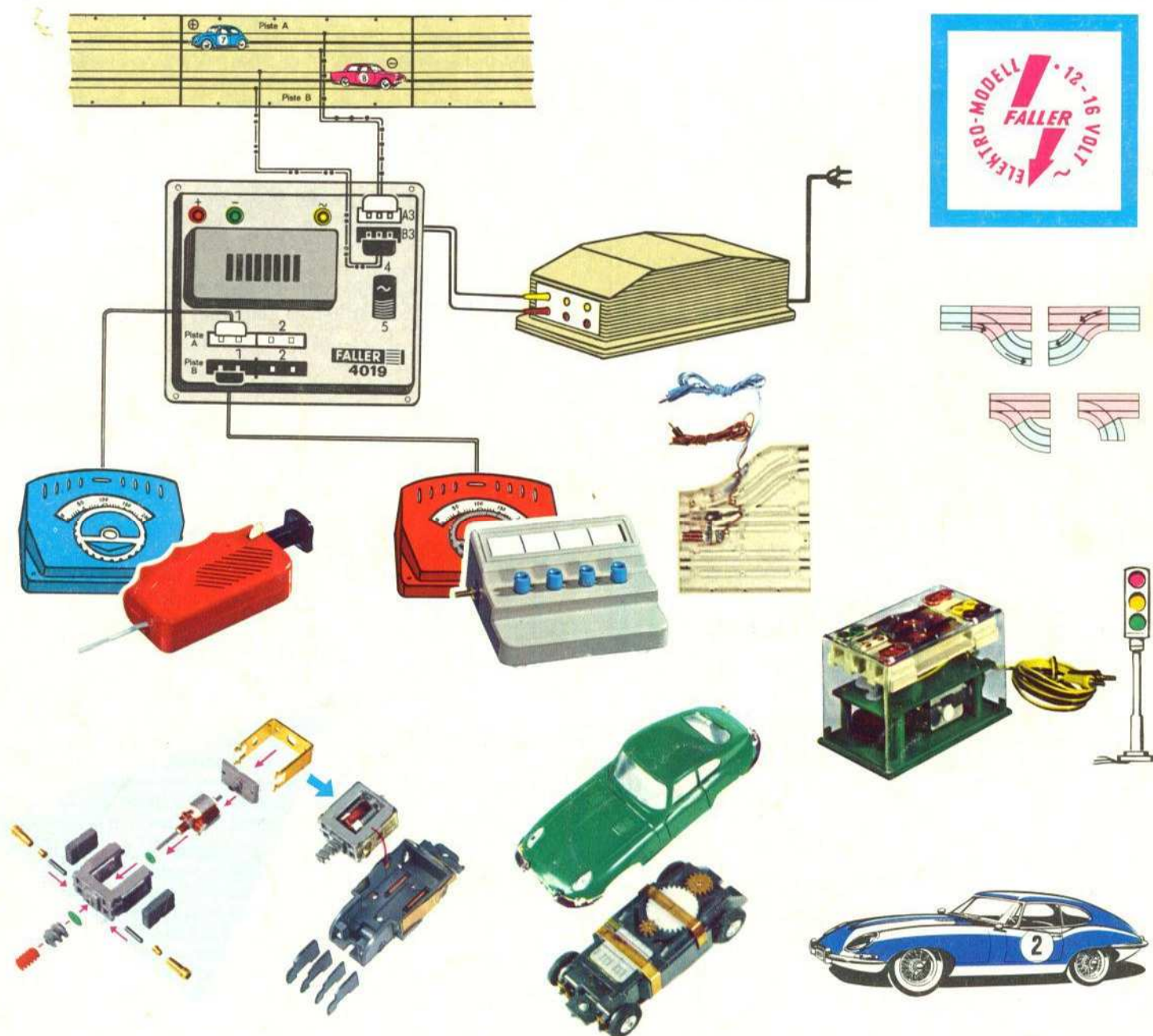




# FALLER

## A-M-S POST



## 2 TECHNIC



## FOREWORD

The cover picture on this pamphlet shows a number of electrical accessories, all of which have some particular function within the AMS system. They belong together, they match and complement each other and form the basis of the interesting FALLER expandable H0 system. The purpose of this pamphlet in the AMS POST series is to present systematically the technical side of the matter and explain clearly all details.

The more technology reaches into our everyday lives, the more interesting it is to work with. Technological toys bring you into more intimate understanding of these things in a pleasant and painless way, and educate your mind without your realizing it. When you understand the basic principles you soon realize that everything rests on really very simple natural laws. Clear thinking is all it takes to pave the way to comprehension of any technological problem.

It isn't always easy for the manufacturer of mechanical and electrical toys to achieve the most satisfactory functioning of technological parts within minimum size that will be handy to deal with, and still keep the price down to a sensible level. To meet all these requirements in a single package, some compromises have to be made. The FALLER AMS system is a well-planned and conceived one, based on many years of experience in solving this kind of problem.

The thought of producing an H0-gauge model highway

system arose from the idea of completing in the most realistic fashion the scenic background of the model railroad layout, where dead, motionless highways would be unrealistic beside moving trains.

All FALLER electrical items in the AMS system are so constructed that the so-called expendable parts, parts that may be expected to wear out in the course of normal use, are replaceable. You will notice in this connection that almost all parts either snap or screw together and there are practically no rivets used. This is intentional, for the above reason. In this way every purchaser knows that he will be able to service, repair, and renew his FALLER AMS items himself and save expense. Besides, it's a nice feeling to know you can handle these things all by yourself as they arise. In addition, cars and motors come in kit-form, not only to save money, but again to give you the added fun of actually assembling these little miracles of modern engineering. This way you learn the function of all the parts and if some malfunction should occur you can easily trace the source of the trouble.

If the following discussions seem dry and too detailed at times, bear in mind that no technological victory is ever won without some little bit of hard work. You have to work neatly and in orderly fashion and proceed logically step by step. But even this sort of thing can be fun. This pamphlet was written to help you, not to bore you.



Fig. 2

**If your FALLER  
dealer displays this sign,  
he has AMS spare parts**

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The motive power for all revolving and moving parts of our products is electricity. The highest voltage permissible for toys is 24 volts. All electrically driven FALLER parts run on 12 to 16 volts. This absolutely safe current is obtained from house current by means of a power pack or a transformer. Via distribution systems this low-voltage current is regulated and delivered to the roadway and other accessories.

## ROADWAYS

AMS roadways are assembled from joinable sections. There are single-lane and double-lane sections which can be assembled to form multi-lane raceways or highways.

The roadway sections are moulded in plastic. This plastic is tough and resists punishment but is slightly flexible to enable curves to be faired nicely. It is also trample-proof.

Guide pins on the cars run in a slot in the roadway to steer them. Sometimes bits of plastic flash may intrude into the slot as sections of roadway are pushed together, thus narrowing the slot and impeding the cars. If this happens, carefully remove any excess plastic with a knife till the slot is free. An accumulation of dirt can do the same thing. Check occasionally to be sure the slot is not only clean but clear of obstruction.

The road sections are joined by means of special hollow metal pins. These not only join the sections mechanically but also pass the current from one to the other. The current then reaches the car motor through the metal rails set in the surface of the roadway. Two spring-brass pick-ups on the bottom of the car brush along the rails and carry the current to the motor. If the joiner pins become spread too much through use and fail to make good contact, the current may not get through from section to section of the roadway, even though the sections are mechanically joined. This can be corrected by squeezing the pins a little so they make tighter contact with the rail tips.

The question arises, why we use separate joining pins instead of having permanent pins embedded in the plastic roadbed sections. The point is that these separate pins can readily be repaired or replaced if they grow too loose, as such projecting parts are bound to do with repeated use. Besides, the loose pins make possible sectioning of the track circuits for more individual control of traffic, by omitting selected pins you can break the circuit at any desired point. For example, an insulated section would be desirable at a parking place or in front of a gas pump, where a car would be under separate control by means of a separate electric switch, or if preferred by means of an automatic relay. Again, if more than one car is operating in one lane, one can be stopped by this means to let the other move instead, or one may be temporarily parked in a turnoff to let the other pass.

The power rails (roughly  $1\frac{1}{8}'' \times \frac{1}{32}''$ , or  $3.8 \times 4$  mm) are embedded in the plastic roadway and riveted fast. They project about  $\frac{1}{32}''$  above the road surface so that the car pick-ups brush them and not the road surface itself, thus making positive contact. The surface of the rails is treated to prevent rust, but even so, the roadway sections should always be stored in a place protected from dampness. After repeated use and especially after being cleaned by scraping with a piece of brass sheet, the rails become more and more susceptible to rusting.

In normal use on table top or floor, the hollow pins suffice to hold the roadway sections together properly. This is also true in the case of simple overpasses. But for long viaducts or places where a single-lane road makes a sharp climb, it is a good idea to use additional attachment in the form of special clips No. 4889. These are applied underneath to the ends

of the sections being joined. They are U-shaped and give the roadway greater rigidity, so that longer stretches, as for example a whole oval, can be handled in one piece without falling apart. Thus a small layout need not be disassembled while being moved from place to place or stored temporarily. With double-lane roadway, the same can be achieved by using two clips at the outside edges of each joint instead of just one at the center as with single-lane road.

Fig. 3



Fig. 4



With these introductory remarks behind us, we can now go on to discuss the actual electrical accessories. Although sometimes the discussion of some accessories may overlap, we will try to make everything clear. We will start with the power source, go on to discuss the two kinds of electric current, direct and alternating, and conclude with the transformer or power pack. After that we will proceed to the control devices and finally come to the actual toys themselves, the cars. After that come the other accessories such as traffic lights, crossing gates, turnoffs, and lap-counters. At last we will tell about generally useful items such as relays, switches, and the like.

Wherever it seems appropriate, the special replacement parts will be taken up at the point of their application and explained.

You may ask, is it really necessary to make such elaborate fuss over a toy that is so simple and easy to understand? Well, it is true, AMS is quite simple to understand, but it can be much more meaningful if the relationship between the various elements is thoroughly understood. And you can save costly repairs or replacements if you know what you are doing and how to take care of your equipment properly, and know how to make your own repairs and do your own servicing.

All our remarks here should be taken for what they are — hints and suggestions that enhance the enjoyment by making you independent of repair shops.



# POWER SOURCES - POWER PACKS

## POWER SOURCE - Power pack

By transformer we mean a device for changing house current, usually 110 volts, but in many countries 220 volts, to a more usable safe 12 to 16 volts. These latter voltages are met with in the field of H0 trains. The important characteristics of electric current are:

Current flow measured in amperes (A)

Potential (pressure) measured in volts (V)

Capacity (power) measured in watts (W) or volt-amperes (VA)

To understand easily the interrelation of these, compare a flow of electrical current with a flow of water. The amount of water passing by corresponds to the current and the water pressure to the voltage. The power of a stream of water, that is its ability to operate a mill, is the product of the quantity times the pressure (VA) or (W). A tiny brook with a considerable vertical drop can do as much work as a larger brook that flows slowly. It is just the same with electric current. The power, VA, is the product of the voltage times the current flow and is expressed in the formula  $V \times A$ .

So the power of a transformer is given in watts or volt-amperes. But in addition to the nominal voltage we sometimes give only the top permissible amperage. So both ways of stating the power are correct. If the motor of an AMS car, for example, draws 0.20 amps and we want to use four cars at once, then we will need a power source of at least  $4 \times 0.20$  A or 0.8 A or 13 VA.

When buying a transformer or power pack therefore we must always know what it is to be used for and allow for a certain amount of reserve power. Small, inexpensive transformers are not cheap if we

Of course, there are also power packs with both AC and DC output plugs. Usually, in America at least, when we speak of a transformer we mean only an AC source. A power pack is understood to mean a source of DC alone or both DC and AC. In Germany both are called transformers or "Trafos". So make sure what you are buying: "Universal transformer" is another European name for the power pack which gives AC and DC both. Naturally the latter is the best buy if you expect a wide variety of uses for your unit.

## Power pack 3604 (4017)

Let us begin with our smallest unit, found in our beginner's set 3900. Its power is rated at 3.6 VA and suffices for operating 2 cars, and it has a built-in rectifier as well as a thermal circuit breaker and puts out 12 volts DC only.



Transformer 3604

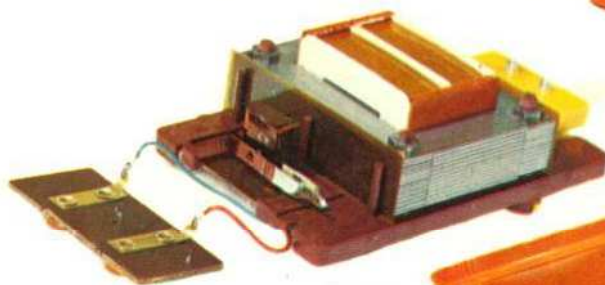


Fig. 5

find out after buying them that they lack power for the job and a larger one must be bought. More powerful units are usually relatively cheaper because of savings in manufacturing cost. On the other hand it would be a waste of money to buy a much-too-powerful transformer for a job needing only a low output of power. Therefore we urge you to choose wisely and buy advantageously. In themselves, AMS cars and other accessories draw very little current, because the cars weigh very little in comparison to the larger model cars of the 1:32 or even 1:24 scale sizes.

When buying a transformer or power pack, there is another important thing to watch. As you probably know, there are both alternating and direct current forms. Transformers put out alternating current, or AC. To get DC the AC output must be "rectified". You can add a rectifier to your set-up beyond the transformer, or, what is often more advisable, buy what is called a "power pack", that is, a transformer with a rectifier built into it, so that its output is already DC. If you need only DC, use a power pack, which gives DC from the AC house current, and thus have only the one unit to buy.

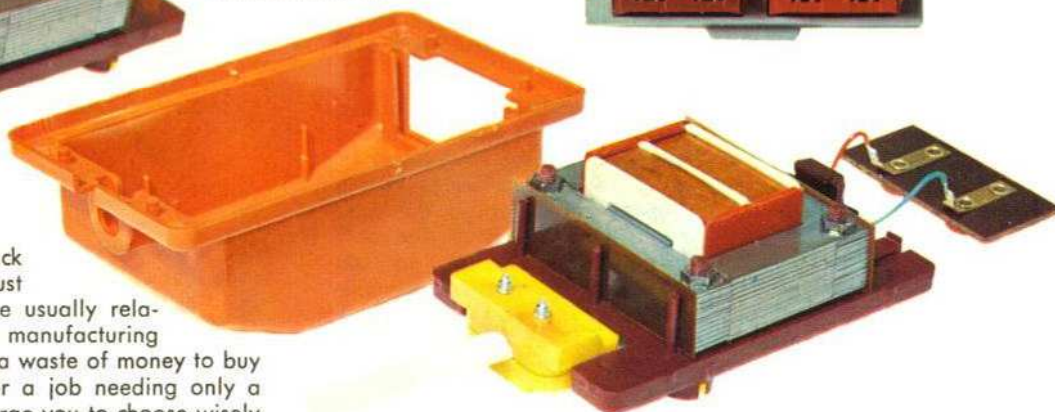


Fig. 6

Transformer 3514



On its front side are the output connections. They consist of four color-coded special-shaped outlets as well as one pair of regular jack sockets (2.5 mm size) for putting out 12 V DC. Set 3900 contains four color-coded double plugs which are to be plugged in to their matching colored outlets. This completes the hook-up. To add additional accessories (lap-counters or turnoffs) use the standard outlets. If it is desired to enlarge a double-lane raceway to a four-lane one, it is suggested that you buy an additional power pack of the same sort, to power the addition. But with this set-up it is not possible to operate cars under separate control one behind the other in the same lane.

