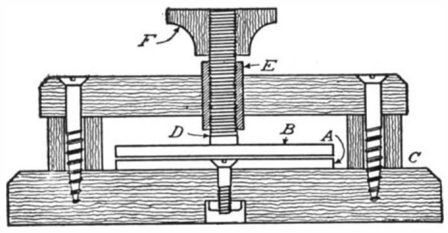
A Variable Condenser

By Frederick E. Ward

IN constructing his own wireless receiving apparatus, the average amateur probably encounters his greatest difficulty in making a good variable condenser, because the commercial form of this instrument, consisting of a system of fixed and of movable vanes, requires that a large number of parts be made and assembled with considerable care.

To overcome these difficulties the author has de-



Constructional details of the condenser.

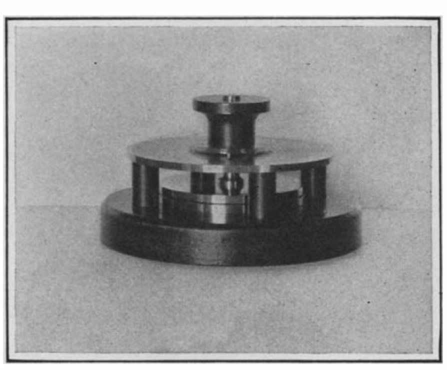
veloped the simple form of condenser shown in section in the accompanying drawing, where *A* and *B* represent the condenser plates, which are two brass disks about 3/32 inch thick and 2 inches in diameter. The first of these plates is fixed to the frame *C*, of wood or of other suitable insulating material, by a machine screw and nut which also serves as a binding post. The other plate is attached to the screw *D*, passing through the nut *E*, and carrying at its upper end the insulating knob *F*, by the turning of which the top plate is adjusted up or down, thus taking advantage of the law that, other things remaining constant, the capacity of a condenser is inversely proportional to the distance between its plates.

In making the simple form of variable condenser just described, it should be borne in mind that the best results are to be obtained by the use of a screw of fine pitch and of large diameter, such as is used in the well-known micrometer caliper. Not less than forty threads per inch, with a diameter of ¼ inch, is recommended. Care should be taken that the nut and screw are a reasonably good fit, and that the upper disk be turned off in the lathe so that its face will be truly at right angles to the axis of the screw. The lower disk should be leveled up by shims of tissue paper, if necessary, so that the two disks meet squarely when screwed together.

When the condenser is to be used in series with a large receiving aerial, for shortening its natural wave-length, it is of advantage to have nothing between the disks but air, for then they can, on occasion, be conveniently screwed together and short-circuited. If, however, the condenser is to be used in parallel with receiving instruments, where a short-circuit would be undesirable, this mishap may be guarded against by laying between the disks a slightly larger disk made from a film of clear, white mica one thousandth of an inch thick. This mica film has the effect of multiplying the maximum capacity of the condenser by a factor of about six.

In the photograph is shown a well-made instrument of the type just described. This one has a top piece of brass supported by four hard rubber posts, through which pass the four machine screws by means of which it is fastened to the base. The adjusting screw is provided with a graduated thimble so that the distance between the plates can be read off as with a micrometer, this serving as a scale. The knob could just as well have been provided with a hand or pointer moving over a scale marked on the top plate.

Such an instrument is suitable for use in a wavemeter of the Doenitz type, for which purpose it has a slight advantage over the usual form of condenser in that its capacity increases rapidly toward the end of the scale where the plates come together, while in



Home-made variable condenser.

the ordinary form the capacity varies uniformly along the scale. Since it is desirable to calibrate the scale directly in wave lengths, which are proportional to the square roots of the capacities, the disk type condenser, therefore, gives more nearly uniform scale divisions.

