LeJay Manual

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WARNING

Remember that the materials and methods described here are from another era. Workers were less safety conscious then, and some methods may be downright dangerous. Be careful! Use good solid judgement in your work, and think ahead. Lindsay Publications Inc. has not tested these methods and materials and does not endorse them. Our job is merely to pass along to you information from another era. Safety is your responsibility.

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Plan 1
PLANS FOR 110 VOLT A.C. LIGHT PLANT
made from Ford Model 'T' Generator

By following these step by step plans carefully and correctly you will be able to build a complete 110 volt A.C. plant that will supply power for your farm. Take great care in operating your 110 volt A.C. radio and circuitry. A 6 or 5 of the 25 watt bulbs all at the same time. Without radio turned on this plant will light 5 or 6 of the bulb or bulbs of the same watt. Just so the entire load does not exceed 150-200 watts or thereabouts.

A 25 watt bulb will give you 3 to 5 times more light than the kind you have now and that you can not light for about the same work. A 25 watt bulb is also bright enough to read or write by if used in a reading lamp or desk lamp. However, if used in a ceiling fixture it is suggested that a 40 watt be used.

Other 110 volt A.C. apparatus may be used on this plant if it does not exceed 75 watts. The wattage limitation of the 25 watt bulb is 180 watts. Any 180 watts the A.C. generator will probably get hot and if left on too long necessary because you can not use too much force which will harm the commutator. The plant is designed for all kinds of work, not all kinds of the work. There is no easy to tell if the generator is overloaded as the voltmeter will drop. Frequency of the plant is not a matter of importance as it is high enough for all practical use, develops 50 cycles at 1000 r.p.m. If your radio is made for 25, 50 or 60 cycles it will work on this plant—most radios are designed for 60 cycles.

Motors of 1/2 h.p. or less will work providing they are of the brush type. Larger than 1/2 will not work as they take more watts power than the plant will deliver.

DIRECTIONS
First secure an old model "T" Ford generator that has good field coils as these are the most important of its parts. It's a good condition and with good bearings. It is not necessary to get a new generator for this change. Remove the armature and take generator apart. By using a screwdriver carefully you can pry the wires out of commutator rings (be sure not to use too much force which will harm the commutator). The plant is designed for all kinds of work, not all kinds of the work. A large soldering iron is needed. heater to place the copper wire into the grooves of the armature. Remove both fiber and lamination and replace with new lamination. To put commutator end lamination on, cut through one side, and spread out portion to side over shaft. Both laminations are held in place by means of rubber binder or string, which can be run through slots. Wrap insulation tape around both ends of shaft to protect new windings from touching shaft. No take insulation material 3/8 thickness and cut into pieces 3/8 by 1/2, a piece of tape is needed. Put one piece in each slot. This size paper will extend a little above the slots which will later be folded over to protect tops of windings. Now hold armature in your hand with commutator end away from you. By using a piece of white chalk or bright crayon, number each slot. It makes no difference which slot you start on, as long as you get all numbers are in rotation from 1 to 21. Picture in your mind the armature as a flat surface instead of round like Fig. 2 with slot number is left end.

You will now need about 1 pound of No. 25 heavy Formvar magnet wire. Wrap several turns around shaft and glue bond. Match the wire and use a small piece of 1/16 inch diameter and 1/4 inch long. Bend each end out into a loop, and pass each end through slot. Now bend each wire loop into a turn of wire on the armature. Next take a heavy feeler gauge and push wire into a slot. Then bend the wire to the proper length and form a loop on the armature. Use a blunt wooden stick—use this packing stick about every 10 or 15 turns in order that all turns will fit in properly.

From slot 4 move to slots 2 and 6 and continue by winding 80 turns in these slots—pack every 10 or 15 turns as you did before. From slot 6 on move to slots 1 and 6 and repeat the operation in each slot. After these 8 coils are completed you will have finished 1 pole.

There are 4 poles to the armature so you will have to repeat this same operation 3 more times. Continue next by running wire from slot 5 to slot 3 and from slot 7 to slot 5 and wind in 25 turns—be sure to pack in each winding—from slot 8 move to 10 and 7 and place in 80 turns. From 4 to 7 and 6, here place in only 40 turns. From 6 to 13 and 14 and 6 to 80 turns long and from 16 to 20 and put in 20 turns, then to 11 and 12 where you put in only 40 turns. From slot 10 move to 13 and 17 and put in 60 turns. From 16 and 17 and put in 80 turns and finally to 11 and 12 where you put in 40 turns, then finish by bringing wire out slot 21—allow about 6 inches and cut off. This gives you one continuous winding in each armature.

If you will notice slots 1 and 21 have only 40 turns each so fill in remaining space with Wooden wedges. If the insulation is not sufficient, use fiber and fold down into slots, then force a wooden wedge into each slot as (D) Fig. 1. These wedges hold winding in place.

If you desire to test the winding for ground use an old radio head phone and dry cell. Connect one wire from phone to armature shaft. Connect other wire to the side of the battery. If you hear a click when contact is made then your winding is grounded, if you do not hear a click then winding is O.K. If grounded then start unwinding until ground is located, insulate, then rewind. Now connect end wire from slot 21 to commutator pin and solder. (D) Figs. 1 and 2. Solder the starting end of winding to shaft at point close to windings, (A) Fig. 1 and (C) Fig. 2, and be careful not to damage windings with soldering iron.

The armature is now ready for varnishing. Use any non-conductor varnish and paint, the armature well. You might set the armature into pan and pour the varnish over armature and keep doing this 3 times using the varnish over and over until all windings are well sealed.

Field coils arc next. Disconnect the two field coil leads and bring out the leads through front frame and connect each coil to the commutator. Connect the connections as they are. Remove from the generator the grounded brush holder and take out the brush holder which leaves only one brush. (D) Fig. 3. The remaining brush is ungrounded. A wire (P) should be connected from this brush to the commutator shaft. Then do what has been said above in connection with the generator and armature together, then you will have a complete 110 volt A.C. generator.

Brush (K) Fig.3 are connected to regular 8 volt generator which is turned at the same time as A.C. generator is turned. This 8 volt generator functions as an exciter for the A.C. generator, however, to keep A.C. voltage more constant it would be better to connect leads (K) to 8 volt storage battery then connect the 8 volt generator direct to the battery. It makes no difference which lead from A.C. generator goes to positive terminal on battery, but be sure to connect the lead for the 8 volt generator output to terminal on battery. The 110 volt line will draw about 3 amperes so you should adjust the 8 volt generator to charge about 5 amperes. This plant will function without battery but better results will be obtained if you use a 1/2 or 1 h.p. engine.

Run this A.C. generator at about 1,200 r.p.m. 6 volt machine can be run slower. Speed is governed by pulley sizes.

To make the entire apparatus complete we have made a special rheostat to be used in hollow circuit of A.C. generator as shown in Fig. 4. By adjusting this rheostat you will be able to change the A.C. voltage to correspond with your use. For instance, 2 or 3 lights would take less power than 5 or 6 lights, so you can set the rheostat back or adjust the voltage to the lights and always have 110 volts, without rheostat the voltage will vary slightly.

The A.C. machine can be turned in either direction, however, the 8 volt generator should be turned in different direction, as you face the commutator. A 3 1/2 h.p. engine will be large enough but better results will be obtained if you use a 1/2 or 1 h.p. engine.

Some builders will prefer a voltmeter hooked across the line at all times so they can tell exactly what the voltage is. Hook same from (N) Fig. 3 to the generator frame (O) Fig. 3. The rheostat is not used. Wire from (O) should also be run to ground which may be made by running a long rod into ground at least 6 to 10 feet.
This generator can be made to deliver up to 175 watts for a fairly long period by changing field connections as follows: Disconnect (4) and (5) Fig. 3, then connect (4) to (8) and (5) to (1). Field coils are now in series parallel and will draw about twice the current from battery. This means the charging rate of a 6 volt generator will have to be advanced to about 8 ampere-hours. In view of increased A. C. output it will be necessary to drill about three more 1/8" holes in drive end bell for ventilation. Even 100 watts can be had for short periods without danger of burning out. Another way to increase A. C. output is to wire the generator with 12 volts instead of 6 volts, field coils are left in series for 12 volt excitation.

The plant is turned on the battery will again be charged up. You see the plant has many valuable advantages and the overall cost is very low.

A suggested layout for you to follow in setting up your plant is shown by insert in Fig. 4.

A suggested schematic hookup is shown by Fig. 5.

FIG. 2

FIG. 3

FIG. 5

If you own a 6 volt radio set then this plant will come in handy for charging the battery. Just advance the charging rate of a 6 volt generator and hook on radio battery and it will be charged in one or two nights run at no cost to you. You can charge more than one battery at one time if you wish. They should be hooked in parallel. Parallel means that positive terminal is hooked to positive and the negative terminals are hooked together, then connected to generator. You may also have 6 volt lights where you want them by connecting to the plant battery. These lights can be turned on at any time whether the plant is running or not, then when the lights are turned off the battery will stop charging, but remain charged.

Listed below are supplies for making the above change. These supplies are offered at low prices and fully guaranteed.

ARTICLE

Kit No. 101—A complete kit for rewinding your own Ford model "T" generator which consists of the following parts:

1 pound No. 55 heavy Formvar magnet wire.
1 can air drying varnish.
21 wooden armature slot wedges.
21 insulation papers for slots .0017 thickness.
2 wire and lamination.
2 pieces scotch electrical tape. Use of same previously described.
1 commutator brush.

Complete above kit—we pay postage...... (See catalog for price.)

7G19—Model "T" Vee type pulley, postpaid...... (See cat. for price.)

W2—Voltage control rheostat (double duty)—postpaid............
(See catalog for price.)

560—Factory rewound Ford Model "T" A. C. generator, 110 volt, 116 watts (enough power to light 5 or 6 of the 25 watt bulbs or 2 bulbs and radio)—shipping weight, 16 lbs. F.O.B. .........
(See catalog for price.)

348P—0 to 150 scale A. C. voltmeter (110 volts), panel mounting—we pay postage............. (See catalog for price.)

97—Exchange price on rewind and reconditioned Model "T" armature for 110 volts A. C. ---------(See catalog for price.)

310—Complete plant consisting of the following items:
1 No. 348P voltmeter.
1 No. 560 generator (110 volt A. C.),
1 No. W2 voltage control rheostat.

Complete plant, ship. wt. 18 lbs. ........ (See catalog for price.)

You save over $1.00 when you order all 3 items at one time.
Plan 2

200 WATT A.C. GENERATOR FOR AUTOMOBILE
made from Ford Model 'A' Powerhouse

In changing the Powerhouse to 110 volts suitable for mounting on car engine to be run by the fan belt, follow the diagram below when winding the armature use No. 24 heavy Formvar wire. Study Plan No 1 for other information. Remove all brushes except grounded main brush which is used like (g), Fig. 2, Plan 1. Field coils are to be connected in series parallel. First connect any 3 adjacent coils in series, next connect remaining 2 coils in series, then connect both groups in parallel. When connecting wires (K) (Fig. 3, Plan 1) of Powerhouse run one wire to battery side of cutout and other wire to frame of car generator. Wires (L) (Fig. 1, Plan 1) deliver 110 volts A.C.

We recommend a 2 1/2" or 3" pulley so generator will turn fast enough when under idle. Speeds over 300 r.p.m will operate lights and radio O.K. Delivers 60 cycles at 1200 r.p.m.

Kit No. 245 -A complete kit for rewinding Ford Powerhouse for fan belt operation consists of the following items:
1 pound No. 24 heavy Formvar magnet wire.
1 can impregnating varnish (air drying).
20 wooden armature slot wedges.
20 insulation papers .007 thickness.
2 fiber end laminations.
1 commutator brush.

Plan 3

A 6 VOLT SLOW SPEED GENERATOR
made from Ford Model 'A' Powerhouse

By following this step by step plan carefully and correctly you will be able to build in a few hours time, a slow speed 6 volt generator that will start to generate at about 375 r.p.m. and will deliver up to 12 amperes. Especially designed for direct drive propeller.

First secure an old model 'A' Ford generator of the powerhouse type that has good field coils (field coils are the stationary coils), good commutator and good bearings. It is not necessary to get a new generator for this change. Next remove the pulley and take generator apart. By using a screwdriver carefully you can pry the wires out of the commutator rings (be sure not to use too much force which will harm the commutator), then push out all old wedges that are holding old windings in place. Remove old wire and clean slots thoroughly.

Next take insulation material .007 thickness and cut into pieces about 1 1/2 by 1 1/2 inches. 20 pieces are needed. Put one piece in each slot. This size paper will extend a little above the slots which will latter be folded over when wedges are put in to protect the new windings.

Now hold the armature in your hand with commutator next to you; draw an imaginary line along the left edge of any one slot and parallel with that slot and through to the commutator bars such as shown in diagram by line "A." The bar which "A" strikes will be center of coil one or starting coil. Start with this bar and count to the left 7 bars, the 7th bar will now be called bar 1 and the bar which line "A" strikes will be bar 2 as shown. Continue on to the right, giving each bar a number—40 bars in all.
Use number 12 heavy Formvar wire, and as there will be two coils in each winding we will refer to them as wire No. 1 and wire No. 2. Formvar wire No. 1, bar 1, then run both wires together through slot 1 and back through slot 4—return to slot 1. Formvar wire No. 2, bar 1, then run both wires together through slot 2 and back through slot 5—return to slot 2. Slot No. 1 to bar 14 and wire No. 2 to bar 12 as shown by heavy lines. Then let these wires be fastened to commutator post by means of screws or bolts as shown. Now let them be soldered to commutator after all windings are complete.

Next, fasten wire No. 1 to bar 3 and wire No. 2 to bar 4; run both wires through slot 3 and back through slot 6 as shown. Here wire in 12 turns also then from slot 3 extend wire No. 2 to bar 11. One turn of the coil, run 12 turns of No. 1, 1 turn of No. 2, and one turn of No. 3. Continue on in like manner until all 20 double coils are wound, 12 turns per coil.

When winding coil four you note that when you pass through slot 4 it will already have windings of coil one in it. Therefore, it will be necessary to fasten these windings together with a blunt wedge-shaped stick so that you can get all turns into slot. After this coil is wound, cut insulation paper off flush with top of core. Fold insulation paper around arm bar 8. Then fold arm bar 8 in half and cut wedge on inserting these wedges as fast as coils become complete. Then wrap the 4-model brush sleeve around arm 8 to connect to coil four. Then fold ends of each coil over this paper and (fasten to proper commutator post by means of a small screw. A larger number of screws will be needed for this operation in order to avoid bending the solder to commutator bars).

Grounds and shorts—use a non-conductor varnish and soak armature wall and allow to dry—put two or three coats in like manner, allowing each coat to dry thoroughly.

Now test your generator. Field coil connections to remain as they are, in series. If the maximum output is below the rated maximum, with the control brush fully closed, it will be necessary to make a further change on the control. To make this change it will be necessary to remove the windings. Remove the grounding brush to the frame of the generator with a piece of flexible wire. Then remove the brush sleeve, the brush, and the brush rigging to the shell.

With the generator running at a good speed, open the control brush to the position A. When the maximum output is reached, replace the brush sleeve, brush, rigging, and closed to the position B. This completes the grounding brush rigging in its new position. After the grounding brush rigging is completed, take the wires from the generator and connect the grounded brush to the frame of the generator with a piece of flexible wire. Then remove the brush sleeve, brush, and brush rigging to the shell.

The grounding brush rigging is complete by shifting the control brush. When the brush is shifted to limit the output of the generator to the desired point, the machine is ready for operation. These supplies are offered at low prices. All supplies fully guaranteed.

3B—FOR SLOWER CUT-IN SPEED

To rewind the Ford "A" powerhouse generator so it will start to generate about 290-320 r.p.m., wind the armature with 12 turns of No. 14 Formvar wire. Coil span and commutator connections remain the same. See Fig. 4 for drawing of above kit and the kit is available with No. 10 wire in place of No. 12 wire. 12 amperes maximum.

3C—TOWER AND TURNABLE ASSEMBLY

The entire assembly is made of metal, is simple construction, and can be built with tools used in the ordinary farm workshop.

(1) Insulation—iron pipe—which leaves the fourpoles type, and because this model generator is plentiful, one can be procured for a small price.

The entire assembly is made of metal, is simple construction, and can be built with tools used in the ordinary farm workshop.

(1) Insulation—iron pipe—which leaves the fourpoles type, and because this model generator is plentiful, one can be procured for a small price.

Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

SOLID LINES—WIRE No. 1. DOTTED LINES—WIRE No. 2.

Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

SOLID LINES—WIRE No. 1. DOTTED LINES—WIRE No. 2.

Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

SOLID LINES—WIRE No. 1. DOTTED LINES—WIRE No. 2.

Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

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SOLID LINES—WIRE No. 1. DOTTED LINES—WIRE No. 2.

Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

SOLID LINES—WIRE No. 1. DOTTED LINES—WIRE No. 2.

Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

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Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

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Since the generator is grounded to the frame of the plant, the frame carries the negative (-) charge, and it is only necessary to connect the 1280 Ohms collector ring to the frame of the plant at the negative (-) post on the battery and the lead to the collector ring at the negative (-) post on the battery. The wiring diagram shows a wire from the positive (+) post of the battery to the positive (+) post on the generator; see Fig. 4 for wiring of the collector ring. A 480-Volt 10,000-watt generator is shown with the collector ring at the positive (++) side of the battery.

SOLID LINES—WIRE No. 1. DOTTED LINES—WIRE No. 2.
Plan 4

6 VOLT and 12 VOLT SLOW SPEED GENERATORS from Dodge 'G' or 'GA' Northeast Generator also from other Generators

4A — A 12 VOLT SLOW SPEED GENERATOR

This 12-volt slow speed generator is supplied with the Dodge 'G' or 'GA' 12-volt generator for wind propeller direct drive and has a cut in speed of about 110 r.p.m. Delivers up to 450 volts, and will charge as many as six 6-volt batteries, maximum output at 400 r.p.m.

Study Plan No. 5 to simplify procedure. When winding armature use No. 16 H. 1 Formvar magnet wire and wind in 13 turns per coil. The commutator connections and coil span to remain the same. Use No. 14 H. 1 Formvar magnet wire and wind four new field coils, winding 250 turns per coil. Assembly generator: hook fields in series and connect as shown in Fig. 2. Turn clockwise direction.

Kit No. 152
Complete kit for rewinding Dodge 12-volt generator to 12 volts slow speed includes the following list of parts:
1. 500 yards No. 14 H. 1 Formvar magnet wire.
2. 75 feet No. 18 B. p. e. wire for field.
3. 1 large can ingreppening varnish (air drying).
4. 25 wooden armature slot wedges.
5. 25 insulating paper 0.07 thickness.
6. 1 cotton tape for insulating shaft.
7. 1 roll cotton tape for field coil leads.
8. Cotton sleeving for field coils.
Set of 2 special commutator brushes.
Complete kit, shipping weight: 15 lbs. F.O.B. — (See catalog for price)

4B — A 6 VOLT SLOW SPEED GENERATOR

This 6-volt slow speed generator is supplied with the Dodge 12-volt generator for wind propeller direct drive and has a cut in speed of about 220 r.p.m. Delivers up to 450 volts, and will charge as many as six 6-volt batteries, maximum output at 400 r.p.m.

Study Plan No. 6 and above 12-volt change to simplify procedure. Wind armature with 5 turns No. 16 heavy Formvar magnet wire (two wires in hand that is two wires to each winding. Solder the two starts and the two finishes as though they were one wire. Two wires are used instead of one heavy wire for purpose of making the work easier and you carry the death current. Coil span and commutator connections remain the same.

Make new field coils by winding 400 turns No. 18 plain enamel magnet wire. Connect as parallel, varnish, test and assemble. Turn clockwise direction. Connect brushes as shown in Fig. 2.

Kit No. 151
Complete kit for rewinding Dodge 12-volt generator to 6 volts slow speed including the following list of parts:
1. 500 yards No. 16 heavy Formvar magnet wire.
2. 75 feet No. 18 B. p. e. wire for field.
3. 1 large can ingreppening varnish (air drying).
4. 25 wooden armature slot wedges.
5. 25 insulating paper 0.07 thickness.
6. 2 pieces tape for insulating shaft.

1 roll cotton tape for field coil leads.
Cotton sleeving for field coils.
Set of 2 special commutator brushes.
Complete kit, shipping weight: 15 lbs. F.O.B. — (See catalog for price)

4C — FOR SLOWER CUT-IN SPEED (6 Volts)

To wind the Dodge 12-volt to 6 volts so that it will start to generate about 175 r.p.m. Wind the armature with 5 turns No. 14 heavy Formvar. Coil span and commutator connections remain the same. With 60 turns No. 18 plain enamel. Order this kit by number 151A and kit will come with No. 34 and No. 18 wire. Only one wire in hand when winding armature. Hook fields in parallel. This generator will deliver 55 amperes at 600 r.p.m.

4D — OTHER GENERATORS

6-VOLT SLOW SPEED GENERATOR from other standard 6-volt auto generators for wind propeller direct drive with cut in speed between 350 and 475 r.p.m. Delivers up to 450 volts depending upon the generator used.

First remove armature and measure wire size, also count number of turns per coil and note commutator connections and coil span. As most auto armatures are originally wound with No. 16 wire and assuming that your armature is of 16 wire the proper size to wind with will then be 19 heavy Formvar as 3 sizes smaller is usually used for slow speed.

Clean all slots thoroughly and insert insulating paper of proper size in each slot—this paper to be .007 thickness. Before starting winding it is necessary to figure out how many turns is to be made in each coil. As armatures vary in total slot numbers and slot sizes it is hard to give a definite figure that can be applied to all armatures. It is very simple to determine if you follow these easy instructions. First count number of No. 19 (or wire you are going to re wind with) about 5 turns longer than slot length. Use one slot and lay the cut wires into the slot, counting each one and packing them in often so no space will be wasted. After the one slot is full and wedge inserted, remove wedge and take out wires, recount to see if you will have a double check. Then wind your places 25 wires in this slot—and as there will be two coils in each slot you will then wind each coil with 15 turns, making a total of 30 coils in each set. Commutator connections and coil span the same as original winding.