#### Technical data:

Input (primary voltage): 220 volts

Output (secondary voltage): 12 V DC/0.3 Amps.

Power rating: 3.6 VA (watts)

Has thermal circuit breaker (short-circuit protection)

### Transformer 3514 (4016)

This transformer gives 16 V AC only. It was formerly the standard power source for AMS. Its power rating of 0.9 amp is sufficient to operate 4 cars, with or without turnoffs, lap-counters, etc.

To obtain DC (for example for top racing performance) add unit 4020 (formerly 4019).

This transformer can still be recommended, especially since the improved cars do not necessarily call for use of DC, although the performance of the cars is as a matter of fact enhanced by use of DC in racing.

### Power pack 3725

This new unit came into being as a result of experience in racing with the larger cars in the 1 : 32 and 1 : 24 sizes.

It has a choice of output, 12 V DC at 1.5 amp or 16 V AC at 1.5 amp.

The power rating is 24 VA on AC or 18 VA on DC.

Thus you can operate a raceway with two cars drawing 0.7 to 0.8 amp each, in the 1 : 32 or 1 : 24 sizes. With a view to all possibilities, this unit is adapted also for use on larger AMS layouts with up to 10 cars plus accessories or on H0 train layouts. This power pack is thus a very good buy, considering its wide range of usefulness.

### Power pack 3740 (6016)

This is a real power pack, similar to 3725, but with an output power rating of 40 VA on AC and 32 VA on DC.

In addition it has on the rear side a voltage selector switch, giving a choice of 8, 14 or 18 V on AC, or 6, 12 or 14 V on DC. This unit has short-circuit or overload protection in the form of a button that pops out on the top of the housing and shuts off current until the short or overload is corrected, after which current is restored by pressing the button in again. Thus even if the layout is operating with no one in charge, no damage can result from a short.

Now we come to the use of direct current. As you probably know, alternating current consists of two components, flowing in opposite directions, and these alternate or reverse their flow 50 or 60 times per second, depending on the "frequency" of the power source. A pictorial representation of this would be a so-called sine-curve, that is, a uniform wavy line with wave crests and wave valleys alternating with one another. The crests represent the alternate flow in one direction and the valleys the alternate flow in the other direction.



Fig. 7

Power pack 3725

As a symbol for AC therefore we frequently see a wavy line, while an equal sign = stands for DC. In AC the frequency is measured in "cycles", or pulses per second.

Since selenium has the property of letting through current in only one direction, this property can be used on AC to act as an electrical valve, letting only one half-wave through. Metal plates coated on one side with selenium are thus stacked to form a one-way valve for an electric current. By the use of four suitably arranged such valves (selenium plates or rectifiers) we can convert AC into double-wave DC (two-way rectification).

The capacity of the rectifier depends on the size of the selenium area. This is the most usual method of rectification. It can be performed with silicon as well as selenium. The above-described function of AC and its rectification is of importance not only for the production of DC, but has also a special application in the operation of two cars under separate control in one and the same lane at the same time. This will be discussed later on.

To prevent the overloading of a transformer and to keep a short circuit in the toy circuit from affecting the house current, safety devices are needed.

All FALLER power packs and transformers are protected against shorts. This protection consists of a strip composed of two different metals with different expansion rates when heated. Too much current heats this strip and the unequal expansion of the two metals makes the strip curve and break the circuit until it cools down. This turns off the transformer until the cause of the short is removed. Then the cooling strip straightens out again and restores the current flow automatically. The only exception to this is the big power pack 3740, where for special reasons the flow must be restored by the operator pushing the button back to normal position.

For reasons of safety, the transformer or power pack must be sealed inside a housing. This housing should never be opened except by a licensed electrician. For this reason all our units are sealed either with a fused plastic pin or, in the larger models, with a painted-over screw fastening. FALLER power packs and transformers come with a 79-inch cord.



## HALF-WAVE PRINCIPLE

If we wished to run only one car on our roadway, we would need to use only DC and this would be the end of the chapter. All our auto motors are basically DC motors. They give best results when operated on DC. A DC motor must never be operated on AC. If we want to operate two cars in one and the same lane at the same time but under separate control, we will have to work with half-wave current. The performance is not so high as on pure DC but quite sufficient for our play operation.

All FALLER AMS cars have a built-in one-way rectifier. We divide our stud of cars into two groups. One group runs on the upper half-wave (plus) and the other group on the lower half-wave (minus).

We will now discuss a combination which depends on this exploitation of half-wave current. For the sake of simplicity, we imagine to ourselves the AC current as consisting of two different kinds, in our diagram represented by a mixture of an equal number of red and blue pellets. Now we send this mixture through a pipeline that opens into a sorter that separates the red and blue pellets and sends the red ones through one off-shoot pipe and the blue ones through another. The separator consists of two filters or rectifiers (selenium plates) which, being placed facing in opposite directions, separate the two half-wave components of the AC and send the plus component down one route and the minus down the other. Now we install in each of the separate routes (pipes, wires) a gate-valve (speed-controller 4031 or 4033) and operate these latter independently of one another. This regulates the proportion of red and blue pellets (plus and minus electricity). Now the two streams of current are reunited into a single conductor,

in which of course are found only the relative proportions of red and blue pellets (plus and minus current) as are let through by the two independent controls, as the relative setting of each allows. Now if we expose two cars to this remixed current, and equip both with selenium rectifier valves, one set to accept only red pellets ("plus" current) and the other to accept only blue pellets ("minus" current), one car will be run on red pellets (plus current) only and the other on blue (minus) only. Now as we advance or retard one or the other control valve, we send more or less of the individual kinds of current to the one or the other car, and thus are able to control the speed of each car independently of the other, or even stop one and not the other.

This interesting development is now exploited and this is how we are able to operate two cars in one and the same lane but under individual control. And we can run a special kind of race based on this principle.

Of course, we could achieve the same sort of result if we built more power rails into the roadway, for example in scale 1 : 32. While this method is perfectly possible even in simple racing, it would lead to unacceptable complications in restricted space and in the case of turnoffs and the like.

No special explanations are needed for starter set 3900, since the hook-up from power pack to roadway is already color-coded right on the unit.

The other sets contain the universal switchboard 4019 or 4020.

But since the quality of the cars is so high that we can dispense with DC under normal operating conditions and use it only

## UNIVERSAL SWITCHBOARD 4020

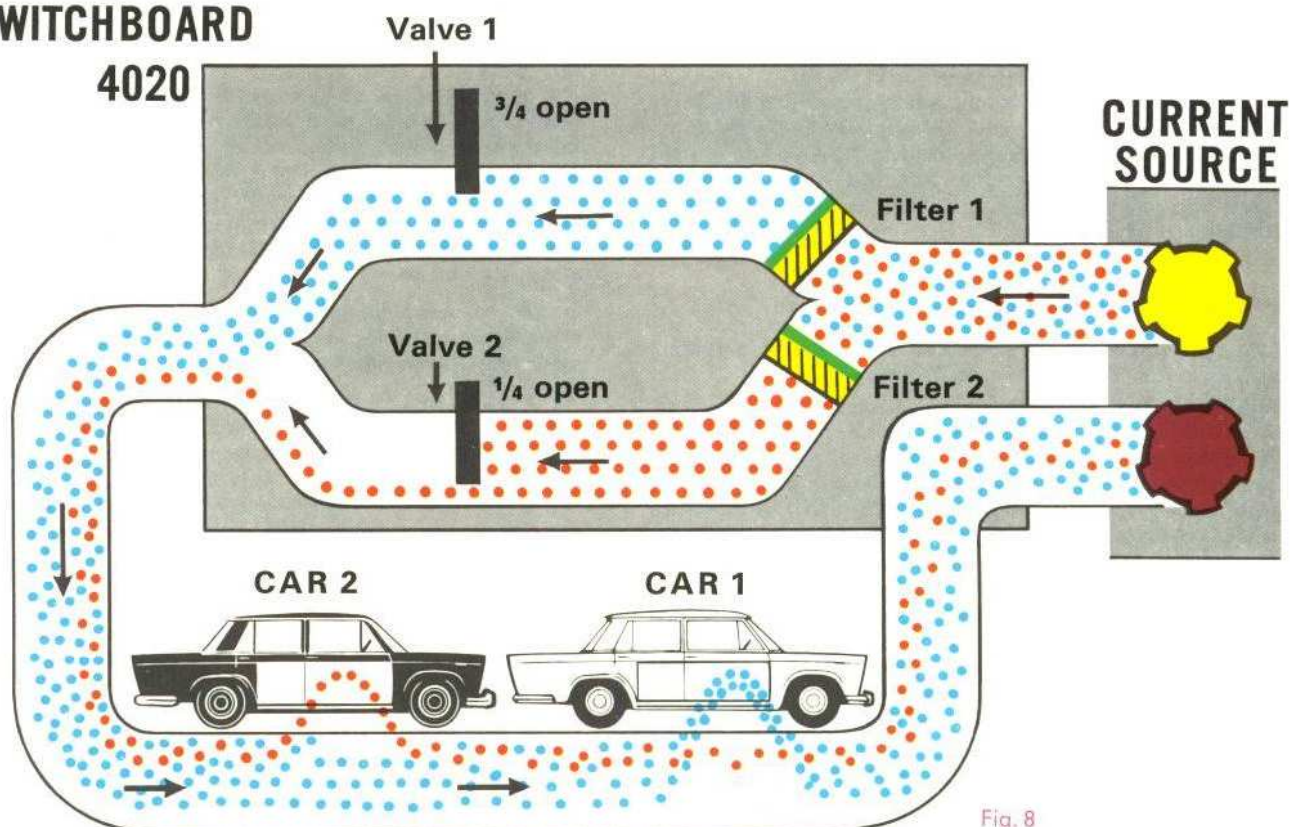


Fig. 8



# CURRENT DISTRIBUTION

under most exacting competitive racing conditions, a distribution system is all we need, without switching over to DC. Besides, we use now a power pack which when needed can supply DC.

Therefore switchboard 4019 was simplified and made less complicated in its hook-up. The new unit is supplied under the number 4020, beginning in 1968. All we need do therefore is describe the new 4020 unit. Anything we say about 4020 of course also applies to 4019.

## Hook-up unit 4020

1. Plug in cord with yellow-and-brown plug into the AC-DC power pack.
2. Light red or dark red double outlet for plugging in roadway lanes 1 and 2.
3. White and black row of outlets for plugging in control units 4031 or 4033.

Fig. 9

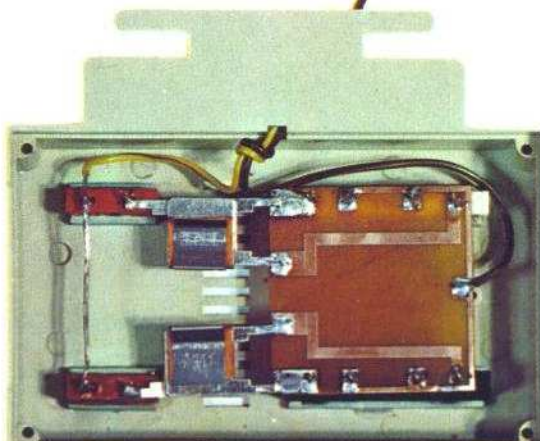
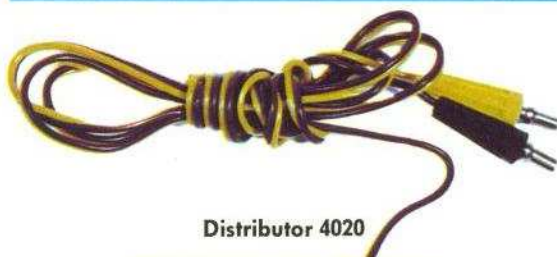
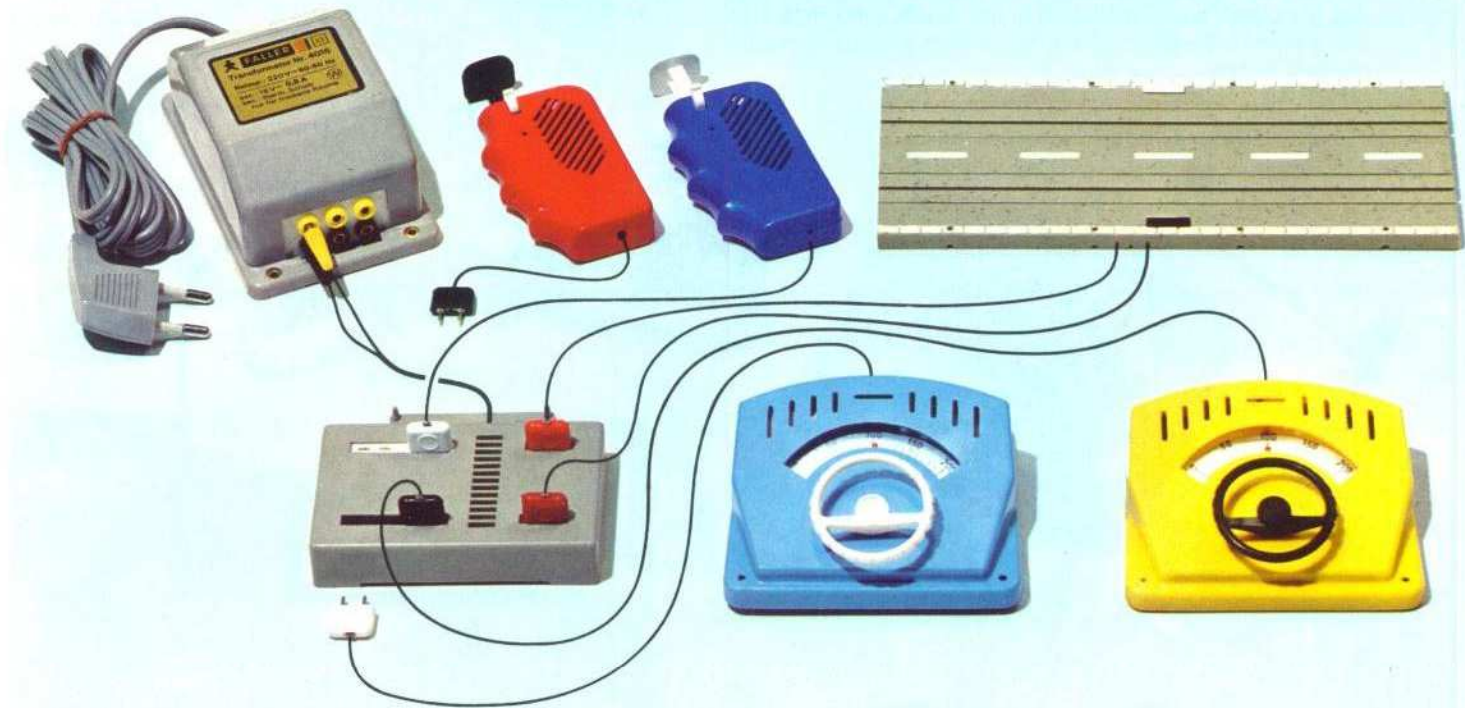


Fig. 10

For normal operation (side-by-side racing) only one pair of outlets in the black and white outlet rows is needed. The two unused outlets are covered with a blind-plate. It must be removed for pursuit racing (both cars in same lane).

In this unit there is a rectifier built in. The AC coming from the power pack via the yellow-and-brown cord is filtered through the rectifier as described above and then fed in reassembled form to the roadway. So, when running on AC the cars operate on half-wave current.

But if we plug 4020 directly into DC from the power pack or some other DC source, this current is likewise fed to the roadway. But in this instance bear in mind that the yellow plug must be inserted into the plus outlet and the brown one into the minus outlet. Of course, you can now operate cars without the little selenium cells or the like built in.

