ELECTRIC PLANTS Offer

tricity from a power company than to make it yourself, it is no longer necessary to wait for the coming of the high lines to get it. About 800,000 rural homes today enjoy some sort of homemade current produced by plants ranging all the way from little wind chargers selling for less than $50 up to big 5,000-watt systems which supply all the current needed for a home and make enough extra to light the barn and other outbuildings and run a lot of stationary farm machinery besides.

If you can't hook up to a high line, there is just one way to get electric light and power. That is to make it yourself. In making your own juice you have a choice of

Wind charger, top, which runs radio and two lights. Below, small gasoline-engine generator

ABOUT one-third of America's 31,000,000 homes still are unconnected to electric power lines. Of almost 10,000,000 homes without central station service, about half are on farms.

Thousands of these rural homes will never enjoy the blessings of electricity if they wait for the high lines to bring it because they are in areas so sparsely populated that power lines cannot be made to pay for themselves. Even where the high lines reach out into the country, the outlook for wholesale rural electrification has not been encouraging. During the three years ending with 1936, it is estimated that less than 400,000 farm homes were hitched to the electric lines, bringing the total to 1,128,000.

While it usually costs less to buy elec-

POWER to EVERYONE

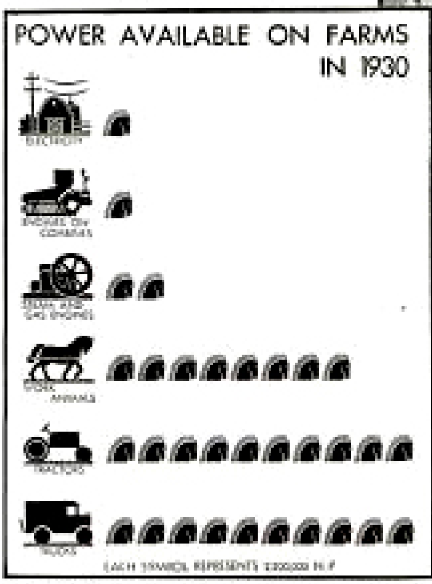
three systems. You can use a wind charger and let the wind do it for you, you can run a generator with an engine which uses gasoline or kerosene as fuel, or you can employ a small Diesel plant for the same purpose.

Like everything else, the amount of power you get depends to a great extent on how much you spend for a power plant. The larger the plant, the greater its capacity. An Oklahoma farmer, for example, enjoys a few of the advantages of electricity with the aid of a wind charger costing less than $50. The outfit is intended to keep his radio batteries charged, but he has enough extra juice to run two lights, one in the kitchen and one in the living room.

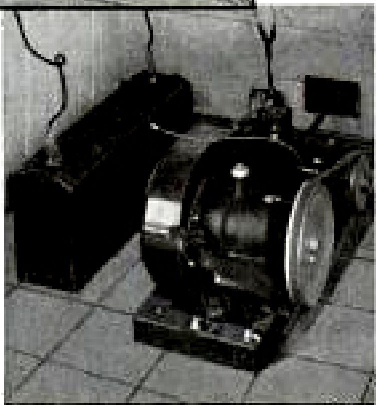
The great advantage of the wind charger is that it offers current at low operating cost, since the wind is free. The disadvantage of a wind-driven outfit, of course, is that the amount of power is dependent on the amount of wind. In sections of the country where the wind averages ten miles an hour or more, air-driven electric plants usually are quite satisfactory.

For less than $100, a six-volt wind charger, a battery and the necessary materials for wiring can be obtained. Such an outfit should run a radio and a few small lights and perhaps turn an electric fan of the automobile type. For a little extra, it can operate an intercommunicating system between house and barn and a loudspeaker in the latter building.