Some armatures have twice as many commutator bars as slots, therefore it will be necessary to wind with two wires in hand which would mean each slot will have 4 coils instead of 2. In this case the proper number of turns per coil will be 15, two wires in hand or a total of 30 wires in each slot.

Field coils to remain the same, however, the cut-in speed can usually be lowered somewhat. If you make your coils using wire 2 sizes larger and same number of turns as original coil, brush connection to remain the same.
Plan 5

A 32 VOLT SLOW SPEED WIND LIGHT PLANT GENERATOR
made from Dodge ‘G’ or ‘GA’ Generator

5A-25 BAR COMMUTATOR TYPE

This changed generator has a cut in speed of 350 r.p.m. and will
generate a maximum of 14 amperes.

For 12 volt generators of Model G or GA, with good brush
rigging, commutator, shaft and core, is required.

First tear down generator, removing oil filled coils and armature
wire. Carefully and thoroughly with an alligator type of pliers.

Insert new armature insulation paper in each slot. The edges of the
paper should be folded back double when coils are finished and before wedge is inserted—this protects the
windings.

Run a continuation line parallel to the shaft through one bar and
slot as is indicated by lines running through center of slot 4 and
bar 7 of Fig. 1. Number all bars and slots to right, as indicated.

Use No. 17 H. Formvar wire. Fasten the wire to bar 1. This
connection is just temporary as it will be soldeater later. So we can
be left free from a beam of varnish being wrapped around the
commutator, or it can be driven into the easier in the bar by
means of a hammer and small blunt chisel or screwdriver point.

Now run the wire through slot 1 and back through slot 7, through
slot 1 again and back through 7, winding in a coil of 2 turns. On
the last turn run wire to bar 13 and cut it off. Hold this tail end
out of slot 7 temporarily. Now start with bar 2, wind through slot
two, back through slot eight, again winding in 2 turns and then
the tail end of coil to bar 14, cut off and fold back. Continue on in like
manner until all 25 bars have been wound. When winding the 7th
and following bars, a coil you will be winding in slots which already
have wire in them. It may be necessary to press this wire down to make
room for all the turns. This can be done by a free brake of shaped wood or fiber slab. After each slot which contains parts of
two coils is filled, the tail end wire which was laid out should be placed back through slot 7 of the wooden slot wedge
inserted. Continue on until all 25 slots are filled and closed.

Now lay the second layer of wire on top of the commutator end,
and lay the tail end wire down, connecting them to their proper bars. Wrap a few turns of string around these wires
close to the bars to hold them in place and prevent solder from
dropping behind the bars. Now solder the wires to the bars, using
a very small amount of solder to the heavy wires. Test the armature for grounds and shorts, saturate with insulating varnish, and allow to dry.

Core and fill with No. 25 and 26 armature coils and 38 p.s. magnet wire, and winding 450 turns per coil. The first and third coils will be wound in one direction and the second and fourth are to be wound in the opposite direction. It will be necessary to wind these on a form. After the coils have been removed from the form, wrap with cotton tape, shape, saturate with insulating varnish. Insulate with No. 22 Armature wire and varnish. Assemble finished coils in shell, connect in series and test for polarity. Assemble the generator, using only the two main brushes, one of which should be grounded. Connect generator positive
terminal and one lead to the ungrounded brush. Connect the other lead to the ground. Apply a ground to the ground side of fuse and ground the other end of the fuse (if a fuse is desired in the
circuit). These connections are shown in Fig. 1. (Fuse used as regu-
lar auto type, 4 amp. noted to keep generator from burning out when not connected to battery.) If the generator ro-
tates in counter-clockwise direction, reverse the 4 fuse connections.
The generator will then be shown to be proper, at least as far as the
attachment to the battery is concerned.

Should the generator show excessive arcing at the brushes and
show a very low rate of output, this can be readily overcome.

On the ‘GA’ generator simply remove the four screws which hold
the brush end bell to the shell. Then shift the end bell to the posi-
tion at which best results are obtained with the generator revolving
at about 750 r.p.m. Then oil the holes in the bell to take the
squeak out of the gears. In a very low position the commutator is a little higher. It will be impossible to overcome this except by installing an adjusting bridge of another type, such as the rigging removed from
Ford Model ‘T’ starting motor.

Kit No. 5012C—Dodge to 32 Volts—Slow Speed

Complete kit for winding your own Dodge 12-volt generator into
a 32-volt slow speed generator.

15 volts—No. 17 heavy Formvar magnet wire.
25 pounds No. 18 insulation paper for coils.
1 roll impregnating (air) drying varnish.
1 wooden slot wedge for slots.
25 insulation papers for slots.
25 varnish for brushes.
1 roll tape for filling holes.
2 pieces tape for insulating shaft.
2 cotton sleeves for armature coils.
1 1-ampere field fuse.

Above kit complete, f.o.b. _________________. (See catalog for price)

5B—SLOWER CUT-IN SPEED—49 BAR COM. TYPE

32-volt, 12-bar generator from Dodge ‘G’ or ‘GA’ having a cut
in speed of 270 r.p.m. and a maximum output of 15 amperes. It is
not necessary to use a 49-bar commutator on any of the Dodge 6 or
Dodge 6x slow speed changes.

Remove old 25 bar commutator by means of a press, and install
new commutator so that mica will line up directly with center line
of slot as shown by arrow in slot 7, Fig. 5.

Insert armature paper as described in Plan 5A in each slot. As-
guarding against separation of the coils from the commutator, we will designate these as bars A and B. For ease in winding it is well to have these wires on separate spools, fasten wire ‘A’ to bar 1 and wire ‘B’ to bar 2. This connection will be the same as bar 1 and 2, each being wound into the bars slots of the bars by means of a small blunt chisel or screwdriver. Now take both bars in hand and run through slot 1 and back through slot 7, and then again, winding in 4 double turns of No. 16 heavy Formvar wire. On the last turn run both wires so that wire ‘A’ will then be in bar 25 and wire ‘B’ in bar 26. Cut the wires off, leaving them about 2 inches longer than is necessary. Mark wire ‘A’ to identify it, making a kind of wire. Now lift these wires out of slot 1 and fold back.

Next fasten wire ‘A’ to bar 2 and wire ‘B’ to bar 4; run them through slot 1, and back through slot 4, again winding in 4 double turns. On the last turn bring tail end wires to bars 25 and
28, and again cut them off. Continue on in like manner until 24
double turns have been wound. On the 25th coil only one wire
will be used, the starting end of 1 being connected to bar 49 and
the finishing end to bar 34. The other wire will also be wound
but will be used only to fill the slot and to balance the armature,
but both ends of the second wire will be clipped off near the arma-
tor core as they will not be fastened to bars. This is shown in
coil 25 at the extreme left end of the connection diagram Fig. 3.

Wind seven new armature coils, using No. 18 p.s. magnet wire and
winding 450 turns per coil. Wind coils 1 and 3 in opposite direction and 2 and 4 in opposite direction, then connect coils in series. If you should find that the 4 fuse connections should not be
proper, the generator will not turn out if battery becomes disconnected while charging.

Kit No. 5012D—Dodge to 32 Volts—Extra Slow Speed

Same as kit No. 5012C. It includes 15 heavy Formvar, 5 lbs. No. 18 FE, and 49 bar commutator. (See catalog for price.)
Plan 6

One 32 V. Motor, One 110 V. Motor, One 32 V. Generator and One 110 V. Generator from Dodge Generator

6A—32 VOLT CONSTANT SPEED GENERATOR

This 32-volt constant generator rewind from the Dodge 12-volt generator is for engine drive, or for wind plant with a reduction drive of 4 to 1 ratio. Delivers about 20 amperes at 1500 r.p.m. Cut-in speed approximately 150 r.p.m.

Study Plans Nos. 1 and 2 to simplify procedure. Wind four new field coils, winding 45 turns No. 19 F.E. wire, wrapped with 3/8" cotton tape. Connect field coils in series. Armature to be wound with 5 turns No. 15 heavy Formvar wire (2 wires in hand). Also, armature requires a 45-bar commutator. Clockwise rotation.

Kit No. 166

Complete kit for rewinding your own Dodge 12-volt generator into a 32-volt 1100 r.p.m. generator.
5 pounds No. 15 Formvar wire
5% pounds 18 plain enamel wire.
1 can impregnating (air drying) varnish.
25 wooden wedges for slots.
25 insulation papers for slots.
2 commutator brushes.
10 1/2" tape for field coils.
2 pieces tape for insulating shaft.
Cotton sewing for field coils.
1 special 49 bar commutator.

Above kit complete, F.O.B. (See catalog for price)

6B—32 VOLT D.C. MOTOR

This 32-volt D.C. motor is made from the Dodge 12-volt generator. This motor develops 1/4 H.P. at 1500 r.p.m. and is shunt connected, constant speed motor.

Study Plans Nos. 1 and 2 to simplify procedure. Wind 4 new field coils, winding 45 turns No. 21 plain enamel wire, wrapped with 3/8" cotton tape. In this motor there is no change to be made in the armature. Only two main brushes are used—control brush not used. It is well to have the armature and brush holders tensioned for ground and shorts.

Connect field coils in series then connect to brush as shown in Fig. 2. Plan 5. If you want to vary the speed then connect as in Fig. 3. Plan 5. and use a W.15 rheostat (15 ohm, 25-watt). (See catalog for price)

Kit No. 167

Complete kit for rewinding your own Dodge 12-volt generator into a 32-volt D.C. motor. (Rheostat speed control) not included with this kit but sold separately.
5 pounds No. 21 plain enamel wire.
1 can impregnating (air drying) varnish.
1 roll 3/8" tape for field coils.
1 special 49 bar commutator.

Above kit complete, F.O.B. (See catalog for price)

6C—110 VOLT D.C. GENERATOR

This 110-volt D.C. generator is made from the Dodge 12-volt generator. Follow 32-volt constant speed generator change except wind armature with 12 double turns (two wires in hand). No. 18 W. Formvar and field with 1350 turns No. 25 F.E. Connect field coils in series and hook up as shown in diagram 5. Clockwise rotation. Armature is for engine drive, or for wind plant with reduction drive of 2:1 to 3 ratio. Delivers about 150 watts at 1200 r.p.m.

Kit No. 161

Complete kit for rewinding your own Dodge 12-volt generator into a 110-volt 1200 r.p.m. generator.
5/2 pounds 18 heavy Formvar wire (2 wires in hand).
5% pounds 25 plain enamel wire.
1 can impregnating (air drying) varnish.
25 wooden wedges for slots.
25 insulation papers for slots.
2 commutator brushes.
1 roll 3/8" tape for field coils.
2 pieces tape for insulating shaft.
Cotton sewing for field coils.
1 special 49 bar commutator.

Above kit complete, F.O.B. (See catalog for price)

Plan 7

This Plan Tells How To Make a Grinder, Series Motor, Constant Speed Motor, A Universal A.C. or D.C. Motor and a Soldering Iron.

7A—32 VOLT GRINDER OR BUFFER

This 32-volt bench grinder or buffer is made from an old Ford Model "T" generator or other 3-volt standard auto generators without rewinding the field and using original armature.

First make sure that all field coils are connected in series as shown in Figure No. 1, thus coils C, D, E and F are all connected in one continuous circuit. The start of coil C is connected to stationary and ungrounded brush Y while the end of coil F goes to one side of a 50-ohm 3-ampere variable resistor M which is used as a speed control. In this hook up while brush X or other stationary brush is connected to the generator frame. One side of the 110-volt line is connected to the generator frame and the other side of the 110-volt line is connected to the control M.

7B—HIGH-SPEED 110 VOLT A.C. SERIES MOTOR

This high speed 110-volt motor is made from an old standard 6-volt generator without rewinding the field and using original armature.

First make sure that all field coils are connected in series as shown in Figure No. 1, thus coils C, D, E and F are all connected in one continuous circuit. The start of coil C is connected to stationary and ungrounded brush Y while the end of coil F goes to one side of a 50-ohm 3-ampere variable resistor M which is used as a speed control. In this hook up while brush X or other stationary brush is connected to the generator frame. One side of the 110-volt line is connected to the generator frame and the other side of the 110-volt line is connected to the control M.

7C—SOLDERING IRON

Here is a soldering iron that will work on 6, 12 or 32-volt storage batteries and is easy to make.

First remove the carbon from a flash light cell leaving the metal cap in place. File off one end to a point and solder an insulated wire on cap. Mold it in small iron pipe about 18 inches long and run wire through handle. Attach the carbon to the iron wire near the tip. Connect wire to battery and connect other side of battery wire. Clean tip to be soldered, apply flux and bring carbon point in contact with work, draw back a little and apply solder as soon as arc has heated the work. Repeat until work is completed.
Plan 8

A 75 to 110 Ampere Arc Welder Made From Dodge 'G' or 'GA' Generator. Also Dual Welders.

An arc welder made from the Dodge 'G' or 'GA' 12-volt generator which produces 40 volts and up to 110 amperes, and two welders in parallel produce up to 220 amperes for short periods.

First remove armature from generator and remove all the field coils. To take out these coils you will need a heavy punch and hammer for loosening the eight screws that hold the pole pieces to the armature frame. Discard these coils. The original armature is used without rewinding. Be sure it tests O.K.

Build a winding spool to the dimensions given (Fig. 1). To be certain of accuracy, clamp the spool ends together while drilling. Mark corresponding corners of the spool ends with black paint, and assemble the spool. Polish all roughness from the 4" x 4" end, insert them in their proper holes after dipping them in paraffin. On this form wind four new field coils, each having two separate windings. The light winding, which is wound first, consists of 350 turns on No. 20 for 230 ampere wire. After you have wound 250 turns, then without removing coil from winding form, a piece of armature copper is then placed around the coils so as to separate the windings from winding next to be put on. Now use No. 3 DCC magnet wire and wind 100 turns, in same direction as No. 20 is wound (latter winding, 2 turns to layer), have all leads start and finish at same end of coil. The 350 turns of No. 20 will weigh approximately 1½ pounds. The 100 turns of No. 8 will weigh approximately ½ pound. Tie the coil with strands through the saw cuts (Fig. 5).

Rewrap coil from winding form then use ½" or 1" cotton tape for wrapping. Soak well in a good insulating varnish and allow to dry. The coils can be shaped when drawing them into place in the generator frame.
Two of the above field coils are wound in one direction and two are wound in opposite direction so when inserted in frame the two like polarities are opposite. This makes sure the coils of same polarity—the other two wound in opposite direction will be of opposite polarity. See Fig. 1—the opposite poles are also of the same polarity. These poles are connected to each pair of brushes. Connect large wire coils in series with only one lead from each pole to one pair of brushes. The other end will be connected directly to resistor. See Fig. 1. Use No. 8 stranded, heavy rubber covered cable for the terminal leads. Solder all connections.

If generator rotates in wrong direction, then reverse brush connections.

This welder requires a changed brush rigging consisting of four Dodge brushes spaced equally on a 3/8" fiber ring (Fig. 2). Locate brushes 16 degrees ahead of the pole centers in the direction of rotation, and connect opposite coils of same polarity to each pair of brushes. The connections in the welder are No. 8 wire or its equivalent.

To increase the efficiency of the welder, provision for ventilating holes in the end of each case. These holes are 3/4" and are drilled exactly between the pole pieces, and should be in close to the edge of the pole faces. The holes are spaced so that there will be three holes in each slot.

A resistor is necessary with this welder. There are two types of reactors in common use, the Type A is constructed of the laminated core type. The laminated core type is a little more efficient, however, the solid core reactor is much simpler to build, and the difference in efficiency is not sufficient to justify the extra time required to construct the laminated core type. A solid core reactor is explained in Fig. 3. On each pole piece wind one layer of No. 4 M.C. magnet wire, utilizing the same number of turns for each layer. Each layer approximates the equivalent of one flat wire. In this type of reactor, the solid cores are shown in Fig. 3. Wind turns close together. The flat pieces which hold the reactor legs together are made of mild steel and are bolted to form a metal core with a metal contact between each leg. The fiber strips near the flats are for the purpose of insulating the ends of the coil, and have 3/8" holes cut in them to allow the coil to be wound as shown in Fig. 3. Some operators recommend the hookup shown in Fig. 6. In this hookup the ground and electrode connections are the reverse of those shown in Fig. 3. The shunt is made from a 1/4" brass pipe as shown in Fig. 4 which will hold a 3/4" or 1" pipe for a 200A or 300A arc welder.

This reactor can be used with other welding generators producing up to 200 amperes.

Caution: Never turn the rheostat to full "OFF" position. This control varies the arc-striking voltage and is beneficial when welding light materials.

Plan 9
PENDULUM TYPE FENCE CONTROLLER
Made From Ford 'T' Coil

An electric fence charger operating on a six-volt battery and capable of charging 2 or 3 miles of fence, however, if you do a perfect job of it there is no reason why you could not get as far as possible, then the unit will handle at least 4 to 6 miles of fencing. Reason for this is very simple—the control puts a high voltage on the circuit and a high voltage is necessary for good shock. At low voltages, the arcing tendency is very great and a certain amount of voltage will occur at every point or point of insulation regardless of the type of insulation. (Therefore, as above mentioned, be sure to have as few posts per mile as possible.) You can readily understand why the insulators are important which is why the following principles should be understood, and the use of porcelain insulators.

The fence is no doubt the most important application of the charged single wire system, but there is no limit to the number of uses. For instance, with a side of real low fence, rats and mice can almost be eliminated. Also, if you plant a vine or single wire on a board, then embedding the board flush into the ground, you can practically eliminate bats. When the electric fence is energized (at a high tension), the electric field that is created away from shrubs, cats away from fish ponds, rabbit out of gardens, coyotes out of grazing groups, and other unwelcome intruders from places they are not wanted.

The fence does not need to be in one continuous length. It may have many branches and ends just as needed so they are all connected; also the wire does not need to return to fence controller. On other words there is just one wire leading from controller to each wire and back to controller. The barbed wire is recommended for livestock while bare wire may be used for poultry. The fence controller keeps working whether an animal touches the wire or not.

Once animals become acquainted with electric fence the unit may be turned on throughout the day without any trouble.

DIRECTIONS
First obtain a Model "T" Ford spark coil (1) in good condition (see Fig. 1). Remove the coil points (2) and (3) and cut off the point adjustment screw close to the nut (4). Remove the little red wire (5) in order to have a double point support (2) into the shape indicated in Fig. 2. This bending must be done so that the red wire (5) touches the outer side of the point support (2), may be cut off to a convenient length. Drill a hole in the point support (2) and tap it to receive the bolt (6), which is a 6-32, 8-32 or 10-32 bolt, on the end of which a lock nut and small rubber knob "A" are fitted. The tension spring (7) is the one which was being screw cut from the coil (1) at (4). The small knob "A" may be found on an old "B" or "C" coil, perhaps, on the terminal post of an old radio.

From the coil upper cut the two pendulum blades according to the dimensions given (see Fig. 2). solder a 3/8" carriage nut to the end of blade (8). Solder large end of blade in the top end of the coil as shown in Fig. 3. Now clamp the two blades (9) and (10) together and secure them as indicated (see Fig. 2), again allowing the solder to grip on only 3/8". Now replace the built coil point assembly as in Fig. 1.

To the terminals (10), (11) and (12) connector clips can be soldered or crimped on a wire connection. All wires between coils and returning to the battery are to be heavy rubber covered to avoid any possibility of a short circuit. Regular battery clips are used on the battery wires.

The wiring diagram (see Fig. 3) shows a wire from coil terminal (11) and a wire from the terminal (12) of the leaf spring, which may be inserted at (13) but is not necessary. From coil terminal (11) a wire runs to the front fork, then a wire down to the base of the rod driven into the earth. Moisten ground near this pipe occasionally during dry weather which will help to make shock more effective.

Fig. 4 shows the method of making the connection to the fence wire which is done with a good quality 3/8" pigtail eyelet (14) soldered on to a piece of tubing to form a lead-in which is connected in the correct method of the lead-in to the fence wire. All leads in the fence should be as smoothly clean and red real tight.

To the terminal post (10) add a piece of tubing about 1" long, opened or closed without danger of a shock while the control is operating, form a top in the main wire into which a connecting hook may be fitted. A small shielded, E-G shackle is used for a convenient fitting, also a nut and lock bolt (15) for a simple and effective clamping device (16).

A protection case for the completed fence controller is shown in Fig. 5. The four sides and the bottom of the case may be of light metal. The top is of light wood or other non-conductor. Holes are cut in the sides and base for the battery clips with a rubber grommet in put. When leading the wires through the holes, be sure to tape the end of each lead to prevent fraying. The case is fastened by four screws which are inserted through the case and into the top. The thickness of a lead pencil by wrapping tape around them for 1/4" on each side of the metal.
Plan 10

Plans for Building a Complete Wind Light Plant Including Tower, Propeller and Generator Charger

10A—6 VOLT SLOW SPEED GENERATOR

By following this step by step plan carefully and correctly you will be able to build a slow speed 6-volt generator that will start to generate at about 376 r.p.m. and deliver up to 12 amperes. Especially designed for wind propeller direct drive.

DIRECTIONS

First secure an old model “T” Ford generator that has good field coils (field coils are the stationary coils), good commutator and good bearings. It is not necessary to get a new generator for this change. Remove the gear and take generator apart. By using a screwdriver carefully you can pry out most of the commutator rings (be sure not to use too much force which will harm the commutator), then push out all old wedges that are holding old windings in place. Remove wire and clean slots thoroughly.

Next take insulation material .007 thickness and cut into pieces 2x3 x1/8 inches. 21 pieces in all. Put one piece in each slot. This slip paper will extend a little above the slots which will later be folded over when wedges are put in to protect the new windings.