In the construction of unit 4020 a solution has been found which combines simplicity and universal applicability. It is so built that it can be mechanically coupled with FALLER power packs or transformers. Of course, other makes of power packs or transformers can also be used if they have either a 16-volt AC or a 12-volt DC output.



# CONTROL APPARATUS

In order to control the intensity of the electric current and thus the speed of the cars, a variable resistance is needed. So the current is led through a coil whereby the resistance can be varied in infinite stages. This "rheostat" consists of resistance wire wound around a heat-proof core.

In passing through the rheostat the current is used up to a greater or lesser extent according to the position of the setting and converted into heat. At one particular setting, all the current is thus diverted. There is a range of variation as the setting is changed, from complete diversion of the current, giving 0 power, and fully free current flow, giving maximum power. With the setting on full power, the rheostat is to all intents and purposes completely cancelled out and the controller gives off no heat. The more the rheostat comes into play and the longer the time elapsed in this position, the hotter the unit becomes. Therefore the core of the coil must be highly resistant to heat.

In the AMS line we recognize two types of controllers.

## 1. Speed control 4031

Here a metal finger attached to the shaft of the "steering wheel" slides along the rheostat coil. The more the wheel turns to the right, the shorter the segment of the coil that is in action to impede the flow of the current and so the faster the car will run. The wheel can be left at any desired position and thus maintain even speed.



Fig. 11



Fig. 12

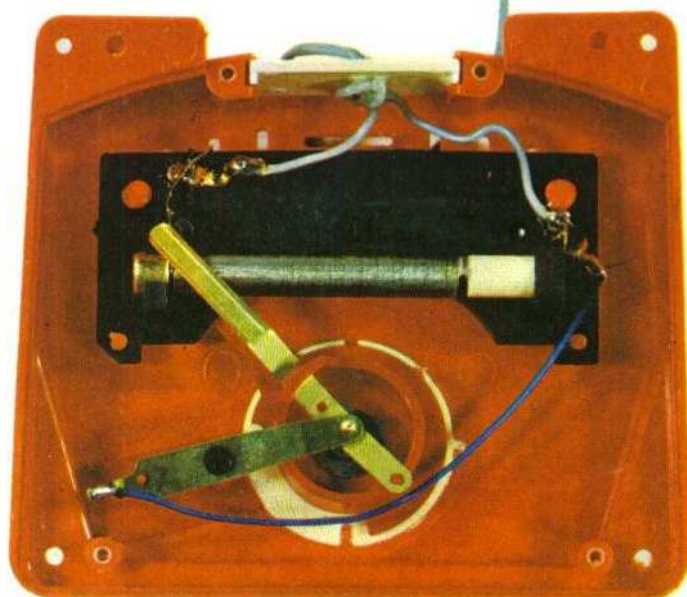
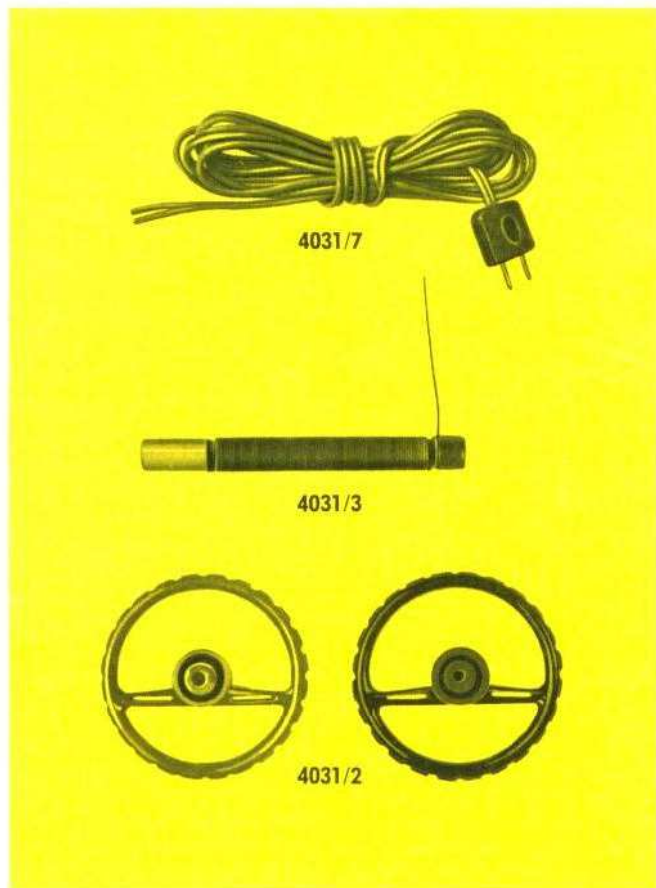


Fig. 13

- 4031/2 red or black "steering wheel"
- 4031/3 complete resistance coil for 4031
- 4031/7 cord and plug for 4031 or 4700



# HAND THROTTLE

## 2. HAND THROTTLE 4033

This unit is preferable for racing situations where quicker reaction is desirable. It is held in the hand and operated by thumb pressure on the button. This action reduces the part of the resistance coil being used and so the harder the pressure of the thumb, the faster the car runs, just as in the speed control. The heating effect is more noticeable here than in the other type controller.

Both types of controller are fully demountable. Their construction calls for more material and labor but results in far longer useful life. Worn parts can be readily replaced and damage repaired. For reasons of economy, replacement parts are sometimes sup-

plied in grouped sets. In these matters we always plan on the normal routines of service and repair, and the sets contain parts usually replaced at about the same time in the life of the unit. This saves you money.

the type of control needed. Resistance is measured in Ohms ( $\Omega$ ). The tiny AMS cars require much higher ohm values in the controls than the larger 1 : 32 and 1 : 24 cars. For comparison, the AMS cars need 100 to 120 ohms, and the 1 : 32 cars 20 to 50. The supermotors, which draw 2.5 amps require only 12 to 20 amps.



Fig. 14

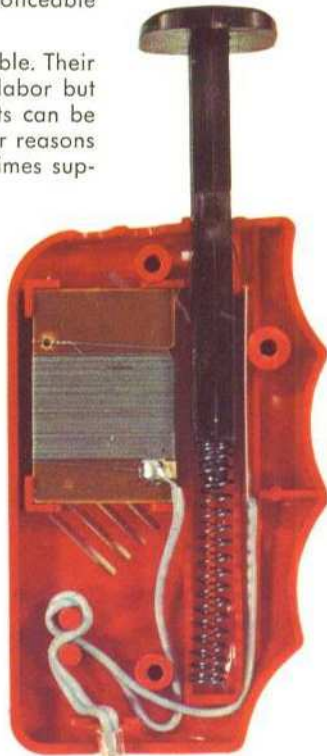


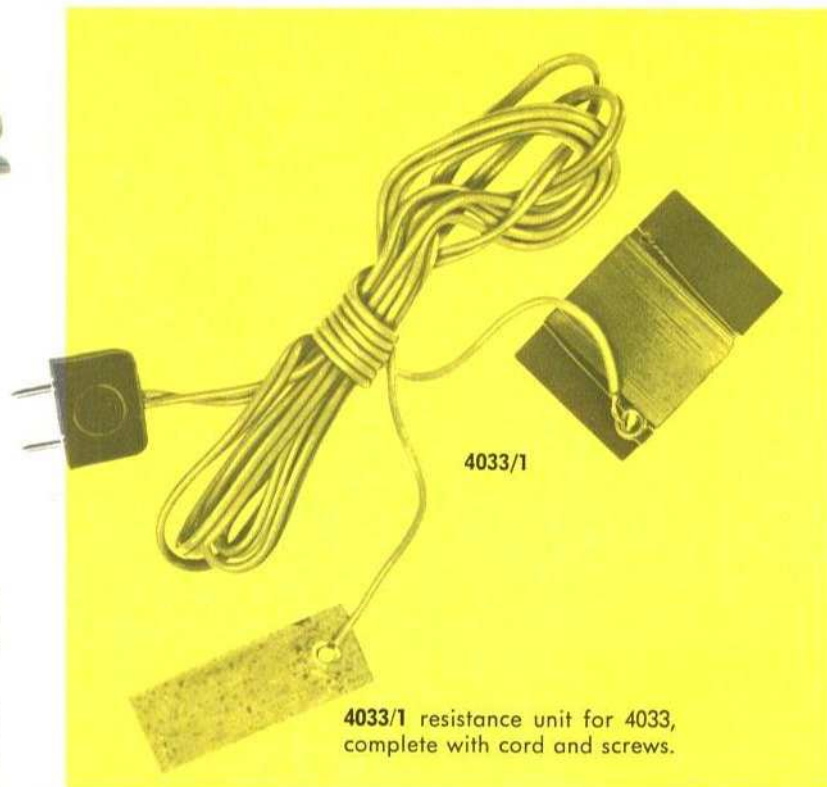
Fig. 16



Fig. 15

plied in grouped sets. In these matters we always plan on the normal routines of service and repair, and the sets contain parts usually replaced at about the same time in the life of the unit. This saves you money.

How great a resistance is required in these controller rheostats? This of course depends on the amount of current needed in various applications and the amount drawn by the car types in use. It is very important that the resistance be matched to



4033/1

4033/1 resistance unit for 4033, complete with cord and screws.

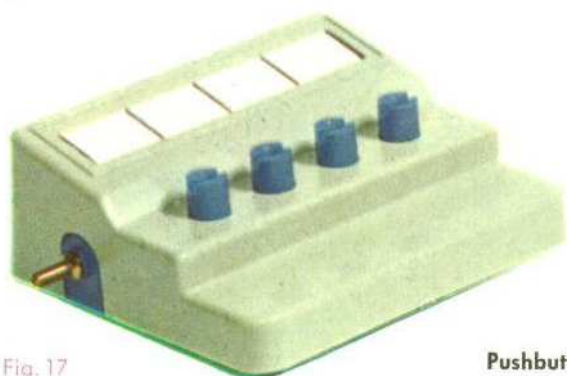


## ON-OFF SWITCHES

For operating momentary electrical impulses, as for example in operating the turnouts, a push-button is ideal. For longer current feed a way to turn the current on and then off again is needed.

Our 4034 unit fulfills both functions. For purposes of economy it is made up as a bank of four separate contacts, each operated by a pushbutton. Current is fed to the unit via a projecting pin on the left side which connects to an outlet socket on the right side. Thus as many 4034 units as may be necessary can be snapped together in a row, all fed from the one input pin.

Across the back of the unit are four sockets from which electromagnetic accessories may be operated via cords and plugs. Each of the four push-buttons of course controls one of these sockets. The spring mechanism returns the button to the off position as soon as the finger is removed, so this is the ideal arrangement where momentary bursts of current are required.



Pushbutton unit 4034

No replacement parts are ever needed for this unit. But it can happen that after long use or exposure to dampness the contact surfaces may become dirty or corroded and need cleaning. It may also be desirable at times to strengthen the contact pressure by bending the spring strips a trifle.

For CONTINUOUS CURRENT the same unit serves. When for instance lights are to be turned on with it, twist the button after pressing it and it will stay down and feed current to the lights until released by twisting the button back.

Now to demonstrate the use of unit 4034, we can use the operation of traffic lights as an example. And here we will need an additional accessory, the distributor 4044.

4044 has four rows of plug sockets. In each row one socket is for input and the other three for output. In our demonstration we will use the traffic lights at a "squeeze", where one-way traffic has to be maintained at a given point because of some obstruction. In principle this is no different from traffic lights at an intersection, where there are four lights. Here we need only the base unit pictured on page 12.



Fig. 19

Distributor 4044

While one light shows red the other shows green and vice versa. So the red of one light must be fed current from the same row of sockets as the green of the other, as in the diagram in Fig. 24. The yellow lead from both lights is here shown plugged into the second row. Row three of course is hooked up just the reverse of row 1. The three rows are now each connected to a different socket in unit 4034, and you are ready to roll. Press the first button and one light shows red and the other green. Let as many cars pass in that direction as desired, then press the second button and both lights show yellow in warning of change. After a brief pause release the first button and press the third, which reverses the signal, and then release the second button to turn off the two yellows. Now traffic moves in the opposite direction.

At an intersection you are the cop and control the traffic on two streets, and after you try it you will see that the real cop's job is not quite so easy as it may look.

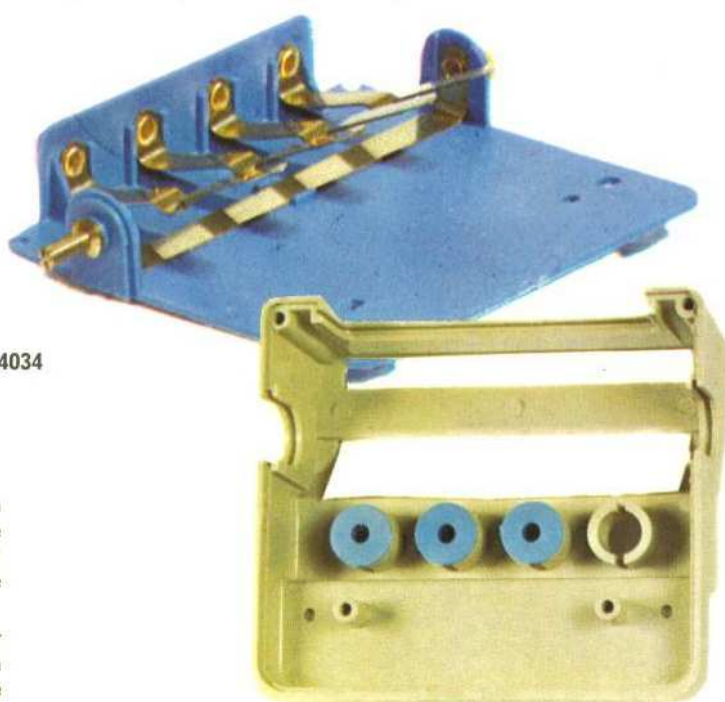


Fig. 18



The sockets in the pushbutton unit and the distributor are standard size for 2.5 mm plugs.

FALLER plugs come in two forms:

694/1 100 plastic plugs, small, assorted colors, in box.

