

fuel and labor is much higher than in the kilns, and is computed at 2 s. 6 d. per ton.

Magnetic Separation.—The roasted ore is spread out on a floor to cool, and separated from sintered lumps, when it is lifted by an elevator, and passed through a sizing-drum to remove particles above 4 millimeters, which are returned to the crusher, while the finer siftings pass to the electro-magnetic machines. These differ materially from machines previously used for the same purpose, as they are continuous in action, while the magnets are kept out of contact with the material under treatment. The machine has a fixed horizontal axis, carrying a series of electro-magnets arranged radially on a frame, covering an arc of about 90° within a brass drum, nearly, but not quite, touching the magnets, which receives motion from a belt and pulley. The outer surface of the drum is made into an elevator by a series of small ribs projecting radially. The magnets, which are so arranged that the lower series is a little below the horizontal plane, face the feeding-apron, which, by an arrangement similar to that of a percussion table, delivers the ore from the feeding hopper in a thin stream against the excite-surface of the drum, when the magnetic particles are retained and travel upward, being kept from falling by the radial ribs, and passing over the vertical plane fall off on the opposite side, while the blende particles, not being attracted, fall down a shoot into a hatch in front. The separation is only approximate, and has to be repeated upon the roughly classified product of the first operation, the ultimate products being—

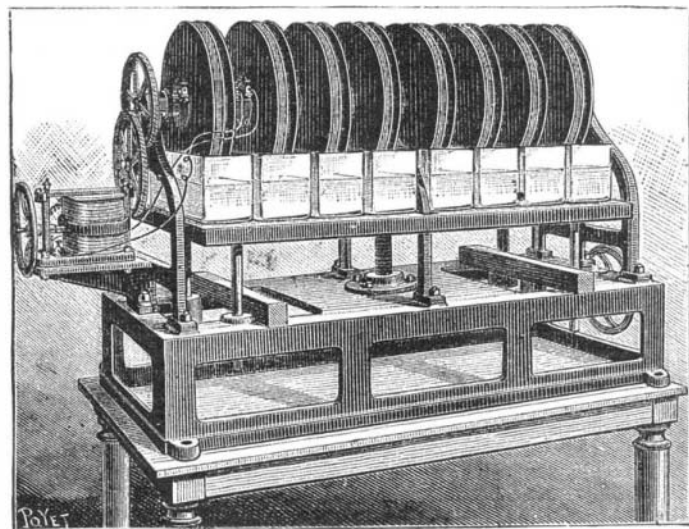
1. Blende and quartz.
2. Spathic ore.
3. Mixed blende ore.
4. Mixed iron ore.

The two latter classes requiring further treatment. As the operation is attended with the production of much dust, the whole of the apparatus is connected with an exhaust-fan working continuously. Sixteen machines are in use. They are arranged by series of four, of which an upper pair effect the first rough separation, and deliver to the finishing pair placed below them. The four machines in each series are excited by a Gramme dynamo of 1 horse-power; the current is introduced at one end of the hollow axis of the drum and passes out by the other. Each of the two divisions of the establishment (eight machines) treats 24 tons of roasted ore in twelve hours, producing 7 to 8 tons of blende and 16 to 18 tons of iron ore. The rough stuff from the mine averages 12 to 15 per cent. zinc and 20 to 22 per cent. iron, which gives dressed zinc ore of 33 per cent., and iron ore with 36 to 38 per cent. of iron and 10 per cent. of manganese.

Finishing Concentration.—The iron ore obtained as described is not subjected to further treatment, but the blende requires further concentration in jigging machines. For this purpose, the blende freed from iron ore is delivered by an elevator to a sizing-drum, which divides it into three sizes, of 3, 2, and 1 millimeter, each of which is treated on a separate jigging machine to remove earthy waste, as well as intermixed lead ore. This gives a final salable product enriched up to 38 per cent. of zinc and lead ore, with 63 per cent. of lead, and 40 grammes of silver. The fine stuff and dust from the exhauster are treated on slime buddles, and give a zinc product of 32 per cent., and lead ore of 65 per cent. —*Berg- und Hüttenmännische Zeitung.*

BAZIN'S ROTARY PILE.

