a different composition and hardness corresponding to the speed of the generator and the hardness of the commutator for which they are intended.

"Standard" brushes are made to exact equipment specifications, and 18 materials are used in their composition in varying proportions depending on the type of generator. Therefore, it is absolutely necessary to use the type of brush specified in the guide for the particular job.

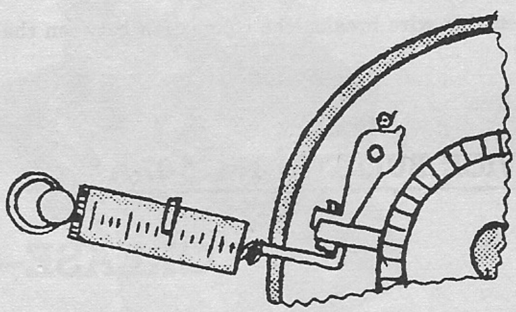
After the brushes are installed they should be sanded in to secure a good seat and prevent sparking. The arc produced by a badly sparking brush is almost as hot as an electric welding arc, and will damage the commutator or insulation, and often take the temper out of the brush springs. New brushes must be made to seat properly as much as new valves in the motor must be ground in.

To sand in the brushes proceed as follows:

Cut a strip of very fine sandpaper (Grade 00) the exact width of the commutator surface, and the full length of the sheet. Wind this around the commutator in such a way that the normal rotation of the armature will tend to keep it tight. Slip a rubber band around the sandpaper to hold it in place while assembling the armature in the generator. Connect up the generator ready for a test run. With the brushes in place cut the rubber band and remove. Turn the armature around, either by hand or on the test bench, about 30 or 40 times. Remove the sandpaper strip and blow out the carbon dust. The generator is now ready to test, and the brushes will be curved to fit the commutator.




At the same time the tension of the brush springs should be checked. A tension gauge calibrated in ounces should be used and the factory specifications should be followed in setting the spring tension. Improper tension will cause the brushes to wear rapidly if it is too high, and the brushes will bounce and give an erratic charge indication on the ammeter if the tension is too low.



If these instructions are followed, you will find that your brush jobs will be satisfactory and trouble-free.

## SERVICE BULLETIN No. 55A-48

# IMPROVED CIRCUIT BREAKERS FOR FORDS

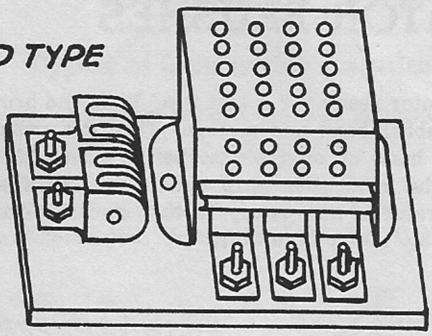
An improvement has been made in the construction of of circuit breakers for Fords both by original equipment and ourselves

The new type circuit breakers have a different appearance from the old type and operate somewhat differently. In the old type, the circuit breaker is enclosed in a large, perforated metal container, while in the new type it is completely sealed in one or two (depending upon the car model) small shells with molded bakelite face plates, and the entire assembly is considerably smaller.

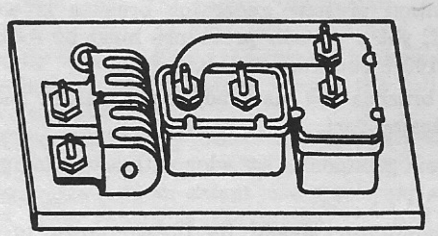
So far as operation is concerned, the new type circuit breaker is quite an improvement. Where the old type operates by means of a thermostatic element, the new type supplements the thermostatic action with a magnetic circuit. As a result, when the new type circuit breaker contacts open in the case of a short-circuit, they do so with an arc-killing snap, thus prolonging the life of the contacts.

The new type circuit breaker fits on the car exactly like the old one, and no changes in installation are required.

