quickly as far as the attainable maximum. This cannot here be very high, since an efflux of opposite electricities very soon takes place from the springs, G, G', leading to the earth, as may be detected by the odor of ozone, and tufts of light visible in a darkened room. The apparatus is self-exciting. If two electric pendulums are fixed to E and E', the rapid increase of the charge is plainly perceptible.

Of course the apparatus would be considerably more efficient if, instead of the metal cylinder fixed radially to the axle, we used a revolving glass disk with sectors of tinfoil, and replaced E and E' each by two parallel glass plates coated externally with tinfoil. But then we should essentially return to the construction of Topley's machine, for evidently only a step is wanting to dispense with the charges of the solid conductors, E and E', and in their stead to introduce a spark interval in the metallic conduction of the two springs, G, G', which must now, of course, be insulated. If, finally, also the tinfoil sectors of the revolving disk are omitted, and if points are substituted for the contact-springs, we have the essential features of Holtz's construction. The connection thus indicated between the different forms of the influence machines has been already fully explained and theoretically founded in a treatise by Veltmann, "Theory of the Influence Machine,"* to which we refer.—*Annalen der Physik und Chemie; Electrical Review.*

HISTORIC ELECTRIC APPARATUS AT THE PHILADELPHIA EXHIBITION.

In one corner of the Exhibition adjoining the lecture hall there was a collection of old apparatus borrowed

FIG. 1.—FRANKLIN'S ELECTRICAL MACHINE.

from the Patent Office at Washington. These models, which were quite numerous, were very rude, and it would prove tedious to enumerate them.

What was especially interesting was a small number of instruments of a scientific rather than of an industrial nature. First, there was the electrical machine which Franklin employed in his researches. Fig. 1, which gives a faithful portrait of this apparatus, needs no description.

Alongside of this there was a large and very interest-

FIG. 2.—PROF. HENRY'S ELECTRO-MAGNET.

ing electro-magnet, once the property of Joseph Henry. After the labors of Arago upon the magnetization of iron by a current, Sturgeon (in England) constructed an electro-magnet, but contented himself with winding a single layer of wire round a horseshoe-shaped core. As the wire was not covered with an insulating material, the spirals were somewhat distant, and such a magnet could not possibly be very power-

ful. It occurred to Henry to make use of silk-covered wire, and to wind this in several layers round the core. In this way he got a magnet that was much more powerful than any of those that had been made up to that time. He afterward studied the conditions that were necessary in order to obtain powerful electro-magnets, and was led to construct the apparatus shown in Fig. 2, which consists of a soft iron horseshoe suspended from a wooden frame. The winding of this core consists of a series of flat bobbins, whose extreme wires are so arranged that they can be grouped in several ways, and that grouping be determined in which the attraction is strongest. It is curious to see sectional electros dating back to so remote an epoch (1831).

FIG. 3.—HENRY'S ELECTRIC MOTOR.

In the course of his researches upon electro-magnets, Henry likewise constructed the first electric motor that had been seen. The apparatus was, it is true, very rude, but it nevertheless demonstrated the possibility of producing motion by means of the electric current. It consisted (Fig. 3) of a magnetized bar placed in a fixed position. Above this there was a long electro-magnet that projected beyond two pairs of wires that could dip into the mercury cups of two pile elements. If we suppose the electro to be inclined so that the wires of one side dip into the mercury cups of the pile to the left, the polarities will be such that there will be a repulsion to the left and an attraction to the right. The electro will then assume the opposite position, and the polarities be changed, and so on. There will thus be obtained an alternating motion.

But the apparatus exhibited were not the only interesting things. A search in the library revealed some curious works; we shall be content to cite Hare's Treatise upon Galvanism and Electricity. In this work we found a description of a motor (Fig. 4) formed of a permanent horseshoe magnet, between the

FIG. 4.—HARE'S ELECTRIC MOTOR.

branches of which there is a galvanometric helix. The continuity of the motion is secured by a commutator. In a word, we have here a Deprez motor without iron.

In this same volume we find electro-magnetic reversibility described. The experiment pointed out consists in revolving by hand a Ritchie motor connected with a galvanometer. The current produced is shown by the deflection of the magnetized needle. Will it be always possible to say, then, that "there is nothing new under the sun?"—*La Lumière Electrique.*

APPLICATIONS OF ELECTRICITY TO MEDICINE.