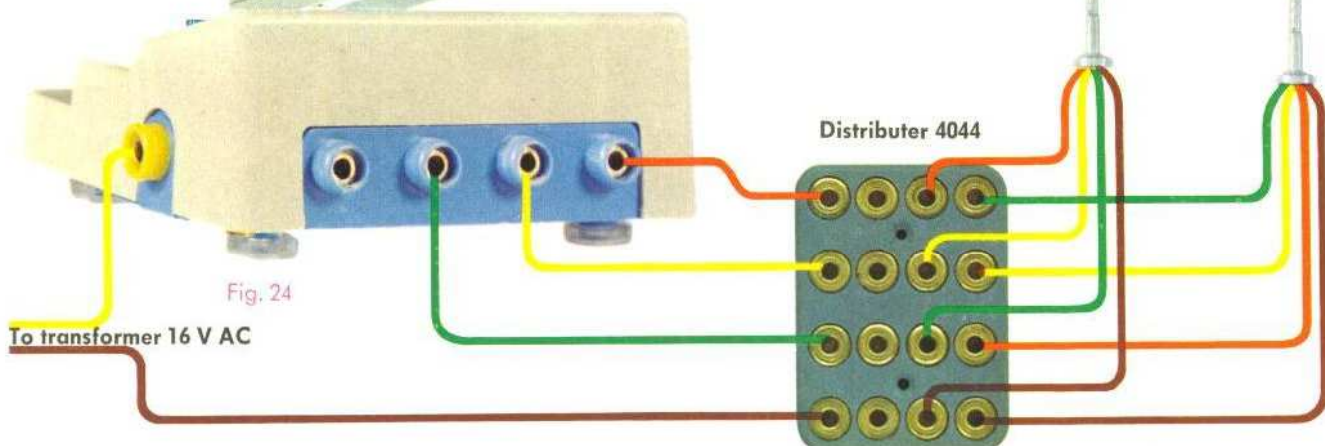
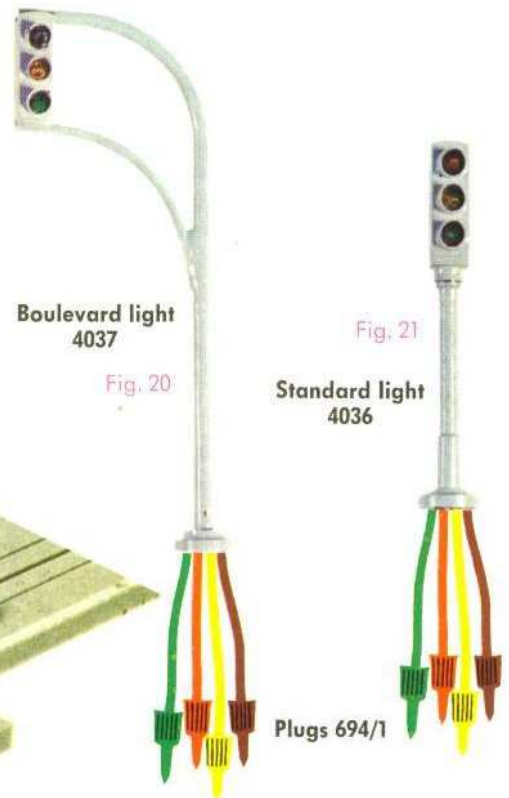
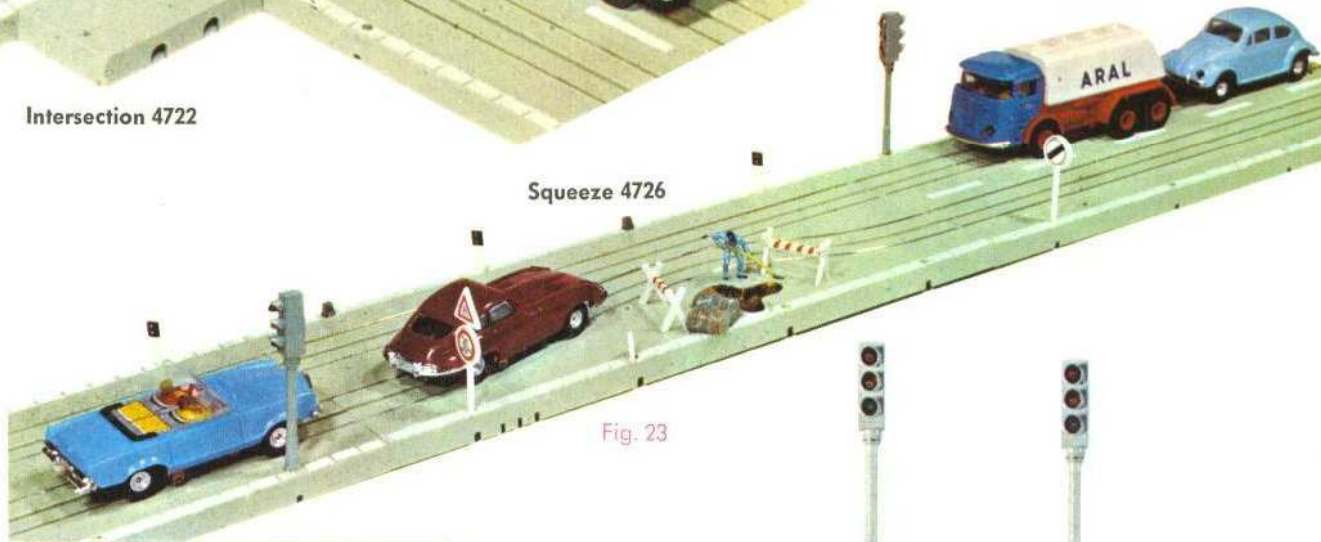
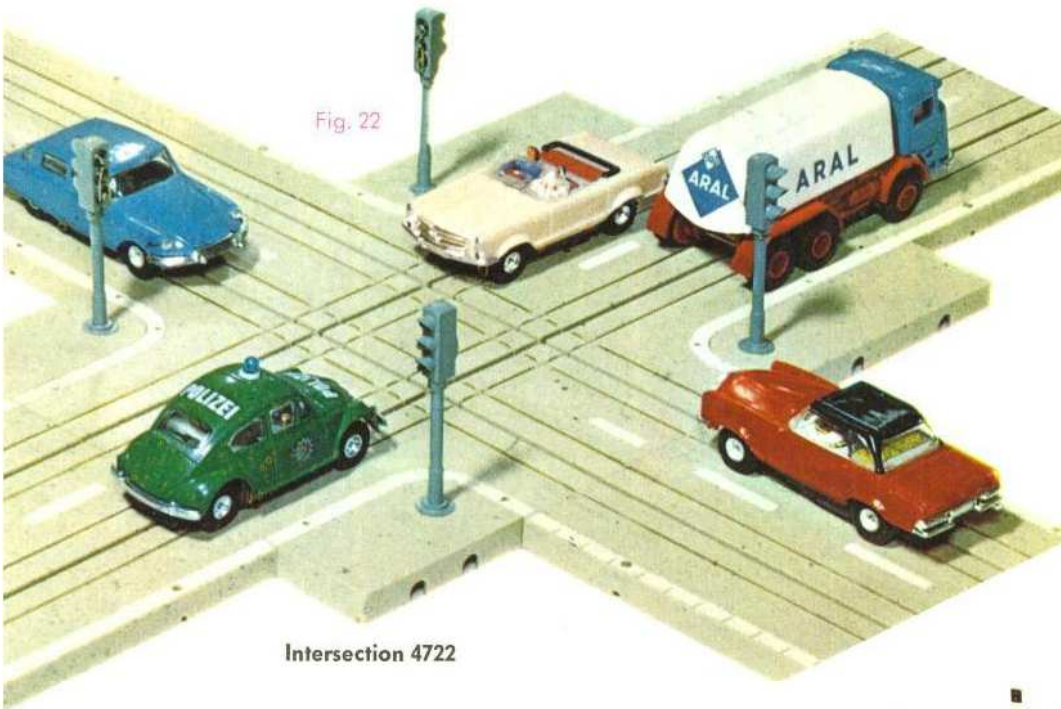
694/2 20 plugs with cross-slot, 2.5 mm, insulated grip, assorted colors.



# TRAFFIC LIGHTS

Wherever traffic is heaviest, the simplest way to regulate it is with traffic lights. We have created model traffic lights for the sake of truly faithful model traffic.

The bulbs required for this are very tiny and therefore very fragile. The current must be fed through very tiny spaces. Color-coded wires and terminal plugs indicate the red, yellow and green lights. It takes some doing, but it is perfectly possible to replace burned-out bulbs.





## TRAFFIC LIGHT BASE SET 4040

The chief use of traffic lights is at street intersections, where four are needed. To regularize the current-feed system, a special set of parts was created. Here again, the major problem was to get all the essential parts into minimum space.

The light standards are inserted into four grey base pieces on the four street corners and wiring is carried across under the

roadway. Along the inner edges of the two larger base pieces is a blue strip for the wiring terminals.

After plugging in the color-coded wiring into the proper sockets, we end up with essentially the same arrangement for the four lights as we met with in the case of the two lights guarding the squeeze situation on page 11. At an intersection the two diagonally opposite lights are always wired in parallel by means of unit 4040.

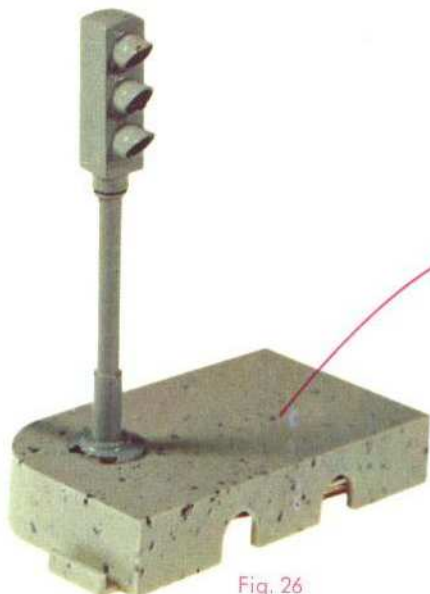


Fig. 26

Fig. 25

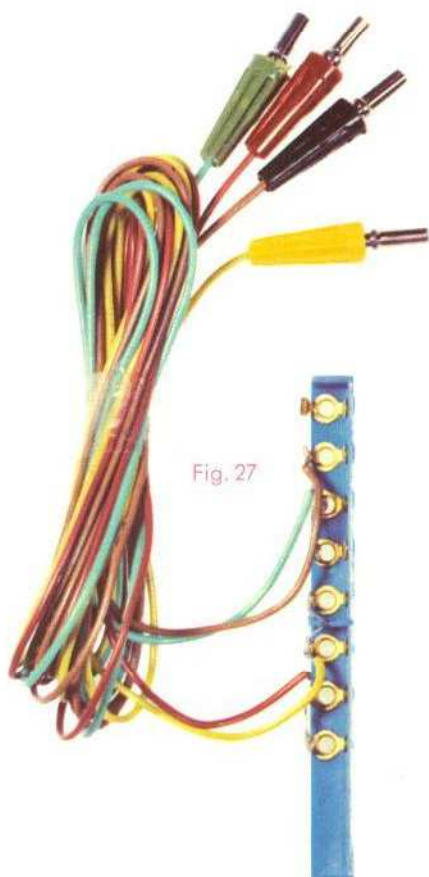
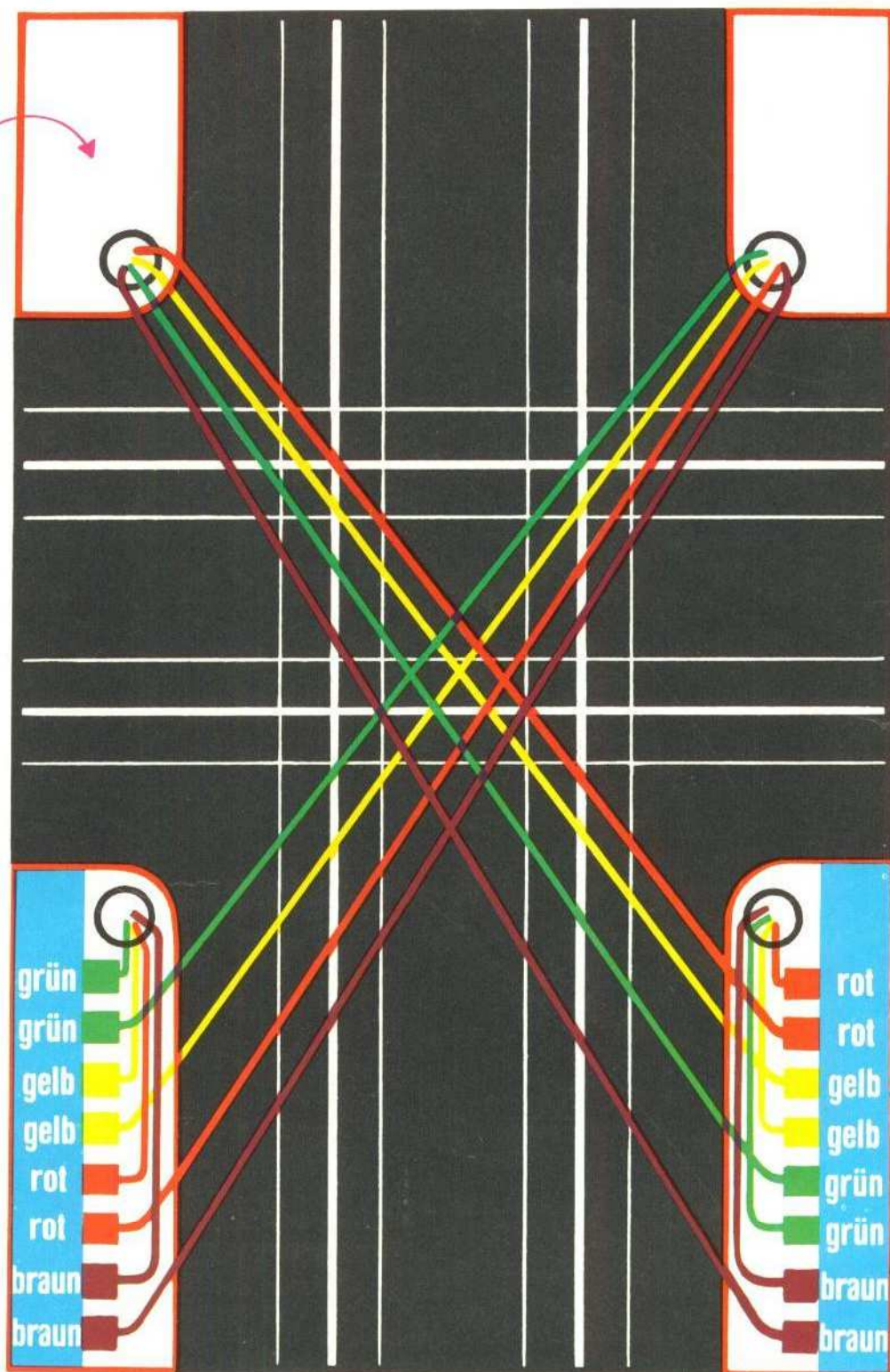


Fig. 27



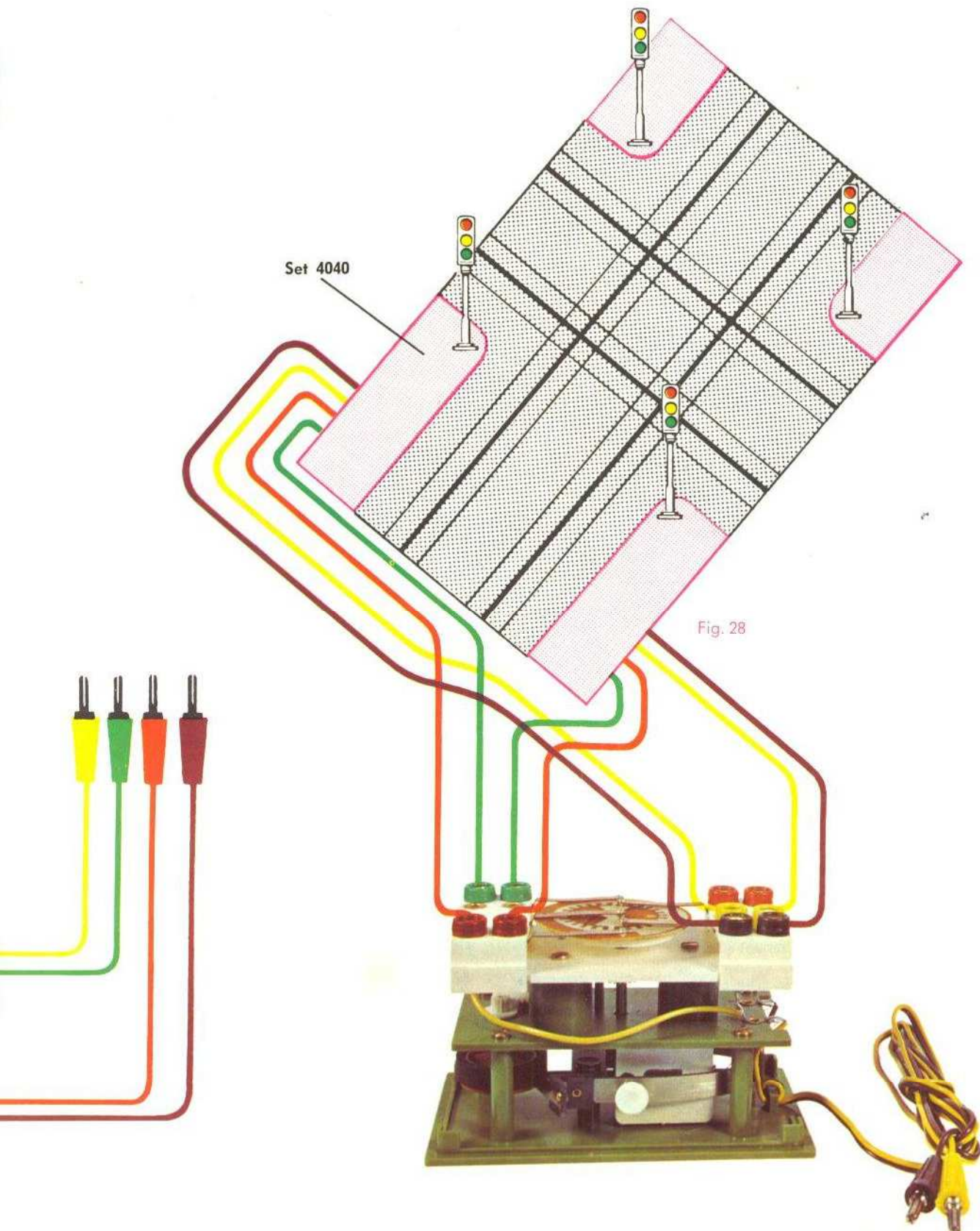
# AUTOMATIC TRAFFIC LIGHT CONTROLL 4041

As a rule, real traffic lights are operated by an automatic device. We have reproduced this effect in miniature with our automatic light control.

