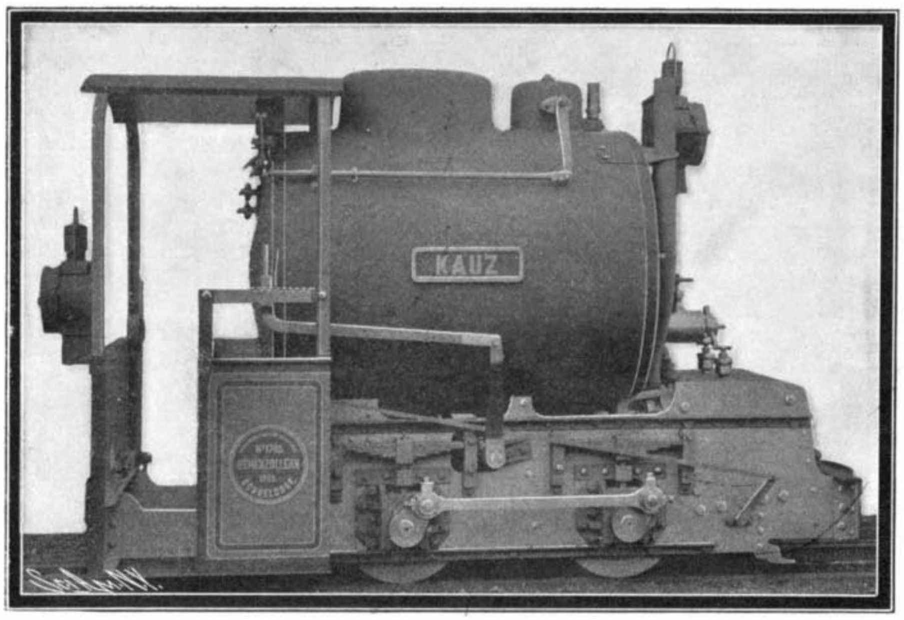
SAFETY LOCOMOTIVE FOR EXPLOSIVES FACTORY.

The accompanying illustration shows a handy little locomotive that has been designed and built at the Hohenzollern Works in Dusseldorf for use in factories that are devoted to the manufacture of gun powder and high explosives. Although it is a steam engine, it has no fire box, nor does it carry fire or flame of any kind whatever. For its motive power it depends entirely upon its boiler or hot-water reservoir which is filled with water, under a pressure of several hundred pounds to the square inch and a corresponding temperature of several hundred degrees. Our readers will recognize in this an adaptation of a system that has been in use for many years, and that has found considerable favor in Germany. The boiler is charged from a stationary plant with water heated to a point far beyond the temperature at which it would boil under atmospheric pressure. When the locomotive commences to move and the steam is drawn off from the boiler, the pressure of course is lowered, and as soon as it falls below the point corresponding to the temperature of the water, the latter begins to boil, giving fresh supplies of steam. Thus, as the engine is operated there is a fall of pressure with a corresponding boiling of the water. Care is, of course, taken to thoroughly lag the boilers, steam pipes and cylinders, and when once the boiler is charged, the engine is capable of independent operation for a considerable period of time. The first warming up of the locomotive requires about thirty minutes, and an unskilled laborer can soon learn to handle it satisfactorily.



SAFETY LOCOMOTIVE FOR EXPLOSIVES FACTORY.

BOILER SCALE DETECTION.

BY GEORGE J. JONES.

The subject of boiler scale is now the most embarrassing matter encountered by engineers in the economical operation of power plants. In these days, every item of cost is carefully watched and results noted, in order to see that full return is received for the expenditure, and every penny which cannot prove its justification is cut out. But in the matter of boiler scale, power plant engineers and operators have been more or less in the dark. It has been known full well that a coating of scale on the tubes of a boiler stood for a vicious extravagance, but as the formation is not in view, and has been heretofore hard to determine without throwing the plant, at least partially, out of service for a considerable time, many a plant has been allowed to run along with its efficiency impaired to a great degree by a coating of the scale on the heating surfaces of the boilers.

