SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.
VOL. XV. No. 373.

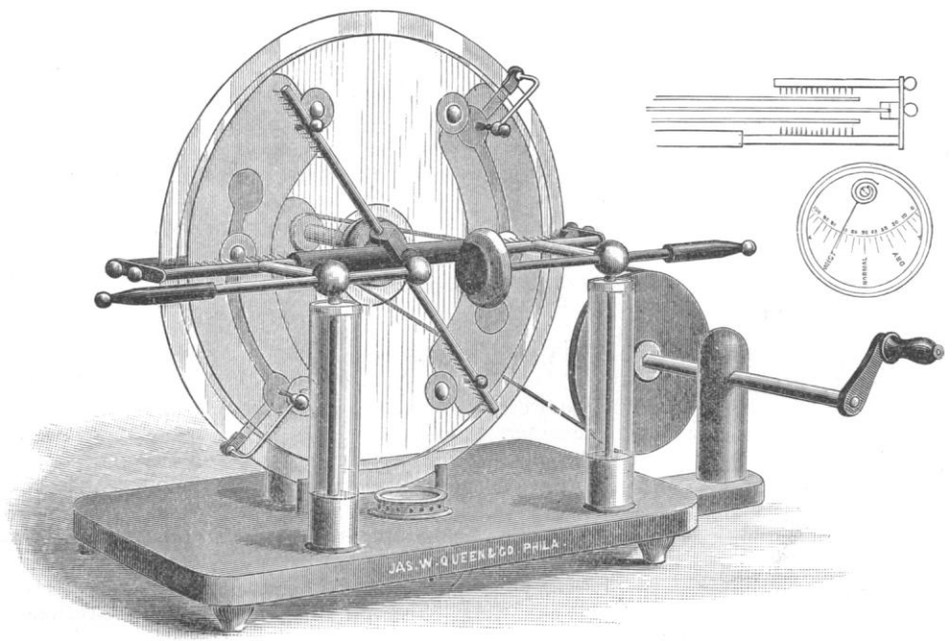
NEW YORK, MARCH 28, 1890.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

QUEEN'S NEW TRIPLE-PLATE TOEPLER-HOLTZ MACHINE.

ON this page we print a cut showing some of the details of the new Toepler-Holtz machine, which has just been patented by James W. Queen & Co., the well-known manufacturers of philosophical apparatus and electrical test instruments. This machine, unlike very many that have appeared from time to time, is not simply a modification of the orthodox model, embodying certain conveniences, but is an entirely new thing, owing its efficiency to entirely novel ideas of construction and action.

This machine, as its name indicates, is a three-plate machine; it is not, however, the same thing as the machine usually spoken of as the "double revolving plate machine," although it does have two revolving plates. The latter machine is simply an ordinary Toepler-Holtz machine doubled; i.e., with a revolving plate behind the fixed plate, exactly like the one in front, and acting in exactly the same manner. In this new form, the additional plate is not like the front revolving plate, nor does it act in at all the same way. The third and additional plate is here a perfectly plain glass plate, mounted upon the same axis as the usual revolving plate, and placed behind the fixed plate. Its *modus operandi* is, like many other points in the theory of the Holtz machines, not entirely understood, although there is no doubt but that much of the increased efficiency obtained by its use is due to the screening effects it has upon the other plates; i.e., to the leakage that is prevented by its presence. There is also supposed to be a considerable generation of electricity by friction of the plain plate and the air. Undoubtedly many other causes also tend to increased effects, of possibly even greater importance than those just mentioned. The advantage of this new form of machine becomes especially marked during moist weather. At such times ordinary frictional machines will not work at all; and all older text-books direct that electrical experiments must be performed during January and February, when the weather is clear and dry. With the Toepler-Holtz machine, as now known, this requirement has not been so rigid, although such machines are not to be always trusted during damp seasons, as lecturers have found out to their sorrow. This difficulty it has been desired to do away with in this new form, and that it does it very effectually will be evident from the following letter sent to Queen & Co. by Professor William A. Anthony, the well-known electrician, and late professor of physics at Cornell University. Says he, "Below is a report of the small Holtz machines you sent up a few days ago. First, in order to determine whether the extra plate gave any increased effect to the machine, I set up both machines, and arranged them so that they both could be revolved by means of one crank, and so that they would both run at the same speed, and then adjusted the terminals until the sparks occurred with about the same frequency in both. Then I removed the combs from one of them, so that the third plate would have no effect in the development of electricity, and found that the frequency of sparks on that machine was very much less than on the other. I repeated this several times, with the same result, and tried the same experiment on the other machine; that is, leaving the combs on the first machine, I removed them from the second, when that one was found to give considerably less electricity than the first. I can say unhesitatingly, therefore, that the addition of the third plate does



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very much increase the rate of discharge, and, as nearly as I could tell by this rough experiment, about double the rate.