A driving mechanism turns a disc on which are printed contact rings. Metal fingers with silver rivets transfer the rhythmic series of electrical contacts to the lights themselves.

For Sunday or late night traffic the pattern can be altered to flashing yellow lights.

The driving mechanism in this control corresponds to the one in the grade-crossing gates B-4733 on page 21.





# CARS

The center of the stage in the AMS line is occupied of course by the actual cars themselves. There are two types of cars, each adapted to a particular role.

1. The "block motor" with traditional armature and commutator. It represents the smallest feasible DC motor. The fore-and-aft drive shaft makes installation and replacement of the driving worm easy.

2. The flat-armature motor with large-diameter 3-pole armature and disc-type commutator. This motor is very powerful, the drive-shaft is mounted vertically and the drive is transmitted to the rear axle by means of gear wheels.

We will discuss the block motor in detail first. It is so constructed that it can be easily assembled and dismantled at any time.

The armature is centrally located and is built up out of a number of armature stampings, pressed into a unit and mounted on a shaft that passes through the center. This metallic core is insulated and wound with the finest lacquer-coated copper wire. Each of the three separate windings consists of 280 turns. The ends of each of these coiled wires are led to the three curved commutator segments and are soldered fast.

The armature and commutator are inserted into the motor housing which also contains the main bearings, the two magnets and the brush holders. The brushes, whose job is to pass the current to the armature windings via the commutator segments, are held against the latter by springs of suitable tension. These springs are mounted inside the brush holders. At one end of the motor housing the motor shaft protrudes. A driving worm is pressed on to this. Depending on the ratio between this worm and the one on the rear axle of the car two different speeds are possible. For city traffic you should have the slow-running ratio of 1 : 12. For fast running the ideal ratio is 1 : 5. In the kits equipped with this motor we supply the 1 : 12 gear ratio.

The car chassis is shaped to receive this motor easily. There are also cavities for the weights. The basic problem with these tiny cars is to give them enough weight to make good contact with the pick-ups on the power rails. In model locomotives it is far simpler to get good contact. They travel slower and are heavier. Larger-scale cars are also easier to make sufficiently heavy in comparison to their power. So we must always bear this factor in mind and service the cars to assure good contact. This brings us to the pick-up shoes which are slung from the underside of the chassis. The pressure of these pick-ups on the rails is governed by tiny spiral springs. These are also inserted in the underside of the chassis but clumsy handling can result in their being lost. So be careful!

The insertion of the rectifier into the cars, mentioned above, can be done in two ways. Either a selenium plate is inserted into the wiring system or a pick-up is used with a highly effective diode rectifier inserted into the circuit. The latter is the more recent scheme of things, although the earlier practice of using the selenium cell is technically just as good. The reason for the change in method is that in normal racing side by side no rectification is needed and the selenium cell is more of a nuisance than a help.

In case you want to operate two cars in one and the same lane, one behind the other, it is far easier and handier to remove the regular pick-up and substitute a diode-equipped one that it is to take the car apart to insert a selenium cell. So the change of method was made in the interest of convenience.

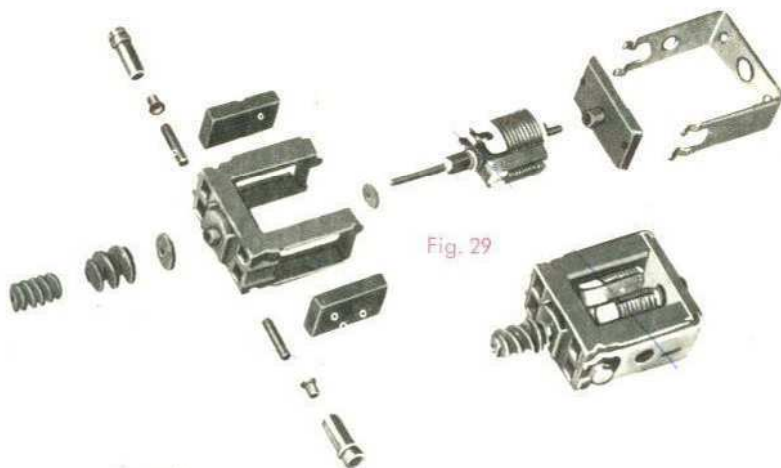


Fig. 29

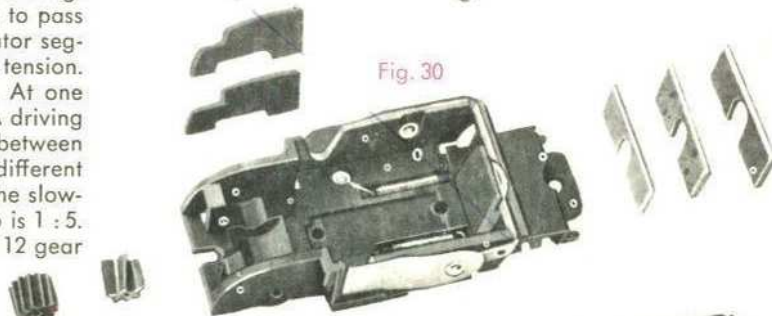


Fig. 30

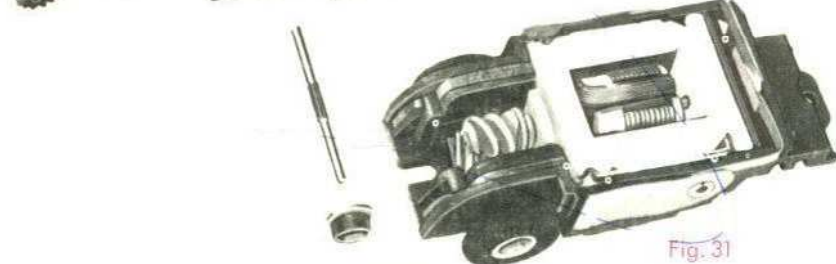


Fig. 31

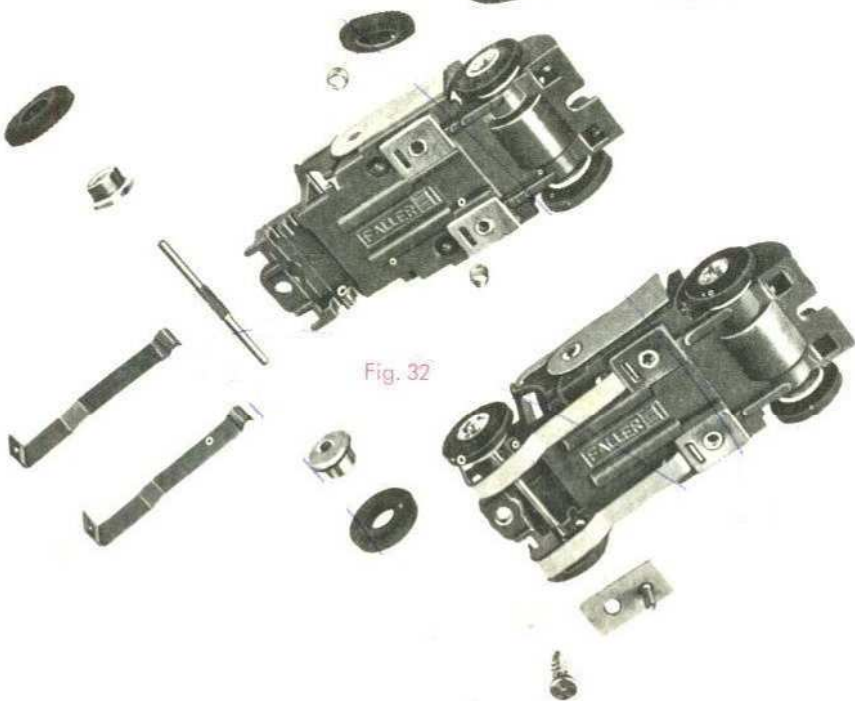


Fig. 32



## Pick-ups

Material — bronze strip about  $\frac{1}{64}$ " x  $\frac{1}{8}$ " (0.4 x 3 mm). Must be replaced after about 120 hours of service.

## Pressure springs for pick-ups

Material — 0.15 mm phosphor bronze. This is not a part that can wear out but they are easily lost when changing pick-ups.

## Rubber tires

Material — rubber. Tires must be replaced after 200 hours of use, more or less, according to type of operation.

## Selenium plates

- A  $\frac{1}{4}$ "-square size is used for cars with block motor.
  - B  $\frac{7}{16}$ "-square size is for cars with flat-armature motor.
- The selenium plate can be ruined by too high current intensity or by mechanical damage to the selenium layer. If a car or electrical accessory is operated on AC with a damaged selenium plate, the winding of the coil or the armature will be ruined, too!

## Guide pin

Material — nylon. Must be replaced after about 60 to 80 hours of use.

## Block motor

3-pole DC motor for use on 12 V DC or 16 V half-wave current. Speed without load — 12 000–16 000 rpm, drawing 80–100 mA. Under load the maximum current drawn is 120–140 mA.

## Chassis for block motor

TV interference suppressor built in. 2 chokes with HF-core and ceramic condenser 2500 pf.

## Gears

Material — nylon. Two white gears are for 1 : 5, red ones for 1 : 12.

## Armature for block motor

3-pole armature with cylindrical commutator. 280 windings per pole, using special lacquered wire 0.08 mm diam.

## Brushes for block motor

Special brushes must be replaced after about 150 hours' use.

## Pressure springs for brushes

These are not subject to wear and need be replaced only if lost through careless handling.

## Ceramic magnet

These magnets built into the block motor are of magnetic-quality Oxite 100. The N pole may be indicated either by a notch or red paint. In installing these into the motor housing it is of utmost importance that one N pole be turned inside the housing and the other outside.

Not shown:

4801/12 Weights for block motor.

Fig. 33

4800/1a



4800/2



4800/3



4800/4



4800/5a



4800/5b



4800/6



4800/8



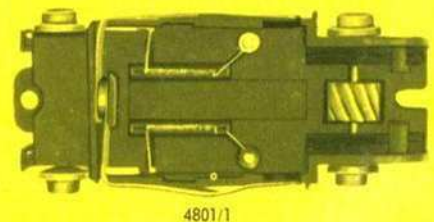
4800/10



4801/0



4801/1



4801/4a



4801/4b



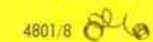
4801/6



4801/7



4801/8



4801/9



4801/11





# FLAT-ARMATURE MOTOR

This is also a high-speed, very powerful DC motor. But it does not come apart into so many separate pieces as the block motor, for some of the gears are permanently mounted on their axles. However an auto kit with this motor can be just as interesting to the hobby-minded as the block motor kits.

If you have assembled your car from the ground up you know and understand it much better than if you bought it ready to run. Servicing and repairs will be far easier to do since you will know what you are doing. Cost is important, too. You can get 3 car kits for the price of 2 ready-to-run models.

When assembling, it is important not to confuse the pick-up springs with the brush springs. The pick-up springs are of uniform diameter while the brush springs taper at each end. As mentioned above, the armature has only one bearing. This keeps the commutator cleaner. The bearing insert consists of sintered metal so it need not be oiled. At this point you may ask the question, whether the higher-quality product is really worth the extra cost. At first glance we often do not consider quality. Cheaper cars and motors could be produced but the question is whether it is worth it to buy a cheaper car and simply throw it away when it gives trouble. We prefer to manufacture in such a way that the user gets a quality product that he can repair or renew himself economically when necessary.