A thirty-two-volt air-driven electric plant, including generator, batteries and



Electricity can milk, hoist hay, pump water, do the washing, supply light and ice and do scores of other farm tasks if it were generally available



wiring, may cost several times as much, but it will supply an average home with all the current needed except for cooking or water heating. Such a plant not only takes care of the lighting and runs the electric household appliances on one Illinois farm, but also supplies power to run a washer, a refrigerator, an iron, a churn, an emery wheel, a forge blower, a soldering iron, a band saw, a rip saw, a planing mill, an air compressor, a rotary pump and a car battery charger.

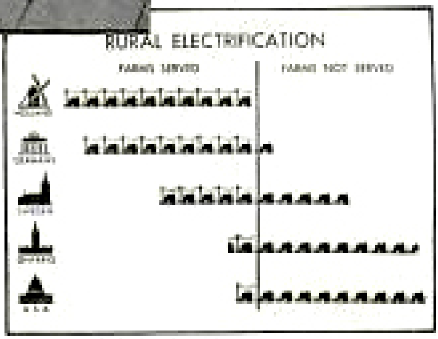
For those who want to be independent of the wind and who desire a plant which may be operated continuously at or near its full capacity, a generator driven by an engine burning gasoline, kerosene or perhaps fuel oil meets all requirements. Engines are now produced which will run 4,000 or 5,000 hours without much attention, and the cost of operating some of them is estimated at less than five cents per kilowatt-hour. With the muffler buried in a barrel of stones or otherwise sound-insulated, the engine makes little noise.

Such a charger developing up to 100 watts at six volts may cost about $35 and will run eight or ten lights and charge the radio batteries. For around $60 a charger which develops 200 watts at six volts can be obtained. This outfit will take care of the radio and run the lights in a small home. A six-volt charger also is combined with a gasoline-powered washing machine, permitting battery charging while the family washing is being done. The system also can be run continuously, if desired.

A 400-watt system supplies all the lights needed for a small home and will also take care of the ordinary household appliances which are operated intermittently. For a medium size home, an 800-watt plant will furnish light and power for most ordinary purposes. For larger places, a 1,500-watt plant or even a 3,000-watt one may be needed to electrify the home and also provide enough power for pumping water, running a heating plant and perhaps operating some stationary farm machinery.

By using a 110-volt system ranging from

(Continued to page 138A)



Wind charger, top, which runs radio and small lights. Center, battery and engine belted to motor generator. Bottom, rural electrification is much farther advanced in some foreign countries than in the United States

Electric Plants Offer Power

(Continued from page 852)

300 to 5,000 watts, homemade electricity is produced without batteries, and regular city appliances can be used with it. The operating cost will be higher than for an air-driven plant, but the initial cost is likely to be lower than for a wind system of equal capacity. An electric refrigerator employing a brine tank is available for such systems. The plant is not operated continuously and the brine retains the cold.

Small Diesel plants are used mostly where two or three neighbors share the expense of producing current because the output of such a plant usually supplies all the juice needed by more than one household. The same idea is employed sometimes even in homes connected to the high lines. In such homes, the equipment is intended principally for emergency use.

With heating systems, refrigeration and other necessities depending more and more on an uninterrupted flow of current, some households are installing some kind of plant for producing homemade juice in the event high line service is interrupted. One of the most popular is a gas-engine generator unit which starts automatically when the regular current fails and stops when service is restored. Such an installation does not require separate wiring, and lamps for the unit are connected direct to the main panel board. The only battery needed is a small one for starting and this is kept charged by a trickle charger connected to the regular source of supply.

Another unit which can be used for emergency service is the large glass-cell storage-battery kind. A change-over switch throws on the current from the batteries when service is interrupted but, with this system, a separate emergency circuit must be provided, including the lights themselves, because batteries store only direct current. For emergency purposes, a unit with a capacity of 400 or 500 watts is likely to be sufficient to operate a home heating plant or a refrigerator, a few lights and perhaps keep a water supply going during an emergency.