Now hold the armature in your hand with a commutator next to you and number each commutator bar with white chalk. 21 bars in all. Use No. 18 heavy Formvar magnet wire. Connect wire to bar 1. This connection is temporary as it will be soldered later, so the wire may be placed in place and held by means of a rubber band wrapped around the commutator or it may be driven into the riser of the bar by means of a hammer and small blunt chisel or screwdriver point. Now run wire out through slot 1 and back through slot 9—return to slot 8 again, and place in a total of 17 turns. Run wire to bar 11 as shown in diagram. Cut this wire off and fold tail end out of slot 8 temporarily.

Now start with bar 2, go out through slot 4 and back through slot 5 again winding in 17 turns. Lead wire to bar 12 and out of slot 6, folding tail end and out of slot. Continue on in like manner until all 21 slots are wound. After the fifth coil which contains part of two coils is filled, the tail end wire which was lifted out will be placed back, the paper folded down and the wooden slot wedge inserted. Continue on until all 21 slots are filled and closed.

Now lay a moon shaped paper over the ends of the coils on the commutator end and lay the tail end wire against, connecting them to their proper bars. Wrap a few turns of string around these wires close to the bars to hold the wire in place and to prevent solder from dripping behind the bars. Now solder the wires to the bars, using a heavy soldering iron to properly sweat the solder to the heavy wires. Test the armature for grounds and shorts, saturate with insulating varnish and allow to dry.

Assemble the generator and note the space between the armature and field pole pieces. The cut in speed can be lowered still more by decreasing the width of this space. This can be done by cutting a small hole (48) in the bakelite frame, and then placing the bakelite frame through the hole and soldering it in place.
10F-7 FOOT PROPELLER

For making an 8-foot propeller, refer to plan and lengthen each 7th section to 10". Also lengthen the 3rd section to 9½" and the 4th section to 8½". All other dimensions remain the same. The 7 and 8-foot propellers are for Dodze or other 600 to 800 watt generators.

10F-10 FOOT PROPELLER

For making a 10-foot propeller, refer to plan and lengthen each 7th section to 16", also lengthen the 3rd section to 9½" and the 4th section to 8½". All other dimensions remain the same. This 10-foot propeller is for wind plants using a reduction drive.

10J-TOWER AND HEAD ASSEMBLY

This plant has been designed for the model "T" generator because it makes the best slow speed generator, being of the four pole type, and because the model generator is usually supplied with 4-pole winders.

The entire plant assembly is made of metal, is of simple construction, and can be built with tools used in the ordinary farm workshop.

(A) - 4½ length of 1½ (inside measurement) iron pipe to which the four tower legs are bolted. Build tower according to dimensions

(B) - 8½ length of 3/4 (outside measurement) iron pipe which slips 8½ down into pipe (A) inside of which it rotates. Plates (C) and (D) are 4½ lengths of 3/4 by 1/8" strap iron which support vane arms on pipe (E). The holes in (F) and (G) through which pipe (E) passes should fit the pipe so snugly that the plates have to be driven onto the pipe. In tightening the vane arms to (F) and (G) use flat head bolts and countersunk washers. Build vane support, as illustrated for 3/4" iron. Side of upper vane arm (B) extended, bolts to pipe (B) as shown, to hold (B) rigid and keep pulley in line. Slot sides of pipe (B) at top and shape to house a 1½" pipe with no side play. (E) and (F) of 3/4" strap iron, support generator and assembly on pipe (B). The holes in the ends of (H) through which pipe (B) passes should be just large enough so that (H) can swing freely on (B) with no side play. (L) - A piece of 3/4" strap iron which is bent up at (X) Fig. 1, to catch on upper vane arm (S), and stop the generator assembly at the proper point when it swings into operating position. (L) - 3/4" copper twist cable fastens to the outer end of (E), passes over pulleys and down through pipes (B)
Plan I

A 110 VOLT A. C. LIGHT PLANT GENERATOR
made from Dodge 'G' or 'GA' Generator

This 110 volt 750 watt light plant generator is made from Dodge 'G' or 'GA' generator with the parts shown in the diagram. Use just one brush and place it in any ungrounded position. Connect this brush to terminal post on generator. Wind 4 new field coils with 200 turns of No. 17 F.E. per coil. Tape and varnish, then connect in series. For excitation, connect field leads to standard 6 volt generator, and turn this 6 volt generator at same time you turn A. C. Generator. For battery excitation, use 12 volt leads and connect in series parallel (two wires per coil). See diagram in plan 28C General Information if you do not understand how to make series parallel connections.

See catalog part No. 861 for armature exchange and No. 5A for field coils, also if you wish to use a rheostat, which is shown in diagram refer to No. 241-1 ohm.

A. Winding diagram for 110 volt Dodge...giving size of turns, direction and locations of wire, armature slots, and connections of coils.

START OF WINDING - CONNECT TO SHAFT TAIL COLLECTOR FLANGE...FINISH OF WINDING - CONNECT TO COLLECTOR RING.

Figure 1

Schematic Diagram
Plan 12
A "B" Eliminator For Your Battery Operated Radio

To eliminate the battery for your battery radio, make your radio All 12 volt and operate entirely from a 12 volt battery. No B or C batteries needed.

First secure the following list of parts: Line cord, fine switch, large power transformer, two—6 m.f.d. electrolytic filter condensers, one—20 m.f.d. filter choke, one—5 m.f.d. 200 volt bypass condenser, one—10 m.f.d. 200 volt bypass condenser, one—25 m.f.d. 200 volt bypass condenser, one—25 m.f.d. 200 volt buffer condenser, one—film oscillator, one—8 volt rectifier, one—12 volt terminal strip, one—2250 ohm adjustable voltage divider, one—100 ohm resistors 5% watt, one—Mallory 651M1 vibrator and one—Raytheon 6X5 tube. Some radio hook-up wire, solder, insulated bolts and nuts, etc., will also be needed.

RPC consists of 40 turns of No. 16 enameled wire. coil wound to 1/4" in diameter.

Inasmuch as this eliminator has not been designed for your particular radio, it may harm a little; in such case try additional capacitors in parallel with C3 or C5, or both.

CAUTION: As far as operation of eliminator is concerned, polarity of battery makes no difference but be sure to connect the terminal of eliminator to the positive post on battery that formerly was connected to negative "B".

Plan 13
An Automobile Generator Booster Control

A generator booster control for your automobile generator when operating the car radio, hot water heater, etc. Boosts the charging rate for these extra loads without third brush adjustment. Also cuts down generator for day time driving if battery is fully charged.

INSTALLATION: On the average automobile generators the field coils are hooked in series with one side grounded to generator frame and the other side going to regulating brush as shown in diagram. Disconnect one lead that goes to generator frame and to the least connect one lead of the LeJay Control or any other suitable control. Punch a hole in the generator frame to be covered with a control through this hole. Mount control on instrument panel or other suitable place. Then return other side of control to generator frame to be covered with a control. This hook-up applies to all generators regardless of number brushes used or their positions.

Move adjustable brush to a point of highest charging rate, then adjust output of generator with the LeJay Control. A 3 ohm 25 watt variable rheostat is suited for this control.

No. SW32 - The LeJay Control including 6 feet copper shielded wire, mounting nuts and caps. (See catalog for price).

Plan 14
A 6 Volt Slow Speed Generator from Stand. 14 Slot 28 Bar Generator

Changing the Chevrolet, Ford A, Pontiac, Plymouth and all other 11 slot 28 bar generators to 6 volt slow speed for direct drive: will start to generate about 400 r.p.m. and deliver up to 30 amperes.

DIRECTIONS:
Remove and discard findings from armature and clean slots thoroughly. Cut insulation papers 23/4" inches. 14 pieces in all. Put one piece in each slot.

Now build armature in your hand with commutator next to you; number each bar and each slot with white chalk. Slot 1 will be directly above commutator.

Use No. 20 heavy Formvar wire and as there will be two wires in each winding we will call them wire No. 1 and wire No. 2 for identification. Connect wire 1 to bar 1 and wire 2 to bar 7. These connections are to be made temporary as they will be soldered later. Wire can be held in place by means of a rubber band wrapped around the commutator or can be driven into the grooves by means of a hammer and small blunt chisel or screwdriver. Now run both wires through slo 7 and back through slot 1, return to slot 1 and wind a total of 12 turns. On the last turn, run wire 1 to bar 7 and wire 3 to bar 1 as shown in diagram. Cut wires off but be sure to leave a knot in the wire to prevent it from coming out of slot 7 temporarily.

Now start second coil by connecting wire 1 to bar 7 and wire 2 to bar 3. Run them together through slot 2 and back through slot 8. Again placing in 12 double turns, then extend to bars 9 and 10 and cut off, making a kink in wire 2 for identification as above. Also fold ends out of slot 2 as you did when finishing previous coil. Continue on in like manner until you have wound all 14 double coils. When winding the 12 double coils, you will be fed into slots which already have wire in them. It may be necessary to press this wire down to make room for all the turns. This can be done by pounding with a wedged shaped wood or fibre club. After each slot which contains parts of two coils is filled, the tail ends wire which were left folded back out of slots will be placed back, paper folded down and the wooden slot wedges inserted. Continue on until all 14 slots are filled and closed.

Next place a moon shaped paper over the ends of the coils on the commutator end of the armature, then lay the tail end wires down into their proper commutator bars. Wrap a few turns of string around the former to keep commutator bars in place and hold the wires in place and to prevent solder from dropping behind the bars. Solder wires in place using a heavy soldering iron to properly spread the solder to heavy copper bars.

Test the armature for grounds and shorts, if any, and replace broken or faulty commutator bars. Adjust the brushes as required to make double slide connections to the brush holder. Wires must be adjusted properly by hand, water pump, water pump drive, etc., so that when the high speed motor is running, the generator will start to generate as soon as the motor is turned on.
Plan 15

A 32 Volt Constant Speed Generator made from Ford ‘T’ Generator

Changing the Ford Model 'T' generator into a 32 volt Constant Speed generator that will deliver 8 amperes at 1250 r.p.m.

DIRECTIONS

First secure an old model 'T' Ford generator that has good field coils (field coils are the stationary coils, good commutator and good bearings. It is not necessary to find a new generator for this project. Remove the gear and take generator apart. By using a screwdriver carefully you can pry the wires out of the commutator slots (be sure not to use too much force which will harm the commutator), then push out all old washers that are holding old windings in place. Remove wires and clean slots thoroughly.

Next take insulation material .007 thickness and cut into pieces 2 1/8 x 6 inches. 21 pieces in all. Put one piece in each slot. This size paper will extend a little above the slots which will later be folded over when wedges are put in to protect the new windings.

Now hold the armature in your hand with the commutator next to you and number each commutator bar with white chalk. 21 bars in all. Use No. 22 heavy Formvar magnet wire.

Connect wire to bar 1. This connection is just temporary as it will be soldered later, so the wire can be held in place by means of a rubber band wrapped around the commutator, or, can be held in place by the armature, or put an armature in the place of the commutator and hold it in place by the armature. Now adjust the brushes so that they will touch the commutator end, and lay the tall end wires down, connecting them to their proper bars. Wrap a few turns of string around there wires close to the bars to hold the wire in place. (Be sure to slide from dropping behind the bars. Now solder the wires to the bars, using a heavy soldering iron to properly heat the solder to the iron. While the iron is warm, repeatedly dip it in solder to keep it warm.

Listed below are supplies for making this 32 volt change. These materials are offered at the following low prices and are fully described.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Article</th>
</tr>
</thead>
<tbody>
<tr>
<td>32A</td>
<td>Complete kit for rewinding your own Ford 'T' generator to 32 volts Constant Speed.</td>
</tr>
<tr>
<td>1/4 pound No. 22 heavy Formvar magnet wire.</td>
<td></td>
</tr>
<tr>
<td>1/4 pounds No. 22 P.E. magnet wire connections as they are.</td>
<td></td>
</tr>
<tr>
<td>1 roll cotton tape for field coils.</td>
<td></td>
</tr>
<tr>
<td>2 complete new brushes.</td>
<td></td>
</tr>
<tr>
<td>2 fiber end laminations.</td>
<td></td>
</tr>
<tr>
<td>Scotch tape to hold end laminations.</td>
<td></td>
</tr>
<tr>
<td>2 can special air drying varnish.</td>
<td></td>
</tr>
<tr>
<td>21 wooden slot wedges.</td>
<td></td>
</tr>
<tr>
<td>21 insulation papers .007 thickness.</td>
<td></td>
</tr>
</tbody>
</table>

Above kit complete: weight 4 1/2 lbs. (See catalog for price).

Plan 16

A 2 Volt Slow Speed Generator from Stand. 14 Slot 28 Bar Generator

Changing the Chevrolet, Ford "K", Pontiac, Plymouth and all other 14 slot, 28 bar Autellet or Delco-Rayon generators into a 2 volt slow speed for wind propeller direct drive; starts to generate about 350 r.p.m.

DIRECTIONS

It will be necessary to follow plan 14 to make this change, and plan 15 may be followed in detail except that the armature will be wound in 4 turns of No. 22 Formvar magnet wire per coil. No changes are to be made in the fields.

The following are supplies for making this 2 volt change, and these materials are offered at low prices. All supplies are fully guaranteed.

DOTTED LINES - WIRE ONE; SOLID LINES - WIRE TWO

Part Number | Article
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Complete kit for rewinding the Chevrolet and other 14 slot, 28 bar generators into 2 volts slow speed as above described.</td>
</tr>
<tr>
<td>1/4 pound No. 22 Formvar magnet wire.</td>
<td></td>
</tr>
<tr>
<td>1 can special air drying varnish.</td>
<td></td>
</tr>
<tr>
<td>14 wooden slot wedges.</td>
<td></td>
</tr>
<tr>
<td>14 insulation pieces .007 thickness.</td>
<td></td>
</tr>
<tr>
<td>2 fiber end laminations.</td>
<td></td>
</tr>
<tr>
<td>Scotch tape to hold end laminations.</td>
<td></td>
</tr>
<tr>
<td>3 new commutator brushes.</td>
<td></td>
</tr>
<tr>
<td>1 end insulation paper.</td>
<td></td>
</tr>
</tbody>
</table>

Complete above kit, postage paid. **$2.25**

22X - Kit 22 as above, less brushes, postage paid. **$2.10**

Plan 17

How To Convert A 6 Volt Cut-Out For 2 Volt Operation

Directions for making a 3 volt cutout from the standard 6 volt autolite or delco-rayon generators with this wire change. Now measure the entire length. Now, that 3 volts is just 1/2 of 6 Volts, it will be necessary to cut this wire into 3 equal lengths—make a 3 strand cable of these 3 pieces by soldering the ends together at the start. Rewind this cable onto core and finally join the 3 outer ends by soldering, then be sure to connect as before. After this wire is replaced, install same as it was before, then replace the heavy winding and the cutout. The result will be a wind of 2 volts. This cutout is designed for those who wish to charge their 2 volt radio battery.
Plan 18

Directions For Repairing Your Own Batteries

Pour out old acid. Be careful not to spill on clothing or wood. If any spilled, its action can be neutralized by covering with baking soda.

(a) Next bore a slight depression on center of spot where strap is connected to each terminal, using a 5/8" drill. Dry off strap with screwdriver. If strap refuses to loosen, bore a bit deeper. It should not be necessary to do more than brushing off strap.

(b) Next fill battery with hot water and allow to stand until sealing compound is loosened. Lift out old plate, using pair of pliers. If the plates refuse to pull out, dump water and fill again with hot water. It will also help to pour hot water over cover and pry off the top of unit with a screwdriver. After plates are removed scrape off remaining sealing compound from box and cover. Fill this in with an old coffee pot with the spout narrowed for easy pouring. Clean out sediment.

(c) Now remove the nuts from around the posts and take cover off the elements. Examine plates and remove all loose filler. Remove all unused plate units. Wash off separators, examine for breakage and place in container filled with water to keep moist. If allowed to dry they may crack.

(d) Next cut slits in connecting strap to take the lugs off the new plates. Place unit in running rack (see sketch). Now place new plates with lug auto generator (No. 2) by means of bolt-down torch or small welding outfit. It would be well to practice this on ruined plates first.

(e) Coat with a mixture of ridged or corrugated side of separator facing positive (brown) plate. Cover must be taken so the posts are placed proper distance apart. It will be necessary to put the cover back on. Place flat board on each side of unit and squeeze in vice. You are now ready to assemble the units in the case. Note carefully to which post the brown or positive plates are fastened.

(f) Next put groups into boxes, placing the first group in the front box with the positive post to the right. Place the other unit with positive post to right. Put on gasket, covers and nuts. Lay the straps over their respective posts and bolt in. If using gaskets of mixed new and old plates, fill battery with hot water and secure until plates and terminal shells from 2 to 2 ½ volts. Dump out water.

(g) Mix your new electrolyte to 1250 specific gravity (1750 extreme points) being careful to pour acid into the water. If the liquid is poured into the acid it will cause excessive heat and break the battery. Place cell with terminal shell up. Cover with new cell cover and secure. Duplicate cells are connected to form a battery.

(h) See that box covers are thoroughly dry and pour sufficient sealing compound in each cover to dry and close the cover. Pour the compound in the cell will contract. This may be caused by an excess of acid. Turn the cover over. If the current is too weak for service, you should add some of the water to the charge. The battery should be examined and the current should be raised to 2.5 volts per cell or until battery bubbles freely. Your battery is now ready for service.

(i) For lead burning a handy auxiliary tool is an iron or steel rod about 6 inches long, pointed and then flattened at the tip. This may be used when lead is at melting point to stir in order to prevent oxidation and improve a more perfect bond.

(j) Useful hints and things to remember: Always keep your work clean. You are working with acids and foreign substances in a battery of that contain an amount of water that is free of iron. Use sulphuric acid of 1.25 S.G. This may be furnished by or by any drug store. Never pour the acid into the water. In rebuilding farm light batteries, a rubber band cut from an automobile tube may be used for binding the plates together. The old method of binding as used in some batteries has decayed. A permanent binding call may be made by following the sketch.

Plan 19

A Water Wheel Made From Old Automobile Wheel

Building a Water Wheel suitable for running auto generators for light plant use. Generator can be either rewound for slow speed or built up in the usual condition—depending upon flow of stream and equipment available.

Since water weighs 825 pounds per cubic foot and a horsepower equals 33,800 foot pounds per minute, all figures for horse power must follow this rule. First figure out the number of cubic feet of water in your stream. Next figure out the number of gallons per minute. Now multiply the by the diameter in feet and then divide your answer by 33,800 and you will get the exact horsepower rating of your stream.

DIRECTIONS

Take a flat 17 board (No. 1), 12 x 18, braced across bottom. On this make a cutout (No. 4) and belt pulley, "V" type (No. 3). Mount a Ford or Chevrolet rear axle shaft (No. 6) with hub and wheel bolt to block (No. 11) to board by means of wooden block bearings (No. 7). The end motion of the shaft being taken up by stop collar (No. 9) drilled and tapped for 1/2" set screw. Drill oil holes in a "V" shape. The bearing block to be made of hard-wood. On end of shaft opposite from hub, press on wooden or metallic wheel (No. 9) of a diameter from 2 to 3 times that of the bearing block. The hub (No. 10) will stay on the pulley, which may be a brake drum fastened to a wooden wheel (No. 11), with appropriate bolts for tightening screw to shaft.

The water wheel (No. 12) is built by removing the rim from the wheel and sawing a slot down to desired depth crosswise of the wheel. The inner part of the paddle (No. 13) as shown, by means of two machine screws, the paddle being made of fairly heavy sheet metal with one side of two corners cut, the edges turned up on the dotted line and the corners rounded.

The size of the paddles being determined by the size of the flume or stream. For an over-shot wheel the paddles will be reversed. Where the water pressure is derived from water under pressure and flowing through a pipe, a nozzle may be fitted to the pipe and cups substituted for the paddles on the wheel.
Plan 20
An Electric Outboard Motor from Old Ford ‘T’ Generator

Easily done in a few hours time. Runs from 8 to 12 hours on standard 6 volt storage battery. Low cost, light weight, silent and variable speed.

First secure a model ‘T’ Ford generator. If the bearings, bushing holder, brushes, commutator or other parts are badly worn they may be replaced by purchasing from us—see catalog for parts list.

Remove brush and take generator apart. Carefully pry wires out of commutator rings (the sure to not harm commutator), then pull out old wedges holding old wires in place. Remove wires and cleanslots thoroughly.

Next take insulation material .002 thickness and cut into pieces 25⁄64 X 25⁄64 inch. Three pieces the size of the slot will extend a little above the slots which will later be folded over when wedges are put in to protect the new windings. Hold in place with a piece of tape to you and number each commutator bar with white chalk. 21 bars in all. Use No. 18 heavy Formvar wire (2 two strands of wire in hand when winding), solder ends of both wires to bar 1 (a large soldering iron will be necessary for this operation). In order to seat the solder to the heavy copper segments, then run both wires through slot 1 and back through slot 2—return to slot 3 again and in place in 4 turns, then from slot 5 solder both wires to bar 11 as shown in diagram below. You now have completed one coil.

Next solder both wires to bar 2 and run through slot 4 and back through slot 3 as shown. Here wind in 4 turns and then finish off, solder both wires to bar 12 as shown in diagram below. Continue in an identical manner until all 21 coils are in place. 4 turns of two wires in each coil.

Fold insulation paper down in slots over wire and insert wooden wedges. Next test each coil for grounds and shorts. Use a non-conductor varnish and seal armature well and allow to dry—repeat two or three times, allowing to dry each time.

Next remove all field coils. Use No. 18 P.E. wire, two strands in hand and wind 4 field coils to same size and shape as coils just removed. Wind these coils carefully with No. 67 tape, then varnish. Connect all field coils in parallel, see Fig. 2. Use No. 18 P.E. wire for this. Two or three of these field coils are only brushed, using eliminating contact brush. Connect one field lead to generator terminals and other field lead to main ungrounded brush. Other main brush is properly exchanged. Be sure to use best brushes obtained. Connect 6 volts to generator frame and generator field leads in same way. All motor runs in wrong direction then reverse the two field leads. Lubricate as you do your car generator.

Listed below are supplies for making this change which are offered at following low prices. All supplies fully guaranteed.