THE OLD TYPE



THE NEW TYPE



**SERVICE BULLETIN No. 31-40**

# PONTIAC GENERATOR LEAD

An unusual source of generator trouble has been found on some of the early 1940 Pontiac Torpedo cars. The wire which leads from the generator to the voltage regulator is part of a wiring harness which is fastened to the fender apron by a clip. It has been found that this harness is sometimes clipped on too far back, so that the generator-to-regulator wire is stretched tight. Eventually the tight wire breaks, due to normal engine movement.

When this wire breaks, the connection between the generator and the battery is interrupted, causing the generator to operate on open circuit. This will burn out the armature of the generator in a very short time.

Whenever a 1940 Pontiac Torpedo comes in for any reason, it is advisable to check it for this condition. The condition can be relieved by loosening the clip and moving the harness forward, so as to provide the necessary slack in the generator wire.

**SERVICE BULLETIN No. 5-37-A**

# GREASE—WHEN AND WHERE

**Many failures in the ignition system can be traced directly to improper lubrication or the neglect of the distributor breaker cam. In some cases the cam is not lubricated at all, causing the bumper block of the breaker arm to wear down rapidly due to excessive friction or become brittle and break due to the heat developed by this friction. It sometimes rusts and the rust deposit acts like an abrasive and cuts up the bumper block.**

**In other cases, too much or the wrong kind of lubrication is used. The centrifugal force of the rotating cam throws the grease or oil all over the distributor and onto the surface of the tungsten points. As a result, the grease either forms an insulating film on the points causing hard starting, or even failure to start, or it burns up under the action of the spark between the points and forms an oxidized bluish-black film, which is often mistaken for indications of condenser trouble or a high-voltage condition. Sometimes too much oil is put on the wick on top of the distributor shaft, with the same results. This condition is easily recognized by the fact that the blue-black deposit can be scraped off the points with an ordinary knife.**

**One of the original equipment manufacturers recommends that a light grease be used with a melting point of about 280°. The cam is to be given a light wipe of this grease so that when the cam is rotated after greasing, the grease will pile up on the rubbing block not higher than 1/16". Where the breaker arm blocks show evidence of excessive wear or the cams show rust, the cams must be replaced.**

**This subject is one to which the average mechanic pays little or no intention, yet it is extremely important. We suggest that you service every car according to the above instructions and eliminate come-backs.**

## SERVICE BULLETIN No. 19-39

# HEAVY DUTY???

### What is a "heavy duty" ignition part?
### Why is it needed?
### When should it be used?

These questions, no doubt, occur to many mechanics who use a reliable make of ignition parts of conventional design and who want to know when they are justified in recommending to their customers "heavy duty" parts at a somewhat higher price and why.

Some mechanics even advance this argument: "If heavy duty parts were necessary, the original equipment engineers would have put them on cars as standard equipment". Well, let us see whether this argument is based on fact or just an impression.

Take tires, for instance. Most of the cars are delivered to the buyer with 4-ply tires, yet every tire manufacturer who furnishes the 4-ply tires for car equipment also makes and sells 6-ply tires for the same cars. That 6-ply tires will give longer tire life and more freedom from tire troubles is admitted by everyone, and surely by the automobile engineers, but a new car is equipped with 4-ply tires nevertheless.

Consider piston rings. It is no secret that equipment piston rings are made by outside manufacturers who also make rings with special advantageous features for replacing the original equipment rings of their own manufacture. If the equipment ring is best for the car, why make better ones? Yet, we all know that the good mechanics seldom use the same quality of rings for replacement as they find in the car.

Now, let us take our own field—ignition. Delco-Remy makes all the coils that are original equipment on General Motors cars and the General Motors engineers apparently accept these coils for their cars. Would you say that these coils are best for the cars because the engineers accepted them? Hardly so, because the Delco-Remy catalog lists a Master Universal coil No. 545B about which they say: "It gives the motor car a flexibility of performance and speed ranges not possible with the ordinary ignition coil. It will replace *all* Delco-Remy coils of the lock extension (switch and cable) types as well as all standard coils without the locking feature". In the application guide that follows this description are listed all of the Delco-Remy equipped cars using lock switch coils, even the lighter cars like Chevrolet, Plymouth, etc.

