### The Care and Use of Spark Coils.

BY E. Q. WILLIAMS.

One of the most important considerations with any coil is to keep it dry. Although we hear a great deal about waterproof coils, it is a good plan with any kind to keep them in a dry place, not where they will get hot, but where they do not get damp, as the pressure of the jump spark is so high that it will run along a little streak of moisture almost as well as on a wire, and though it tends to dry up this moisture in so doing it sometimes carbonizes the wood* and makes another path for itself. Too much care cannot be taken, especially on launches, to have a good place for the coil and battery. And here let us sound a note of warning: Do not put on over six cells of dry battery or three cells of storage; if your coil doesn't work with this amount of battery in *good condition*, look for trouble in it; increasing the voltage will only burn out the contact points without helping the secondary spark materially.

Another thing to be guarded against is the tendency to set the vibrator spring too tight, "so as to get a good, big spark." This is tested in the air, and when a big, flaming spark is secured, the operator thinks "that will fire anything," while as a matter of fact it will skip and bother on a quick-moving engine. What is wanted for successful running is a "quick spark," that will get there just when it is needed and every time. Such a spark is usually a small one. The adjustment to secure it is the following: The vibrator screw is drawn back until it does not touch the spring. Then set the spring so that the iron head is from 1/16 inch to 1/8 inch from the core. Now bring the screw up until it touches the spring lightly, and start your engine; if it skips any, try adjusting the screw a little tighter, but leave the spring just *as weak as you can* and not have the engine skip. In this way the engine will run at its highest speed, and the battery will last very much longer. The battery consumption can be frequently increased to three or four times the amount a coil should take, by merely setting the spring stiff and getting a "big spark." On the other hand, there is a danger of setting it too weak, so that when the engine stops the vibrator spring does not touch the contact screw, and the engine will not start.

Another puzzling trouble to find is a wire that is broken inside the insulation. This sometimes happens in the most unlooked-for places, but usually where the wires are moved or bent most, as at the commutator or where there is a great deal of vibration. It can usually be located by bending and pulling, as the wire will be very much weaker and more limber in the broken spot. The writer frequently uses another piece of wire, and "jumps" the suspected wire; this tells the story quickly and surely, when the defective wire is replaced or repaired.

Spark coils when in use almost always have one secondary terminal connected to the primary, or "grounded," as it is called. This is to reduce the number of wires to the engine, and to enable the spark to complete its circuit.

In the dashboard or multiple types this connection is made inside the coil box, but in the ordinary single and some multiple coils, both secondary terminals are brought to the outside, and the ground connection is put on outside. Sometimes when a coil ceases to spark or breaks down, by changing this ground to the other secondary terminal and putting the plug wire on the terminal that was grounded, the coil will work as well as ever and run for a long time.

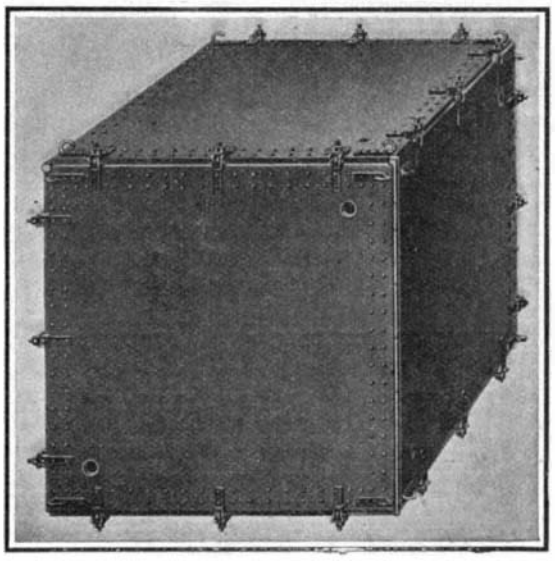
A secondary or plug wire lying over a hot pipe or cylinder is pretty sure to give trouble sooner or later. Block it up with a piece of wood or fiber, or if possible, move it away entirely; also keep oil away from your wiring, as oil rots rubber, and the wires are, or should be, insulated with rubber to guard against dampness. Do not draw the spark out in the air to see how long it is; this strains a coil, and if there is any weakness it will be sure to increase the trouble, even if it does not break down then.