THE agitation of the elements of a pile and the renewal of their active surfaces constitute a mode of depolarization that is already very old, and from time to time new models appear in which the inventor endeavors to utilize such action to advantage. One of the most recent attempts in this line is the rotary pile lately presented by Mr. Bazin to the Société Internationale des Electriciens, and shown in the annexed engraving. Upon an axle fixed in space are mounted eight elements, each composed of a zinc placed between two carbons. Communication between these different elements is established by stripes of brass affixed to the axle. Seven of the elements are coupled for tension, and serve to supply the external circuit, while the eighth element, forming an insulated circuit, supplies a small electric motor that serves to communicate to the axle a rotary velocity of about one revolution per minute. The active liquid is contained in oblong glass



BAZIN'S ROTARY PILE.

troughs placed upon a horizontal table that may be moved up or down by means of a screw actuated by a hand wheel at the right of the apparatus.

Each trough contains 5¼ pints of a bichromate of potash solution of the following composition:

Water.....	1,000 parts by weight
Sulphuric acid.....	300 " "
Bichro. potash.....	125 " "

We have had an opportunity of making some experiments with this pile, and of studying its constancy with different discharges. It has not, in our opinion

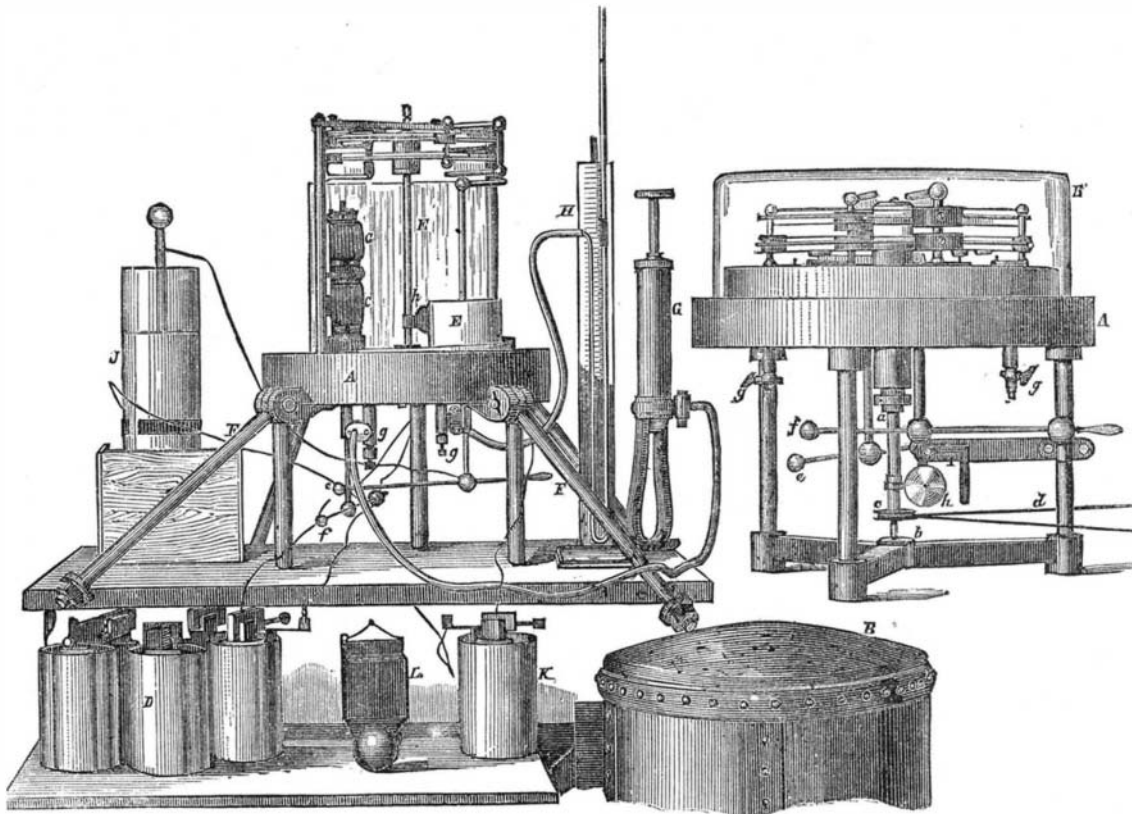
(up to the present, at least), answered the expectations of its inventor. The curves of discharge have always shown rapid decreases after but an hour's operation. It is possible, it is true, to lessen this decrease in the discharge by a suitable immersion of the elements and by an increase of surface to compensate for the increase in internal resistance; but frequent maneuvers like these are incompatible with the ordinary needs, of practice. In fact, we think that a more regular operation and a greater constancy would be secured with immovable elements, on condition that a proper surface were given the zincs and carbons. The benefit of rotation, then, is entirely lost in consequence of an arrangement that we consider as vicious. In fact, Mr. Bazin revolves both the carbons and the zincs. For the former this is undoubtedly an advantage, but for the latter it is manifestly the opposite, since these carry along with them a certain quantity of the liquid, and