Cities have been made over by electricity. Night has been turned into day, work has been lifted from weary shoulders in home and factory, the wheels of industry are turned by electric motors and electri-

(Continued to page 139A)

(Continued from page 136A)

cally operated conveyances ranging from trolley cars to elevators carry millions of people many billions of passenger-miles each year. What has happened in cities indicates what will happen in the country when electricity is put to work on the farm.

Less than eighteen per cent of America's farm homes are served today by the high lines. Of that number, and of those making their own current, few are using this energy to do more than supply lights, operate a few household appliances and perhaps pump water. And yet, much farm work done with other power could be done better and cheaper by electricity.

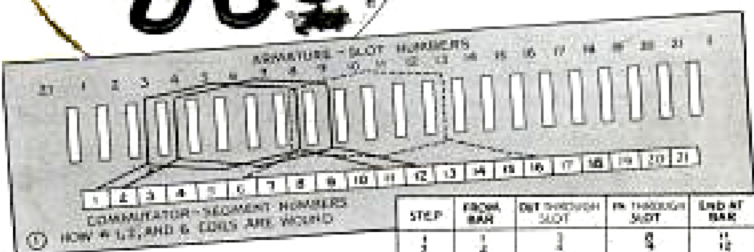
There are more than 250 ways in which electricity actually is being used in rural districts today, and these jobs range all the way from tending the pigs and hatching chickens to clipping the hair of prize steers and milking the cows. A lightly charged wire, it has been found, discourages pigs and cattle from straying out of bounds.

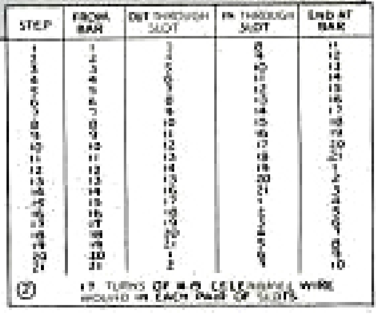
In 1925, American farmers, it was estimated by the government, used about 47,000,000 horsepower in agriculture—twice as much as was used in manufacturing. This power, derived from horses and mules, oil and gas engines, wind, water and electricity, cost an estimated $3,000,000,000. Electricity did only about four per cent of all this farm work. In 1930, the available horsepower for agriculture had increased to about 70,000,000, of which only about 3.1 per cent was electrical.

The average cost to farmers for the power used in 1925 was estimated at nineteen cents per horsepower-hour or about twenty-five cents per kilowatt-hour. It was also estimated that it cost a farmer twenty-five cents to work his own horse for one hour. That's the cost of a horsepower-hour supplied by a horse. But electricity can do many types of farm work for anywhere from five to fifteen cents per kilowatt-hour, depending on the task and the source of the electrical energy.

Shortly before his death, Thomas A. Edison declared that "the electrical development of America has only just begun." Perhaps he had in mind the day when the blessings of electricity will be bestowed as freely on the rural resident as on his city brother. For electricity is the servant of all, a tireless, versatile worker which plays the radio, saws wood, lights the home or churns butter with equal ease.

Wind-Driven GENERATOR





By C. A. CROWLEY

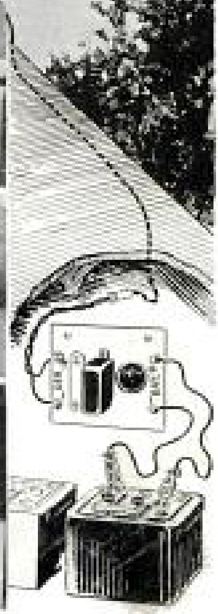
COSTING little to build and practically nothing to operate, this power plant charges radio batteries. A 6-ft. propeller is coupled to a rebuilt Ford model-T generator, which is rewound so that it will start charging at about 290 r.p.m. The use of a simple governing device prevents excessive speed.