* A peculiar characteristic of wood is that when wet it is a conductor, when dry it is a non-conductor; when blackened by heat or carbonized it becomes a conductor, and when burned to ashes it is again a non-conductor.

Watch your spark plugs, too, as well as the spark points, as many a coil is blamed on account of the plugs; the outside gets greasy and dirty, then the spark occasionally jumps there and the engine skips, or if the plugs are foul, the spark cannot ignite. If you want solid enjoyment from your ignition system, keep everything clean and dry.

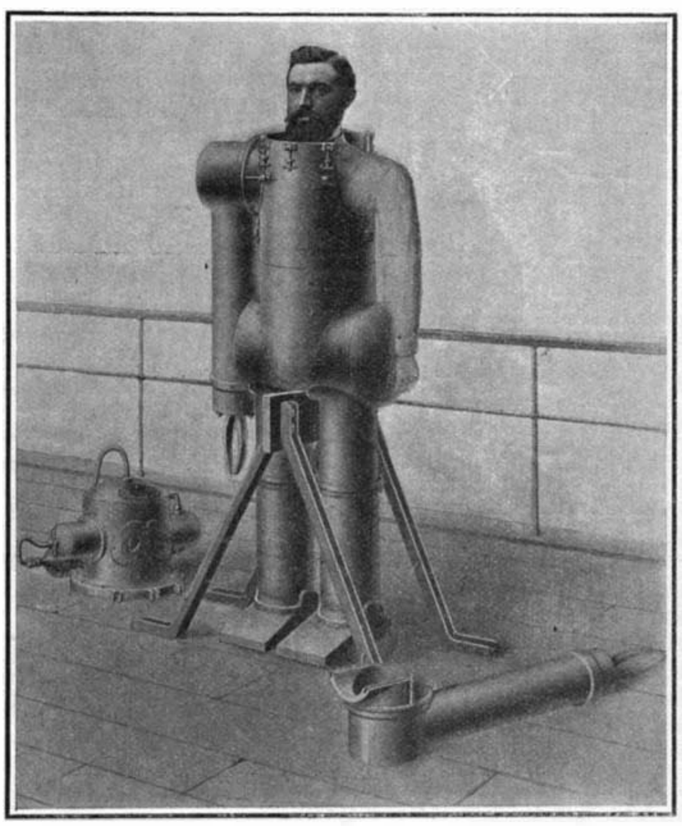
### THE DE PLUVY DIVING DRESS.

A novelty in the way of diving apparatus is the invention of M. de Pluvy, a prominent hydrographic engineer of Paris. This invention forms the subject of our cover illustration and is one which promises to be

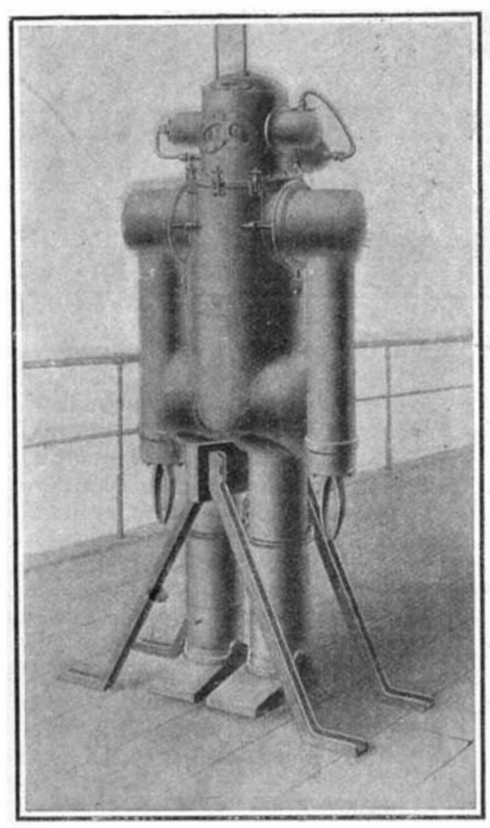


**The Collapsible Caisson.**

of great value in salvage operations. As De Pluvy has had many years' experience in diving operations, there is no doubt that the apparatus is of practical value. He uses a metallic diving suit which is made somewhat on the plan of the ancient coat-of-arms, being built of light and strong sheet metal having a thickness varying from 0.2 to 0.3 inch according to the position of the pieces. The joints and coupling points are made of pressed leather and rubber, and a special form of hydraulic joint is employed. On the top of the armor is fixed the helmet, which is the principal feature of the apparatus. The air is not brought to the diver from the outside, as usual, but the air he breathes is sent by a tube into a special regenerating chamber containing certain chemical products which renew the supply of oxygen and the air is then sent to the