On the same page of the Delco-Remy catalog is listed another Delco-Remy coil No. 1115126, which is described as having "a special winding which produces a higher secondary voltage". They say about this coil: "the superior performance of this coil will be noted particularly on cars equipped with down draft carburetors and those having wide spark plug settings. Ideal for car owners requiring a coil with greater voltage than standard". Peculiarly enough, the widest spark plug settings, .040" are found on the Chevrolet and Oldsmobile 6, and practically all modern cars having down draft carburetors.

It would appear from both of the above descriptions that a certain type coil is furnished with the car as original equipment, but a different, better and more expensive coil should be used in order to get the best performance out of the same car.

Here we have an answer given us by Delco-Remy to the question: "What is a heavy duty ignition part?" It is evidently a part that is better than the part originally furnished with the car, and one that will make the car perform more satisfactorily under all conditions. This same answer can also be applied to the second question: "Why is it needed?"

Looking over the list of cars for which the Delco-Remy special coils are recommended and noting that it covers every car they originally equip with coils, the answer to the third question: "When should a heavy duty part be used?" is made clear.

*Every car owner who wants to get flexibility of performance and speed ranges out of his car, (and show me one who doesn't) is urged by the original equipment coil manufacturer to replace the equipment coil with what is commonly known as a "heavy duty" coil.*

This seems to settle the matter of coils. But what about condensers and breaker points? They are just as important in the ignition system as the coils, as they actually control coil performance, and constitute links in the ignition system chain and upon their performance depends the whole system.

A close study of the conventional types of breaker points and condensers brings out certain weaknesses of construction that can be eliminated by somewhat different construction; improvements in design that can step up the performance of the car and prolong the life of the parts. In other words, it is possible to design "heavy duty" condensers and breaker points that will, like the coil, give the car owner an opportunity to get the best performance out of his car with more trouble-free enjoyment of its performance.

The same holds true for other electrical parts of the car. Generator cutouts, dimmer switches, battery cables, etc.

That improvements on design of equipment units are not only possible but have actually been made and how they were made will be shown in a succeeding bulletin.

## SERVICE BULLETIN No. 9-38

# WHY POINTS TURN BLUE

One of the most frequent and puzzling troubles in the automobile electrical system is the burning of breaker points. They turn a bluish-black color and sometimes have white marks around the sides of the tungsten. In nine cases of out ten the repairman removes these points and replaces them with new ones which also burn up in a short time. This is only natural, as the burning of points is simply an indication of trouble elsewhere in the electrical system that causes abnormal currents to pass through the points. **Points never burn of themselves** — they rather act like a thermometer when it indicates the presence of fever in the human system. You can no more cure a bad condition in the electrical system of the car by changing points than attempt to cure fever in the human system by changing thermometers. One might say that the points actually get blue in the face trying to tell you that the electrical system is sick.

There are various causes which result in the burning of points, the chief offender being what is known as "High-Voltage", a condition that shortens the life of every electrical unit on the car and accounts for more than 60% of all point troubles.

High-voltage can be briefly described as follows. All the units of the car are designed to operate on 6 to 8 volts. Normally, the generator delivers current to the battery and to the electrical unit at not more than 8 volts. However, should any obstruction to the passage of the generator current develop in the path of that current, the generator voltage will immediately jump up, and more than 8 volts will be impressed upon all the electrical units and strain or damage them. In an extreme case, like the breaking of a battery cable terminal or lug, when the generator charging circuit is completely open, the voltage may run up as high as 30 volts. In such a case, all the bulbs blow out and the coil burns out, besides damage to the generator itself. In milder cases, such as corroded battery cable terminal, a loose connection on the ammeter or cutout, etc., the results will not be as noticeable but the damage will be there just the same; bulbs will have to be replaced oftener and **the points will burn up.**

This trouble always existed in cars, but has become more frequent with the introduction and the present popularity of "floating power" and rubber mounted engines. The generator is grounded to the engine which in turn is grounded to the chassis, the latter serving as a return path of the charging current to the battery through the ground strap. When, as often happens, the rubber mounting dries up somewhat and the engine is a bit loose on its supports, there is an imperfect electrical connection between it and the chassis, which invariably causes a high voltage condition. As a precaution against this, most rubber mounted engines are provided with a special ground strap between the engine and the chassis. The trouble is that this strap is often overlooked by the mechanic who cannot then figure out why points burn out on the particular car.