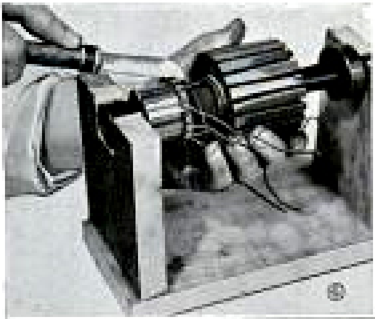
The photo above shows the various parts of the generator. The first step is to remove the gear. Next, remove the screws that hold the end plate, and remove in turn the armature or rotating part, the field coils and pole pieces, and the brush assembly. The armature must be stripped entirely of its wiring. To remove the fiber wedges that hold the armature coils in place, first tap them against the wire to loosen them and then drive them out with a hammer and a blunt piece of wood or metal. Cut all the wires near the commutator, and then locate the coil that was wound last, which is the only coil that is not covered by some of the other winding. Remove this coil, one turn at a time, and proceed to remove the other coils, one after the other, in the same way. After all the wire has been removed, pull the old insulation from the slots and saw the wire and solder from the commutator bars, as in Fig. 6. This is done with a short piece of a hacksaw blade. A convenient jig for holding the armature while it is

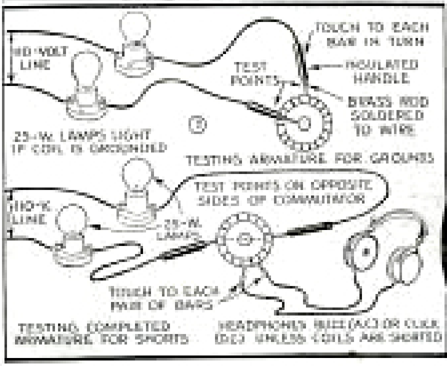
CHARGES BATTERIES

being stripped and rewound is also shown. Number the commutator bars and the corresponding slots consecutively, going clockwise around the commutator.

The material needed includes a pair of slotted-fiber end laminations, sheet-fiber insulation for the slots, wedges to hold down the windings, brushes, cotton tape, and shims for the field pole pieces. The wire needed is 1¼ lbs. of No. 19 "Celenamel" (Cellophane-covered-enameled) magnet wire for the armature, and 2 lbs. of No. 18 enameled wire for the field coils. Cut through the slotted-fiber end laminations and slip them into place, as shown in Fig. 3. Insulation papers are inserted into each of the slots in the armature, as in Fig. 4. These papers can be purchased cut to size, or they can be made by cutting insulating paper .007 in. thick into pieces 2½ by 1¾ in. in size. The insulation will extend somewhat higher than the slots so that the fiber can be turned down to protect the top of the coils. Cotton tape is then wrapped around the shaft between the commutator and the armature. One



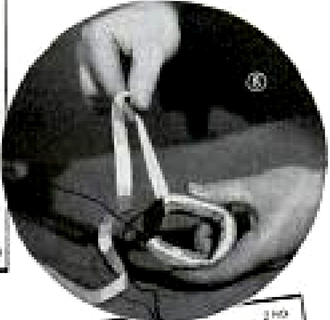


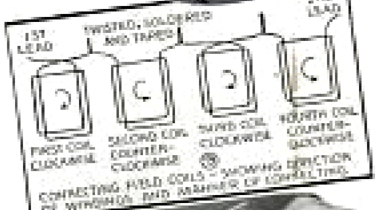


or two layers of the tape will be sufficient.