α in a stuffing-box and at b on a point. The motion is given by means of a small drum, c, and a belt, d. The polar balls of the machine, e and f, are fixed on supports movable in all directions, fixed in the iron plate and insulated by means of vulcanite disks.

On the extreme edge of the iron plate are cast two concentric ridges, forming a deep groove, in which the glass bell, B, can be placed. The iron plate is further fitted with two cocks, g, and a rotation indicator, h, for the purpose of comparative measurements.

All the space beneath the glass bell not taken up by the glass-work of the machine is filled up, as far as possible, with paraffine. If a little mercury is introduced into the groove of the plate, the machine is enclosed perfectly air-tight, and yet it can be opened without difficulty.

If oil of vitriol is also placed under the bell, the machine is soon surrounded by air absolutely dry and



HIGH PRESSURE INFLUENCE ELECTRIC MACHINE.

this attacks them out of the liquid without producing any electric energy, and thus uses them up prematurely. Under such circumstances the pile operates with as much local action as would a bichromate element whose zinc surface were uselessly exaggerated. We believe that Mr. Bazin is occupied in modifying his pile in the direction indicated, that is, in such a way as to render the zincs stationary—a circumstance, moreover, that will much facilitate their exchange. We shall await there new elements and new experiments in order to publish some figures, for those furnished by the present elements are far from being favorable, and in no wise justify the dithyrambic articles with which the political press has saluted the appearance of this pile and called the attention of the public to it.—*E. Hospitalier.*

A HIGH-PRESSURE INFLUENCE ELECTRIC MACHINE.

By WALTHER HEMPEL.

IN January, 1884, I published in the *Berichte der Deutschen Chemischen Gesellschaft* a memoir on the effect which the chemical nature and the pressure of gases exert on the development of electricity by influence machines. I had then ascertained that the

free from dust, which offers the great advantage that it always excites itself at once, and can be used even in the worst atmosphere of a laboratory.

It was found that the glasses of machines thus fitted up do not require to be lacquered, so that all parts of the machine are perfectly proof against the action of the ozone which the machine generates when working in air. We can also, without interfering with the action of the machine, use ordinary window glass (which for the common construction is quite useless) for the preparation of the disks, as it insulates quite sufficiently in perfectly dry air.

As the paper coatings of the machine when perfectly dry cease to conduct electricity, they must first be rubbed over with graphite, which renders them slightly conductive.

The arrangement just described permits of the use of various gases, but it excludes the use of high pressures. Fig. 2 shows the arrangement adopted for studying the action of the machine at different pressures.

To render measurements possible without the disturbing effect of friction in a stuffing-box, the machine was placed on the iron plate, A, under an iron bell, B (represented in the figure as lifted off), in such a manner that the movement is effected by a small dynamo machine set in motion from without by the battery, D. It was thus possible to keep the friction of the pegs constant at varying pressures, and to effect a really perfect closure of the space under the bell. The entire room under the bell not required for the moving parts of the bell was filled up with paraffine, E. The iron bell was lined internally with a stratum of paraffine an inch in thickness, and could be pressed down upon a caoutchouc ring laid upon the plate, A, by means of four iron screws, F. The plate contained two valves, g, one of which is in connection with a forcing pump, G, and the other with a pressure gauge, H.