There are other causes for point burning and the following list describes them:

1. **Bad condenser.** Over or under-capacity, leakage and high-resistance internal connections.

2. **High voltage** due to:

(a) Loose or corroded battery terminal which may look perfect on the surface, yet have a high resistance contact at the battery post. We have found cases where a certain all-lead terminal was used and an oxide formed on the inside surface of the terminal due to the electrolytic action of the battery current. A light coating of this oxide was enough to introduce sufficient resistance into the charging circuit to make the generator push out enough voltage to burn up points and bulbs.

(b) Generator charging rate boosted too high for winter driving.

(c) Battery overcharged—Gravity over 1275.

(d) Motor supports bolts loose, producing an imperfect ground.

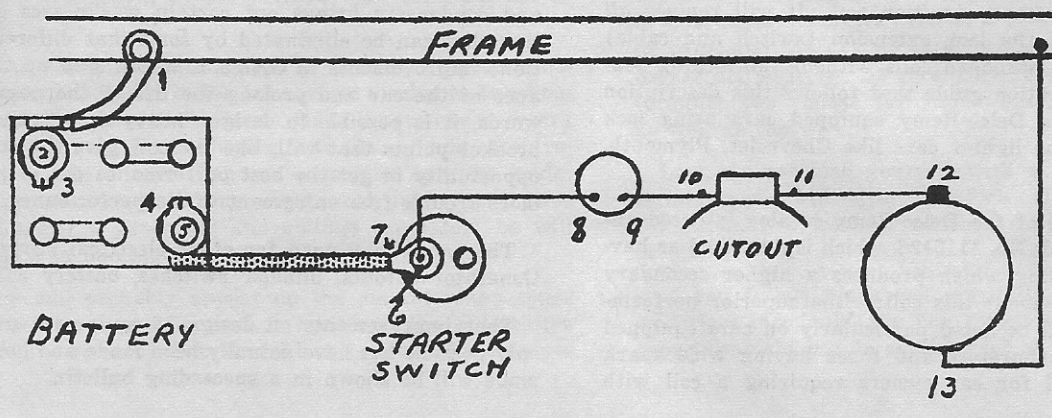
(e) Floating-Power and rubber-mounted motors. There is, or is supposed to be, a ground strap between the motor and the chassis to compensate for the rubber mounting. This strap must never be overlooked when the electrical system is checked.

(f) A sulphated battery or one with defective coils will cause the generator voltage to jump up.

3. **Oil or grease in the distributor.** Frequently too much oil is put on the felt wick in the center of the distributor shaft and is splashed all over the distributor by centrifugal force. Too much or the wrong kind of grease is sometimes used on the distributor cam. In either case the tungsten points get a coating of oil or grease, which burns under the action of the spark between the points into an insulating black film. This condition can be distinguished from a high-voltage burn by the fact that the film can be scraped off with an ordinary knife. Our Service Bulletin No. 5-37A deals with this subject in detail.

4. **Distributor ground.** A worn distributor will often make poor electrical connection with the motor. It is sometimes necessary to run a wire from the distributor to the motor block for a perfect ground.

5. **Loose connections.** A loose connection anywhere will cause trouble. A low reading voltmeter—about 3 volts, is the most reliable method of checking. If the connection is very



loose it can be detected by the fact that it feels warm or hot to the touch.

**6. Ignition switch.** Especially in the case of lock-switch coils where the switch is built into the coil, the spring that controls the pressure of the switch plate against the coil contacts weakens and causes a loose connection. In the case of switch-cable coils, the terminal that connects to the contact stud on the coil loosens up.

**7. Electrolocks.** The lock-nut to the cable inside the distributor may be loose or the spring contact may be weak. The insulation paper and fiber washers should also be checked. Sometimes the Electrolock snaps itself into a partial or complete "on" position overnight, which will burn the points in a short time.

**8. Incorrect cam angle.** The "Cam-angle" is the number of degrees of cam revolution during which the points remain closed. If the cam angle is too large or too small it will cause the points to burn, as in either case the synchronism between the coil action and the condenser effect is destroyed. See Service Bulletin No. 6-37.