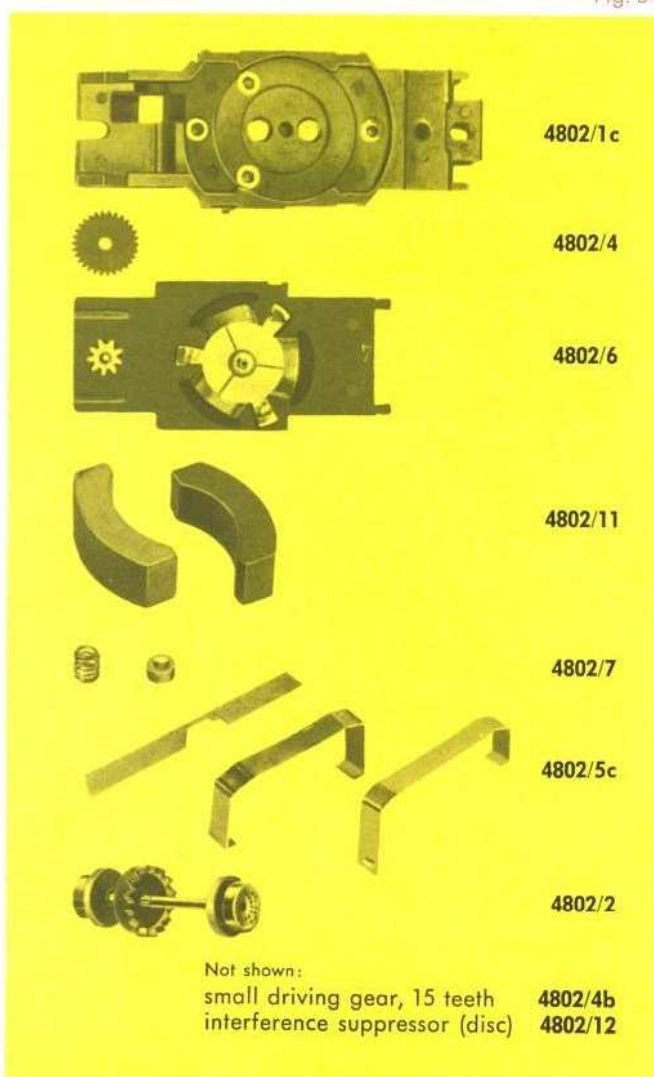
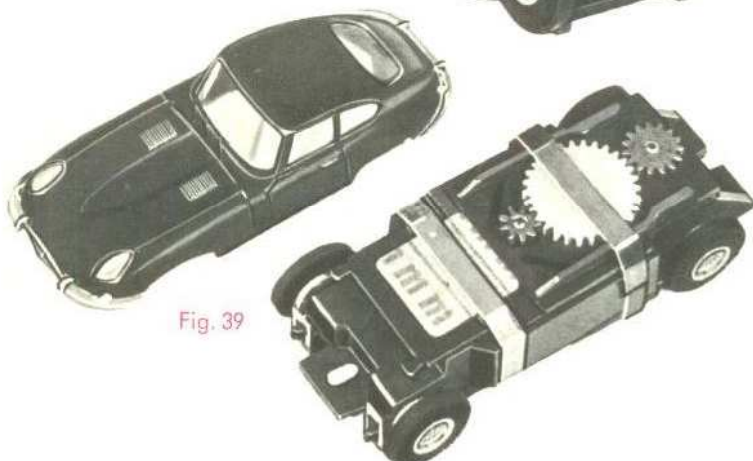
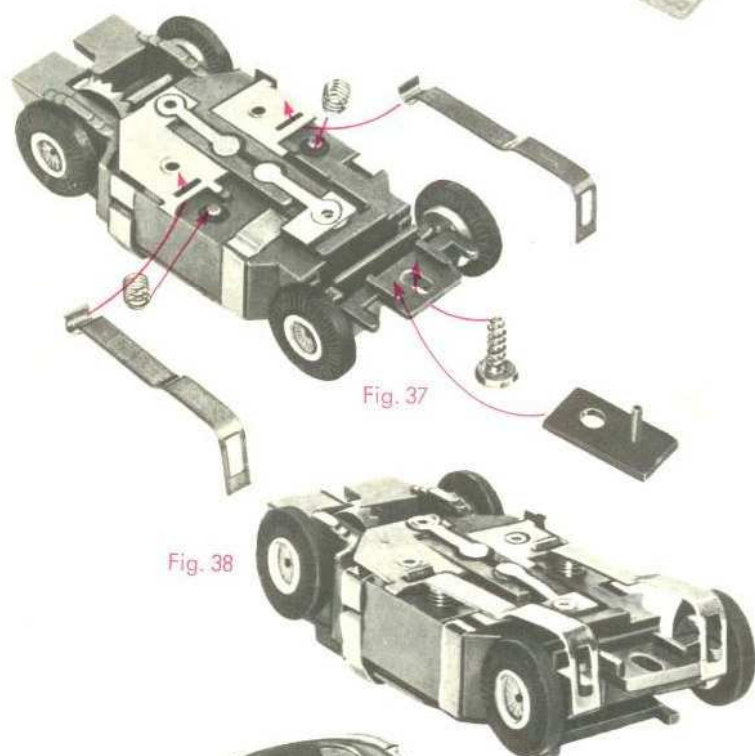
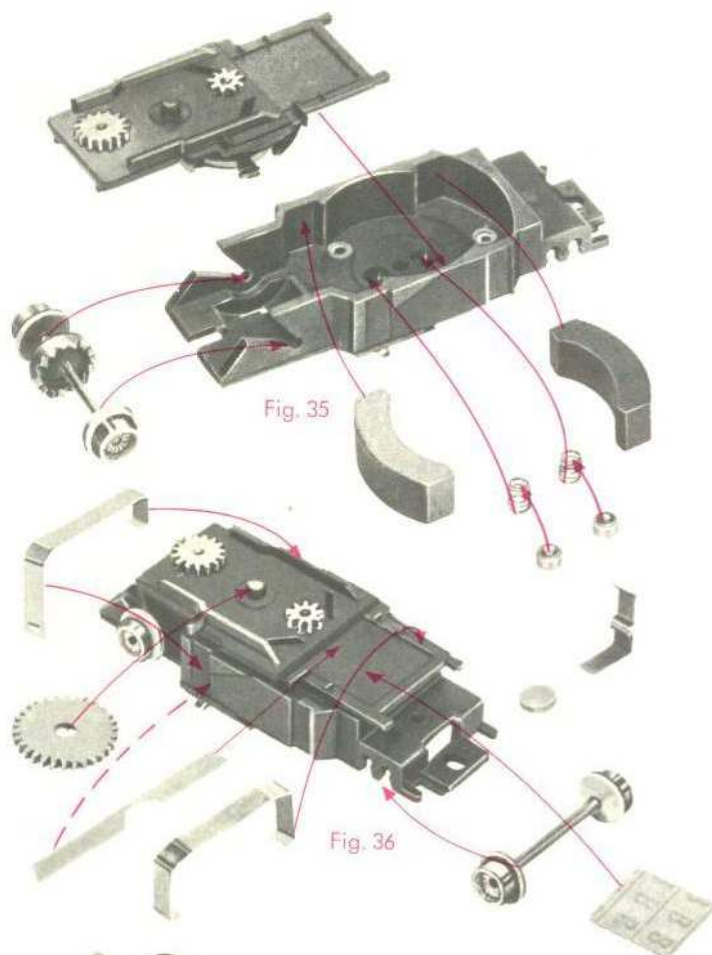


Fig. 34





## SPECIAL TYPES



Fig. 40



Fig. 41

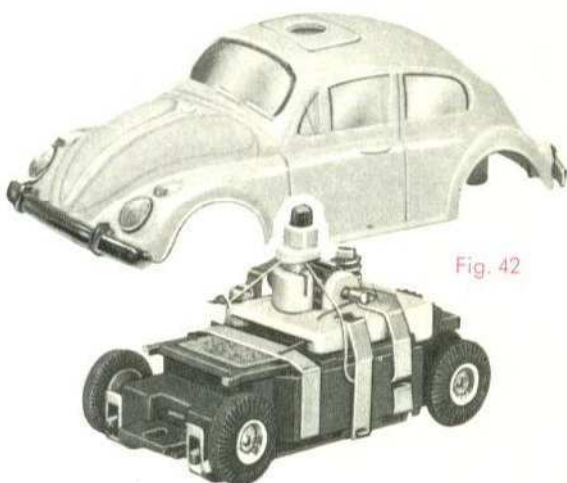


Fig. 42

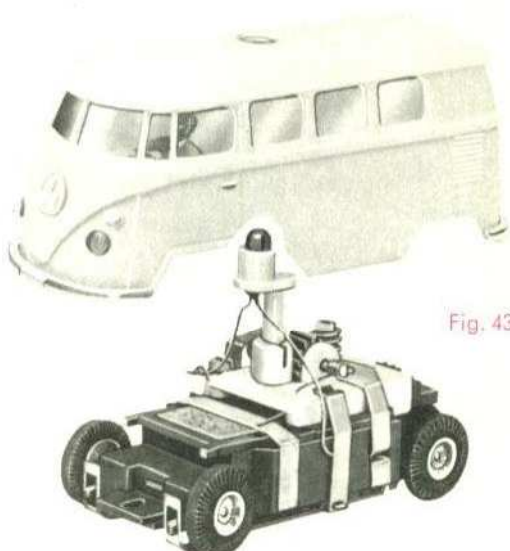


Fig. 43

The truck and the tank truck likewise come with the flat-armature motor but these types have a lower gear ratio, therefore at repair time they require a different bearing plate.

The FALLER cars with blinker lights differ from the regular vehicles by having an additional gear with contactor mounted on the flat-armature chassis. The gearing is the same for all blinker cars. Only the bulb mounting differs.

Fig. 44

4803/4



4803/2



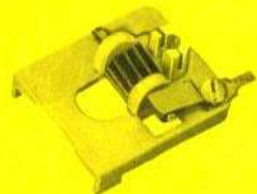
4803/5



4803/6



4803/7



4803/8



4803/9



4803/10



Not shown:

4803/13 trailer tongue with hook, for 4872

4803/11 fastening pin, angled

4803/14 bearing plate for truck



# TURNOFFS

Turnoffs are a very interesting accessory in the AMS roadway line. To be able to switch from one roadway to another, two things are needed: there must be a mechanical device to divert the car to the other route and there must be suitable means of carrying the current to the other route.

The basic units for this function are contained in turnoff 4710, so all we need do is describe the latter.

There is a small moving blade, pointed at the tip, which guides the guide pin of the car into one or the other route, as selected. If the blade stands across the slot it guides the guide pin off to the right into the turnoff route. Since the other end of the blade has a little protuberance, the passage of the guide pin automatically flips the blade back so the next car will pass through straight unless the turnoff is reset. This amazingly simple device assures fool-proof behavior.

The pivot on which the blade turns consists of a metal pin which is fastened into the transparent, removable base plate. A glance at the underside of the turnoff will make this clear.

The turnoff blade is operated by means of a small electromagnet in combination with a permanent magnet attached to the movable blade. When the turnoff is in normal position for straight ahead, the permanent magnet clings to the core of the electromagnet. To throw the blade to turnoff position, press a button which sends a momentary electrical impulse through the electromagnet. Since the turnoff works on the principle that like magnetic poles repulse one another, there is no need for any further attention when using AC. If DC is being used, you must make sure the polarity is correct, that is, it may be necessary to reverse the leads to the power source. The leads to the magnet coil are three in number, one brown and two blue. The brown lead runs directly to the power source (brown socket in transformer 4016). The two blue leads run to the output sockets of two push-buttons of unit 4034, which are in turn connected to the other side of the power source (yellow socket). Two push-buttons are needed so that either of two operators can have equal opportunity to operate the turnoff as needed. Malfunction may be mechanical or electrical. The

glass-clear cover plate makes it readily obvious whether dirt in the swivel bearing or some mechanical obstacle is hindering operation. In unscrewing the cover plate be very careful not to damage the hair-thin wire leading to the coil. This can also be a source of trouble.

Turnoff 4710



Fig. 46

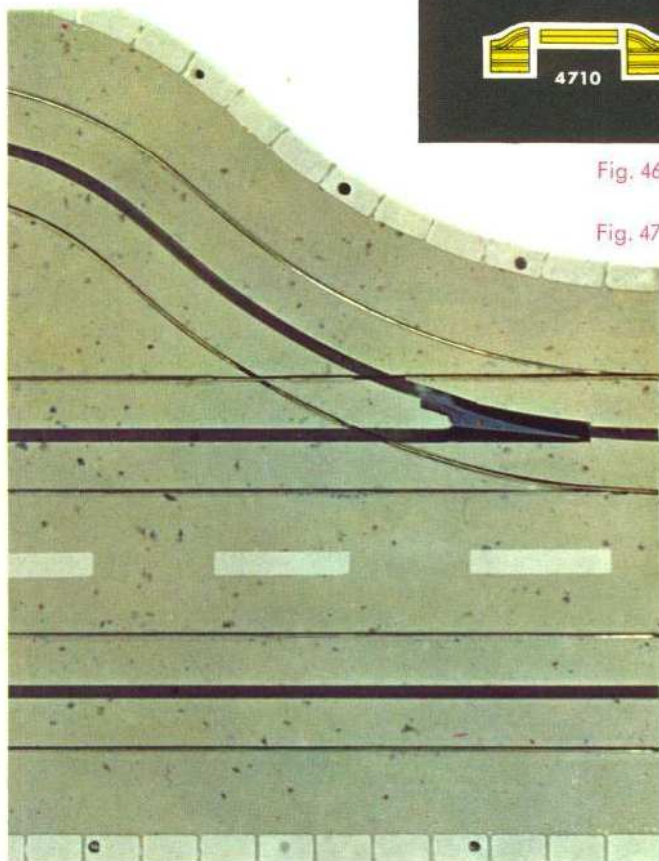


Fig. 47

## SPARE PARTS

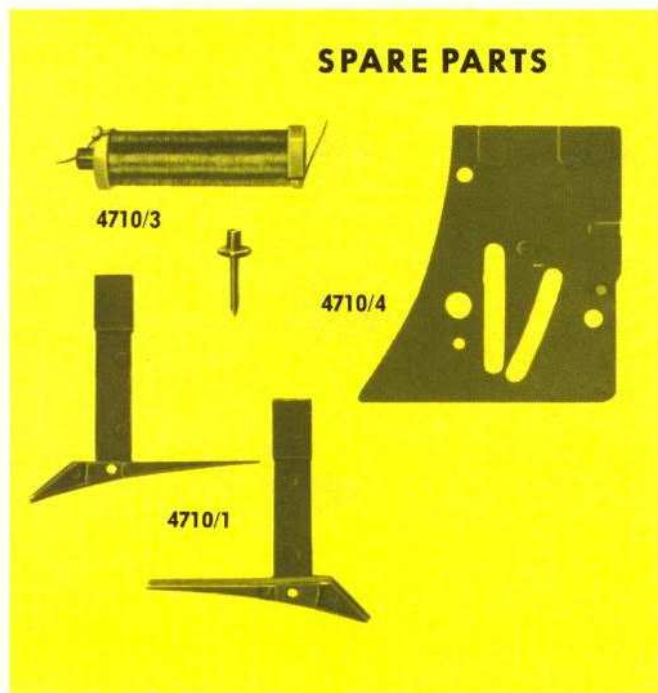


Fig. 45

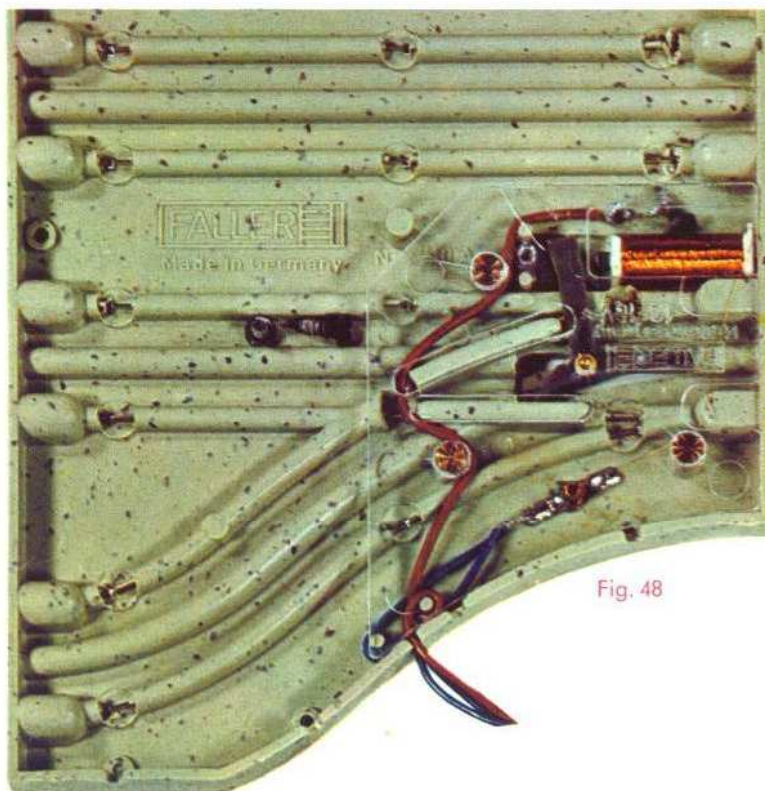


Fig. 48



# TURNOFFS

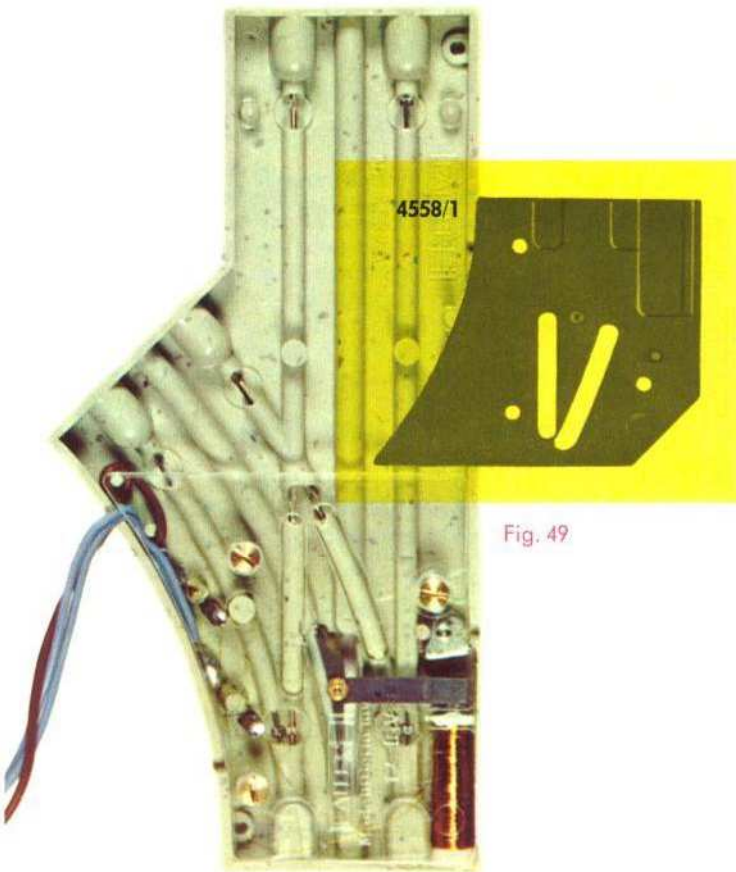


Fig. 49

Electromagnetic accessories are engineered for momentary current impulses only. If the current is left on, the delicate windings of the coil may be damaged. Of course, repeated use, each time with only momentary current pulse, is quite in order.