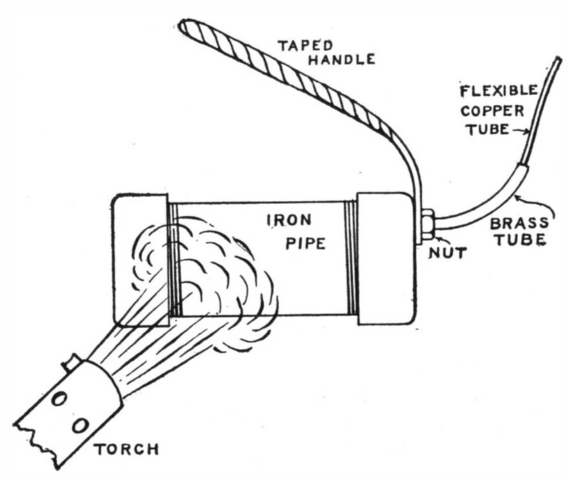
The maximum capacity of the average commercial type of variable condenser is about 0.003 microfarad. The calculated capacity of a pair of 2-inch circular plates spaced one thousandth of an inch apart in air is only about 0.0007 microfarad, but this value is increased to about 0.0045 microfarad by the introduction of a mica film, as recommended. In either case unscrewing the plates until they are 0.01 inch apart reduces the capacity to about 0.00007 microfarad. It will be seen from these figures that 2-inch disks are large enough to serve a useful purpose in many cases, though larger plates may often be employed to advantage.

Construction of an Oxygen Carbon Remover

AN oxygen generator for removing the accumulation of carbon from the combustion chamber and the piston of an internal combustion engine may be constructed as follows:

Take a short length of wrought iron pipe 1¼ inches in diameter, and thread and cap it at either end. Through one cap drill and tap a hole to receive a length of brass tubing. Solder a suitable length of annealed copper tubing into the end of the brass pipe. A handle may be provided by fitting in position a piece of ¼-inch strap iron, drilled for the passage of the brass tubing, and securing it with a nut as is shown by the sketch. The handle should be taped.

To use the device, a couple of ounces of chlorate of potash, to which has been added a teaspoonful of manganese dioxide, the two being thoroughly incorporated, are introduced into the chamber formed by the pipe, the rear cap being removed for the purpose. After the cap has been screwed tightly in place again, the chamber is heated with a blow torch and the end of the flexible copper tubing is introduced into the combustion chamber of the motor. As soon as the ingredients are sufficiently heated, oxygen is given off and the heat should be kept constant to insure a steady flow. In the presence of the oxygen, the caked car-



Oxygen generator for removing carbon from pistons and cylinder.

bon can easily be ignited and will burn from the surfaces in a minimum of time. Care should be taken not to apply too much heat. For cleaning multiple cylinder motors, the quantities of chemicals can be increased. Since the manganese dioxide acts merely to stimulate the decomposition of the potassium salt, it is evident that the proportions are not all important. Both chemicals can be obtained from any chemist in small quantities, and at low cost. Care should be exercised to keep foreign substances from contact with the chlorate of potash.

Dangers of Aviation.—In an interesting volume by Roger Depaginat on the martyrs of aviation, some interesting statistics are given showing the progress accomplished from 1908 to 1912. The total number of aviators for each year is given, together with the total distances traversed in the air. The price paid in lives for these triumphs is also given.

Year.	Aviators.	Miles Traversed.	Killed.
1908	5	1,500	1
1909	50	40,000	3
1910	500	920,000	29
1911	1,500	3,000,000	78
1912	5,800	17,000,000	140

Another table is attached showing the advance made per life lost.

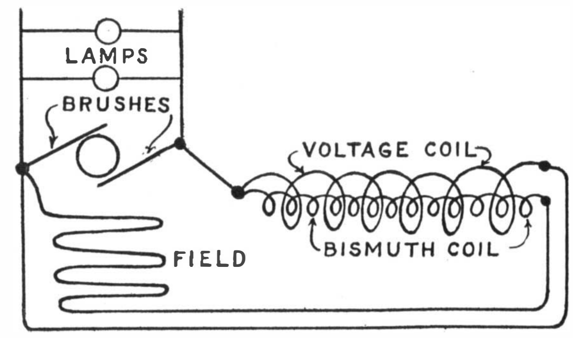
1908 one killed for 1,500 miles of flight.
1909 one killed for 14,000 miles of flight.
1910 one killed for 32,000 miles of flight.
1911 one killed for 40,000 miles of flight.
1912 one killed for 120,000 miles of flight.