**9. Loose bearings in the distributor.** This causes the cam to be pushed to one side when it strikes the bumper block on the breaker arm. In this way the points do not open sufficiently and burning results.

**10. Worn pivot pin.** A worn distributor pivot pin (the pin on which the breaker arm is mounted) will cause the points to "creep" instead of breaking clearly. This will also burn points.

**11. Improper spring tension.** This will cause points to chatter if the tension is too low and "creep" if too high. In either case the points will burn.

**12. New point adjustment.** After a new set of points is in operation for a short time the gap should be readjusted, as the bumper block will wear in and change the gap. Otherwise the points will burn due to insufficient gap.

In all cases of electrical trouble the use of testing instruments is highly recommended, as that is really the easiest way to locate trouble. We do not mean elaborate analyzers but an ordinary good-quality voltmeter with a 3 volt scale and an accurate ammeter. With these two instruments you can check all the troubles listed above and the check will be correct.

A simple test for high-voltage can be made by means of a voltmeter with a 3 volt scale, such as used for checking battery cells. Start the motor and let it run for a few minutes, then speed it up until the generator charges at 10 to 12 amperes.

Connect one post of the voltmeter to the frame of the car making sure that a clean electrical contact is secured. Connect the other voltmeter post to the lug of the ground cable or strap (1). The voltmeter should show no reading. If any reading is shown the indication is that there is resistance at this connection and the connection should be removed, thoroughly cleaned and tested again after it is reconnected.

Test the same way between 2 and 3, between 4 and 5, between 6 and 7, between 6 and 8, between 9 and 10, between 11 and 12 and between the generator frame and the car frame. In no case should the voltmeter show a reading, nor should any reading of the voltmeter be allowed to pass without correcting the particular imperfect connection.

## SERVICE BULLETIN No. 20-39

# HEAVY DUTY BREAKER POINTS

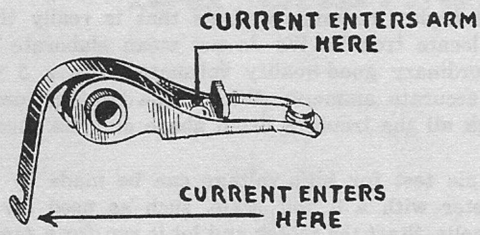
In Service Bulletin No. 19-39 we mentioned that we would show how improvements on design of equipment units can be made. In this bulletin we will take up the subject of improved breaker points.

A word about points in general. These simple bars of metal with their tungsten ends practically control the entire performance of the engine. If you figure that in the average six cylinder car traveling at sixty miles per hour, the points must close, make perfect contact and open ten thousand times a minute, you can readily see that they must be right to do it right. Yet, DR-118, for instance, first appeared in 1925 and is still being used today in original equipment without any change. In the same fourteen years many changes have been made in the automobile engine: from 2000 RPM in 1925 the engine has been jumped to 4000 RPM in 1939; the compression of fifty pounds for a square inch was gradually boosted so, that it is now about one hundred and forty pounds, etc.

Practically every working part of the engine has been changed, strengthened and generally improved to meet the greater strains imposed upon them by this pepping up of the engine—everything except the breaker points furnished as original equipment.

Some time in 1934 we took this problem up seriously and analyzed it from all angles. This is what we found:

1. The breaker arm carries the current flowing through the coil and thus controls its action. The current is conducted from the distributor terminal, through the steel tension spring of the breaker arm, through the rivet that fastens



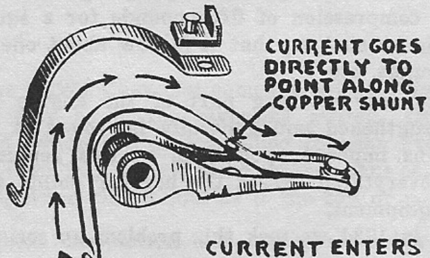

together the arm, the spring and the rubbing block, and then, along the arm to the contact points. It is evident that the entire successful operation of the coil circuit really depends upon this rivet, and any looseness there, corrosion or rust that might and does creep in between the rivet and the metal of the arm will introduce resistance into the coil current circuit, so that the coil will not get a 100% build-up current. Don't let anyone fool you about the importance of this angle, — remember—you are working with low voltages, 6-8 volts, and the permissible voltage drop in the circuit is limited to millivolts (one-thousandth part of a volt), so that the slightest amount of resistance cuts down the power delivered by the coil.