Part Number Article 0-185-Complete kit for rewinding your own Ford ‘T’ generator to a 6 volt outboard motor.

14 lugs. No. 16 heavy Formvar magnet wire. 2 lbs. No. 18 P.E. magnet wire.

FACTORY WOUND ARMATURE AND FIELD COILS

Assemble your own motor without doing the rewinding. Use a factory rewound armature and LeJay made field coils. Will work in any ‘T’ generator.

FACTORY BUILT MOTOR FOR OUTBOARD

6 volt motor for outboard built from ‘T’ generator including rewound and reconditioned armature, new brushes, new field coils, grease sealed bearings, etc. Especially designed for outboard motor use.

0-46—Shipping weight, 17 lbs. F.O.B. (See catalog for price.)

ELECTRIC OUTBOARD IN KIT FORM

The information above shows in detail how to rewind a ‘T’ generator into a motor suitable for this kit. A complete kit for the motor is

PRICE LIST

B—Battery clips. Included with Y and Z.
C1—Main clamp casting. Ship. wt. 8 oz. F.O.B. $1.83
C9—Pole clamp casting. Ship. wt. 6 oz. F.O.B. $1.70
C3—Clamp screw assembly. Postpaid 49
C4—¾ x ¾” bolt and nut. Postpaid .15
C5—½ x ¾” rod from end at right angles with hole and cotter pin in other end. Postpaid .15
C6—¾ x ¾” thumb screw. .12
D—Pin shaft 1⅝”. Drilled and drilled to fit into hole A Fig. 1 into end of armature shaft A to a depth of ¾”. The ¾” drive pin 1 is Fig. 1 rigidly and loosely and held in place by pin F1 or rivet which is inserted through armature gear pin hole A2 as shown in Fig. 2. The armature pin gear and universal coupling. Fig. 2 above shows lower end of drive shaft fits into upper coupling of flexible shaft assembly No. 121.

N—Casting machined to take housing A. Motor M. Rheostat R. and steering handle S. Ship. wt. 2 lbs. F.O.B. 1.65
N1—Rivets. 100. Screw 10/32” X” x”. F.O.B. 6.50 for 250. Postpaid .23
N3—Rivets ½” X” X” x”. Postpaid .06
N4—Rivets ½” X” X” x”. Postpaid .06
Q—Special cast propeller, Ship. wt. 1 lb. F.O.B. 4.70
Q1—Oval brass nickel plated 30/32” x”. Postpaid .06
R—Rheostat complete with knobs. (See catalog for price)
S—Steering handle 6⅛” piece of ½” O.D. tubing with a ½” hole drilled ⅛” from end to take holding bolt and wing nut. Postpaid .18
W—¾” wing nut and bolt. Postpaid .06
X—One 5-foot length of No. 8 stranded rubber covered flexible wire connecting to either battery post and direct to motor terminal. Includes battery clip B. .43
Y—One 5-foot length of No. 8 stranded rubber covered flexible wire connecting to other battery post then to other terminal on rheostat. Includes battery clip B. .43
Z—One 5-foot length of No. 8 stranded rubber covered flexible wire connecting to other battery post then to other terminal on outboard. Includes battery clip B. .43
Z1—Complete SET: 3 pieces complete. F.O.B. 1.85
Z2—Complete SET: 2 pieces complete. F.O.B. 1.00
I—Insulating tape. 1000 ft. per 500 ft. F.O.B. 1.25
K—Kevlar knob. Included with R.
M—6-Volt Factory built motor. Same as C1 in catalog. Ship. wt. 17 lbs. F.O.B. (See catalog for price)
Plan 21
A Gas Engine or Motor Driven Generator with Drawings In Detail

Directions for Fig. 1

A—Connect to electric line wires.
B—Line fuses.
C—Line switch.
D—1/4 R.P.M. driving motor with counter clockwise rotation; or, if the motor has a shaft on each end, then be sure to use the end that rotates counter clockwise.
E—Common garden hose from 2 to 4 inches in length. Drill 1/4" holes through the shaft at a point 1/2" from shaft end. Now make corresponding holes in rubber hose and mount with stove bolts through holes as shown in diagram, after both shafts are in alignment. F—6 volt automobile generator with cutoff leads and 6 volt automobile fuse.
G—Automobile dashboard type ammeter.
H—Connecting wires from generator to storage battery. Wire coming from the cut-out is to be run to one side of the fuse housing; from opposite side of fence mounting run wire to one terminal in back of ammeter; from other ammeter terminal fasten a piece of wire which has a single-nail soldered to the top part of head—said nail to be slightly driven into one terminal of the battery. Make up a similar connection of nail and wire and connect from other terminal of fence to generator frame. Now the generator polarity must be determined (from local garage man) and the battery connected accordingly. When in operation, if the ammeter reads discharge, simply reverse the two wires on back of ammeter. All connecting wires should be no smaller than No. 14 and of rubber covered insulation. 3—6 volt storage battery.

L—Generator mounting block.
M—Gas engine which can be used in place of motor and should be coupled in same manner. Generator can also be run with belts and pulleys if necessary.

Plan 22
An Armature Growler for Testing Auto or Slow Speed Armatures

First secure the shell and fields of a Ford "T" generator and make sure that at least two of the field coils are in good shape. Mount the generator shell into a vise and cut the shell into two parts with two field poles in each half. A hack saw may be used for cutting.

Make two legs for the growler, using two pieces of 1/4" x 1 1/2" x 3" long pieces of flat steel. Bend as shown in sketch and drill one hole in top. Place pole bolts and drill two smaller holes in flats to take in screws. Remove the two pole bolts and bolt on these legs, using 3/8" x 8" machine bolts. A hammer and punch may be necessary to loosen the original pole bolts. If you are using the field coils which are already there, do not disturb the connection. If you are forced to substitute other field coils to replace those that are damaged, be sure that they are of opposite polarity. Connect the leads as shown with the auto starter switch series with one lead. A door bell button may be substituted for the starter switch.

The test lamp need not be connected to the growler leads, but this may be necessary where only one wall receptacle is available. The test probes are made of two pieces of No. 6 or No. 8 wire soldered to the ends of the leads, and insulated to about one inch from the head. Means of fibre or rubber tubing, or wrapping with friction tape.

This growler is to be used on AC only and for best results use 500-ampererefer to element (250 watt to 250 watt) in series with growler input. If used continually this growler will get hot. Not made for production work.

Plan 23
Two 32 Volt Series Motors Made from Dodge "G" or "GA" Generator

23A—32 Volt Series Motor
This motor will turn up to 2700 R.P.M., the speed depending on the load, with 10 amps. starting load and 4 amps. running load, at no power load. If higher loads are put on the motor, the amperage will increase up to a maximum of 50 amperes, which is the stalling point of the motor.

To make this change, only the shunt windings of the generator fields are used, no change being made on the armature or brushes, other than removing the control brush and grounding one of the other two brushes. Field coils to remain in series-connected.

Now connect one field to positive terminal on battery. Connect other field lead to ungrounded brush, then connect other battery terminal (negative) to generator frame. To reverse direction of the motor, simply reverse the field connections.

23B—32 Volt High Speed Series Motor
This motor requires no new installation of parts or wire. The armature, brush holders and shunt fields (small wire) in the fields are to be tested for grounds and shorts. The series fields (heavy winding) are to be disconnected and allowed to remain on the field poles only for a filler.

Remove the control brush which will not be used. Connect the first and second field coils in series and also the 3rd and 4th. This gives you two groups of two fields in series. Connect two groups of fields in parallel, and connect in series. See Fig. 3. There is no change made in the armature.

This motor takes 8 amperes and reaches a speed of 2700 R.P.M. It is capable of 1800 R.P.M. at about 1800 R.P.M.
Plan 24

A 32 Volt Heavy Duty Motor made from Dodge G or GA Generator

This motor is capable of high speeds, and because of the large winding in the field is also capable of handling a heavy load for an indefinite period. Developed 4,122, at 3,000 R.P.M. Motor especially designed for cream separator or any other machine requiring a great amount of starting torque.

In this motor there is no change made on the armature, and only the two main brushes are used. It is well to have the armature and brush holder tested for grounds and shorts.

Remove original field coils from the generator. Wind 6 new field coils using about 1½ pounds of wire for each coil. Use number 18 B.E. wire, and with two wires in hand, wind only 40 turns per coil.

Kit No. 163—Dodge to 32 Volt Series Motor.
Complete kit for rewinding your own Dodge 12 Volt generator into a 32 volt series motor ½ H.P.
1½ pounds 18 B.E. wire (2 wires in hand).

1 can Impregnating (air drying) varnish.
1 roll ½" cotton tape for field coils.
Cotton sheathing for field coils.

Above kit complete, F.O.B. (See catalog for price)

Install the new fields in the motor and connect them in series, with the field connected in series with the armature. See Fig. 4.

Plan 25

A Bench or Breast Drill for 6, 12 or 32 Volts made from 'T' Generator

The taper on armature shaft should not be put on until you have your chuck as different chucks have different tapers. After you have determined the taper required, the armature shaft should be centered in a lathe then taper machined to fit chuck. If you want to use chuck No. 360 listed in catalog then weld a 1½" length of stock to end of armature shaft. With a lathe turn the shaft to ½" diameter for a distance of 2" from end, then with a ½" die (21 threads to inch) thread the shaft for a distance of 1½" from end. This is same chuck used on our factory made drills.

Finish these edges after assembly to motor.
Drill 4 holes for lower motor bolts.
Snug fit on 1" pipe

When the motor is used in either the breast drill or bench drill, it is obvious that the top bearing is to take a considerable thrust. Therefore we recommend that this bearing should be replaced with a new combination and thrust bearing which can be purchased from us and is No. L.Y.T. (See catalog for price.)
Plan 26
A 6 Volt Motor for Drill Press, Washing Machines, Etc.
made from Model 'T' Generator

First secure an old model "T" Ford generator that has good commutator, good bearings, and a good brush holder. It is not necessary to get a new generator for this change. Remove the gear and take generator apart. By using a screwdriver carefully you can pry the wires out of the commutator risers (be sure not to use too much force which will harm the commutator), then push out all old wedges that are holding old windings in place. Remove wire and clean slots.

Next take insulation material .007 thickness and cut into pieces 23/4 x 1/4 inches. 21 pieces in all. Put one piece in each slot. This size paper will extend a little above the slots which will later be folded over when wedges are put in to protect the new windings.

Now hold the armature in your hand with the commutator next to you and number each commutator bar with white chalk. 23 bars in all. Use No. 15 heavy Formvar wire (two strands of wire in hand when winding). Solder ends of both wires to bar 1 (a large soldering iron will be necessary for this operation in order to sweat the solder to the heavy copper segments), then run both wires through slot 1 and back through slot 2—return to slot 3 again and place in 3 turns, then from slot 3 solder both wires to bar 12 as shown in diagram. You now have completed one coil.

Next solder both wires to bar 1 and run through slot 4 and back through slot 5 as shown. Here wind in 3 turns also from slot 5, solder both wires to bar 12 as shown in diagram below. Continue on in like manner until all 21 coils are in place. 3 turns of two wires to each coil.

Fold insulation paper down in slots over wire and insert wooden wedges. Next test each coil for grounds and shorts. Use a non-conductor varnish and soak armature well and allow to dry—repeat two or three times, allowing to dry each time.

Next remove all 4 field coils. Use No. 18 B.S. wire, two strands in hand and wind 4 field coils to same size and shape as coils just removed. Wind these coils carefully, winding 37 turns per coil. Connect all field coils in parallel, see Fig. 2 and "Schematic Connection Diagram." The two main brushes are only brushes used, thus eliminating control brush. Connect one field lead to generator terminal and other field lead to main ungrounded brush. Other main brush is already grounded. Be sure to use best brushes obtainable. Connect 6 volts to generator frame and generator terminal. Polarity has no effect. If motor runs in wrong direction, reverse the field leads. Lubricate as you do car generator.

Listed below are supplies for making this change.

**Kit No. Article**
165—Complete kit for rewinding your own Ford "T" generator to 6 volt motor suitable for bench drill, wash machine, etc.
1/2 lbs. No. 15 heavy Formvar magnet wire.
2 lbs. No. 15 P.E. magnet wire.
1 roll cotton tape.
2 copper brushes.
2 fibre end laminations.
2 Scotch tape to hold laminations.
1 can special air drying varnish.
21 wooden slot wedges.
21 Insulation paper .007 thickness.
Above kit complete, shipping weight 5 lbs.
F.O.B. .................
(See catalog for price)

1629—Set of two copper carbon motor brushes, postpaid.......$0.45

Plan 27
One 12 Volt Motor and One 32 Volt Motor
made from Model 'T' Generator

27A—12 VOLT MOTOR FOR DRILL PRESS, WASHING MACHINES, ETC.

Wind armature with 2 turns of 15 H. Formvar with two wires in hand. See diagram in Plan 26. Use original field coils. Field connections changed so only 2 brushes are used—connect one field lead to grounded main brush then other field lead connected to ungrounded brush. Armature does not need to be rewound. Also connect ungrounded main brush to terminal post.

**Kit No. 165A—"T" to 12 Volt 1/5 H.P. Motor**

Kit includes all necessary parts for making a 12 volt 1/5 H.P. motor like our Model No. 712. Develops 1/5 H.P. at 1800 R.P.M.

1/2 pounds No. 15 heavy Formvar wire.
2 commutator brushes.
2 fibre end laminations.
Scotch tape to hold laminations.
1 can impregnating (air drying) varnish.
21 wooden wedges for slots.
21 Insulation paper for slots.
1 end Insulation paper.
Above kit complete, postpaid.............
(See catalog for price)

**Kit No. 165B—Factory rewind "T" armature for 12 volt motor.**

(See catalog for price.)

27B—32 VOLT MOTOR FOR DRILL PRESS, WASHING MACHINES, ETC.

Study above 6 volt change to simplify procedure. Wind four new field coils, winding 400 turns No. 23 plain enamel wire.

There is no change made on armature. Connect the four new coils in series to make a new field and connect to armature like a shunt motor as shown in Fig. 5.

**Kit No. 166—"T" to 32 Volt 1/4 H.P. Motor**

Armature does not need to be rewound when using this kit. Kit includes field coil materials only. This motor is like our Model No. 732. Develops 1/4 H.P. at 1800 R.P.M.

2 pounds No. 23 plain enamel wire.
1 roll cotton tape for field coils.
1 can impregnating (air drying) varnish.
Cotton gauze for field coils.

Above kit complete, F.O.B. .................
(See catalog for price)

Coils 5P used with original armature make a 32 volt motor like our 732. (See catalog.)
Two 6 Volt Generators from the Dodge, Also General Information

28A—6 VOLT SLOW SPEED GENERATOR

This rebuilt generator has a cut-in speed of 300-450 R.P.M. and delivers a maximum output of 25-40 amperes. Original armature and rewind field coils.

Secure a Dodge "C" or "GA" generator with good armature and brushes. Have the armature tested on a growler if possible to make sure that it is in good shape, as the armature in this generator will be used without rewinding.

Next remove the old field coils. A hammer and punch will have to be used to loosen the pole bolts. Clean generator thoroughly with gasoline and allow to dry.

Make new field coils, using 460 turns of No. 18 wire. Wind so that the field coils are wound in one direction and the 2nd and 4th coils are wound in the other direction. Wrap with cotton batting or varnish. Make a new field coil by connecting the starting ends of each coil to one field lead and the finishing ends of each coil to the other field lead. Test for field polarity by connecting a 6 volt battery across the field coils, with armature still removed from the generator. With the battery connected to the field, pass a pocket lamp inside the shell and near each field coil in turn. As the needle passes each pole, the needle will change ends, the north end of the needle pointing to one pole, the south end to the other. If any two adjacent poles show the same polarity, one of them should be changed to opposite polarity by reversing the connections of that coil.

Connect one end of the field coils to grounded main brush, then connect the other end to ungrounded main brush. Also connect ungrounded main brush to positive terminal of generator, frame of the generator which serve as negative terminal. Control brush and holder may be removed as they are not used.

Assemble the generator and run for a moment as a motor. If it rotates in the direction desired, leave generator as it is. If it rotates in the opposite direction, reverse the connections of the lead connections or by shifting the end ball 1/2 turn in either direction.

A new set of factory made field coils can be purchased directly from us. Refer to Dodge Slow Speed Field Coils, part number 5A in our catalog.

Kit No. 1518—Dodge 6 Volt—6.5. Armature does not need to be rewound when using this coil kit. Kit includes field coil materials only. Cut in speed 500-650 R.P.M. frame output 35 amperes. Use original armature.

Kit No. 35 plain enamel wire.
1 can immersion oil
1 roll ¾” tape for field coils.
Cut in the field coil leads.

Above kit complete. F.O.B. .......................... (See catalog for price)

28B—6 VOLT HIGH SPEED GENERATOR

Like our model No. 2116. No. rewinding of field coils or armature.

This plan uses the original Dodge short field only. It is not necessary to rewind the armature when replacing the windings, as it can remain as a space filler. Cut all connections to these series coils and leave unconnected. The shunt fields (nail wire winding) are already connected, as is the field and armature. The armature can be rewound as described in 23A.

28C—GENERAL INFORMATION

TESTING FIELD COILS

To test the field coils for grounds or shorts, first make sure that there is no contact between any of the wires and the brushes or the frame of the generator when the battery is connected to the two wires of the armature with a light bulb of proper voltage in series with one wire. Connect one of the wires to one end of the field coils, and the other end to the other coil circuit. The light should go on to indicate that there is a continuous circuit through the coil. Then move the wire on the frame of the generator. The light should not light. If it lights, it indicates a short circuit between the field and the frame. To locate this short, it will be necessary to remove one field pole and move the coil so it does not touch the shell. Try the light again, and if it still lights, it will be necessary to remove another pole using the brush for shorted brush holder, also to find out if the terminal post is properly insulated.

The next test is for field polarity. To do this, first secure a small pocket lamp, and connect the battery so that it will have a current passing through all the field coils. With this current on, pass the pocket lamp near each pole in turn. The first and third poles in a pole machine should attract the pole, and the second and fourth poles in a pole machine should attract the opposite pole of the needle, and in a 6 pole machine, every other pole should attract the one end of the needle. If any one or more poles fail to attract the proper end of the needle, disconnect that pole, and reverse the wires of that pole only, with respect to connection with other poles.

TESTING ARMATURES

An armature test is made difficult unless there is A.C. power available. In this case, all that is necessary is to make a growler like in plan 22 which operates on A.C. To use the growler, place the armature into the growler, turn the switch, and with the machine running, making a growing noise, contact a hack saw blade on the top side of the armature. If the blade is strongly attracted by the armature, the armature is shortened, and the only positive cure for this condition is to wind the entire armature coil. If the blade is not attracted to the armature, the armature is free of grounds and shorts. Continue this procedure until all sides of the armature have been tested. If the blade is not attracted to any of the bars, there can be no circuit from bar to bar, and the light will then indicate a circuit from bar to armature core. When the light is on, the coils will have to be rewound. Now connect one lead to the tail end wire of any coil. Touch the other lead to each of the bars in turn. The lamp will light only when the lead is touching the bar, the coil is fastened to the starting end of the coil. If the lamp lights at any other time it indicates a short circuit between two bars and this short will have to be found by unwinding the armature until it appears. There should be no shorts in the armature.

WINDING ARMATURE

When winding armature, the armature can be simplified by mounting the armature into a rack such as shown in Fig. 4. A rack of this nature can be easily constructed from metal by having the upright pieces mounted on a solid base and using wood screws or nails to form the points which fit into the hollow poles in the ends of an armature shaft.

Figure 1.

Where a growler is not available then satisfactory tests can be made as follows: Have the tail end wire of each coil disconnected from the armature. Then test for grounds by connecting one side of your test lamp (as described in first paragraph) to the shaft of the armature, and the other lead of the lamp to each of the bars. When the lamp is off, the coil is not connected to any of the bars, there is no circuit from bar to bar, and the light will indicate a short circuit from bar to armature core. Wherever this light appears the bar which that coil will have to be rewound. Now connect one lead to the tail end wire of any coil. Touch the other lead to each of the bars in turn. The lamp will light only when the lead is touching the bar, the coil is fastened to the starting end of the coil. If the lamp lights at any other time it indicates a short circuit between two bars and this short will have to be found by unwinding the armature until it has been located. There should be no shorts in the armature.

Now replace the light with an ammeter, and carefully measure the current which passes through each armature coil. It is generally assumed that the lowest voltage coil or coils are all right. If any coil shows a higher reading it indicates that the coil has an internal short or is sly some turns.

Figure 2.

The first step after the armature has been stripped to test each bar to see that there is no short between it and the bar on either side of it or to the shaft. If it can be done by means of the lamp test as described above. If any shorts or grounds appear they will have to be cleared by means of scraping away any foreign sub- stance. Next make a test for grounds by using a piece of metal from a slip of metal between the commutator bars or extending from the bars to the shaft or commutator core. These shorts can be cleared by scraping them out with a hack saw blade, the teeth of which have been ground on sides to remove the "set" of the saw.
Parallel connection (starting ends of each coil are joined to one field lead and finishing ends of each coil joined to other lead). Where the machine has more than 4 poles, the same methods may be used throughout.

FORMING FIELD COILS

It is necessary to wind field coils over a form to simplify the work. A form may easily be made by using a piece of wood the thickness of the coil just removed from the generator but 3/4" longer and wider than the smallest portion of the pole shoe. If the block tapers to one side somewhat, it will be easier to remove the finished winding from it. To this block are fastened two strips of wood or fiber the same height as the form. After the coil is wound, it is well to make saw cuts in both sides of the spool to hold the string tied to hold the windings in place until they can be secured by the tape covering. The general appearance of the spool or form is as shown here.

COIL WINDING FORM

The sides of the spool are held on by means of screws which are to be removed after the strings have been tied around the sides of the coil. It is then a simple matter to remove the coil from the wooden core.

MOTORIZING

We mention motorizing several times in the plans. By this is meant that a generator will run as a motor when connected directly to a battery. All generators will run as a motor but at a much slower speed, the direction of rotation being always in the direction in which the generator is to be driven to charge.