THE interesting exhibit of apparatus by Dr. Boudet at the recent Electrical Exposition at the Paris Observatory merits special study. The application of the telephone to the auscultation of blood vessels is remarkable. This instrument not only permits of auscultating

the membrane of the drum, which amplifies them, and converts them, through the microphone and a telephone receiver, into sonorous vibrations that may be very readily heard. A chloride of silver pile, P, suffices for the operation of the microphone.

Dr. Boudet has likewise constructed an apparatus that permits of transmitting sonorous vibrations to the teeth of deaf mutes, and has also applied the microphone (Fig. 2) to the detection of vesicular calculi, by adapting it to the handle of a metallic sound. In a lecture delivered at London, the Doctor asserted that he was able not only to assure himself of the presence or absence of a calculus in the bladder, but in nearly all cases to know its nature if present.

FIG. 2.—MICROPHONE FOR DETECTING CALCULI.

Dr. Boudet likewise uses the telephone as a measuring instrument for estimating in known and mathematical terms the nervous and muscular excitement in the different phases of a disease.

For dealing with occlusion of the intestines or with ileus, Dr. Boudet uses an intestinal exciter that permits of submitting the intestine to very intense currents without disorganizing the tissues. To this end, he employs a gum elastic sound provided with a hollow metallic handle connected with the canula of an irrigator filled with salt water. The current from the pile is transmitted to the salt water, which bathes the surface of the intestine over a wide surface. The other pole of the pile is connected with the loins or abdomen, according to circumstances, by means of a large disk covered with chamois skin. The current closes upon a circuit of very large section, and can occasion no disorganization, through excess of intensity, at any point whatever of the intestine. Out of 46 cases submitted to the treatment, 33 cures of occlusion have been effected. In the case just examined, the current is distributed over a very wide surface. In other cases (for example

FIG. 3.—EXCITERS.

when the brain is operated upon), all derivation may exert an injurious influence. To avoid this, concentric exciters (Fig. 3) are employed, and the form of which may be varied *ad infinitum*, according to the effects to be obtained and the part of the body to which they are to be applied.—*Le Gentle Civil.*

A NEW AND RAPID METHOD OF GERMAN SILVER ANALYSIS.

By THOMAS MOORE.

THE manufacture of copper, nickel, and zinc alloys, generally classified under the comprehensive title of German silver, has within late years increased to such an extent that many of the manufacturers who formerly made only a given number of qualities find themselves now called upon to make alloys of very exact composition, and so keen has the competition become that a variation of 1 p. c. on nickel contents would now

FIG. 1.—MICROPHONE FOR AUSCULTATION.

the pulsations of a blood vessel, but also of hearing all sorts of internal sounds. The apparatus as modified for this purpose is constructed as follows: The microphone system (Fig. 1), which is formed of two movable carbons, CC', with paper spring and regulating screw, M, is carried by a well stretched membrane, T, that covers a small drum whose interior is connected by a rubber tube with an exploring funnel, B. This latter is applied to the part to be auscultated, and the vibrations are transmitted by the air in the rubber tube to

scarcely be tolerated. One obvious result of this competition is that the analysis of the alloy has become more the rule than the exception, and as time is an important factor, I venture to hope the under-noted process will prove useful to those engaged in such analysis. Hitherto, the only difficulty in German silver analysis was the separation of the zinc from the nickel, but now, thanks to Zimmermann's ammoniac sulphocyanide method, this has almost disappeared, and were it not for the introduction of ammoniac salts into the nickel

* Veltmann, *Pogg. Annalen*, 151, p. 513, 1874.

solution, the process would be all that could be desired.

The following is the process I employ, which includes a zinc from nickel separation, which, I think, is quite new, and is also very accurate, and also a new way of dissolving the copper sulphide, by means of which a considerable saving in time is effected.

Dissolve 0.5 grm. of the alloy in *aqua regia*, and evaporate to dryness over the water bath; to the dried residue add 25 c. c. hydrochloric acid, sp. gr. 1.160, dilute to 250 c. c. with distilled water, keep the solution at 70° C., and precipitate the copper with sulphureted hydrogen; filter, and wash out with hydrochloric acid, sp. gr. 1.05, which is saturated with sulphureted hydrogen and then with water containing that gas in solution; by so proceeding, a second precipitation is thus avoided (Gerh. Larsen); wash the precipitate into a beaker glass, and dissolve it by adding potassic cyanide. Heat facilitates the solution, which takes place in a few seconds, and do not use more cyanide than is necessary to effect the complete solution, except perhaps a small black insoluble residue of plumbic sulphide or a yellowish powder of separated sulphur. Add to the solution so obtained 20 c. c. of a strong solution of ammonic carbonate, and dilute to about 250 c. c.; boil for a minute or two, and submit the solution to electrolysis, keeping it about 70° C. and occasionally adding a little of the carbonate solution. I use three Bunsen's cells, pint size, and find that from two to three hours are amply sufficient for the complete deposition. The deposited copper has a brilliant and compact appearance, and is dried and weighed in the usual manner.