2. At high speeds, the breaks between the points occur in very rapid succession (about ten thousand times a minute), so that the arc between the two tungsten surfaces is almost continuous. It would seem that a larger surface area of tungsten should be provided so as to offer a greater area of heat dissipation in order that the points may remain cooler and burn to a smaller extent.

What this increase in heat, due to the faster engine operation in recent cars, means to the points, can be compared with trying to run a 1939 engine with a 1925 radiator—in both cases overheating would take place.

3. To further guard against the burning of points due to overheating, the idea presented itself that a tungsten with a higher current carrying capacity would be desirable. The higher the current carrying capacity, the less resistance and therefore the less heat develops in the tungsten with consequent lesser burning.

Having analyzed the problems as presented above, it became obvious to us that if all these angles could be changed, the weaknesses removed, and breaker points built so that they would follow the original basic design without changes in the method of installation, etc., but without the weaknesses —a great improvement in the operation of the ignition system would obviously follow. We took up each of the problems separately, and this is how we proceeded:




1. To eliminate resistance between the rivet, the spring and the arm, we introduced into the assembly a copper shunt that follows the shape of the spring to the arm, and then continues along the arm to the tungsten point. As a result, we have provided a continuous, low resistance path for the coil current, a path that does not depend on one rivet, and is also independent of any resistance between the rivet and the arm. The current therefore flows uninterruptedly from the coil to the tungsten points with practically no resistance in the circuit, so that the coil gets a 100% build-up, and is allowed to deliver its full power.

2. To provide a greater heat dissipation area we increased the size of the tungsten points from .150" in diameter to .187", which means a jump of 55.4% in area. It stands to reason that the greater heat dissipation provided by this greater surface keeps the points cooler and less subject to burns.

3. To provide a higher current carrying tungsten we made use of a special process of tungsten manufacturing. The conventional tungsten used in ordinary breaker points consists of a large number of small crystals, each crystal surrounded by a band of amorphous or uncrystalized tungsten. As the amorphous portion is less conductive than the crystalized tungsten, some method has to be used to make the conductive crystals larger and the non-conductive amorphous bands smaller. It is done in this manner:

After the tungsten has been brought to the stage in which it is used in ordinary points, it is ground up again then fused in an electric furnace until the small crystals fuse into large crystals and most of the amorphous material is removed. As a result a high amperage tungsten is produced, which is many times more conductive than the ordinary type and will handle larger currents without burning.

These problems settled, we took up the matter of the tension spring. It is common knowledge that for high speed operation, the tension spring must be extremely accurate, as too little tension allows the points to bounce or chatter, so that they do not make perfect contact during the extremely short period of contact (one ten-thousandth part of a minute). Too much tension, on the other hand, makes the bumper block wear rapidly, so that the cam angle is changed and the system is thrown out of synchronism.

Ordinary flat springs are punched out of ribbons of tempered steel, which is alright for ordinary purposes. For precision springs, however, this method is not good enough, as a long steel ribbon cannot be uniformly tempered throughout its length, and springs punched out of it will be correspondingly non-uniform.

The precision spring we use is punched out of soft steel; it is then formed and tempered. In other words, instead of tempering the metal of which the spring is made, the spring itself is tempered and is therefore sure to be of the precise, proper temper. In addition, each spring is individually "set" and tested and held to plus or minus two ounces of the desired tension, — a result impossible to achieve in any other way.

All of the above features were combined in our breaker arm and resulted in a heavy duty arm that apparently takes care of the increased demand put upon the ignition system by the modern engines. We call this heavy duty arm the "Blue Streak" breaker point. Results in the use of these arms in the field for the past four years have more than justified our contention that the improvements we have put into our arms were necessary and beneficial.