When new field coils have been installed into a generator or motor, they should always be tested for polarity. This can be done as follows: Remove the armature but leave the fields in position. Now connect the fields to a battery to allow a current to flow through the fields. Now pass a pocket compass near each of the poles in turn. In a two-pole motor or generator, one of the fields will attract one end of the compass needle and the other pole will attract the other end of the needle. Where the machine has 4 poles, the first and third poles should attract one end of the needle and the second and fourth poles should attract the other end of the needle. If any of the poles attract the same end of the needle, simply reverse the connections of that pole. Where new fields are being installed in a machine like the arc welder, the heavy coils and light windings should be tested separately. The above test is used, and both the heavy and light windings of each pole should attract the same end of the compass needle. Reversing the connections of the pole attracting the wrong end of the needle will always reverse the polarity of that pole. The generator is to be then assembled as a motor. It is believed that if the ag must be reversed, it is necessary to reverse the direction of rotation of the armature, all that is necessary is to reverse the field lead connections.

ARCMG AT BRUSHES

Should the generator show excessive arcing at the brushes and show a tendency to charge only at low rates, this can be readily overcome. On the Dodge "QA" generator simply remove the four screws which hold the brush endbell to the shell. Shift the endbell to a position in which it will rest upon the bearing when the generator is revolving at a charging rate. Drill new holes in the endbell to take the screws in this new position. If the generator is a Dodge model "Q", it will be impossible to overcome the arcing except by installing an adjustable brush rigging of another type, such as the rigging removed from a Ford model "T" starter.

LOWER CUT-IN SPEED

In some generators the cut-in speed can be lowered somewhat by reducing the air space which is between the field shoes and the armature. This is especially true with Ford types. This space can be reduced by placing thin shims cut from a baking powder box against the back of each pole shoe and inserting them between the pole shoe and the generator shell. These shims must be of material containing iron or steel as shims of brass, copper or paper are useless. Place shim under each pole.

CONNECTING BATTERIES

Each cell of a lead plate battery has a potential of 2 volts. In an ordinary 6 volt auto battery three of these cells are connected in series. To make a 12 volt battery out of two 6 volt batteries there are to be connected in series as shown on next page.
Note that batteries are connected negative to positive. When it is desired to use 6 volt batteries on a 32 volt plant, 5 batteries can be connected in series as above, giving you 30 volts, which will work on a 32 volt plant, or 5 complete batteries with one extra cell, all connected in series will give you 32 volts.

When 6 volt batteries are used, and you desire to charge 2 or 3 of them at a time from a 6 volt plant, they should be connected in parallel. Note that in this case the negative posts are all joined to the negative wire and the positive posts to the positive wire. When batteries are joined like this it is best that all batteries have about the same charge in them before joining them, as the stronger batteries will discharge slightly and build up the weaker ones, until all have the same charge.

**SERIES**

**CONNECTING GENERATOR TO BATTERY**

When connecting the battery to the generator, the procedure is as follows: Connect the generator terminal to one terminal of the ammeter, generally the terminal to the left, as the ammeter is seen from the rear. Connect the other side of the ammeter to the positive post of the battery. The proper sides of the cutout are always indicated by the words "GEN" or "BATT" on the connecting straps. Connect the negative battery post directly to the frame of the generator or to any piece of metal having direct contact with the generator shell. If the cutout is mounted on the generator shell the frame of the cutout is automatically grounded. If it is not mounted on the generator, the frame of the cutout must be connected directly to the negative wire of your circuit. A connection scheme appears below:

**SCHEMATIC DIAGRAM**

To see that your ammeter is connected correctly, close the cutout or short circuit it by touching a piece of wire to both connections of it at the same time. The generator will now run as a motor and the ammeter will show discharge if the wind is not turning the generator over. If the ammeter shows charge when this is done, simply reverse the ammeter connections. There are times when the cutout refuses to close when the plant is first put into operation. This is because the cutout is improperly polarized. To correct this, simply close or short circuit the cutout as described above, and the trouble will be corrected.

**IMPORTANT**

There are two important things to remember when operating a wind plant or any other generator. Never allow the generator to run with the battery disconnected. Never allow the generator to charge more than its maximum rated charge, even for a short time. Either of these cases will result in a burned out generator. Make sure that your generator bearings are in good condition, as loose bearings will allow the armature to rub on the poles, causing excessive heat which will also result in a burned out generator.

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**Plan 29**

**A 110V. or 220V. A.C. Portable Transformer Arc Welder**

The accompanying diagrams and the following instructions explain clearly the construction of a heavy duty arc welder with an input of 1½ to 3 kW, and an output of from 35 to 110 amperes. It will work on any 110V. A.C. line, through 30 ampere fuses. See note for 220V. construction.

The building of this welder is not difficult. It consists of four important parts: (1) the coil; (2) the case; (3) the transformer, and (4) the transformer case.

The coil consists of a primary winding of 338 turns tapped at the 28th turn, and a secondary of 195 turns tapped at the 80th turn. Prepare a winding of hard wood to the dimensions given in Fig. 1. Fasten the end (1) to the large end (2) of the spool drum (2) with flat head wood screws, and fasten spool end (3) to the tapered end (5) of the drum with round head wood screws and washers. Lay an 18" piece of stout string along each of the four sides of the spool drum, allowing the ends to project equally over the ends piece of paper. Wind the string over the strings and around the drum, then tie the paper in place with a few turns of linen tape. Paste the ends of the string out of the way by means of small tacks on the outside of the spool ends. (See Fig. 1.)

The primary, of No. 11 S.C.E. magnet wire, is wound in even layers over the paper. Leave a 15" length of wire at the beginning of the winding, to serve as the common primary lead (4). Wind on 225 complete turns, fasten this with paper tape, and tape the ends of the same No. 11 wire to form the low tap (5) of the primary.
Plan 30
A 110 Volt Spot Welder—1 Kw. Input Normal Draw 10 to 11 Amps.

This unit will weld a 1/4" maximum thickness of material. The welder is designed to work on any service without the necessity of a service draw of from 10 to 11 amps. It is designed for 110 volts, 60 cycles, but can be used without any change on 110 volts at 50 cycles.

The core, Fig. 1, compresses to a thickness of 1/4" and is built up to the specifications in Fig. 5.

Note carefully that layers are laid so that all joints are staggered and grouped. This will make it more difficult for the operator to draw the waves, as is the case with the primary core. This will force the operator to work the core into the transformer, causing core losses and overheating.

The coil is wound on a spool (Detail 3C). Lay 34" pieces of strong string along the four sides of the spool and over them a double layer of white paper. The two layers should be wound in opposite directions. This is to hold the core in place. Over the paper, wrap one layer of 34" "Empire Cloth", or varnished cloth, starting at the bottom, and spirally winding up to the top. Also lay a piece of almost the same length and width, a little of the insulating varnish applied to the under side and then wound with this. Trim away the surplus cloth and allow the varnish to dry. In the centers of two 34" squares of a 34" fiber (Fig. 6), cut openings one and thirty-six inches by thirty-six inches, removing the center core, and carefully wind the winding of the core, as shown in Fig. 4. Slip one of the fiber squares over the cloth covered core, and slide the coil into place over the cloth, drop the second square of fiber into position, and replace the end section of core. Clamp the core as tightly as possible, after making sure all cores are joints perfect.

Lay out and drill the terminal panel made from 1/4" tempered pressed wood obtained from lumber yard. Form loops in the ends after trimming to size and mark them for the layout of the transformer. Run solder over these loops. Fig. 4. Cut the brass bus bar in the double outlet, removing just enough that it so that short will be impossible between the high and low primary leads, which are connected to the two resulting terminals of the transformer. (See Fig. 4.) Complete the secondary leads to their proper terminals, Fig. 5. Connect the secondary leads to their proper terminals, Fig. 6. Construct the case to hold the transformer, Fig. 7. The case is held in place by the three bolts that fasten the rubber feet to the bottom of the core clamps.

The working leads for this transformer welder are of flexible rubber covered wires. The bare ends of the secondary leads, Fig. 5, are covered with the copper bus bar and the terminal panel. The complete set of leads to the operator, the core clamps, and the transformer, is shown in Fig. 7. The welding leads, Fig. 4, are connected to the bus bars as is, thereby making contact with both outlets, Fig. 6. Complete the secondary leads to their proper terminals, Fig. 5. Connect the secondary leads to their proper terminals, Fig. 6. Construct the case to hold the transformer, Fig. 7. The case is held in place by the three bolts that fasten the rubber feet to the bottom of the core clamps.

The welding leads for this transformer welder are of flexible rubber covered wires. The bare ends of the secondary leads, Fig. 5, are covered with the copper bus bar and the terminal panel. The complete set of leads to the operator, the core clamps, and the transformer, is shown in Fig. 7. The welding leads, Fig. 4, are connected to the bus bars as is, thereby making contact with both outlets, Fig. 6. Complete the secondary leads to their proper terminals, Fig. 5. Connect the secondary leads to their proper terminals, Fig. 6. Construct the case to hold the transformer, Fig. 7. The case is held in place by the three bolts that fasten the rubber feet to the bottom of the core clamps.

Kit No. 12

Includes transformer materials only.
110 Y. B. Co. Transformer, 110 V. D.C. transformer.
12 pieces fiber 36" x 36".
1 small cotton bag.
1 large insulating varnish (air drying).

Complete kit. Ship. wt. 46 lbs. F.O.B. Minneapolis.

WELDING CABLE
A tough rubber jacketed cable for lasting service, suitable for all uses. The cable is designed for the electrician, the mechanical, and the industrial use. The jacket is made of a tough rubber material which will stand up under hard usage. The copper conductors are made of high-grade, hard-drawn copper, and are stranded together for a strong, flexible cable. The jacket is made of a tough rubber material which will stand up under hard usage. The conductors are stranded together for a strong, flexible cable.

Details 4A and 6D are important as they are figured to give the exact leverage to bring the electrodes together in the proper manner. Pay particular attention to these dimensions.

To connect this welding to your source of supply, have a snap welder ready to make the connection. This is done by the use of a connecting box which is placed between the transformer and the welding leads. The switch is then closed to complete the weld (from one to three seconds depending on material and conditions). If the pressure is removed while the switch is still on, there will be a considerable arc from the electrode to the work, which may result in damage to both electrodes and the work itself.

Kit No. 10

Includes transformer and copper materials only. We do not stock the other materials required.
22 lbs. 8 oz. D.C. magnet wire.
22 lbs. 2 oz. D.C. magnet wire.
4 32 ga. 1/4" bar copper connectors.
4 32 ga. bare copper connectors.
1 1/4" bare copper bar, 21/2 ft. long.
1 1/4" copper bar, 6 ft. long.
2 1/2" copper electrodes machined to fit.

Plan 31
A Direct Drive 32 Volt Wind Plant—All Metal Construction

This plant has been designed for the Dodge "G" or "GA" generators because, being of the four pole type, these generators are readily adaptable to slow speeds.

The propeller plan gives the full dimensions for laying out actual size patterns and templates for a 7/8" propeller which is the size recommended for this plant. Note that the leading edges of the two blades are parallel 1½" apart, and the propeller carries a width of 9/16" for a distance of 2½" on each side of the center. From this point the blade tapers to a tip width of 4" measured from the leading edge. Carefully maintain the 4" trailing edge for the whole length of the blade. Note the riser dimensions for positioning the cross-section heights and widths at the section lines "A, B, C, D, and E." All tapers from "F" to the tip are straight lines and should be laid out with a straight-edge. The best results may be had with redwood or straight-grained fir.

The propeller hub is a washer of 7/8" diameter welded to the helical gear of the generator, or a cast iron hub selected from the LeJay catalog.

The collector assembly "E," and the generator bracket "A," which include the clamp "E," may be purchased direct from LeJay factory, but may be home-made as illustrated in Figs. 1, 2, 3, 4 and 5.

The tower is four sided and the corner pieces are 60" long. The pipe "X" is 32½" long if used with the factory head assembly, but only 24" long if the head is to be home-made. The length of this pipe is the only necessary change in the tower construction to adapt it to either the factory head or the home-made head.

The pipe support collars "C" are of cold rolled steel, 2½" in diameter by 1½" thick. A hole is bored in the center of each collar to provide a tight fit on pipe "X," which is a piece of 1½" standard pipe. Drill 3 holes through tower legs and collars to pass the ¾"x1½" square head machine bolts "L" which are threaded into the pipe "X." Bolt holes are 9½" down from the tops of the tower legs. Then the lower bolt holes are 6½" below center of top holes.

The brush collector ring "O" is a tight fit to the pipe. Saw a slit in the ring, and by spreading the slit the ring is slipped over the bolt holes. Insert the end of the weather-proof wire in this slit and solder over the joint. Clamp the ring while soldering to make it fit tightly. File the soldered joint smooth.
The lower half of assembly "E" is held in place by a %” x %” square head machine bolt which is screwed into pipe "Y".

From %” wide, 16 ga. band steel, form the clamps "H," Figs. 1, 2 and 3. The angle iron "R" are 16” long, and have a slight bend, Fig. 3. Pipe "P" is threaded at the top, as is pipe "Y," to take a lock nut cut from a standard coupling. This nut holds the head in place.

The main vane has its lower support bolted to the top or brush half of the "E" assembly in the factory job. The top support is hung from the clamp "S." The main vane of the home-built plant has both supports hung from clamps, Fig. 1. The "S" clamps are fitted to the pipe on which they are used.

The pilot vane on both plants are identical.

The pull cord on the factory job is anchored to the top pilot vane support, passes through the pulley "Z" on the top main vane support, through the pulley "Z" mounted on the "S" clamp of the top support of the main vane (by means of a small bracket), and then is drawn down inside pipe "Y".

The pull cord on the home-built plant is anchored to the main vane top support, passes through pulley "Z" which is mounted on the top pilot vane support, through pulley "Z" which is mounted directly on the top generator arm "R" and then down through pipe "Y".

On the factory casting of the head assembly stops are provided at the open and closed positions of the vane. The home-built head uses a small chain "F," Fig. 3, to hold the vane in the open position. A tension spring connected at point "D" on the top pilot vane support "W" holds the vane at right angles when the pull cord is released. The cord is of %" light stranded flexible cable.

The wiring diagram is clear, and no explanation is needed. Much of the success of the plant depends, however, on the brush assembly described in Fig. 5. Adjust the wiper arm "N" to give a good strong contact of the ring at any position and provide a strong flexible cable for the connection to the generator from the fastening bolt in the insulator block. This circuit is the positive shown in the diagram. The negative travels through the generator case to the tower and may be taken off tower at any handy point.

If one desires to run this plant with a governing propeller there will be no need of a pilot vane. Cut off upper pilot vane support "W" at point "P" beyond where pullout cable fastens to support. This portion of upper support "W" will be used as arm for pulling plant in or out of wind. There will be no lower support "W".

**PARTS**

No. A—Cast iron generator bracket with clamp. Factory machined..........................$4.00

No. B—Cast iron collector ring assembly. Includes a special machined brass wiper brush which is held firmly by means of tension spring and insulated with fiber tube. This brush makes constant contact onto a machined brass ring which is pressed onto insulated lower casting. Wires are embedded to wiper and ring so quick connection to battery and generator can be made. Complete assembly, weather proofed.............$9.50

No. C—Brass collector ring to fit 1½" pipe—Insulation material included..........................$4.25

No. N—Spring brass wiper complete with bakelite M: drilled and See catalog for price.)

No. 3—24" coil spring for governing tension...................$0.15

No. 25—3/4" copper twist pullout cable. 10 feet for...........$3.00
Plan 32
A Battery Spot Welder

The accompanying diagrams and following instructions explain clearly the construction of a spot welder designed to work on any ordinary 6 volt storage battery and spot weld two pieces of iron 22 gauge or lighter. Under proper conditions much heavier materials can be welded. Very thin materials may better be welded on 2 or 4 volt, more than 6 volts not recommended.

First secure two pieces of channel iron 1 1/2"x1 1/2"x1/16" each 12" long and bend from one end as shown. On the bent ends small holes are to be drilled so hinge 1 1/4" long can be fastened. This hinge permits welder to actuate freely.

Next drill 3/8" holes in either end of channel to accommodate the electrodes. In drilling the 3/8" holes, be sure their centers are at least 1 1/4" from end. Three fiber washers are then made for each electrode and installed according to diagrams so each electrode is insulated from channel iron.

Handle is made from piece of 1"x5/8" iron 12" long and bent so it will not touch upper electrode until welder is in operation. Slot the hole in handle as described in detail at upper left by drilling two holes, then file—this will allow handle to give proper leverage on upper channel without binding on 3/8" holding bolt.

Another coil spring that can nicely fit over the 3/8" holding bolt and hold the two channel arms apart, so electrodes do not touch, can be used.

Be sure the cable connecting electrodes and battery are of No. 2 cable or heavier. Lighter wire will not work as anything lighter cannot carry the desired current. For best operation use an auto starter switch in one cable, then connect to battery as drawing indicates.

When using the stock to be welded is placed between the electrodes, then pressure applied. The foot switch is then closed long enough to complete the weld, taking from 1/2 to 2 seconds, depending on thickness of materials. Switch must be turned off before pressure is released—if pressure is released while the switch is still on, there will be a considerable are from the electrode to the work, which may result in a burned job.

This welder draws a large amount of current at each operation but because the length of contact is so short a good full charged battery will make a large number of welds before battery needs to be recharged.

Plan 33
(Armature Diagrams for Autolite, Bosch-Autolite and Bosch Generators)

NOTE: GK ARMATURES WITH BLANKED SLOTS CONNECT AS SHOWN IN THIS DIAGRAM... THIS DIAGRAM IS FOR GK SERIES WITH STRAIGHT SLOTS...
Plan 34
Armature Diagrams for Delco, Delco-Remy and Remy Generators
(See Directions Plan 41)
Plan 40
Armature Diagrams For Wagner Generators
(See Directions Plan 41)

Plan 41
Armature Diagrams For Westinghouse Generators

DIRECTIONS

The accompanying winding diagrams are given with the connections, number of turns and wire sizes as used in standard high speed generators for automobile use, constant speed generators or reduction drive generators. The previous secret of converting one of these generators into slow speed windcharger use is to rewind the armature with more turns of wire using the same commutator connections and coil span as the original winding. Owing to the large number of generators involved we are attempting to condense this explanation in a general plan which will cover the most complicated features of all types on attached units. We wish to call your attention to the fact that some of these diagrams are covered in detail with respect to converting them into windcharger machines in previous plans which may be purchased singly or in the manual.

First find the drawing that applies to your particular generator. In most cases there are several groups of numbers listed with each drawing. These numbers represent the variety of armatures used in that particular generator. After each armature number, the size wire and number of turns for some special windings is also listed. For instance one model generator can have as many as a dozen different armatures, therefore, be sure to check your armature number so you can determine the correct size wire to use for rewinding.

Now remove all the old wire with care, so as not to harm the commutator bars. Take particular notice how the old wire was removed as new wire will be installed in the same manner. For high speed work, or identically except for number of turns and size of wire for windcharger or other slow speed work. Clean the stripped armature thoroughly. A dirty armature can cause no end of trouble through grounds and shorts.

Select your wire size. For automotive and other high speed work use the wire sizes as recommended in the drawing. For windcharger work we have found the following wire sizes to give best results for lowest cut-in speeds with highest gate maximum output—where the drawing calls for No. 15 or No. 16 wire use No. 19 wire; where the drawing calls for No. 17 or No. 18 wire, use No. 20 wire. Heavy Formvar magnet wire is recommended instead of a.c.e. as more turns can be installed in each slot.

First remove armature and measure wire size, also count number of turns per coil and make note of commutator connections and coil span. As most auto armatures are originally wound with No. 16 a.c.e. and assuming that your armature is of 16 c.e. the proper size to rewind with will then be No. 19 heavy Formvar, as 3 wires smaller is usually used for slow speed. Clean all slots thoroughly and insert insulation papers of proper size in each slot—this paper to be 0.010 thickness. Before you start winding it is necessary to figure out how many turns it is to be made in each coil. As armatures vary in total slot numbers and slot sizes it is hard to give a definite figure that can be applied to all armatures, yet it is very simple to determine if you follow these easy instructions. Cut several pieces of 19 wire (or the wire you are going to rewind with) about 1/8" longer than slot length. Use one end and start laying the cut wires into this slot, counting each one and packing them in until no space is wasted. After this slot is full and wound is finished, remove cutters and take out wires, recount so you will have a double check. Supposing you placed 56 wires in this slot— and as there will be two coils in each slot you will then wind each coil with 14 turns, making a total of 28 wires in each slot. Commutator connections and coil span the same as originally wound.

Some armatures have twice as many commutator bars as slots, therefore it will be necessary to wind with two wires in hand which would mean each slot will have 4 coils instead of 2. In this case the proper number of turns per coil will be 9 turns, two wires in hand or a total of 18 wires in each slot. Remember that the cut-in speed depends entirely on the number of turns in the armature and not by the size of wire used. Therefore, the more turns in the armature, the lower the cut-in speed is going to be. The dotted lines in each drawing indicate whether the starting slot, or slot No. 1 lines up with a commutator segment or with the wire between any two segments. The numbers appearing under the commutator bars such as (1-11) in Ford, 21 slot, 22 segment, Plan No. 10 means that the end bar for coil one is the 11th bar to the right of the starting bar.

In winding any armature the job is simplified by fastening the wires of the coil to the commutator bar or bars, then winding in the proper number of turns, then bringing the wires or wires to the finishing bar of the coil. These end wires are then cut off and folded back until following coils have been wound, in identical fashion. After the last coil has been wound, lay a moon-shaped paper over the slots which have been fastened to the commutator, then bring the folded wire through the slots, on top of wires already there and on top of moon-shaped paper, then fasten to proper bars. When 2 wires are wound through each coil we recommend the use of wires of the same size, it is necessary that the two wires are fastened to the proper bars. For example we will take the first drawing in Plan 35. In this armature we wind with 2 wires in hand, a white wire joined to bar 5 and a red wire joined to bar 6. Two of these wires are then taken as if they were one single wire and wound with proper number of turns through slots 1 and 6 after which the white wire is to be fastened to bar 6 and the red wire to bar 7. The same scheme is used throughout.