The conductors to the polar balls, e, f, were carried through the plate insulated by means of long glass tubes. For measurement, a Leyden jar, J, was used, standing in a box filled with melted paraffine. The Leyden jar was connected by wires with the supporters of the polar balls.

Besides, there was in the machine a revolution indicator, h, connected by wires with an element, K, and an electric bell, L, and so arranged that on the completion of every 100 rotations a contact took place and the bell sounded.

The connection between the dynamo and the influence machine was effected by drums and driving belts. To render it possible for the dynamo to be started in any position by simply closing the circuit, it was constructed as a twin machine, so that two small dynamos were united in one. Their keepers were fixed on one and the same axle, and were so placed with reference to each other that the one machine was in the maximum of its action when the other was at the dead point. The arrangement described enables the influence machine under the bell to be set in motion at pleasure in different gases and under varying pressures, the revolutions of the glass disks to be counted and the quantity of electricity evolved to be measured.

EXPERIMENTS WITH THE INFLUENCE MACHINE (FIG. 1).

The quantity of electricity was found by counting the number of discharges given by a Leyden jar for the same number of revolutions and at the same mutual distance of the polar balls.

The machine had lacquered disks. It appeared that on using hydrogen gas the collector points of the machine were not luminous in the dark, while in all other gases this took place very distinctly.

1. The machine gave with hydrogen at 850 rotations per minute 9 discharges, while in air with the same number of rotations there were 45 discharges.

2. In carbonic acid for 850 rotations there were in the mean 47 discharges, a part of the carbonic acid being at the same time converted into carbonic oxide and ozone.

3. The machine, further, when running at the rate of 400 rotations per minute in air at the normal pressure, gave 15 discharges per minute and 32 on an increased pressure of the atmosphere. On diminishing the pressure by half an atmosphere below the normal pressure, the Leyden jar could not be charged at all.

An attempt to obtain larger quantities of electricity by causing the machine to run under petroleum (which is a notable electric non-conductor) proved unsuccessful. It is possible that by using sliding springs instead of the recipient points of the influence machine, a result might have been obtained. It is possible that the petroleum insulates so well that the points are unable to transfer the electricity.

Experiments show that the chemical nature of gases exerts on the one hand an influence on the development of electricity by the influence machine, while on the other there ensues with increasing pressure an enormous increase in the quantities of electricity produced.

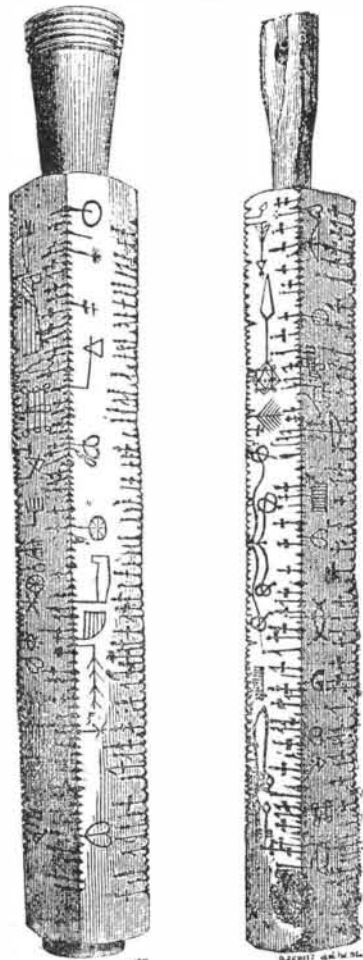
For utilizing the electricity produced by influence machines an arrangement like that in Fig. 1 is suitable, but with the difference that instead of a glass bell an iron cap is used, which may be fixed down air tight with strong screws.

The above researches have been made with a Leyden jar—a rough measuring instrument—in order to obtain an insight into the total phenomena. The pure electric determinations of the dielectric constants of the gases at high pressures must be reserved for future investigations.

Oskar Leuner, mechanic to the Dresden Polytechnicum, has made the entire apparatus in a most satisfactory manner.—*Annalen der Physik und Chemie*.

CLOG ALMANACS.