Just exactly what this embarrassment represents in figures is a difficult matter to accurately determine; but Thurston, who gave the matter some special attention and wrote a book on the subject, says that half an inch of scale on the tubes of a boiler represents an increase of sixty per cent in the coal bill. On what basis this statement was made is not known; but it has been clearly demonstrated more recently in the case of a large plant at Bayonne, N. J., in a very complete test, that the coal consumption was cut down by 23 per cent after a thorough cleaning of the boilers. We have said that heretofore there has been no means of determining its presence, but in most of the large plants it is the custom to clean the boilers thoroughly at regular intervals. By a recently patented invention, that of L. Bancroft Mellor, of Philadelphia, it is now possible to quickly and accurately arrive at the amount and location of formation on boiler tubes or other similar surfaces. This instrument is shown in one of the accompanying cuts. It not only shows the extent of scale and other extraneous matter, but also detects blistering and other defects which may increase or diminish the normal diameter of the tube or cylinder. The variation in relative distance between two measuring points of the device is recorded on a revolving disk. The instrument consists of a tube serving as a frame having a traverse wheel mounted thereon, which rotates by contact with the inside of the tube to be measured, as it is passed through for the purpose of exploration. This wheel by suitable gearing rotates a disk on which is mounted a chart or dial. A movable arm opposite the traverse wheel is mounted on the frame, which acts as a lever, causing a reciprocating motion of a rod carrying a pen, which rests on the chart, the motion of the pen corresponding to the reciprocating motion of the arm. Thus the relative distance between the traverse wheel and the arm is recorded, and the varying distance of the tube through which the instrument passes is approximately recorded in a sinuous line. The length of the frame tube can be varied to suit any length of tube by adding sections of frame tube between the traverse wheel section and the revolving disk. Some of these record disks are shown, indicating different boiler conditions.

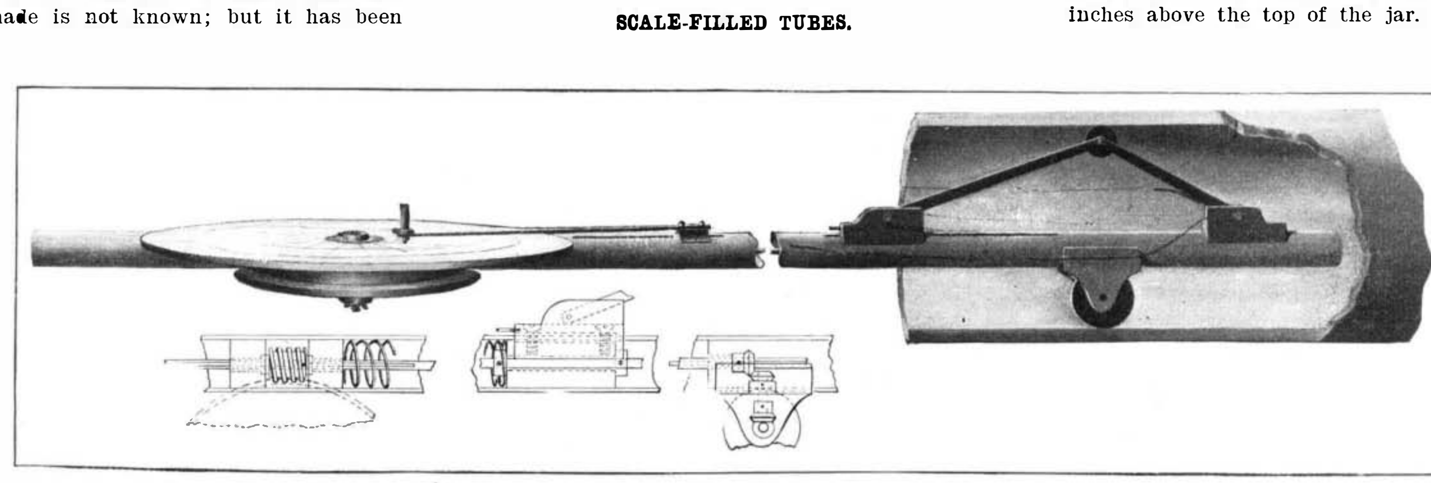
The reason for the presence of scale has never been explained satisfactorily, although a great deal of time has been spent by scientific men in the endeavor to solve, not only the mystery of its origin, but to arrive at some means of preventing the deposit. It takes place with the use of all kinds of water except distilled, and of course this is out of the question for general power plant use.

Because of the inconvenience and expense of determining the presence of the formation, many a plant is in operation to-day, with its boiler tubes choked almost to the point of stoppage of circulation. The engineer is probably making use of some alleged scale-preventing compound or subjecting his feed water to some treatment with the same object in view. In blissful ignorance he is therefore responsible for greatly increased fuel bills, while he is congratulating himself that his boilers are doing their best work.