The coil as well as the transparent base plate and turnoff blade are available as spare parts in case replacement becomes necessary.

For each turnoff there is a corresponding return "turn-in", but these require no electrical operation.



Fig. 50

## SINGLE-LANE TURNOFF 4558

This right-hand turnoff has the same function for single-lane roads, and differs in no way from the 4710 turnoff in its electrical make-up.

## DOUBLE TURNOFF 4712

This accessory is for use with two-way traffic. Therefore in a right-hand double turnoff the right-hand lane is diverted to the right and in a left-hand double turnoff the right-hand lane is diverted to the left. Naturally the turnoff blade for the latter is a mirror image of the other one.



Fig. 51

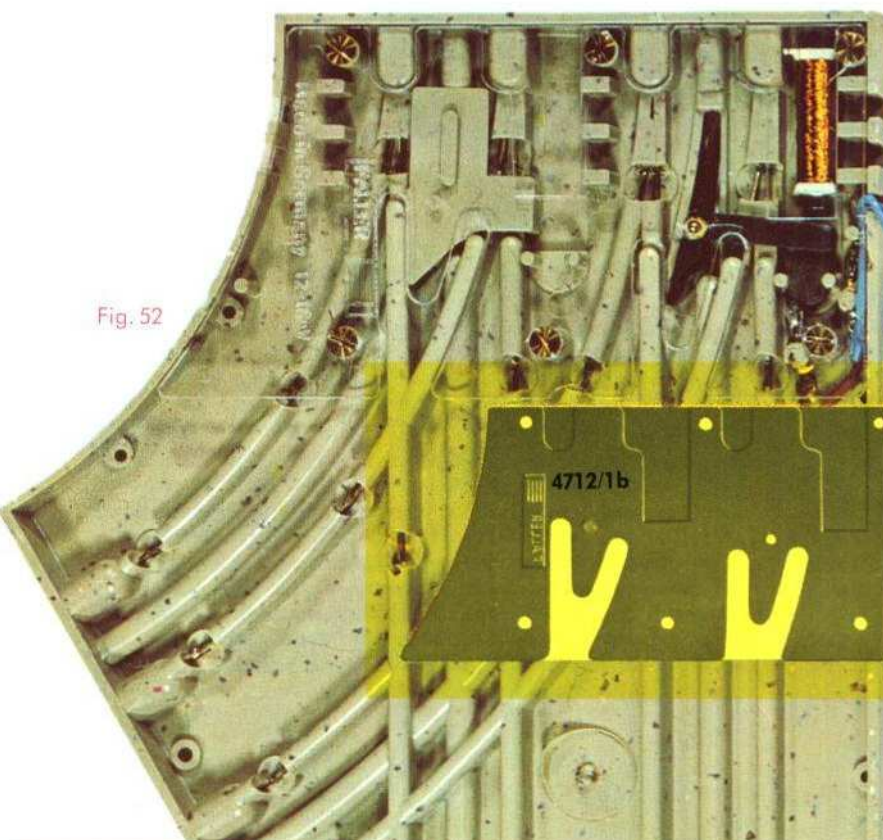
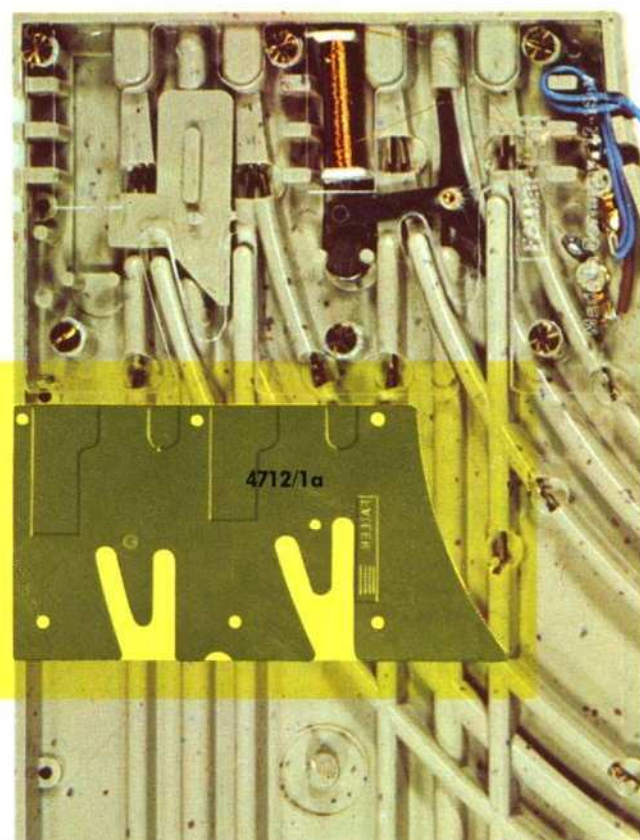


Fig. 52



4712/1a



# ROAD AND RAIL



Fig. 53

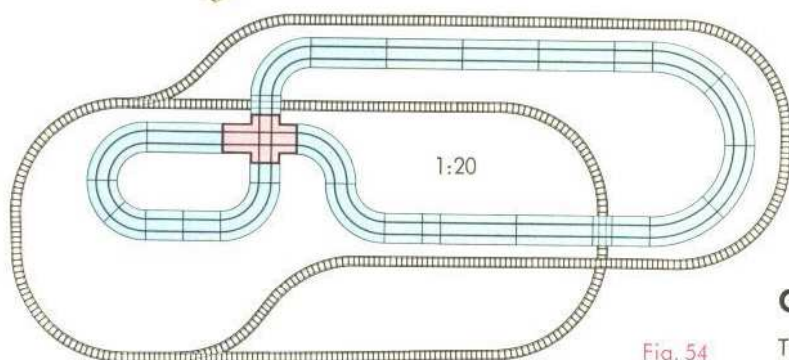


Fig. 54

Suggested layout having two grade crossings with a railroad line, without crossing gates. The roadway here is all at ground level, while the railroad has one overpass over itself.

AUTO MOTOR SPORT has at last fulfilled a long-felt want, namely to enable the hobbyist to combine his model railroad with a live road traffic with grade crossings, just as in the real world.

Motorized road traffic is fully realized in FALLER AMS. For too long only the H0 trains could move. Road-traffic models had to sit still as if glued to the roads in the "scenic" effects. Now FALLER AMS makes it possible to bring the roads in the scenic environment to life. The importance of road transport in the total picture of everyday life is thus brought into focus. FALLER's efforts in this direction have now been crowned with success.

Grade-crossing warning 4031



Fig. 55



1:1



2:1

## Grade-crossing warning 4031

Every grade crossing without gates should be protected with this warning sign with red light that flashes automatically at the approach of a train. It can be operated by use of contact 631 with the train setting off this function by use of a relay.

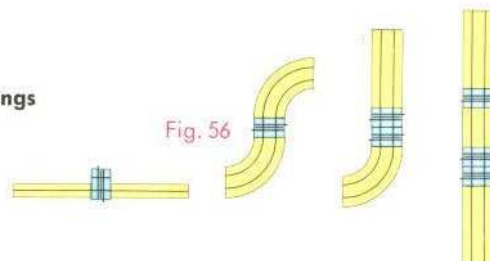
## Grade-crossing without gates 4731

Two-inch roadway section for double-lane highway, which can also be used with single-lane roads, in combination with H0-gauge railroad track.

The sketches show how roadway section 4731 can also be used in setting up grade crossings for double- or multi-track rail lines.

Highway drawings to 1:20 scale

Fig. 56



An unguarded grade crossing of course entails increased danger of collisions. The car operator is often foolishly tempted to try to beat the train to the crossing. In model work this of course injects an element of excitement with no risk to anybody's life or limb, especially if a race or rally is in progress. Building roadways into permanent H0 railroad layouts is shown in our layout booklet 849. A special volume of AMS POST will later on be devoted to this interesting phase of the hobby with its many opportunities for combination of road and rail traffic in the same layout.



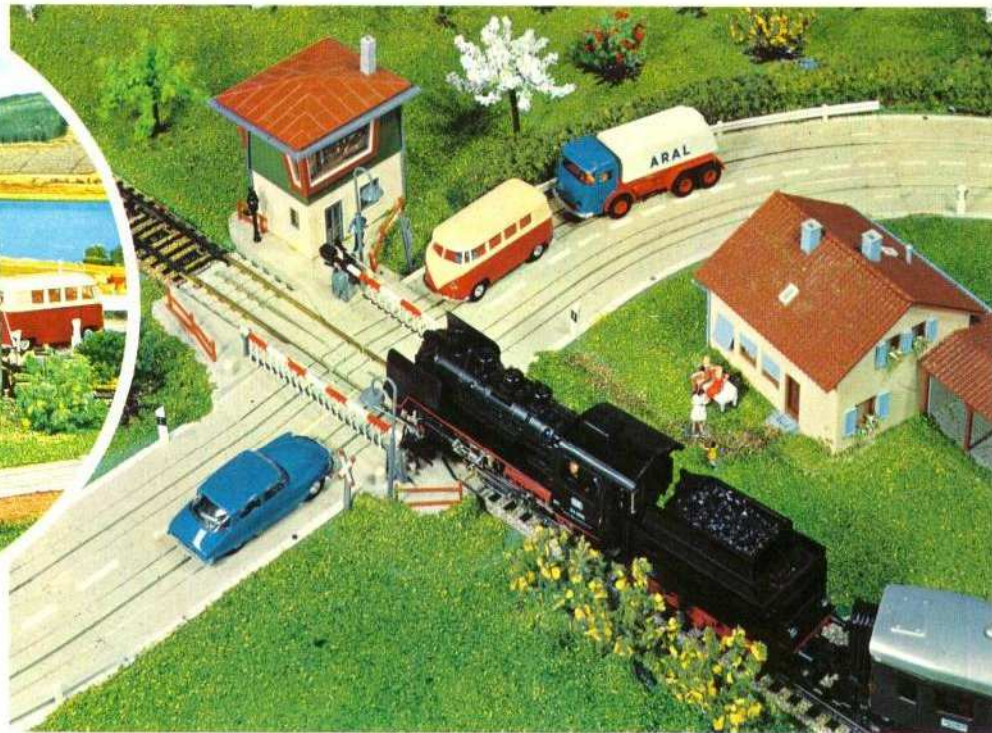


Fig. 57

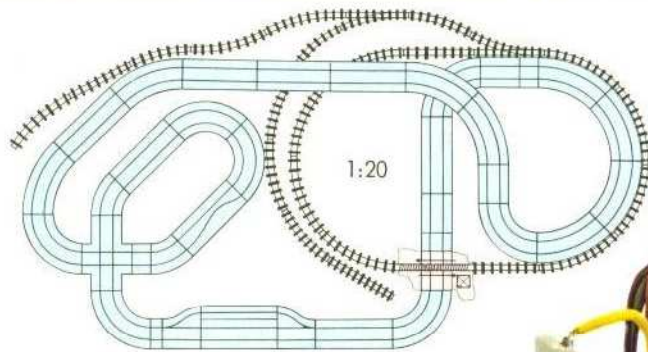


Fig. 59

## Electromagnetic crossing gates B-4733

planned for single-track rail lines crossing double-lane highways at grade. The gates are operated either by hand through a separate control or by means of contacts in the track whereby the approaching train automatically operates the gates. The approach sections supplied with the kit make it possible to use it with or without AMS. By shortening the gate beams to clear overhead conductors these gates can be used with model trolleybuses.



Fig. 58

This crossing with gates affords also an interesting element of play. Just as in real life, at a grade crossing, whether with or without gates, the train always has right of way over road traffic. This must be the same in the model layout, if realism is to be achieved. The train approaches, the gates go down and the driver must stop his car. It is a good idea to let the train run automatically and automatically operate the gates itself. But it would not be too good an idea to have the cars also stopped automatically when confronted with closed gates. Here you, as the driver of the car, have to stay alert and react to the situation in such a way as to avoid accidents.