The loose end of the Celenamel No. 19 wire is inserted into the slot of commutator bar No. 1, so that the wire extends outside the riser of the commutator about an inch for convenience when attaching this wire permanently. As shown in Fig. 1, this wire is now led out through slot 3, back through slot 8, out again through slot 3, continuing until exactly seventeen turns have been laid in these two slots. The loose end of the wire is then brought over to commutator bar 11, and cut off, allowing about 4 in. excess. It now should be folded temporarily on top of the coil just wound and tagged as No. 11. Next start with bar 2, wind 17 turns in slots 4 and 9, and lead the loose end to bar 12, where the wire is cut and folded back out of the way and labeled No. 12. Continue in this manner, as indicated in the winding diagram, Fig. 1, and in the chart Fig. 2, until all the coils have been wound. When winding the sixth and following coils, you will be laying wire on top of a finished coil. It may be necessary in these cases to press down the original coil to make room. This is done as shown in Fig. 5, by pressing down with a blunt piece of ⅛-in. hard-pressed board or fiber. After laying the second coil in each slot, press down the wire, fold over the insulation, and insert a wooden slot wedge such as was removed when clearing the armature of its original winding. Continue winding until all the coils have been completed. As each coil is finished, it is wise to test it for grounds and shorts, using the methods indicated in Fig. 7.

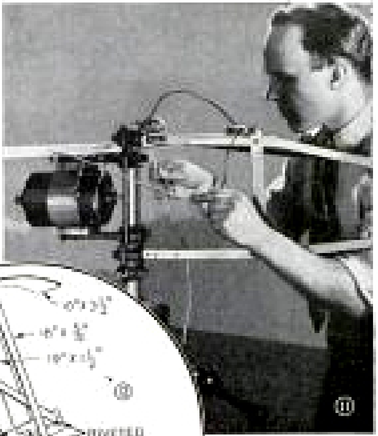
When all the coils have been wound and tested, the moon-

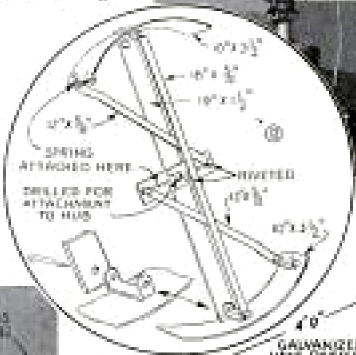


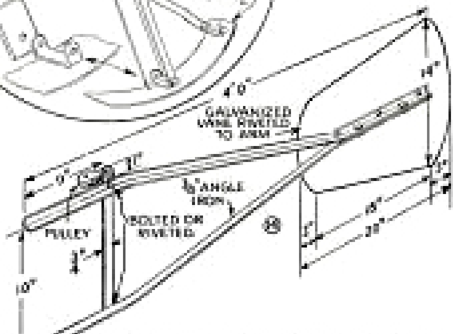


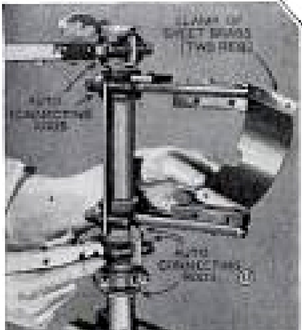
shaped end insulation paper is laid over the ends of the coils at the commutator. The loose ends of the coils are placed in the proper grooves in the commutator bars, and a few turns of twine are wrapped around the wires a little back of the commutator to hold them in place. The wires are then soldered to the commutator bars. Test the armature again for grounds and shorts. The entire assembly is now saturated with insulating varnish or shellac and allowed to dry.

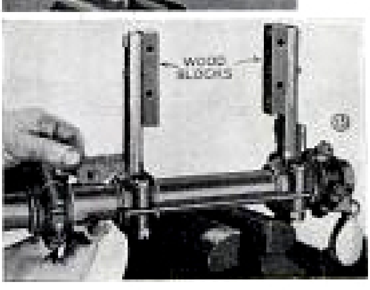
The field coils are wound on a rectangular form, Fig. 10, the size of which will be the same as the inside dimensions of the old field coils. Four coils of 125 turns each of No. 18 enameled wire are required. When each coil is finished, remove it from the form and bind it with cotton tape, as shown in Fig. 8. Shape the coils to fit the contour of the frame by inserting them in place and bending them to fit. Then remove them and impregnate with varnish or shellac. When dry, connect them in series as indicated in Fig. 9 and put them in position, inserting the pole pieces and shims. The first and third coils are to be connected so that their turns are wound clockwise and the second and fourth counterclockwise. The generator now can be assembled with new brushes in the positions occupied by the old brushes. The ungrounded generator terminal is connected to the main insulated brush. One field lead, either one, is connected to the third brush, and the other field lead to the grounded main brush. Connect the gen-