Boiler scale has many marked characteristics, as shown in the accompanying cuts, which are samples taken from boilers worked under different conditions. In the first of the tube sections shown, the interior was almost sealed, the circulation being maintained through a number of small holes in the center of the crust. The large hole shown in the same photograph was made in the operation of cutting the section out.

The device described above has been adopted by the leading boiler-insurance company of this country, to be used in determining the condition of boilers after explosions. It has also received the indorsement of the Franklin Institute in being awarded the John Scott Legacy medal and premium.


SCALE-FILLED TUBES.


A DETECTOR AND MEASURER OF SCALE FORMATIONS IN BOILERS.

A PRACTICAL PRIMARY BATTERY.*

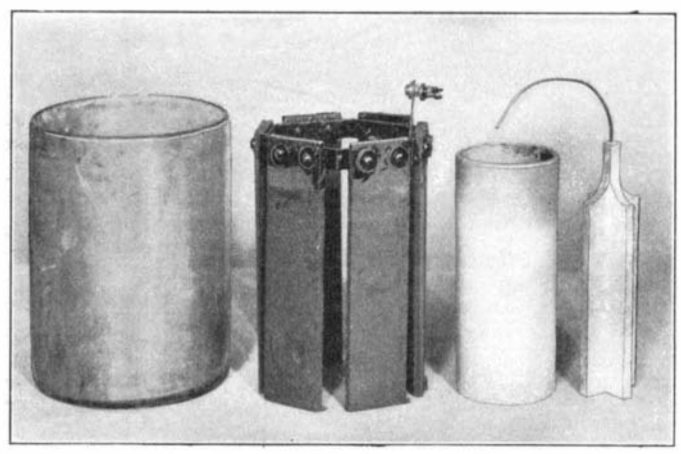
Every amateur who delights in "making things" dabbles more or less with electricity. Most of these are so situated that they have no access to the large sources of supply of the electric current, such as lighting stations can furnish, and if they would do any real work, must make their own generators and apparatus. It is to the assistance of such that the present section is devoted.

The battery represented in our engraving can be made at a minimum cost, and when made will give a maximum of output. The materials to be purchased are glass jars, porous cups, carbons, zincs, burrs, screws, binding posts, and some sheet copper.

All the pieces for the cell come ready for use, except the carbons, which are peculiar to the special form of cell. As the cut shows, there is a ring of carbons to be placed in the glass jar and to fit in the jar as closely as may be without exerting pressure upon the jar. Six plates of carbon are required for each ring. Each plate has two holes of a size to fit the screws. The holes may be made most easily by awls and reamers, such as are to be found in a set of tools in an awl handle. A little patience and experience will enable any one to make the holes neatly. Carbon is very hard and will wear a drill very fast. Hence, it is better not to attempt drilling holes in a carbon plate. Of course the holes should be equally spaced, if the appearance of the finished work is to be considered.

The copper should be about 1-32 inch in thickness and about 5/8 inch wide. It can be bought of this width, or cut by the dealer or by a smith with large shears. A strip must be bent into a six-sided ring of such size that when the carbons are fastened to it the whole will slide snugly into the glass jar. It will be better after one strip has been fitted to its place to straighten it out and use it as a pattern, or template, by which to drill the holes in the rest of the copper strips. They will then be all alike and interchangeable. A template should also be used for making the holes in the carbons, though all holes may be reamed a little on one side or the other to allow the screw to pass through. If the worker has no means of tapping a thread for the screw, he should buy nuts for the screws also. The holes in the copper strips may be punched with a nail punch, if one has no means of drilling them. For punching holes in this way the end of a stick of hard wood should be used as a bed on which to rest the copper which is to be punched. The strip of copper which leads up out to the binding post may be riveted to the ring, or one end of the ring may be left long enough to bend up a couple of inches above the top of the jar. The carbons should be long enough to reach above the jar so that the metal parts shall not touch the glass. In this battery the fluid employed will corrode metals very rapidly.

(Continued on page 138.)


A PRACTICAL PRIMARY BATTERY.

* From "Home Mechanics for Amateurs." By Geo. M. Hopkins. Copyright 1903 by Munn & Co. Publishers.