The filtrate from the copper precipitate is evaporated to dryness, the residue dissolved in water, and sufficient pure potassic cyanide added to dissolve the precipitate first formed. Any iron present will be left partially undissolved, but that will not influence the results. Wash the solution into a flask of 600 c. c. capacity, and add colorless or but slightly colored ammonic sulphide (not the yellow sulphide); dilute to about 400 c. c., place a funnel in the mouth of the flask and a spiral of platinum wire in the flask to prevent bumping; boil until the steam has no action on test papers. A double decomposition takes place, ammonic cyanide is volatilized, while zinc sulphide is precipitated, which is filtered off and washed with boiling water containing sufficient sodic carbonate to make it distinctly alkaline. The filtration of the precipitate so obtained does not present the slightest difficulty, the sodic carbonate preventing any of the sulphide passing through the paper, which, when well washed out, is dissolved and converted into the carbonate and weighed as oxide in the usual manner. If any iron is present, separate from the weighed oxide by repeated solution and precipitation with hydrochloric acid and ammonia, and add it to the other portion of the iron separated from the nickel solution.

The filtrate containing the nickel is acidified with hydrochloric acid, and digested in a warm place with bromine until a clear solution is obtained; or evaporate to dryness with *aqua regia*, and precipitate the solution obtained by either method with potassic hydrate and bromine, filter off the black precipitate, wash well and dissolve off the filter with dilute sulphuric acid, add excess of ammonia, and electrolyze hot. Any iron which separates out, filter off and weigh.

—*Chemical News.*

PRESSES FOR BEET ROOTS, ETC.

DURING the early stages of beet sugar making, hydraulic pressure was the only means of extracting the juice. Strange as it may seem, there are but few factories at present using this costly method. Continuous presses were, for many years, greatly in vogue, the idea of their use being evidently suggested by the cane-crushing mills. The most important presses are Lebee, Champonnois, Poizot, Socin, Collette, Dujardin, etc.; a few of these only will be described.

While, apparently, the principle of the continuous

TRANSVERSE SECTION OF CHAMPONNOIS PRESS.

press is excellent, we regret to say their life has been short; not due so much to the loss of sugar in the pulp, for in that respect there was improvement over the hydraulic presses, but to trouble of working the extracted juices. These contained impurities, such as gums, etc., most difficult to eliminate in processes of purification.

LEBEE'S CONTINUOUS PRESS.

The Lebee press is said to combine the advantages of the Champonnois and some others. While it had considerable popularity at one time, it is now seldom used. The pulp from rasps is forced into chamber, B, of the press through the pipes, C C'. The filtering, revolving cylinders, A A', then press the pulp, which continues moving forward under the solid cylinder, F and A', thence between A' and I and M and A'; finally has exit

at side of the apparatus. The resulting juice flows from the pipes, D and O. Each filtering cylinder, when properly arranged, has about 5,000 blades. The advantage over the Champonnois press is that, if at any time a portion of the filtering surface should need repairs, it may be done in a short time by unscrewing the plates holding the blades in place. About 50 tons beets may be pressed with this apparatus in 24 hours; the cost of repairs is about 75 cents per week.

CHAMPONNOIS PRESS.

This press is composed of two cylinders deeply sunk

END SECTION OF CHAMPONNOIS PRESS.

into the frame of the apparatus, and revolving in opposite directions, receiving movement from a well arranged gearing placed above. The cylinders are inclined at an angle of 45°, and are covered with a spiral wrapping of triangular wire. A special device is adopted to prevent the stretching of the wire. The pulp is forced into the lower part of the press by a special pump connecting with the rasp, and at a pressure of two atmospheres. Upon entering, the pulp is forced on both sides into the open space, and subsequently between the rollers; the juice passes through the spaces in their peripheries, and flows from the apparatus. The rolled pulp is scraped from the cylinders by two blades, shown in engraving, and falls into a receptacle, from which it is at times removed. About 50 tons pulp may be worked by the Champonnois press in twenty-four hours.

VERTICAL SECTION OF LEBEE'S CONTINUOUS PRESS.

SOCIN'S CONTINUOUS PRESS.

THE POIZOT PRESS.