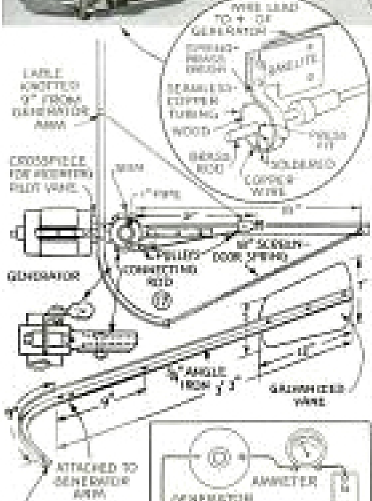


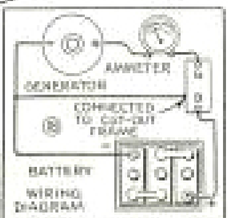


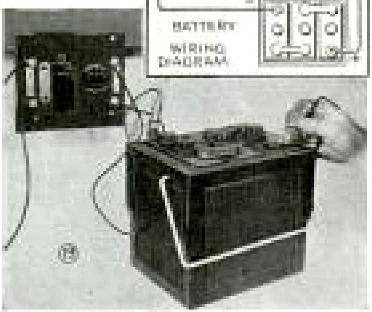












erator to a power supply and run it for a moment as a motor, noting the direction of rotation. If it rotates clockwise, viewed from the front, leave the connections as they are. If it rotates counterclockwise, reverse the field lead connections, so the lead which had been grounded is connected to the third brush, and vice versa.

The shaft on which the outfit is mounted is an 18-in. length of 1-in. pipe. The arms on which the generator and the vanes swing are fastened to the shaft with Ford model-T connecting rods, which serve as swivels. The small bearing is sawed off and the large bearing is reamed or filed out to fit the pipe. The large end of one connecting rod is sawed off and tightly bolted around the shaft at a point 11 in. from the top. This will serve as a bearing for the swivel arms above it. The main vane is cut from galvanized sheet metal to the dimensions shown in Fig. 14. The arm is 4 ft. long and is made as shown from ¾-in. angle iron. The vane is riveted to the arm, which is fastened later to the connecting-rod swivels with ¼-in. bolts. Blocks of wood, ⅝ by 3½ in., are bolted to the other two connecting rods as in Fig. 15. The generator will be attached to these blocks with two sheet-metal bands, as shown in Fig. 13, which are 2½ in. wide and shaped to fit the generator. The generator swivel arms now can be mounted on the shaft and the bolts drawn tight, using shims to permit the assembly to revolve freely. Strap-iron strips, ⅛ by 7½ in., are used as shims, as can be seen in Fig. 15. Additional shims cut from light-gauge metal can be used as needed. The lower end of the heavy shim extends a little below the bottom of the lower swivel and acts as a stop to hold the generator and the main vane in the proper relative positions. The vane swivel arm is mounted in the same manner. A piece of ⅛-in. metal, bent as shown in Fig. 15, is used as the shim on the lower right-hand joint. This engages the long shim on the generator frame and holds the generator and the vane in alinement in a moderate wind. The vane and generator next can be bolted in place.