When you come to a case such as in the Bosch generator armature in Plan 33, you will find the note "Lap to the left—Last coil is dead." This means that coils should all be laid to the left. An examination of this armature reveals that there is one less bar than twice the number of slots which is common in two-in-hand wound armatures. Therefore, when the last coil is to be wound, there will
be but one bar while there are two wires. In this case, the red wire may be eliminated from this bar, but not from the others, for it is advisable to use it as a filler to aid in balancing the armature. Thus the white wire will be fastened to starting and ending point of the coil while the red wire is slipped off close to the slot at each end of the coil. When an armature is wound, it should have two wires fastened to each bar and wires of at least two coils lying in each slot.

After the armature is finished it is well to wind string around the wires just back of the commutator bars as on the original windings, then saturate with varnish, allow to dry and test.

A good armature can be obtained by winding on slow speed generators, which can be readily accomplished by fully advancing the core with Patent Stinger tool until all brushes are held up by the end of the core. A small core is drilled into each slot for bolts to fasten the end of the core. A number of armatures can be made in this manner by drilling new holes for the bolts which hold the end core to the generator. No changes need be made in the field coils or brush connections.

Owing to the large number of armature sold it is impossible to tell the dealer the exact size for slow speed generators. It is always best to order and have them made to the same state of manufacture and number of armatures and as to specification of armature slots and number of commutator bars. Make a note of the size the generator was taken from, it is also helpful to us when filling your order.

You pay postage on following kits.

Kit No. 172—To rewind "T" armature for automobile use. Includes all armature parts, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 171—To rewind Autolite, Bosch, also Bosch-Autolite armatures for automobile use. Includes all materials, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 1816—For slow speed windcharger use (not including the 14 slot 25 horn). Ship wt. 2 lbs. (See catalog for price.)
Kit No. 172—To rewind Delco also Delco-Remy armatures for automobile use. Includes All armature material, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 1616—For slow speed windcharger use (not including the 14 slot 25 horn). Ship wt. 2 lbs. (See catalog for price.)
Kit No. 175—To rewind Ford "A", "B", and "C" armatures for automobile use. Includes all armature materials, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 174—To rewind Ford Powerhouse armature for automobile use. Includes all armature parts, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 176—To rewind Northcoast armature for automobile use. Includes all armature materials, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 1815—For slow speed windcharger use (not including the 14 slot 25 horn). Ship wt. 2 lbs. (See catalog for price.)
Kit No. 177—To rewind Wagner armature for automobile use. Includes all armature materials, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 1815—For slow speed windcharger use (not including the 14 slot 25 horn). Ship wt. 2 lbs. (See catalog for price.)

Plan 42
Plans For Installing Lights On Your Tractor

First secure an old auto generator, any make will do, but be sure it is in operating condition. Next determine how the generator is to be connected to the battery or power. It is also necessary to state number of armature slots and number of commutator bars. Make note of the size the generator was taken from, it is also helpful to us when filling your order.

You pay postage on following kits.

Kit No. 176—To rewind Northcoast armature for automobile use. Includes all armature materials, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 177—To rewind Wagner armature for automobile use. Includes all armature materials, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 175—To rewind Ford "A", "B", and "C" armatures for automobile use. Includes all armature materials, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 174—To rewind Ford Powerhouse armature for automobile use. Includes all armature parts, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 176—To rewind Northcoast armature for automobile use. Includes all armature materials, less brushes. Ship wt. 2 lbs. (See catalog for price.)
Kit No. 1815—For slow speed windcharger use (not including the 14 slot 25 horn). Ship wt. 2 lbs. (See catalog for price.)

Driver's seat. This wire can be brought out of generator by drilling or slotting small hole in cover—this wire is "B" in diagram. Connect this wire to one side of a 3 ohm 25 watt rheostat with other side of rheostat connected to tractor frame. You now have a 3 ohm variable rheostat in series with the field circuit which will limit the amount of current delivered to the battery.

Reason for control is so you can adjust charging rate of generator to your requirements. If your battery is fully charged the generator cannot turn off entirely, however, if battery is nearly full, you may wish to reduce the rate to only 8% of normal. If you have other batteries that need to be charged occasionally then this idea of generator on your tractor will prove very practical and profitable.

No. W3 rheostat is recommended. (See catalog for price.)
No. ST7—Instrument panel with 3 ohm 25 watt rheostat, 10 feet of No. 12 flexible rubber covered wire—ready to mount on your tractor. Shipping weight is 1 pound. (See catalog for price.)
No. 57W—Same instrument panel as ST7 except panel includes a 20-0-20 ammeter. (See catalog for price.)

Plan 43
Two Types 110 Volt, A.C. Insect Exterminators

Either of the two types of exterminators described in the following plans will work satisfactorily on standard house wiring of 110 volt, 120 volt, and 220 volt A.C. wiring. Each of these is made for porches, and they will quickly rid a house or building of the bugs and insects which invariably find their way through the finest protection.

DIRECTIONS

1. The grid cage (1), and the grid ring (2), are of 1/4" slotted blind, 1/4" fiber, and are 4" in diameter. The grid ring is 1" wide. Drill a 1/4" hole in the center of the grid. Assemble the cage and secure it with 2 screws to the frame. The cage is 1 1/4" high.
2. Drill a 1/4" hole in the frame for the grid ring. The grid (3) is 1" wide. Drill 1/4" holes 1/4" apart. Use as many holes as desired. Assemble the grid (3) and the grid cage (1) with 2 screws. The cage is 1 1/4" high.
3. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
4. The grid cage (1) and the grid ring (2) are 1" wide. Drill a 1/4" hole in the center of the cage. Assemble the cage and secure it with 2 screws to the frame. The cage is 1 1/4" high.
5. Drill a 1/4" hole in the frame for the grid ring. The grid (3) is 1" wide. Drill 1/4" holes 1/4" apart. Use as many holes as desired. Assemble the grid (3) and the grid cage (1) with 2 screws. The cage is 1 1/4" high.
6. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
7. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
8. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
9. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
10. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
11. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
12. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
13. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
14. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
15. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
16. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
17. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
18. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
19. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
20. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
21. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
22. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
23. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
24. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
25. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
26. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
27. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
28. The wire is passed through the grid ring (2) and the cage (1) is fastened to the frame (5). The grid is 1 1/4" high.
Plan 44
An Electric Scooter Using a 6 or 12 Volt Battery for Power

RUNS 50 TO 75 MILES ON SINGLE BATTERY CHARGE

The LeJay Electric Scooter is one that knows no equal in performance, long life and low operating cost. Because you operate it at a speed of 8 or 12 volts per volt battery at home for as little as 6c and because the scooter goes 50 to 75 miles on one charge, makes possible the extreme low operating cost. (Operation on either 6 or 12 volts. To start it merely turn the knob control and you have a smooth running motor. No_ cranking, chugging, backfiring, sputtering or vibration with a LeJay Electric Scooter. Assembly is simple and easy.

DIRECTIONS
First secure a model "T" Ford generator. If the bearings, brush holder, commutator, or other parts are badly worn they may be replaced by purchasing from us—see catalog for parts list. Remove brush holder and take rotor apart. Use a screwdriver carefully pry wires out of commutator pads (be sure not to harm commutator), then push out old wedges holding old windings in place. Remove wire and clean slots thoroughly.

The armature shaft has to be extended to 3/4" measuring from outside edge of 203 bearing. Instead of 11/2" which is original measurement. The extended shaft may either be welded or machined and pressed on, then turn to 1/4" in diameter for distance of 3/4" from end. Thread with 3/4" die 20 threads per inch. The rubber drive roller will fit this extended shaft perfectly.

Next take insulation material .060 thickness and cut into pieces 2x4x15 inches, 21 pieces in all. Put one piece in each slot. This side piece will extend a little above the slot when it is charged. No cooling fins will be necessary for this operation in order to create the heat to the heavy copper segment, then run both wires through slot 3 and back through slot 2—return to slot 3 again and run in 4 turns, then from slot 3 solder both wires to bar 11 as shown in diagram. You now have completed one coil.

Next solder both wires to bar 2 and run through slot 4 and back through slot 2 as shown. Here wind in a turn and then from slot 3, solder both wires to bar 12 as shown in diagram. Continue on in like manner until all 21 coils are in place. 4 turns of two wires in each coil.

Fold insulation paper down in slots over wire and insert wooden wedges to keep test coil in place. Remove strip of cloth from brushes, coat brush, then coat commutator with insulating varnish and soak armature with to dry. Repeat 2 or 3 times. Allow to stand for 48 hours.

Next remove all 4 field coils. Use No. 12 P. E. wire, two strands in hand and wind 4 field coils to same size and shape as coils just removed. Work these coils carefully, winding 22 turns per coil. Tape, shape, then varnish. Connect all field coils in parallel, see Fig. 2, "Schematic Connection Diagram." The two main brushes are only brushes used, thus eliminating control brush. Connect one field lead to generator terminal and other field lead to main ungrounded brush. Otherwise proceed as usual to use best brushes obtainable. Connect 6 or 12 volts to generator frame and generator terminals. For testing, note motor runs in wrong direction then reverse the two field leads. Lubricate as you do your car generator.
Listed below are supplies for making this change which are offered at following low prices. All supplies fully guaranteed.

Part Number       Article
0-1618—Complete kit for rewinding your own Ford "T" generator to a scooter motor.
1/4 lbs. No. 16 heavy Formvar magnet wire.
2 lbs. No. 15 P. E. magnet wire.
1 roll electrical tape.
2 copper carbon brushes.
2 fibre and laminations.
Scotch tape to hold laminations.
1 can special air drying varnish.
21 wooden slot wedges.
21 insulation papers .007 thickness.
Above kit complete, shipping weight 5 lbs., F.O.B. (See catalog for price).

FACTORY MADE ARMATURES and FIELD COILS

This armature has an extended shaft and threaded so the friction drive rubber roller may easily be installed. Armature comes completely rewound, varnished baked and ready to install in your "T" frame and to be used in combination with Lejay factory made field coils.

No. ER18—Set of 4 special Lejay field coils for Lejay Scooter Motor, Shipping weight with coils 16 lbs., F.O.B. 31st St., N. Y. (See catalog for price.)
No. ER19—Set of 2 copper carbon scooter motor brushes, poolpaid. (See catalog for price.)

The accompanying diagrams and instructions explain clearly how to construct and assemble the Lejay Electric Scooter. There are two large drawings to consult, showing all details for making each piece and for assembling, which should eliminate all questions.

12 volts produces approximately twice the power and speed as 6 volts. The Lejay Scooter will carry a 175 pound person up to 16 miles per hour on 12 volts.

FACTORY BUILT MOTOR FOR SCOOTER

Lejay Scooter Motor built from "T" generator including rewound and reconditioned armature with long threaded shaft and nut, new brushes, new field coils, grease sealed bearings, etc. Especially designed for Scooter. Does not include rubber roller drive. Operates on either 6 or 12 volts.

No. ER18—Motor as above described. Shipping weight 7 lbs., F.O.B. (See catalog for price.)
No. RX speed control rheostat and switch 10 oz. (See catalog for price.)

In all cases your armature must be sent in when exchange is desired as we do not make outright sales.

Field coils are connected in parallel when you receive them so that it is necessary for you to do is connect your motor as shown in Figure 2, 'Schematic circuit diagram.'
Mount the rear wheel (21), on the shaft (22), with one lock-collar on each side to hold the wheel in place. Slide the spring (23), onto the shaft and place the axle in the holes (24), in the frame. Place cotter-keys in the holes in the shaft, and center the wheel. Tighten the set-screws in the collars (25).

Slide the motor in its cradle to center the rubber roller on the tire of the wheel, and tighten the bolts in the cradle. Loop the spring (25) over the top of the motor and hook it on one of the clamp bolts. This spring causes the roller to bear on the tire with sufficient pressure to drive the Rocket.

Fit the brake-rod (18), into the hole (26). In the brake-pedal, run it through the hole in the front of the seat-box and through the hole in the brake-carrier (11). Fasten the spring (18), to the frame cross-member at (12), by means of the bolt (17). Place cotter-keys in the holes in the brake-rod.

Mount the rheostat (29), in the hole (28) and the outlet plug in the hole (27). The end of motor extends through hole (21) which is covered and protected by cover (10) fastened with bolts (32) into holes (33). Follow the diagram for connections. Run a wire (c) from the motor terminal to the rheostat. Run a wire (e), from the NEGATIVE side of the battery to the motor case. (This wire may be clamped under one of the motor cradle bolts.) Run a wire (f), from the rheostat to the Positive side of the battery. Battery clips are provided for the battery connections.

The outlet plug provides a convenient connection for recharging the battery without its removal. If you wish to set up your charger some, connect it as shown in "HOOKUP A." Mark the positive side of the plug to avoid mistakes in charging.

If you desire to be able to recharge the battery anywhere without the necessity of returning home, connect the outlet plug as shown in "HOOKUP B" to a charger of the dry type mounted inside the seat-box. Carry a length of extension cord in the seat-box for plugging into 110 volts wherever necessary and you may extend your cruising radius indefinitely.

Now, place one or two six-volt, or one twelve-volt battery in the seat-box, clamp them down firmly, and as soon as the battery clips are fastened and the gas cover is in place, your LeJay Electric Rocket is ready for the road.

Plan 45
An Electric "Go-Bike" Using a 6 or 12 Volt Battery For Power

RUNS 50 to 75 Miles on Single Battery Charge—

The LeJay Electric GO-BIKE rides on a single air-wheel and operates on either 6 or 12 volts. Battery charging can be done at home for as little as 6c, meaning the LeJay GO-BIKE is extremely economical to operate. No need for rollering! Turn the rheostat on handlebars and away you go. No chains, no belts and no gears! Quiet rubber friction drive gives noiseless and smooth riding comfort.

DIRECTIONS
First secure a model "T" Ford generator. If the bearings, brush holder, commutator or other parts are badly worn they may be replaced by purchasing from us—see catalog for parts list. Remove gear and take generator apart. By using a screwdriver carefully pry wires out of commutator ring (be sure not to harm commutator), then push out old wedges holding old windings in place. Remove wires and clean slots thoroughly.

The armature shaft has to be extended to 3 1/2" measuring from outside edge of 350 bearing, instead of 1" which is original measurement. The extended shaft may be either welded or machined and pressed on, then turned to 3 1/2" in diameter for a distance of 3 1/4" from end. Thread with 5c die 24 threads per inch. The rubber drive roller will fit this extended shaft perfectly.

Next take insulation material .007 thickness and cut into pieces 2 1/2 x 1/8 inches. 21 pieces in all. Put one piece in each slot. This wire paper will extend a little above the slots which will later be folded over when wedges are put in to protect the new windings.

Now hold the armature in your hand with the commutator next to you and number each commutator bar with white chalk. 21 bars in all. Use 16 H. Formvar magnet wire (two strands of wire in hand when winding), solder ends of both wires to bar 1 (a large soldering iron will be necessary for this operation in order to sweat the solder to the heavy copper segments), then run both wires through slot 1 and back through slot 2—return to slot 3 again and place in 4 turns. Then from slot 4 solder both wires to bar 11 as shown in diagram. You now have completed one coil.
FACTORY MADE ARMATURES and FIELD COILS

This armature has an extended shaft and threaded so the friction drive rubber roller may easily be installed. Armature comes completely rewound, varnished, baked and ready to install in your "T" frame and is to be used in conjunction with LeJay factory made field coils.

In all cases your armature must be sent in when exchange is desired as we do not make outright sales.

LeJay factory made field coils when used with the above armature make a Go-Bike Motor like our model No. GB48. Use these coils and above armature in your own "T" frame and save the difference.

Field coils are connected in parallel when you receive them so all that is necessary for you to do is connect your motor as shown in figure 2 "Schematic circuit diagram."

No. GB15—Set of 4 special LeJay field coils for LeJay Go-Bike motor. Ship. wt. 2½ lbs. P.O.B. (See catalog for price.)

0-1620—Set of two copper carbon Go-Bike motor brushes, postpaid. (See catalog for price.)

The accompanying diagrams and instructions explain clearly how to construct and assemble the LeJay Electric Go-Bike. There are two large drawings to read, showing all details for making each piece and for assembling, which should eliminate all questions. 12 volts produces approximately twice the power and speed as 6 volts. The LeJay Go-Bike will push a bicycle with a 175 pound man up to 10 miles per hour on 12 volts.

FACTORY BUILT MOTOR FOR GO-BIKE

LeJay Go-Bike motor built from "T" generator including rewound and reconditioned armature with long threaded shaft and

No. RX—Speed control rheostat and switch, 10 oz. (See catalog for price.)
Before beginning the actual assembly, lay all of the parts out on the floor and study the plan until you are familiar with the proper numbering of each part as well as its purpose and operation.

The drive wheel (1) rides free on the axle (2), and is held in position by the two collars (3). Place the wheel in position, run the axle through the holes (4), in the main frame, allowing the collars (3) to remain loose until the cotter-keys (5) are in place. Now center the wheel on the shaft and tighten the set-screws in the two collars. The wheel must turn freely, but it should not wobble nor rub against the sides of the wheel well.

If you have built your own motor according to a LeJay Plan, fasten the roller in place on the shaft between the washers provided, and tighten the nut (7) securely. Slip the motor into the cradle and clamp it loosely by means of the bolts (9).

Fit the rod (11) into the holes (5) in the main frame, bringing the motor assembly into approximately the proper position.

Adjust the motor back and forth in its cradle to center the roller (6) exactly on the tire of the drive wheel, and tighten the cradle bolts (9). The spring (10) is slipped over one of the bolts (3) and hooked into the hole in the cross member as shown at (12). This spring provides sufficient tension between the roller (6) and the tire of the drive wheel to propel the GO-BIKE.

Two hinges (13) are provided, complete with nuts and bolts, to fasten the cover (14) in place over the motor housing.

To mount the bike bracket on your bicycle, remove the nut from the rear axle (on the left side), fit the hole (16) in the brace over the axle stub and replace the nut. Fasten the upright leg of the bracket to the bicycle frame members by means of the two "U" bolts shown at (17) and (18). Adjust the bracket to a vertical position and tighten all of these bolts.

Fit the holes (19) in the bracket over the holes in the hanger bracket (20), and slip the hunger pin (21) into place. Lock it in position with the cotter-keys (22).

A wire (X) runs from the terminal on motor to either one of battery posts. One end of control cable is connected to the other battery post then brought out through the hole (23) which has a rubber bushing. Connect other end of this cable to un-grounded terminal of rheostat. Because other terminal of rheostat is already grounded there will be no other connections necessary.

The plug marked (outlet) may be connected as in hook-up "A" to allow quick connection to a home charger. If you desire to be able to recharge the battery anywhere without the necessity of returning home, connect the outlet plug as shown in "HOOKUP B" to a charger of the dry type, mounted inside the battery box. The battery may now be recharged by simply plugging into 110 volts A.C. wherever available. An unlimited cruising radius is yours with the GO-BIKE when it is equipped with the self-charger.

Now place a 6 or 12 volt battery in the carrier box and clamp down firmly, then as soon as the battery clips are connected your LeJay GO-BIKE is ready for use.
Plan 46
A Carbon Electrode Holder for Soldering, Brazing and Light Welding Direct From Six-volt Storage Batteries.

In and about the shop of average size, a situation will arise from time to time, wherein the shopman finds himself in need of a bit of soldering, brazing, or welding at a point where ordinary commercial methods are either available nor practicable. He may find no power source at hand, or the necessary equipment may be too expensive. In such a case, the small portable type of welder illustrated and described in this plan will be found worth many times its cost.

For convenience, the power source most portable, and most usually available, is the storage battery. Converting its power into the heat necessary for the work desired, requires a carbon contact. Therefore, the construction of a carbon electrode holder of a size and capacity suited to handle the maximum output of the battery is all that is necessary to put into the hands of the workman the ability to handle emergency jobs that otherwise might cause no end of annoyance in the loss of time and expense.

DIRECTIONS

Cut the washers (A) and (C), from ordinary pipe having ¼" walls and an inside diameter of sufficient dimension to slip easily over the ½" tube. The end of this 8" brass tube is flared to prevent the washers from slipping off. This is done by tapping with a small ball peen hammer, or by means of a large file at the center of punch. Not much of a flare is required. The spring (D) fits loosely on the brass tube, but will not slip over the washers. It is about 1½" long when expanded, and should be fairly stiff. The gauge of spring steel wire is about right. The ¼" hole (E), which accommodates the carbon electrode, is centered ⅛" from the end of the tube. This hole is drilled thru both walls of the tube. Hole (F), is centered ⅛" from the center of (G), and is drilled ⅜" to take the 1/4" cotter key (D), which holds washer (C) in place. This hole is also drilled thru both walls of the tube. Hole (H) is centered ⅛" from the center of (M), and is drilled ⅜" to take the connector bolt (G). This hole is drilled thru only one wall of the tube.

Now, slip the two washers and spring onto the tube and set the cotter key in place. Slip the handle onto the tube to the position indicated in the drawing. This handle may be of wood, bicycle grip or a 3" to 4" piece of regular garden hose. Place the bolt (I) in the lug (J), and solder it in place. Insert the cable in the tube until the bolt can be fed thru the hole (N), where it can be tightened securely by means of the nut (K). The nut is fastened on the cable is needed, as the frame of the car will form its own retainer.

Preheating with a blow-torch will be found of material assistance in the successful forming of joint heavier than ordinary.

You may take your power from tips by shaving old dry cell carbons down to the proper size, but better results will be had by the use of the commercial tips manufactured especially for this purpose.

The hook-up diagrams clearly the method of connecting the welder for work. For soldering, brazing, and very light welds, one six-volt storage battery will serve nicely; but for heavier work, two six-volt batteries in parallel with a driven generator and cutout will help materially. Remember that this tool is for all around soldering, medium brazing, and very light emergency welding. Therefore, it should never be expected to compete with the transformer or heavy generator type of commercial welder. However, for light gauge metals, and for welds requiring currents of comparatively short durations, this midget welder will prove its great value in a short time.