BEFORE the invention of printing, considerable difficulty was experienced in remembering the different saints' days and other holy days, and various expedients were made use of to assist the memory, the most usual of which was a perpetual calendar, engraved on some hard substance, either on a large scale or a small one, according to circumstances. At the present day, when every cottage is supplied with its penny almanac for the year, to be thrown aside as waste paper at the year's end, if not previously worn out, it is not easy



Clog Almanack. Bodleian Library, Oxford. Clog Almanack. Ashmolean Museum, Oxford.

to realize the very opposite state of things which existed in the middle ages; but the very difference makes it a matter of interesting research to find out the means employed by our ancestors as a substitute for our almanacs. We occasionally find a perpetual almanac engraved on a large scale on the wall of a church; one of these, as early as the twelfth century, still exists on the wall of the church of the city of Perigueux, in the south of France, and a few others of later date have been preserved. The emblems of the different seasons, with the characteristics and the usual employment of each, are also frequently used as ornaments round the arch of a doorway, and in other situations; and they abound in illuminations of manuscripts. Perpetual almanacs were also engraved on metal, on bone, on ivory, and on wood of different kinds. The most common are on boxwood; these are usually cut on square logs, and are often called Danish almanacs, or Runic calendars, being supposed to be of Danish origin, although they were extensively used in England. These vary considerably in size, some being small enough to

carry about conveniently, others made to hang up by the side of the fireplace, a custom which continued in old-fashioned farmhouses within the memory of man, and which Dr. Plot, who wrote a history of Staffordshire and of Oxfordshire in the latter part of the seventeenth century, describes as common in his day. They have now become rare, and are met with only in museums or collections of curiosities; there are several in the Bodleian library and in the Ashmolean museum at Oxford; and two in the Cheetham library at Manchester.

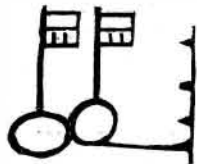
Some of these are very rude, as if cut by a laboring man with his pocket knife. Some are on flat strips of wood; others, as we have said, on square sticks, from which they were also called "log almanacs," or "clog almanacs," clog being a provincial word of the same signification, commonly applied to the piece of wood which is tied to restive animals to prevent them running away or getting through edges.

There were two kinds of these almanacs; one for the immovable feasts, the other for the movable, with the Sundays also, and these are the most usual. When the almanac is on a square stick the days are marked by notches on the angles, the seventh day being distinguished by a deeper notch, and the festivals by their usual emblems, some of which are very curiously expressed. We give engravings of two, one from the Bodleian, the other from the Ashmolean; both of these are believed to be of English workmanship, but some of those in the Ashmolean are clearly Danish or Swedish, having Runic (or secret) characters upon them, and having been presented by a Swede, John Hensig, in 1681, who stated that they were then in use among the agricultural classes in his own country. The emblems or symbols employed seem to have been purely conventional, and nearly the same on all.

The strokes with dots on the right hand side of each face of the almanac denote the golden number or cycle of the moon; if the number is under five, it is represented by so many dots; if five, by a sloping line from the notch for the day, forming with the straight line a rude V, which stands for five. If the number is above five and under ten, it is marked by the number of dots on the sloping line added to five. When the number is ten, a cross stroke makes a rude X, which stands for ten, and the figures above ten are again marked by dots. These clog almanacs were also called prime-staves, because the prime or golden number was marked upon them. This will be more clearly understood by referring to the calendar at the beginning of the Prayer-book, particularly the table to find Easter, and the direction for using it, where the golden number or prime is mentioned.

Annexed will be found, besides the reduced sketches of the "clogs," some of the emblems selected and drawn to the full size of the originals.

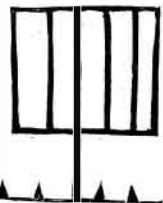
We at once recognize the keys, which were through-



ST. PETER.

out the middle ages considered as the emblem of St. Peter.

The next to it is not at first sight so plain. It occurs, however, on the day on which St. Lawrence is commemorated, and therefore without doubt is intended for the gridiron; this martyr having been broiled to



ST. LAWRENCE.

death because he refused to give up the treasure of the church which was he supposed to be in his custody.