There are two automatic controls to prevent too high a charging rate. The automatic governor, Fig. 12, controls the generator at moderate wind velocities. Centrifugal force causes the curved vanes to move outward, and their wind resistance prevents excessive speed. The mechanism should be balanced accurately at the hub. When wind velocities get too high for the centrifugal governor to be effective, the pilot vane control comes into play. The dimensions of the vane and the angle-iron support are given in Fig. 17. This assembly is rigidly attached to the upper generator arm with two bolts or machine screws. The short end of the angle-iron support is fastened to the main vane arm with an 18-in. spring. A flexible steel cable is fastened to the pilot-vane support 9 in. from the generator and run over the two pulleys as shown in Figs. 11 and 17. When the wind gets strong, its force against the pilot vane will be so great that the vane will be forced back and will pull the generator and propeller partly out of the wind, or even at right angles to a violent wind. When the batteries are fully charged, pulling the cable will also take the propeller out of the wind.

Electric current is conducted from the rotating generator assembly to stationary wires by means of slip rings. A 2-ft. length of ⅜-in. brass rod is run up the center of the main shaft. Turned plugs, of hardwood or preferably Bakelite, at the top and bottom of the pipe hold the rod in place. See Fig. 16. If the plugs are wood, they must be waterproofed by soaking them in melted paraffin wax for an hour. Rubber stoppers, such as are used in chemical laboratories, can be substituted. A copper disk, about 1 in. in diameter and ⅛ in. thick, and drilled to admit a press fit of the brass rod, will serve as a slip ring. This must fit tightly on the rod as shown in Fig. 16. The disk may be wood covered with a ring of 16-gauge or heavier copper. A brush of 16-gauge spring brass, ½ in. wide and curved to fit the slip ring, and mounted on Bakelite, carries the current from the generator to the slip ring. The other side of the generator circuit is grounded to the frame.

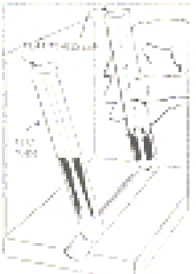
The wiring diagram is shown in Fig. 18. Heavy insulated wires should be used and all connections should be soldered to insure permanence. The ammeter and cutout can be mounted at any convenient point. The cutout can be one from an automobile, or better, a special cutout designed for a wind-generator system. A panel board as seen in Fig. 19 is a convenient means for mounting cutout, ammeter and binding posts. When everything is ready, mount the propeller on the generator shaft and install the governor, and the system is ready to operate.

Loss of Papers on Desk Slide Is Easily Prevented

The folded paper will keep the work on the desk slide from dropping into a drawer below

Loss of papers by leaving them on a desk slide when it is pushed in so that they drop into a drawer or compartment below when it is pulled out, can be prevented with a folded piece of paper. This is glued to the slide near the rear edge so that it keeps the papers from slipping off.

Lip on Test Tube Flattened to Avoid Rolling



If the lip of a test tube is flattened slightly, it may be leaned against a vertical surface or laid on a flat one without rolling. The lip can be flattened by heating the glass in a gas flame and then pressing it against a flat metal surface, preferably one that is hot. Do not bend the lip so much that it is impossible to fit a cork into the mouth of the tube.

¶ Brightly colored fingernail polish is excellent for marking dishes and pans that are to be sent out of the home; when the utensils are returned, the markings can be taken off with polish remover.

Wind Charger Is "Tortured" by Blower in Tests

Capable of producing a gale of sixty mile an hour force, a blower tests wind chargers in an Iowa factory. The wind charger is placed six feet in front of the blower for the test. A tunnel arrangement prevents the wind from losing its force before striking the propeller of the charger. The test ranges from a seven and one-half mile an hour breeze to a sixty mile an hour wind, the results of which enable engineers to design chargers which will produce smooth, steady flow of electricity from the generators and which will withstand vibration and overspeed two to three times greater than that the machine is ever expected to encounter. One torture test of

Wind charger's propeller turning at full speed in blast from tunnel blower

the charger propeller calls for turning at maximum speed, 1,200 revolutions per minute for hundreds of hours. Thus, the engineers discover tendencies of metal propellers to become brittle from vibration, of wooden propellers to splinter, and of both to shatter from vibration and pressure before production is started on them.