For light body and tender work, or minor engine repairs, the car's own battery may be used. Simply clip the main cable direct to the terminal of the starting motor. If no cable is needed, as the frame of the car will form its own retainer.

A ground cable is necessary with which to connect the positive side of the battery to the work. A ground cable consists of a six-foot length of No. 8 welding cable with a heavy battery clip soldered to each end.

The cutout must be mounted onto generator; or, be sure that cutout frame is connected to generator when small and cutout will not function properly. Batteries to be connected in parallel (positive to positive and negative to negative).

For making this welder are not sold separately but a complete kit of parts (you assemble it) may be purchased from us at a very surprisingly small amount. (See catalog). Also listed in the catalog are goggles for use with this welder, small brazing and welding rods also other welding supplies at low prices.
Everyone has a Ford "T" Colli or can easily get one from his neighbor or used auto parts yard. This is one reason the "T" is used for this plan. Another reason is that it has mounting posts on end of coil which make it easy for holding various fittings.

Operating on a six volt battery, the Fence Control built from a Ford "T" Colli is capable of charging from 5 to 8 miles of fence. If special attention is given to proper insulation of the entire circuit, and to the specifications of the manufacturer, a 10 to 12 mile of fence can be electrified successfully. The reason for this added coverage is simple.

The Fence Control delivers a shock of low current at a very high voltage. Because of this high voltage, there is a marked tendency toward leakage at every point of support regardless of the type of insulation used. Therefore, use only first quality porcelain insulators and allow only as many posts to the miles as are necessary to support the wire without undue sag. The superior performance of this installation will more than compensate for the slight additional effort and expense involved.

The control of livestock is without doubt the most important application of the charged fence, yet the number of ways in which it may be used is almost limitless. For instance, the entire foundations of buildings with but a single wire supported only by porcelain knobs, a barrier is formed only one inch from the surface of the wall. This will prevent rats, mice, ground squirrels and similar pests from crawling into the protected building. In the case of corn cribs, granaries, and other buildings sometimes built upon piers, the charged wire is led from pier to pier at a height of 6" above the ground, and around each pier on the porcelain insulators. This wire, along the ground will keep rabbits, squirrels, woodchucks and the like from under the structure, and the wires around the piers will keep out the rats, mice, weasels, squirrels, etc. Grass should be spread on the ground directly under the wire to hold down weeds and grass which would short-circuit the charged wire upon contact.

Trees, shrubs, flowers and gardens will be free from damage by dogs, rabbits, skunks, woodchucks and the larger squirrels if a wire surrounds the area supported by porcelain insulators on stakes of the proper height.

By applying the various methods outlined above to chicken houses and yards, danger to the fowls from weasels, mink, rats, mice, skunks, foxes, and stray cats can be eliminated. For the protection of temporary or movable structures such as brooder houses and range fences, the more common installation is in the form of portable sections capable of being set up in a few minutes time to enclose areas of almost any size or shape. These sections consist of lengths of barb wire mounted on flat boards by means of porcelain insulators, one at each end. A clip of one kind or another fastened to one end of the wire makes the connecting easy.

Where numbers of widely separated buildings must be effectively fenced, it would not be unusual to suggest the building of an individual control for each structure. This would eliminate the need of long lines of connecting fence which would be of no value whatever.

An electric fence does not have to be one continuous length of wire. It may contain as many branches as are necessary to your needs; and no return wire is required, as the control itself is grounded and any animal touching the charged wire forms the return through the ground. There is but one wire from the control to the fence line, and the fence line may end anywhere on the farm. Barbed wire is recommended for livestock, while ordinary fence wire is suitable for poultry. A fence control works steady whether or not an animal is touching it.

Once the animals become acquainted with an electric fence, they will stay clear of it and it may be turned off for days at a time.

Protection against lightning damage is an important part of the installation of any electrified fence. A lightning arrester to by-pass the lightning surge to the ground, and a small fuse between the fence line and the charger are all that is needed for ample protection. Ordinary radio lightning arresters cannot be used. The high voltage of the fence current will ground itself across the small gap provided in these instruments, therefore, an arrestor made especially for fence use must be purchased. A 7½ watt lamp may be used instead of the fuse.

It is a good idea to disconnect the control from the fence line entirely during a severe electrical storm.

There will be less danger to the cattle from lightning where electrified fences are used, because they are soon trained to keep a considerable distance away from the wire, in fact, away from all wires.
**DIRECTIONS**

Obtain a Model ‘T’ Ford spark coil in good condition, and remove the coil points, (1A), and (1B). Drill through the three rivets on (1A), remove the point spring, (2), and enlarge the hole, (3), to a diameter of $\frac{3}{4}$" as seen in Fig. 1. The contact point (4), remains as is.

From the top of the vibrator point (1B), cut a $\frac{3}{4}$" section containing the contact point (5), as in Fig. 2. Now, following the dimensions in Fig. 3, prepare the armature (6), and solder the contact point (6) accurately in position. This position may be checked by placing a strip of paper between the contact point and the $\frac{3}{4}$" hole in the armature. The two contact points must align perfectly. Fig. 4 gives the dimensions of a spacer block (7) of $\frac{3}{4}$" fiber. This block may be of bakelite, hard rubber or pressed wood, and fits exactly the contour of armature (6). Note that of the four rivets (8) in the armature, two are removed for the installation of the new points. These will be explained later. When using block (7) as a pattern, cut a rivet flap (9) from .010 insulating paper. Note that there are but three, instead of five holes as in this flap.

Guided by the assembly details in Fig. 5, solder the armature (6) to the vibrator point (1B), fixing the center of the $\frac{3}{4}$" hole in the armature exactly $\frac{3}{4}$" from (7), the center of the mounting holes in (15). Now, pass the $\frac{3}{4}$ rivets through the point spring (2), and through the spacer block (7), getting them down into the counterbore portion of the holes. Place the rivet flap (9) to cover the rivets (8) which have been filed flush with the surface of block (7), and rivet through the spacer block (7), the flap (9), and the armature (6). Rivet must touch the surface (8) and the rivet flap (9), prevents the rivets (8) from coming in contact with the armature. Be sure that the two points are perfectly lined up with each other, and the $\frac{3}{4}$" holes are even.

Solder a $\frac{3}{4}$ or 4" length of flexible insulated wire to one of the No. (10) rivets for connecting the leads to the coil on the No. 3, as in Fig. 7. Be sure of clearance of the adjusting screw (12) as it passes through the $\frac{3}{4}$" hole in the armature. Connect the pig-tail (11) to the stud (14).

Now, having obtained a glass tube of the dimensions shown in Fig. 7, form front and rear supports of wire as shown in Fig. 8. The inside diameter of the glass tube is given as $\frac{3}{4}$" so that it may be used for the outside measurement of the glass tube, with a slight allowance made for the taps (18), which may be friction or paper or anything to give a grip for the glass tube. Drill (18) through the No. (10) tube support, (16) through the No. (10) tube support and the exact center of the breaker points as it rolls down the incline.

The rear tube support (17) is located on the back of the coil box so that in its lowest position the glass tube is not more than $\frac{3}{4}$ to 5 degrees from horizontal. The support mounting screws (18) are shown in Fig. 7, shown in Fig. 8, driven down into the back wall of the coil box. A washer may be necessary on these screws, in which case cut the piece of glass tube (19) exactly 4" long and drill into the tube and close the end of the tube with a cork (21) or rubber stopper.

The wire (22) which carries the high voltage to the fence line, is a heavy No. 14 or No. 16, varying with the engine, with proper terminal on the coil box. Solder the battery leads to their terminals on the coil, and provide a ground lead from the terminal end (23). Connect the finished unit to the battery by means of small battery clips and tilt the unit back and forth to start the marble rolling.

**NOTE:** If no action is apparent immediately, shift the pigtail (11) from the stud (14) to the corresponding stud on the other side of the coil.

To adjust the action of the spark, tilting the glass tube more or less will vary the interval between shocks, and adjustment of the knob (13) increases or decreases the power of each shock.

Of course the battery will last a longer time when the fence is delivered, delivering a shock at each minute as are absolutely necessary. After the cattle have become trained to electrified fencing, this economy is not at all risky, as the effectiveness of the fence is not in doubt.

**A portable Neon Fence Tester** such as described in the LeJay catalog, can be used for testing the controller at any point along its entire length. If a dead portion of fence line is found after further parts of the line have been found to be O.K., the trouble is probably in the fence line itself. Look for a broken insulator or grounded wire, and check the connections at joint in the wire.

This control will also operate on 4 volts but will produce a weaker shock than if used on a 6 volt storage battery. (A storage battery will deliver a stronger shock.) The controller is connected to any 5 volts of the 32 volt battery, and the same thing also applies to a 210 volt battery.

**KIT No. 8—Complete kit for building your own fence control using a Ford ’T’ coil and including the following items:**

- 1 special constructed glass tube with ball.
- 1 special inside point assembly.
- 1 tube cradle—rear tube support.
- 1 front tube support rack.
- 2 double conductor lead wire.
- 1 single conductor hook-up wire.

**Complete directions and guarantee.**

**Catalog price.**

**FORCELAIN INSULATORS**

**No. 95—Porcelain Insulator with leather, less nails.**

- Shipping weight: 2 ounces.
- F.O.B. Minneapolis.

**Carton of 100.**

**SHIPPING w.t. 15 lbs. F.O.B. Minneapolis.**

**See catalog price for.**

**CORNER INSULATORS**

**No. 94—End Insulator, Ship wt. 25 ga. F.O.B. Minneapolis.**

**See catalog price for.**

**Carton of 25.**

**Shp. wt. 4 lbs. F.O.B. Minneapolis.**

**See catalog price for.**

**NEON TESTER**

**No. 63—Portable Neon Fence Tester for testing fence.**

**See catalog price for.**

**Plan 48**

**110 Volt A. C. 500 Watt Self Excited Generator from Dodge Model ‘G’ or ‘GA’ Generator.**

**THIS GENERATOR IS LIKE OUR MODEL NO. 155.**

- Complete dismantle your Dodge 12 volt generator, removing all windings except that the whole machine may have a thorough cleaning before beginning the rewinding operations. Armature windings are always rewound. They are in sheets with bakelite, a very hard material. When rewinding, the coil must be covered with a back saw just behind the commutator. Be careful not to damage the commutator.

- Slot the commutator risers with a back saw to take No. 10 wire. Coil the wire between the commutator bars and insulate with .010 insulating paper. If any appear, they will usually be cleared by scraping any foreign substances from between the commutator bars, and from between the commutator and the shaft. If the fault cannot be corrected, the commutator must be replaced.

- Insulate the commutator bars between the laminations and the commutator, by a binding of insulating paper, gummed paper, or adhesive tape. Number the commutator bars 1 to 25. A line through the center of bar 7, parallel with the shaft, will locate slot No. 4 of the armature. Determine slots 1 and 7 from this point. Insulate each slot with .010 insulating paper.

- So that the field coil may have a piece of $\frac{3}{4}$" fiber or piece of wood. Fill the brush hole with powdered graphite. Blacken the commutator bars and corners, Careful of proper current and motor current.

- Use as shown in the diagram for A.C. winding. In this diagram the commutator end of the armature is away from you. The winding starts from the end of the core next to you. Now number the ends as shown and start the first coil in slot 1 and back through slot 3 using No. 16 heavy Formvar magnet wire. Note the direction of the current.

- Connect the windings in 21 turns, and increase the voltage to 5 volts. With no break in the wind, move into slots 4 and 5. Wind on 24 turns, and move into slots 24 and 5. Wind on 31 turns. Move into slots 6 and 19, and wind on 24 turns. Move into slots 5 and 11, for 12 turns. Continue winding according to the diagram until the A.C. winding is complete.

The starting lead of the A.C. winding connects to the shaft through the flange of the collector ring assembly. The finish lead connects...
to the collector ring itself, through one of the bolts holding it to the bakelite disc (see diagram).

The construction of the collector ring assembly is quite simple, and can be easily understood from the diagram. The flange is first bored out to snug fit (not too tight) onto the armature shaft. Then, the shoulder is turned in a lathe against which the bakelite disc is to be bolted. Drill and thread holes in the flange to take the disc bolts, and the set screws to the shaft. Bore out the center of the bakelite disc, drill the bolt holes and mount it to the flange. Take a turning cut in the bakelite to receive the collector ring, and drill and countersink the ring bolt holes. Face the ring on one side, drill and thread holes for the ring bolts, and mount the ring on the bakelite disc. Take a finishing cut on the ring, facing the bolt ends off smoothly.

Locate and drill the hole in the end bell to take the collector brush bushing. Examine the inside and outside surfaces of the end bell and the location of these bushings will be easily determined. Be sure the insulating washers and bushings are properly placed to avoid the possibility of shorting at this point.

The special field coils for this generator consist of 350 turns each of No. 18 D.C. magnet wire. They can be wound most easily on a wooden form shaped to the dimensions of the pole pieces. Now tape the coils securely with cotton tape overlapping about 1/2 width of tape. The coils are made to conform to the curve of the pole pieces by tightening the pole pieces down with the coils in place. Connect the field coils in series parallel. Remove from case then dip in air drying varnish and allow to dry or in baking varnish and bake 2 hours at 350 degrees Fahrenheit. Dip armature in air drying varnish and allow to dry or in baking varnish and bake 2 hours. This baking may be done in an ordinary oven at a temperature of about 350 degrees.

After the armature is dry it is placed in a lathe, and the commutator trued up.

Only two of the three brushes are used in this conversion. Connect one field lead to one main brush, and the other to the other main brush. The regulator brush is to be removed and the generator is ready for the test. Start the generator, and check the A.C. terminals by means of a test lamp (110 volt). If the bulb refuses to light reverse the leads on the D.C. brushes.

Properly operating, this generator produces 500 watts, 110 volts at 60 cycles, when turning at a speed of 1800 r.p.m.

Kit No. 164A—Complete kit for rewinding Dodge generator into a 110 volt A.C. 500 watt self-excited generator.

3 lbs. No. 18 heavy Formvar magnet wire.
2 1/2 lbs. No. 16 heavy Formvar magnet wire.
7 lbs. No. 15 plain enamel magnet wire.
1 roll of cotton tape.
25 slot wedges.
25 slot insulation paper.
Insulation paper for winding D.C. from A.C. winding.
1 can air drying varnish.
2 commutator brushes.
2 bronze rings (A and B) for collector ring.
1 fiber piece for collector ring.
1 collector brush assembly complete. No. 485
Complete kit. (See catalog for price.)

Kit No. 164D—Same as 164A but includes factory-made collector ring No. 48D instead of the two bronze rings and fiber ring. (See catalog for price.)

No. 48C—Collector ring completely assembled and ready to place onto your armature. (See catalog for price.)

No. 48B—Brush holder assembly with brush. To be used in conjunction with collector ring No. 48C. (See catalog for price.)
Plan 49
110 Volt A.C. 60 Cycle 1/2 H.P. Synchronous Motor from Dodge Model 'G' or 'GA' Generator

This is a very serviceable 110 A.C. motor which is built from the Dodge frame and includes a 'Squirrel Cage' which is shown in Fig. 1. The purpose of this 'Squirrel Cage' is to smooth out the somewhat uneven operation, or vibration, ('Hunting Action'), usually observed in this type of motor. This 'Hunting Action' is caused by the attempts of the armature to locate its true position in the changing field. By eliminating this 'Hunting' as far as possible, the life of the motor will be lengthened, and its power increased.

While the squirrel cage cannot be assembled in the frame until the motor is assembled, preparation for its assembly is to that extent the thing that must be done. Fig. 2 shows the location of the cage, and explains the reason for the group of holes which must be drilled through the pole shoes. This drilling must be accurately done, and haste or lack of proper preparation for the job will surely be found costly before the job is finished. The easiest way to accomplish these drills is to bolt the pole shoes firmly in place in the generator shell, then place the entire unit on the drill table, and clamp it solidly in position. Drill slowly, to allow the drill point to keep accurately in line. Too much pressure will tend to make the drill "walk," as it passes through one laminating into another. Center the middle hole, and there will be no holes as close as possible to it, leaving about 1/8" of metal between the holes, and locating all holes about 1/2" back from the pole face. These holes are drilled 1/8", which will take a No. 6 round copper wire, from which all the lateral bars of the squirrel cage are made. For No. 6 wire use regular No. 6 D.C.C., and remove the cotton covering. The cage rings can be formed of square copper bar, as shown in Fig. 3, or they can be of the same No. 6 wire as the bars. All joints in the squirrel cage must be firmly soldered. When this soldering is done, place a bit of fiber over the field coils to prevent damage to them by the heat of the iron, and use only a non-corrosive fluid.

Now that the construction of the squirrel cage has been so thoroughly explained, and we know that it cannot be installed in the generator, or frame unit until all of the field coils are in place, let's turn our attention to the winding of the field coils. Build a winding form of the same dimensions as the pole pieces, and on this form wind the four coils according to the directions given in Fig. 3. The 'Serbes' or heavy winding is put on first, and consists of 60 turns of No. 14 heavy Formvar wire. Next, wind all the lines of this coil in the same directions, but cross the leads of the two of them, as shown in Fig. 4, to reverse the flow of current in alternate coils. Tape all four coils with 1/2" cotton tape overlapped 1/4", and dip them in insulating varnish. Be sure to mark the coils with crossed leads, and mark the tops of all coils so that no mistakes will be made in connecting them together. Hook them up as indicated in Fig. 5, and mount them on their poles in the motor case. Shape them carefully, especially those end, to allow room for the squirrel cage, and then you may finish assembling the squirrel cage. Be sure that the cage is compact enough to allow the two end bells to fit snugly in place. Some of the projections on the interfaces of the end bells may have to be filed or ground down a little, but only to allow them to be drawn tightly into place. If the squirrel cage touches them, no harm is done as the cage is already in direct contact with the frame.

Now for the rewinding of the armature. After a thorough cleaning, insulate the slots with 200 armature paper, and lay on the D.C. winding as shown in Fig. 4. This is a "wave type" winding. Each coil consists of 6 turns of heavy Formvar wire, and each coil follows a similar operation of No. 1, which ground through slot 1 and back through slot 7. The winding is begun by driving the clean end of the wire into the inner slits of the commutator bars. The bars in the No. 1. Count to the right on the bars to locate bar No. 7. A line is drawn from this bar parallel to the shaft, and through one of the core slots, bearing No. 1, which is the center of coil No. 1, and from which all of the slot numbers are determined. Wind 6 turns in slots 1 and 7, and bring the finish lead out to bar No. 7. Remember that all wires leading to the commutator bars must all be formed as close as possible to the shaft of the armature. Note that there are two connections to each commutator bar when the winding is completed. Now solder the leads to the risers, being careful to avoid short circuits between bars. Clean up the commutator, clipping excess wire from the risers, and bind the leads wires tightly with cord or tape. Now tap the finished windings down snugly in the slots, and place a layer of insulating paper over them in preparation for the winding of the A.C. section of the armature.

The A.C. distributed winding is wound in next and with only a smaller piece of 907 insulation paper and winding just completed. The Start and Finish leads of this winding protrude from the armature core opposite the commutator as shown in Fig. 5. Start the winding in slot No. 1, tap 5 slots, and return through slot 7. Wind on 12 turns, using No. 16 heavy Formvar wire, and then pass the wire into slots 2 and 6, here wind
Plan 50

An A.C. Welding Transformer Using Dodge Generator Coils

PRODUCES 35-35 AMPERES, 3 TO 48 VOLTS.

NO REWINDING NECESSARY.

(See Notice at end of this plan if you wish to build this welder at very little cost.)

By properly connecting a combination of 8 coils taken from two Dodge NORTH-EAST "G" or "GA" Generators and mounting them on a core built to the specifications given in the accompanying detailed drawing, 1 will understand in the right hand core, which will be required to handle 1 or 200 watts, 60 cycles. A combination of these two brushes or two organs will provide a definite connection at any time. This D.C. may be used to charge the battery or to operate the proper voltage. About 200 watts of power is available at this point. A certain amount of adjusting and experimentation will probably be found necessary to achieve the best results from this motor.

Run it as a series motor to check the direction of rotation. This direction will be the same as that of the series field leads at switch "A." It the commutator brush, check the D.C. winding by running with switch "A" open, and a battery connected across the brushes. You should have spent in connection of the battery.

Kit No. 155A—Complete kit for rewinding Dodge generator using 110 volt A.C. synchronous motor developing 1/2 h. p. 1 b. No. 6, 10 heavy Formvar magnet wire. 2 lb. No. 24 phosphor bronze magnet wire. 5 lb. No. 21 phosphor bronze magnet wire. 2 lb. No. 16 Formvar magnet wire. 1 lb. No. 6 D.C. magnet wire. 1 roll cotton tape. 25 wedge shoes. 5 slot insulating paper. 25 slot insulating paper. 1 load piece of D.C. from A.C. windings. 1 air dryer drying vacuum. 2 commutator brushes. 1 Formvar ring. 1 fibre piece for collector ring. 1 fibre piece for collector ring. 1 collector ring completely assembled and ready to place on your armature. (See Catalog for price.)

Kit No. 165B—Same as kit 155A but includes factory made collector ring No. 45C instead of the two bronze rings and fibre ring. (See Catalog for price.)

No. 45C—Collector ring completely assembled and ready to place on your armature. (See Catalog for price.)

No. 468—Brush holder assembly with brush. To be used in conjunction with collector ring No. 45C. (See Catalog for price.)