**The Helmet and One Arm Piece Removed.**



**Ready for the Descent.**

**THE DE PLUVY DIVING DRESS AND CAISSON.**

interior of the helmet by another tube. The air-renewing apparatus is contained in a pair of cylindrical chambers attached to each side of the helmet. Regulating valves keep the air pressure within the helmet at the right amount and always constant, no matter what the depth may be below the surface. Mounting and descending are effected by a drum and cable worked by an electric motor. At the same time the cable serves to carry the current which is needed for the respiratory apparatus. The diver communicates with the surface by a telephone, and a number of wires run from the armor up to a set of colored lamps, showing how the different parts are working. There are many advantages to be secured from the new apparatus, and we expect to give a more complete and illustrated description of this interesting device. M. de Pluvy has personally been able to go down to a great depth, and during the 115 descents which he has already made with the new diving suit he reached depths varying from 150 to 300 feet. This far exceeds the depth to which an ordinary diver can go.

Besides the new diving dress, M. De Pluvy is also the inventor of a collapsible caisson which may be used in connection with the diving suit.

### Pure Alloys of Tungsten and Manganese and Their Properties.

A method of obtaining tungsten, or alloys of this metal, is presented by a French chemist, G. Arrivaut. By reacting with aluminium upon a mixture of oxides of these metals, it is possible to obtain alloys of tungsten and manganese which are rich in tungsten, but it is difficult to have a complete separation from the slag, and to do this it is necessary to operate on a large scale. But the author is able to obtain good results with reacting masses which are relatively small, by using tungstic anhydride and bioxide of manganese added to the right amount of lower oxides. The heat of the reaction is thus increased by the excess of oxygen in the mass. Alloys which are low in tungsten can be also obtained by the Schloesing furnace by using a current of hydrogen in which are heated the metals in powder mixed and compressed, but the value of 25 per cent in tungsten can hardly be exceeded. The author succeeds in forming alloys ranging from tungsten = 12; manganese = 87.34, up to the value tungsten = 60.05; manganese 39.20, making seven alloys in all.

The properties of the alloys are as follows: These bodies appear in the form of hard and brittle masses with a granular section and a steel-gray color. They are not magnetic. Air acts upon them slowly, forming brown spots of manganese oxide. Sulphuric acid, concentrated and boiling, or better still, bisulphates in fusion, will dissolve them entirely. Dilute acids, acetic, hydrochloric, etc., attack them energetically, even in the cold, but the action is always incomplete, and there remains a residue which contains all the tungsten. The latter finally contains no manganese. Preparation of tungsten by the alumino-thermic process is hard to carry out owing to the relative infusibility of this metal, but it is easier to form the alloys of it with manganese and the former can be then separated as above. Mixing oxide of manganese 360 parts, tungstic anhydride 100, bioxide of manganese 40, oxide of tungsten 100, and powdered aluminium 150, he obtained a mass which is well melted and homogeneous, free from slag and weighing half a pound. It contained about 45 per cent tungsten. When broken up and treated with hydrochloric acid it set free about one-half the weight in tungsten which was very nearly pure (99.55 per cent). This is seen as a steel-gray metallic powder, very heavy and presenting the usual properties of tungsten. Its density at 0 degrees C. is 15.28 compared with Moissan's value for cast tungsten of 18.7.

Flake graphite lubrication has been tested by Prof. Goss at Purdue University in comparison with neat kerosene lubrication. For this purpose one part by weight of flake graphite was mixed with two parts of kerosene. The immediate effect of adding the graphite was to permit an increase of load from 50 pounds to 110 pounds per square inch, and to reduce the coefficient of friction from 0.00547 to 0.00296. Another result was the excellent running of the bearing with kerosene alone after the rubbing surfaces had been cleaned; this was due probably to the enduring effect of the graphite in the microscopic pores of the metal.

A brass solution should be run slightly warm, but not smoking hot. The results are then not as good. A temperature of about 120 degrees is excellent. A solution that is hotter drives off the ammonia rapidly, evaporates the water, and does not give any better results than when a lower temperature is used.