Thus, from 1908 to 1912, the number of fatal accidents has proportionally diminished from 100 to 1, if one considers distances traversed, and from 10 to 1, if one considers the number of aviators flying. At this rate aviation will soon be less dangerous than automobiling.

Automatic Voltage Regulator

By J. Naveman

THE writer recently installed a shunt-wound dynamo on a motor car to supply current for lighting purposes, the drive of the motor being taken directly off the cooling fan pulley. However, the regulation



Automatic voltage regulator.

of the output at the varying speeds offered a serious problem.

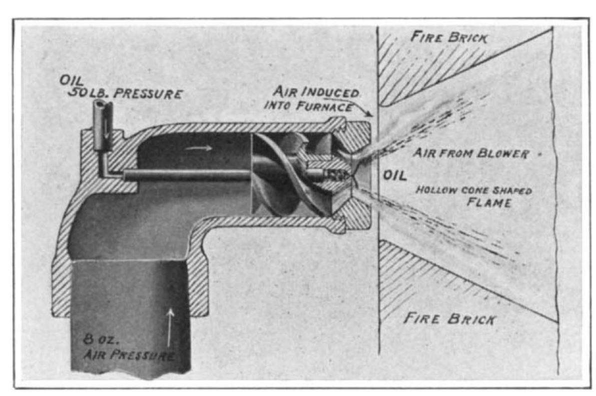
The resistance of bismuth increases when it is placed in a magnetic field, and the amount of increase varies directly as the strength of the field, within certain limits. Forearmed with this knowledge, the regulator shown by the accompanying sketch was constructed. A coil of bismuth wire was placed in series with the field of the dynamo, and the bismuth coil was made the core of a voltage coil which was connected across the lamp circuit. Under these conditions, the bismuth was subjected to the fluctuations of the voltage as indicated by the varying strength of the magnetic field of the voltage coil, and the resistance of the bismuth varied accordingly. When the voltage rose, due to increased speed, the field strength and resistance increased in proportion, cutting down the strength of the field circuit.

The chief difficulty lay in forming the bismuth coil, since that metal is too brittle to be drawn to a filament. It was solved by embedding a long, loosely coiled steel spring, previously oiled, in plaster of Paris, and, after the material had set, unscrewing the spring from the plaster. The bismuth, molten of course, was forced into this mold with the aid of a dentist's vacuum casting machine. When the plaster was carefully broken away, a perfect coil of the desired metal was left.

Low-pressure Atomizing Burner

OIL burners using high-pressure air or steam have been predominant ever since oil has been used as a fuel, owing to the difficulty of atomizing the oil with low-pressure. The typical low-pressure burner merely projects into the furnace a core of oil surrounded by a column of air, which on striking an abutment in the furnace causes an admixture of the oil and air.

The atomizer here illustrated embodies some radical improvements designed to convert the oil into a fog or mist. It comprises an inner nozzle through which the oil is delivered from under a high pressure. The passage-way in this nozzle is terminated, at the delivery end, by a small orifice, and within this passage there is placed a spiral. The oil is guided around this spiral, effecting a violently whirling jet in the orifice, which action causes it, upon delivery, to spread out in a cone-shaped film. Surrounding this nozzle is a casing, inclosing a large spiral, through which the air (or steam) must pass, so that the air, too, is delivered from the final restricted discharge orifice in a whirling current, which action likewise causes the air to assume the form of a hollow cone-shaped film. The oil film is drawn into the whirling current of air, and, being the heavier fluid, the centrifugal force throws it toward



Low-pressure atomizing burner.

the outer edge of the air film. The air from the blower therefore penetrates the mechanically atomized film of oil and reduces it to a fog. This action results from blower air of under 8 ounces pressure, giving a high degree of atomization at low cost and a mixture which affords perfect combustion without an excess of air.