Having obtained the two necessary Dodge generators, dismantle them, taking care not to damage the coils. Cut the coils apart, leaving all of the copper and the same length bands on each coil. Should the insulation become damaged, bind the break with cotton tape and soak it thoroughly with varnish. Study the "SCHEMATIC WIRING DIAGRAM" to understand the function of each coil which must be provided in the hook-up of the completed welder. Note that all similar coils are connected in series. Also note that the coils are numbered 1, 2, 3, 4, 5, 6, 7, and 8 according to your numbering. By examining the "SCHEMATIC WIRING DIAGRAM" you will see that coils 1, 2, 3, and 4 have both start and finish leads of the heavy winding coming out on the same side of the coil. Note also that coils 5, 6, 7, and 8 have the start and finish leads of their heavy windings coming out on opposite sides of the coil. These heavy windings will form the Secondary of the completed transformer when they have been connected according to the plan.

Then you will see that while all of the numbered leads from the heavy windings connect out on the same end of each coil, coils X and Y have their light leads at opposite ends of the coils. This difference is shown in Figure 5. To facilitate connection, coils X and Y are placed on the core leg between coils 5 and 6. The light windings of all 6 coils are connected in series in two groups forming the Primary of the transformer.

Note: In some "G" and "GA" generators the light windings of all 6 coils will be alike which means you will not have 2 coils like X and Y. This is by no means a disadvantage, you will find the light windings of all 6 coils in series, just like coils 1, 2, 3, and 4 are connected.

Now let's get to the actual construction of the welding circuit. Before we can proceed, we must prepare the core. Figure 1 in the Plan gives all the essential information. It is possible to cut all of the pieces by hand if they are not otherwise available, but it will be found more satisfactory and certainly more convenient to purchase them already cut to measure. Prepare two sets of the clamps I 1/8 inch long as shown in Figure 1. Stack the coils as shown in Figure 1 and clamp one end of it tightly by means of one set of clamps. Continue to remove the core sections shown partly removed, and it will be easy to slip the coils into place. After the winding is completed, inspect the winding closely for any indication of windings coming in contact with the core. Be sure to place them on the core in the proper position as shown in Figure 3, that is by the curving of the lower cone and DOWING ON the other. Re-check the coil positions to be sure that they are properly placed, then fit the nose of the core back into position (one piece at a time) and clamp it tightly with the other clamp.

Now build the control panel illustrated in Figure 2. Its size is not important as long as it will accommodate the instrument conveniently. The controls consist of two double pole double throw switches. The two double Throw switches are panels, and a bridge connection whereby any one of five buttons may be chosen for the work being done. Notice especially the position of the bridge selector in the position shown in Figure 2. The bridge from the edge to the drilled hole in such a way that touches this point with a nut on the line. Notice that the binding post on this nut is firmly into contact with its bolts. The bridge connector bolts and the switch points are all 1/8" brass. The panel itself may be built of any insulating material, but plywood is recommended because of its toughness and economy.

We can now start connecting the cores on the transformer. Begin with coils 1, 2, 3, and 4. Connect the heavy windings together as shown in Figure 3, and provide taps at each connection to be led to the bridge switch shown in Figure 4. Note that the No. 6 copper cables are attached to the splice between each coil as shown in Figure 4. Now from coil 4, the bar connector is run to the heavy winding of coil number 5 as shown in Figure 5. This bar connector may also be made of a piece of No. 6 copper cable more convenient. The heavy windings of coils 5 and 6 are connected by means of the No. 6 copper cable. The light connections must be made between coils X and Y, and Y and D. From the finish of the heavy winding of coil 5 and the light winding of coil 6, connect to terminal 0 on the panel. Another piece of No. 6 copper cable is run from the bridge pivot bottom to terminal W. This completes the entire bridge assembly.

If your generator has only one coil like X and Y instead of two coils, you will have to use a Y' winding. Solder all splices after binding them with wire, then wrap them with cotton tape and shellac thoroughly.
Next is the Primary hook-up. A flexible cord with a plug (to connect to the power source) is brought out from the two lower terminals of Switch 1. From the lower right terminal 1, run a No. 10 flexible wire to the light winding of coil 6. Connect coils 1, 2, 3 and light bulb with 20 & 10 wire. The joint connection between coils 1 and 2, bring out a tap lead to connect to the upper right terminal of Switch 2. The remaining lead from coil 6 is connected to the lower right terminal of Switch 2. The lower left terminal of Switch 2 is then connected to the light winding of coil 1. Connect the light windings of coils 1, 2, 3 and 4 as shown. Bring a tap lead from the lower right terminal of Switch 2 and 3. The lower left terminal of Switch 3. Connect the finish lead of coil 4 to the lower left terminal of Switch 1. The upper terminal of Switch 3 is connected to the upper left terminal of Switch 1 and have a jumper connected across them. Now connect the right center terminal of Switch 1 to the left center terminal of Switch 2. Then connect the two outside center terminals of the crystals. All of these connections in the Primary circuit are of number 10 flexible wire. All connections in the Primary circuit must be soldered, taped, and sealed with shellac.

Label the Switch Positions on the control panel as shown in Figure 2. Also, number the Switch Points. The Welding Terminals must have some sort of indication to be sure that terminal E is at all times connected to the electrodes holder and that terminal W will always be connected directly to the work.

This welder can be plugged into either 110 or 220 volts.

To operate the control panel when connected to 110 volts, Switch 1 should be at the 110 V position. However, if Switch 1 is swung to the 220 V position when using 110 volts, it will cut the output approximately in half, which is sometimes desirable for brazing or soldering. The High-Low Switch is used to give half-step advantage between switch points, thereby providing 10 different heats on either 110 or 220 volts plus the possible half-load outputs obtainable on 110 volts with Switch 1 in the 220 volt position.

CAUTION:
Never use 220 volts on this transformer unless Switch 1 is in the 220 V position, otherwise a serious burnout will result. If fuses are used in input we recommend 35 amp. fuse.

Kit No. 50Y—A complete kit for building your own transformer and welder. Ready to assemble, plug in line and operate. Includes:
- 4 coils taken from 2 Dodge generators (inspected and tested)
- Cord for plugging into line including plug, 7 feet long
- Wire for connecting up secondary
- 4 angle iron clamps including 4 bolts and nuts
- 18 pounds 50 gauge silicon steel out to size, varnish coated
- A total of 64 pieces

Complete above kit. (See Catalog for price.)

Kit No. 50W—Complete kit of materials needed to make this welder exclusive of the Dodge field coils, also does not include Control panel 562, but includes all materials for you to assemble your own panel.
- 2 double pole double throw switches
- Material for assembling amperage switch
- Wire for connecting primary
- Cord for plugging into light socket, including plug (7 feet long)
- 4 angle iron clamps including 4 bolts and nuts
- 18 pounds 50 gauge varnish coated silicon steel cut to size
- A total of 644 pieces

Complete above kit. (See Catalog for price.)

No. 50X—A special designed control panel with new type factory made selector switch for adjustment of various loads—also includes 2 double pole double throw switches and terminal bolts with wing nuts for connecting welding leads. (See Catalog for price.)

No. 50S—Dodge field coils per set of 4 (tested and inspected). (See Catalog for price.)

NOTE:
Trade in your generators toward above kit. If you already have two Dodge "Q" or "OA" generators then you can build this welder with very little expense. After you remove both sets of field coils from these two generators you can send all running parts of both coils and we will give you a credit of $4.00 which can be applied toward the purchase of Kit 50W.

WIND PLANT INFORMATION

Wind power can be harnessed to generate electricity for lights, radio, and power.

The amount of power possible in your locality depends on the average yearly wind velocity.

Wind velocities vary in different sections of the country.

Average velocities for your location may be obtained from your local weather bureau.

Wind power is free.

The amount of power you can get by converting the wind into usable electricity is in your own hands.

Be certain that the plant you choose has a power output large enough to keep your batteries fully charged at all times. To determine the size of plant you need, get an average wind velocity for your location from your Weather Bureau. Then find a plant with a power rating sufficient to show a surplus of output over your needs within the time limit of the proven wind velocity shown by the observations of the Bureau.

Propellers used on wind plants are of the power type. Propellers for direct drive are High Speed. The speed of the propeller changes with the pitch of the blade. The pitch of the propeller is the angle of the blade away from a position flat against the wind.

Propeller design increases the r.p.m. speed of the propeller by 3 or 4 times that of direct drive. Propellers are liable to be damaged if allowed to run in rain, snow, or sand storms. Therefore, all wind plants should be provided with a positive shut-off.

Wind power becomes with the speed in r.p.m. Gyroscopic action increases with the speed in r.p.m. In high winds, these actions may cause the propeller to fly apart, or cause the plant to run out of control, burning the generator. Therefore, all wind plants should be provided with an efficient automatic governor. Generators geared or belled to the propeller require 25% more power to operate.
Direct drive propellers in combination with specially wound slow-speed generators eliminate gears and belts. Therefore, power losses through friction is reduced to a minimum.

Wind velocity diminishes at higher altitudes.

Wind electric plants operate more efficiently at constant speeds.

Therefore, wind plants should be mounted as high as the ground as is reasonable, and the generator driven by a high enough to clear all surrounding obstacles for a distance of at least 150 feet.

An electric lamp connected directly to a wind plant will burn out as the speed of the generator increases.

The amount of current generated by the wind plant increases with the speed of the generator, but the voltage remains constant. Therefore, the current generated by a wind plant must be increased to keep the lamp burning.

Lamps can be used directly from the plant if all lamps are turned on to the full capacity of the generator. They will, however, grow brighter in the wind, and brighter with the increase in output due to the wind.

Voltage drop is loss of pressure due to resistance of the circuit or load.

Line loss is current that is used up in forcing the power through the connecting wires.

### DEFINITIONS

**A.C.**... Alternating current.

**Accelerator**... The part that speeds.

**Accessories**... Extra or additional parts or pieces of equipment to improve an appliance or machine, or when it has reached the limits of usefulness.

**Adapter**... A device allowing attachments or applications other than those for which the original unit was intended.

**Air Gap**... The clearance between the pole pieces and the armature core.

**Alloy**... A combination of metals to provide desirable characteristics of each.

**Alternates**... To perform by turns, a repeated changeover from one unit to another.

**Alternating Current**... A current whose polarity reverses itself continuously.

**Alternator**... An electric generator which produces A.C.

**Ammeter**... An instrument for measuring current flow in amperes.

**Amperes**... The unit of measure of the flow or strength of an electrical current.

**Amperes Turns**... The number of amperes in a current, multiplied by the number of turns in a coil through which the current flows.

**Arc**... An electrical current flowing through or across the space between two conductors.

**Armature**... A part of an electrical machine in which an electric current is built up to cause or provide power or motion; or which in itself by reason of applied power, produces an electromagnetic force opposed to a constant flow of forces manufactured usable current.

**Arrastor**... A device to protect electrical circuits or Instruments from damage by lightning or heavy induced currents.

**Band**... A series of turns of wire or tubing wound around an armature or rotor to hold the winding in position.

**Bar Segments**... The segments of a commutator which carry the current from brush to winding.

**Battery**... A group of cells connected together.

**Binding Post**... The terminal of an electric machine or piece of apparatus to which a connecting wire may be easily attached.

**Braided Wire**... Wire in which individual wires are twisted together to form a single wire.

**Breaker Circuit**... A protective circuit employing an automatic controlling device to prevent electric shock, an overload, or a short circuit.

**Brush**... A carbon or rubberized part of an electrical apparatus, which carries current to or from a moving element by a wiping contact on a commutator or collector ring.

**Bus Bar**... A large rectangular bar of copper for transmitting heavy currents.

**BX**... Flexible metal-armored conduit.

**Calibrate**... An instrument for making measurement whereby the action of an instrument may be known by an accepted standard.

**Carrying Capacity**... The maximum current strength which may be used to carry a current in a conductor or in a circuit.

**Cartridge Fuse**... An enclosed fuse of cylindrical form with metal contacts on six sides.

**Cell**... One unit of a battery containing both positive and negative poles.

**Check Cell**... A cell of wire inserted in a circuit to reduce or retard the flow of current.

**Circuit**... A path of conductors provided for the distribution of electricity.

**Cord**... Length of insulated conductor for connecting a piece of electrical apparatus.

**Core**... Iron wire incapable of retaining an induced momentary magnetism.

**Closed Circuit**... A circuit providing a complete path for a current through a portion of an electrical apparatus.

**Colt**... A turn or number of turns of wire.

**Commutator Piece**... Conductor ring furnished for transmitting a current from a brush to the winding of a moving element, or to a portion of a circuit which is stationary.

**Commutator Ring**... Operating current carrying current from brushes to numerous coils or circuits in a moving element.

**Compound**... When field coils of a D.C. motor or generator have two or more windings—the smaller windings shunted across the limbs and the armature, and the larger windings in series with the line or load—the machine is said to be COMPOUND WOUND.

**Conductivity**... The ability to conduct electrical current.

**Conductor**... Any substance or material which will carry electricity.

**Connector**... A device for joining conductors together.

**Consumer**... Used-up—Not possible of recovery.

**Counter-Clockwise**... Opposite to the direction of rotation of the armature of a d.c. generator.

**Corrosion**... A destructive deterioration caused by the action of chemicals or weather conditions.

**Cross Arm**... The cross member on a pole supporting electrical wiring.

**Cross-Section**... Cut-away view to show some otherwise hidden details or portion of interest, or portion of interest.

**Current**... The flow of electricity, measured in watts.

**Cutout**... A switch which disconnects a generator from its load when the output voltage becomes lower than is required... Used to prevent a flow of current from the battery.

**Cycle**... One complete change from neutral to positive, to neutral, to negative to neutral... or from zero high to zero to low.

**D.C.**... Direct current.

**Dissipator**... Insulation value.

**Double Throw Switch**... D.T.S., A switch having a common connector capable of contacting either of two terminals at will.

**Drop**... The loss in pressure of an electric current caused by resistance or load.

**Dutchman**... A metal filler used to complete a path for current or flux.

**Dynamo**... A machine for converting mechanical energy into electrical power.

**Eddy Currents**... Contrary magnetic currents in iron.

**Efficiency**... Work accomplished in comparison with the expended energy.

**E.M.F.**... Electro motive force.

**Energy**... Power efficiency and forcibly exerted... Capacity for work.

**Exciter**... D.C. generator or battery supplying the field current to another generator.

**Filter**... An insulation paper or board produced by tremendous pressure.

**Filter**... The space in which lines of force are active.

**Filtering Device**... To eliminate electrical line or machinery noise.

**Fish Paper**... Thin fiber paper.

**Flux**... Magnetic lines of force... A soldering or welding compound.

**Force**... Any cause resulting in the motion of, or changing the direction of the motion of matter.

**Frequency**... The number of changes in direction of an alternating current... Recorded in ‘cycles per second’.

**Furcell**... A protective covering for an electrical apparatus, caused by contact with the surface upon which it moves... Loss of power, or energy expended, in overcoming this resistance.

**Fuse**... A protective device for a circuit, a wire designed to open a circuit by melting at the passage of a current of greater amperage than its rated capacity.

**Ground**... The diameter of a conductor.

**Generator**... A machine for converting mechanical energy into electrical power.

**Grovler**... A transformer with only a primary coil, used for testing electrical windings, the winding being tested acting as a secondary.

**Hard Drawn**... Wire as it comes from the drawing machines... Unannealed.

**Hardened**... Wire tempered after manufacture.

**Helix**... Helical... Spiral wound, similar to a spring.

**Helper**... A machine with low voltage to assist high-voltage lines.

**Introduction**... The transfer of an electrical force by magnetism, involving the formation of two electrical conductors by a dielectric, or non-conductor.

**Insulator**... Any substance which prevents the flow of an electrical current.

**Iron Core**... A roll of 1,000.

**Kilo**... 1,000 volts.

**Kilowatt**... 1,000 watts.

**Knife Switch**... An electrical switch having one or more blades acting like leaflets.

**K.W.A.**... One ammeter at 1,000 watts, A.C.

**Load**... The amperage when voltage is lower than the voltage rise in an A.C. cycle, it is said to lag.

**Lamination**... A single one of the many thin sheets of metal used in the construction of armatures or machines, etc.

**Lap Wound**... The armature of a D.C. generator is said to be “Lap Wound” when the start and finish of its coils are connected to the same terminal.

**Lateral**... The distance it is possible for an armature to travel backward and forward between the two brushes.

**Layout**... The length of one entire twist in multiple wires or cables...

**Leakage**... The loss of electricity or magnetism through an undesired path.

**Line**... An outdoor circuit... The pair of wires carrying the applied power to a circuit or machine.
Line of Force... An Electro Magnetic wave.

Load... The work being done by a current or machine.

Electrical... Iron or steel having the power to attract similar material.

Magnetic... Having the properties of a magnet. The amount of a magnet's power is called its Magnetic Intensity.

Magnetic Circuit... The path followed by the lines of force from one pole to another.

Maximum... The greatest possible.

Neutral... Neither positive or negative.

Ohm... Unit of resistance.

Ohm's Law... To calculate the current divide the voltage by the resistance. To calculate the resistance divide the voltage by the current.

Parallel... Any incomplete circuit.

Oscillate... To swing back and forth... To vibrate.

Output... The current produced by an electrical machine... Volts times amperage.

Paper... Armature paper... An insulating paper.

Peak... The highest point... The heaviest load... The greatest possible.

Permeability... Permeability is expressed in numbers and indicates the number of times better than air the material will permit magnetic lines to pass through.

Photo Electric Cell... An electric cell sensitive to light rays.

Pitch... The number of armature core slots spanned by one coil.

Polarization... The polar effect of a pole attracting...

Pole... One end of a magnet... A magnetism of a single polarity produced by the action of an electromagnet.

Pole Face... The surface of a pole closest to the revolving element of an electrical machine.

Potentiometer... A clay, used in the construction of insulating bases or supports.

Positive... The opposite to Negative... Of a positive polarity.

Potential... The number of volts in an electrical circuit.

Potentiometer... A low amperage, high resistance variable rheostat.

Protective... First in order... The first winding of an electrical machine or apparatus through which a current flows.

Reactance... The lag of amperage behind voltage, due to the iron core of a coil through which the current is flowing.

Rectifier... To change a current from A.C. to D.C.

Residual... The magnetism retained permanently by a magnet or its places.

Relay... An electro mechanical device by means of which a current flowing in one circuit can make or break another circuit.

Rectifier Control... The means of controlling an operation from a distant point.

Reverse... To change in direction.

Rheostat... A variable resistance unit.

Riser... The usually slotted portion of a commutator bar to which the armature windings are connected.

Rotary Converter... A direct current motor which produces alternating current by means of a tapped armature, or separate windings on the same armature.

Rotor... The total portion of an electric machine.

Safety Switch... An enclosed switch.

Segment... One bar of a commutator.

Solder... A combination of tin and lead which is applied by means of heat for the purpose of joining conductors in good electrical contact.

Spaghetti... Varnished cotton or linen tubing used to insulate wires.

Span... The number of slots or bars over which a coil extends.

Squirrel Cage... The bars and rings of a polyphase motor, having the appearance of a revolving squirrel cage.

Standard... A gauge for accuracy or quality.

Storage Battery... A number of electric cells connected together, and having the ability to chemically produce or absorb electrical energy.

Surge... A momentary rush of current.

Switch... A device used to accomplish the interruption or the completion of an electrical circuit.

Tachometer... An instrument for counting revolutions per minute.

Terminal... The part of an electrical machine to which connections may be made.

Third Brush... On automobile generators, the movable brush, which is adjustable to regulate the field current.

Torque... The tendency of a rotating force to impart the turning effect to the whole machine.

Transformer... An electrical apparatus making use of magnetic induction to produce a change in the potential of an electric current.

Universal... Able to operate on either A.C. or D.C. of the rated voltage.

Volts... The unit of electrical pressure.

Winding... A strip or spiral of insulated wire shaped to fit into the slots of a rotor or stator to serve as the winding in place.

**VOLTS, AMPERES, OHMS**

The three common units of electricity are Volts, Amperes, and Ohms. For our purpose it does not matter so much how they were first established as it does to understand clearly what they mean and how they are related. The Volt is the unit of electrical pressure, the Ampere is the unit of rate of current flow and the Ohm is the unit of measure of resistance to the flow of current. These units are related as follows:

Volts equal amperes multiplied by ohms.

Amperes equal volts divided by ohms.

Ohms equal volts divided by amperes.

These electrical units can be compared to the units used in speaking of speed. An automobile may travel five miles per hour. The mile represents the distance (time) which the automobile travels in one hour. The five miles per hour represents the speed (distance) which the automobile travels in one hour. The automobile's speed depends upon the power of its motor, the resistance of its road, and the weight of the vehicle.

The following electrical units are derived from those above.

Electric power is measured in watts. One horsepower is 746 watts.

Volts multiplied by amperes equal watts.

Watts divided by volts equal amperes.

Watts divided by amperes equal volts.

Watts times the number of hours gives the watt-hours or K. W.

To determine the amperes necessary to do a given work, divide the number of watts by the number of volts.

Maximum efficiency of all 22 volt generators described herein are rated at 40 volts—hence 25 amperes at 40 volts equals 1,000 watts.

The following table shows approximate amperes draw for various electrical appliances and power equipment.

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<td>0.25 A</td>
<td>1.06 A</td>
<td>1.92 A</td>
<td>3.43 A</td>
<td>5.63 A</td>
<td>7.63 A</td>
<td>10.63 A</td>
<td>15.63 A</td>
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**BATTERY WILL FREEZE**

Electrolyte is not very easily frozen, but if the battery is permitted to remain outdoors in winter so as to be exposed to the lowest temperature of the environment it will freeze at about 20 degrees Fahrenheit below zero.

At 112°F the Electrolyte will freeze at 10 degrees above zero.

1150 specific gravity will freeze at about 8 degrees above zero.

The water, or 1,000 degrees below zero, and 1,125 specific gravity, 35 degrees below zero.

**WIRING**

In wiring buildings, it is important that wire of the proper size be used, because it an undersized wire is used, it becomes hot and dangerous. Below is a table which will serve as a guide only in the size of wire to be used. This table shows the number of feet of wire recommended for the various loads.

Maximum distance in feet that a given wire will carry the charging current with only 1 volt drop:

<table>
<thead>
<tr>
<th>Size of Wire</th>
<th>10</th>
<th>10</th>
<th>8</th>
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<th>4</th>
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<tr>
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