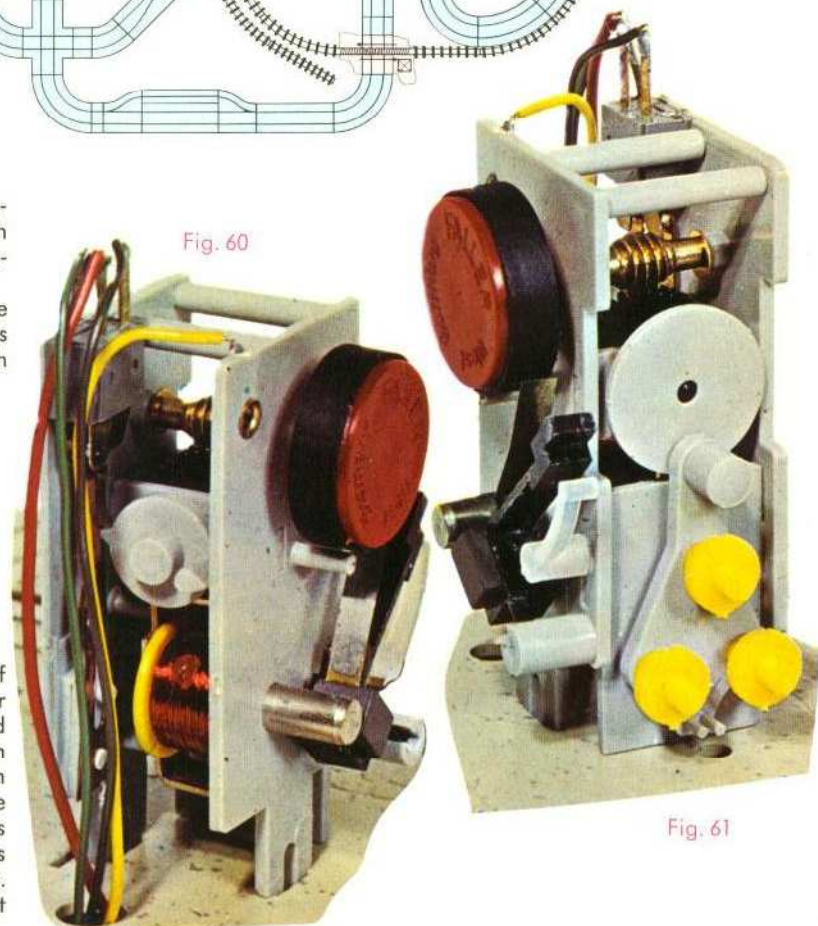


Fig. 60

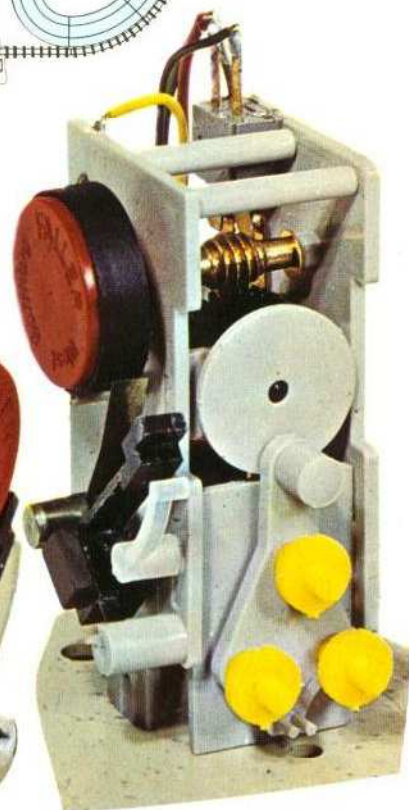


Fig. 61



# LAP-COUNTER



Fig. 64



## TOTAL tower 4901

The lap-counter is constructed on the electro-magnetic principle. As a car runs through the contact point, the guide pin of the car brushes aside a little lever which activates an electric circuit. This passes an electrical impulse to the coil in the counting device. The iron core of the counter attracts a little lever which causes the hand of the dial in the counter to move up one unit. The dial returns to the zero point when you press the white pin at the side of the unit.

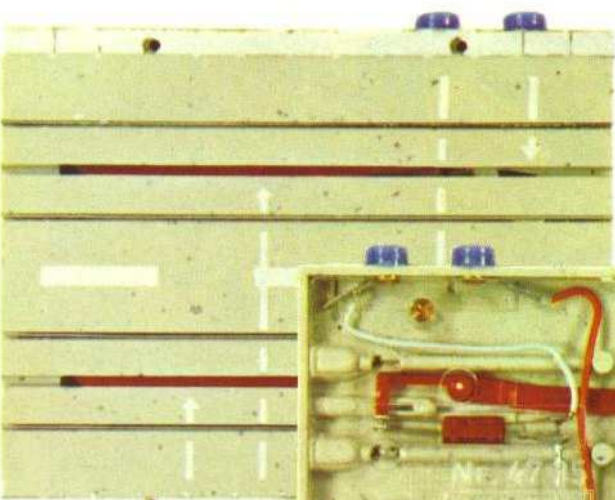


Fig. 62

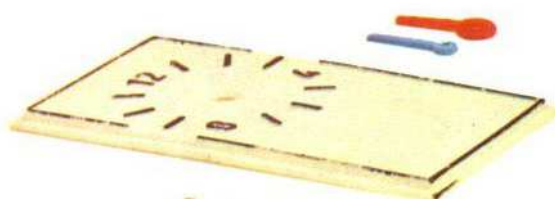
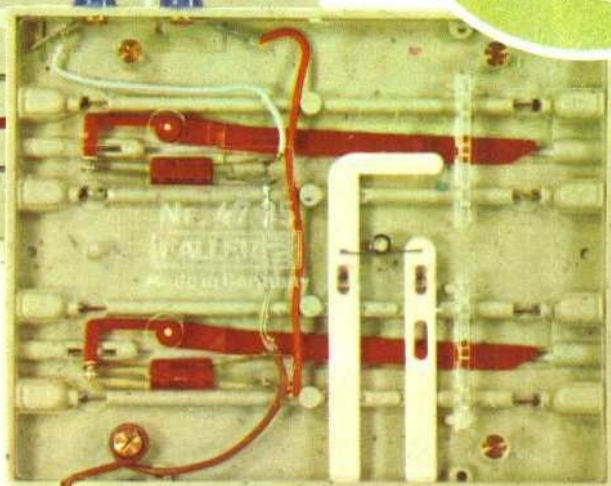


Fig. 63

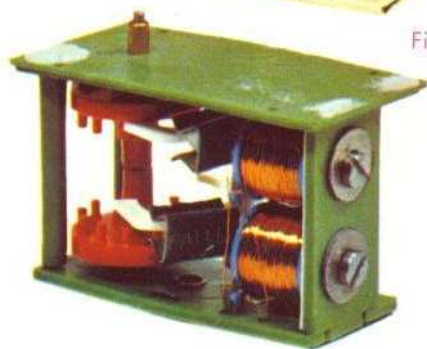
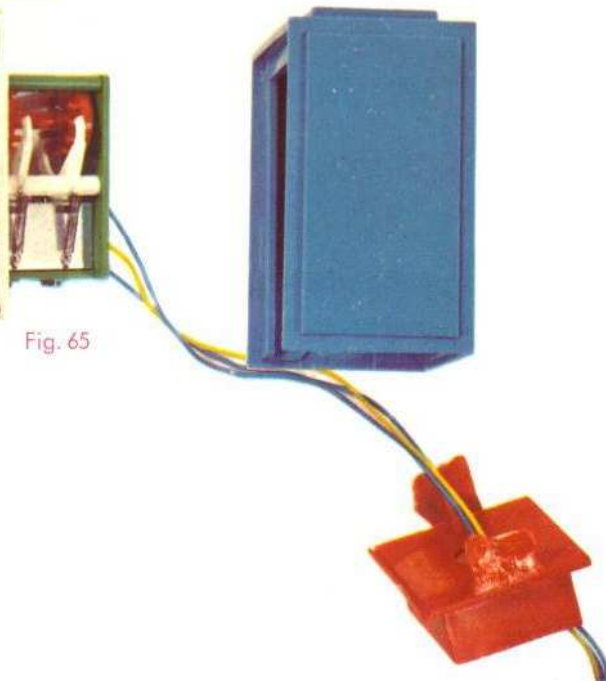


Fig. 65

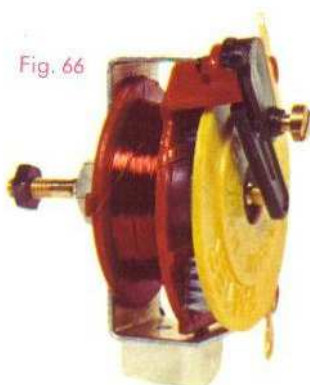


## Slow-running hobby motor 630

This little hobby motor is engineered for 12-20 V AC. It is based on the principle of utilizing the frequency oscillations of the AC.

The iron core of the magnet coil moves an iron disc so far that the latter comes to rest against two brush surfaces. The brush bristles are pretreated to incline toward the direction of turn. By the motion of the iron disc in unison with the frequency of the AC current (50 cycles) and the positioning of the brush bristles, the iron disc receives an impetus for further revolution on its rubber-mounted shaft. The rpm of the motor can be regulated by mechanically braking the vibrations of the magnetic disc (see regulating screw on 630). The stronger this braking effect, the slower the motor revolves. The direction of revolution can be altered by reversing the inclination of the brush bristles. Since the turning moment depends on the brushes, the motor is known technically as a "brush motor". This motor is also installed in contact unit 631.

Fig. 66





## Contact unit 631

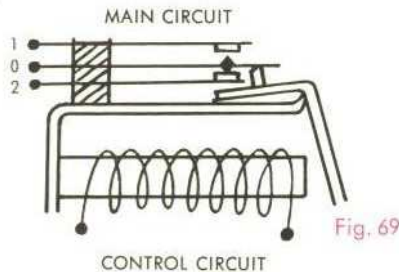
This unit is constructed to use 16 V AC. It is a source of electrical impulses, the speed of which can be regulated. It is especially adapted to operating rhythmic church bells (638), and also for operating flashing lights on AMS layouts, unguarded grade crossings, danger signals, advertising lighting, etc.

The impulses are given by the four-part plastic cam which is press-fitted on to the shaft. The number of impulses desired can be regulated by adjusting the speed of the motor. This is done by setting the pointer-like lever arm on the vertically-mounted resistance coil at the desired point.

## The relay (general)

is an electrical switching device, usually operated on a very low voltage to activate contacts in the main circuit which can carry a much higher working voltage.

There are relays which close or open the main circuit only while the low-voltage control current flows through the magnet coil (Fig. 69).



However a much more interesting type of relay for our purposes is so constructed that the main circuit or circuits remain open or closed until an electrical impulse is sent through the magnet coil of the one control circuit. This impulse need be only momentary, but it causes a switch in the main circuit to open the until-now closed contacts and close those that have been open. This condition prevails until a further impulse is given to the magnet coil of the second control circuit, which then returns the contacts in the main circuit to their original positions.

This last-described type of relay is found in FALLER relays 650 and 651, Figs. 70 and 71.

### Relays 650/651

The relays are built for use on 8 to 16 volts AC, are very positive in their action and will withstand continuous current application. There are the two types:

#### FALLER relay 650

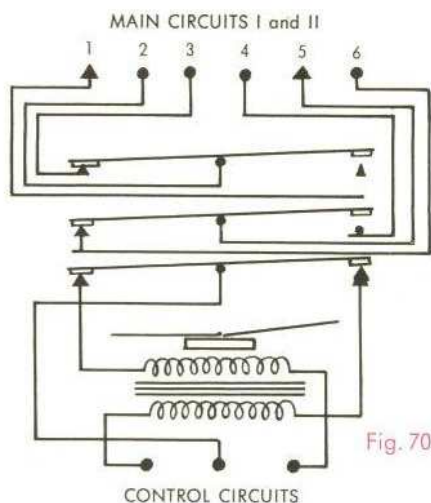


Fig. 70

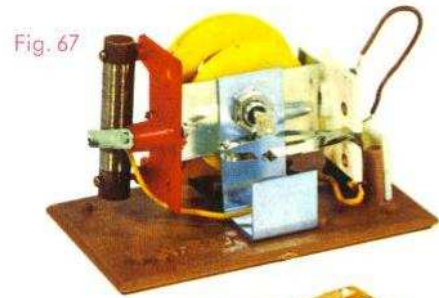


Fig. 67



Fig. 68

1st control circuit: 3 color-coded sockets on the side, blue, yellow and blue.

Main circuits 650, Fig. 70. 6 polished sockets on the other side. 2nd control circuit: 3 color-coded sockets on one end, blue, yellow, blue.

Main circuits 651, Fig. 71 (in preparation). Red, white, red on each side.

Yellow indicates the common lead of the two magnet coils of the control current and is connected directly to the 16 V AC transformer. The blue sockets on either side of the yellow one are for the control of the main circuit. These are connected with the transformer by way of manual switches, push-buttons or automatic contact placed in roadway or railroad track.

For one switching cycle only one momentary contact, that is one brief impulse, is needed. The command thus sent through the control circuit (via, say, the left blue and the yellow socket) and duly obeyed remains in force until the other control circuit (the right blue and the yellow sockets) is activated by a pulse of current, and then as a result the first command is nullified and a new one is issued and obeyed.

The magnet coils of the control circuit and their connections are free of any voltage difference from the contact points of the main circuit. (There is no electrical connection between them!) The active component consists of two double switching contacts, which again are not in electrical contact with one another. So it is possible to control two basically different electrical circuits, even one DC and one AC, one an H0 railroad and the other an AMS highway, simultaneously. This opens the way to some pretty sophisticated circuitry. Among other things it can be used as an automatic reverse unit even with DC.

#### FALLER relay 651

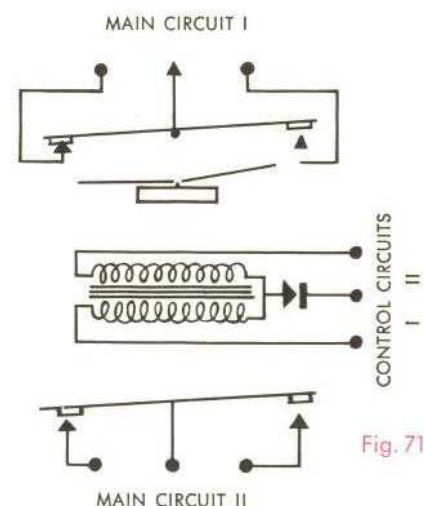


Fig. 71



# SPARE PARTS

694/1	100 small plastic plugs, assorted colors, in box	4801/4a	worm and worm wheel, standard 1 : 5 ratio
694/2	20 plugs with cross slot, 2.5 mm diam., insulated grips, in assorted colors, loose in box.	4801/4b	worm and worm wheel, slow-speed 1 : 12 ratio
694/3	20 AMS double plugs, 5 each white, black, light red and dark red	4801/6	armature complete with thrust washer
695	25 female plugs, matching 694/1 and 694/2, in box	4801/7	motor brushes 1/4" (7 mm)
4018/0	terminal plate with rectifier	4801/8	brush springs
4031/2	"steering wheel", black or red	4801/9	brush holder
4031/3	resistance coil, complete, for 4031	4801/11	2 rectangular permanent magnets
4031/7	cord with plug, for 4031 or 4700	4801/12	weights for standard motor
4033/1	resistance panel complete with cord and screws, for 4033	4802/1c	chassis complete, with TV suppressor
4558/1	base plate with pivot pin for 4558	4802/2	rear axle with hubs and crown gear
4710/1	turnoff blades with ceramic magnet (7 r. h., 3 l. h.)	4802/4	gear wheel, large, 30 teeth
4710/3	magnet coil for all turnoffs	4802/4b	gear wheel, small, 15 teeth
4710/4	base plate with pivot pin for 4710	4802/5c	contact spring, selenium clip, holding clip, selenium contact spring
4712/1a	base plate with pivot pin for 4712 r. h.	4802/6	armature and bearing plate, complete
4712/1b	base plate with pivot pin for 4712 l. h.	4802/7	motor brushes, 1/8" (3 mm), with springs
4800/1a	pick-up with spiral spring	4802/11	2 curved permanent magnets
4800/2	rubber tire	4802/12	TV suppressor (disc)
4800/3	knurled axle, 13/16" x 3/64" (21 x 1.4 mm)	4803/1	replacement bulb for police car or ambulance, without base
4800/4	body-mounting screw	4803/2	spare tires for truck
4800/5a	selenium rectifier plate 1/4" square (7 x 7 mm)	4803/4	guide pin for truck
4800/5b	selenium rectifier plate 3/8" square (11 x 11 mm)	4803/5	truck front axle with hubs
4800/6	chrome hubs	4803/6	truck rear axle with hubs and crown gear
4800/8	passengers (top half only)	4803/7	contact for car blinker
4800/10	guide pin for standard or flat-armature motor	4803/8	spare bulb with base, for VW police car
4801/0	standard motor	4803/9	spare bulb with base for Opel police car
4801/1	complete chassis with TV suppressor, with axles and wheels	4803/10	spare bulb with base for ambulance
		4803/11	fastening pin, angled
		4803/13	trailer tongue with hook, for 4872
		4803/14	bearing plate for truck

**AUTO**  
**MOTOR SPORT**

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7741 Gütenbach/Schwarzwald

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