St. David's day is marked by a harp. It was not intended by this to confuse the Welsh Archbishop with the holy king, but the similarity of the name was a



ST. DAVID.

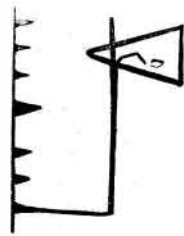
sufficient ground for the use of the well-known emblem of the minstrel.

St. John the Baptist's day is distinguished by the figure of a sword, the instrument of his death.



ST. JOHN THE BAPTIST.

In the same manner we find the hatchet as the em-



ST. PAUL.

blem of St. Paul, as tradition informs us that he was beheaded.

It is useless to remark upon the appropriate emblem of the Epiphany, namely, the star.



EPIPHANY.

But the next, even when we know that it occurs on St. Swithin's day, is very puzzling. It has been explained as intended to represent a shower of rain.



ST. SWITHIN.

The last is the emblem of St. Michael. The office of weighing the souls of the good and bad against each other has been always, in mediæval lore, assigned to



ST. MICHAEL.

this saint; hence the scales are employed in the clog almanac as his symbol.—*Printer and Stationer*.

PHASES OF AMERICAN PROGRESS.

The address of Mr. Atkinson, as Vice-President of Section 1 of the American Association for the Advancement of Science, at the recent meeting at Ann Arbor, recognizes the great progress made in material welfare during the past twenty years, both in the production and the distribution of wealth. But he urges that we have no right to rest upon past achievements. During the past twenty years improvements have been mainly devoted to the increasing production and the cheaper distribution of food. With free commerce over a larger area and among a greater number of people than enjoy the same freedom in any other part of the world, it has come to pass, he claims:

1. That nowhere else are the products of labor and of capital so ample.
2. Nowhere else are wages and profits so high.
3. Nowhere else is the cost of production measured in labor so low.
4. Nowhere else are high wages so sure to be the result and reward of a low cost of labor.
5. Nowhere else is so much general benefit derived from the expenditure of money raised by taxation.
6. Nowhere else is so small a part of the public income used for destructive purposes.

Mr. Atkinson refers especially to the increase in railway mileage, which is partly a result of the Bessemer mode of making steel, and to the extraordinary progress made in securing cheaper transportation. The general use of the screw propeller has resulted in an enormous saving, and likewise the use of agricultural machinery, the opening of oil wells, the invention of aniline colors, the employment of electricity, the development of machine tools, and many other improvements to which he calls attention. Comparative safety from loss by fire has been attained by better construction of buildings. Attention is called to the progress already made in the use of phosphate deposits, and to the opportunity for almost unlimited increase in the use of such deposits at the West, and salt deposits of Canada. In spite of all this, Mr. Atkinson maintains that the average product of the people does not exceed 50 to 55 cents per day for each person. The progress of invention or machinery has displaced a great number of workers for a time. On the other hand, the reaction from a period of unusual activity in railroad building has displaced, he maintains, more than 100,000 persons formerly engaged in such labor. There is enough in the country for all, and yet there is little room for further saving in some directions—in the cost of transportation, for example—while in other directions there is still enormous waste, and especially in the distribution of perishable commodities.

Mr. Atkinson urges that the waste land of New England can probably be employed most profitably by use of the phosphates without nitrogenous fertilizers, and instances his own experience, stating that he has himself supported two cows every year from the product of one acre for five years past. He presents a body of interesting information regarding the use of cotton seed, and the cost of raising cattle with pitted corn as a chief element of food, and believes that New England can yet raise animal food at a less cost than it can be produced in Texas, and can grow all the beef it can eat from its waste land, if the methods he discusses prove feasible.

Concerning the value of different articles of food in consumption, Mr. Atkinson presents tables prepared in part by Professor Atwater and by German scientists, showing the proportions of protein, of fats, and of carbon-hydrogens in the different kinds of food in common use. In the same connection tables are given of the kinds of food most largely employed in this and in other countries, and it is interesting to observe how the natural tastes of the people in many countries have led them to prefer articles of diet which contain, in large measure or at the least cost, the chemical elements necessary to sustain life and to maintain strength for productive labor. The information on this subject which the address presents is too scientific in character for popular