"In regard to the general action of the machine, I can say that I have never seen any machines of the Holtz or Toepler-Holtz pattern that worked so uniformly well in all weathers. One of these machines has been standing on the table here in the office for several days, and I have tried it almost every day, and have never had it fail to generate. During some of the time it has been here, the weather has been very damp and rainy, — sometimes so damp that I did not expect the machine to work at all, — but I have never found it fail to build up quickly, and give a spark two inches long. [This was one of the smallest-sized machines.] This shows that you have succeeded in finding some very good glass, and also that the insulation of the various parts is of the very best. The addition of the round disk, with the insulator in front of it, as one of the electrodes, is also a very interesting one, as it permits of one of the best experiments that I have ever seen for showing the difference in the discharge when the polarity is reversed. The difference in the character of the discharge from the knob is very marked when the knob changes from positive to negative. I may say, therefore, that I consider all the special features of the machine as distinct and important improvements."

Another great improvement that is made in this machine is the form of the electrode which is used. This is made of a metallic disk two inches or more in diameter, and hollow, so as to have very gradually rounded edges, thus preventing any leakage at the edges. Over this disk, separated from it by about an eighth of an inch, and nearer the other electrode, is fastened a thin disk of vulcanized rubber about half an inch less in diameter. This rubber disk plays the part of the rubber sheet sometimes held between the electrodes, and compels a much higher potential to be established between the two electrodes before a spark can pass. It can be used upon either one or both electrodes, as desired.

These new machines are being sold by Messrs. Queen & Co. at the same price as the ordinary form heretofore used, and are gotten up in the finest possible manner. It may be mentioned, also, that the plates used in Messrs. Queen & Co.'s machines are manufactured and prepared by Voss himself, the inventor of what is usually known as the Toepler Holtz machine, and are guaranteed to give much finer and more reliable results than any plates made in the American market. There are certain little tricks of the manufacture and application of the insulating shellac which Americans have not yet mastered, pursued by the Germans to perfection, and which add greatly to the efficiency of the machine.

It may not be generally known that Messrs. Queen & Co. were the first to introduce the Toepler-Holtz machine into this country. In 1880 the manager of their physical department, Joseph J. Walton, while on a business trip abroad, accidentally learned of the existence of this machine, examined it, and was so favorably impressed by it that he purchased a number for introduction into this country. This was the first appearance of the now well-known Toepler-Holtz machine in the United States. It was exhibited soon afterwards by the before-mentioned gentleman at the meeting of the American Association for the Advancement of Science, and attracted much attention. It immediately became popular, and had such a large sale that it was straightway copied by various American makers, and patents secured upon modified forms.

WYNNE'S ELECTRIC TRAMWAY SYSTEM.

THE system of electric tramways invented by Mr. Frank Wynne of 5 Westminster Chambers, London, aims at connecting a moving tramcar with an electric conductor buried beneath the roadway, without the use of an open slot. To effect this there is laid in the centre of the track a crenellated contact-plate or rail, in short sections, of the form shown in the annexed engraving. It is half an inch wide on the surface, and about four inches and a half deep, the form being such as to follow the junction line of the sets. It will be seen that the contact-plate will be quite different in its effect upon vehicles from the tramway rail; wheels will cross it without difficulty at any angle, since they cannot slide along it for more than a few inches; horses will also find a good foothold upon it. The plate is laid in short sections entirely disconnected from each other, and each piece is coupled by a wire to the electric conductor beneath. In this wire is an automatic switch which makes circuit between the section and the conductor as the car comes over it, and breaks the connection when the car has passed. Only three sections are ever connected to the conductor at a time, and generally there are only two. A strong wire brush on the car rubs along the sections, and conveys the current from them to the electric motor, whence it flows to the rails and to earth. The automatic switch is exceedingly simple: it consists merely of an electro-magnet, an armature, and two contact-pieces. Supposing the car-brush is in contact with No. 1 section, the current will flow from the main conductor across one contact to the armature, through the armature to a second contact, thence through the magnet-coils to the section and the motor. A fine wire connects the armature

to the magnet of the next section, but, as no current flows through it, the armature of that magnet is not attracted. But immediately the car-brush touches that section, the current flows, the armature is attracted, and the section is connected directly to the main conductor. At the same time, the armature of the section over which the car has just passed drops, and breaks the circuit. Thus, as the car proceeds, it successively takes sections into circuit and drops them out. The details of the system have been very carefully worked out with the view of meeting every contingency that may arise in working, and it is estimated that the system can be applied to an existing tramway for an expenditure of $11,000 per mile of single line; that is, for about the cost of horses and horse-cars. *Engineering* says, "This seems one of the most promising schemes for electric tramways which has been yet brought out in this country [England], and it is well worth a trial. The astonishing success of electric trams in America will be repeated here as soon as a system has been developed suited to English tastes and ideas."

WATER-SPOUTS.[1]

HAVING sailed from New York the 16th of October in the United States steamship "Pensacola," we had first a few days of westerly winds and moderate sea, and then fell upon a region of easterly winds, generally south-easterly, and with every indication that we were in the easterly portion of a cyclonic region, the storm-centre being three hundred to five hundred miles to the westward. From such observations as we were able to make on shipboard, it was concluded that the storm-centre, which on the 20th of October was south-westerly, was slowly moving to the north-eastward, and would overtake us and pass beyond. This it apparently did, and disappeared from our observation on Friday the 25th. Meanwhile we experienced warm south-easterly winds, with numerous showers of rain and occasional squalls of wind.

On the morning of Tuesday the 22d we were favored with a remarkably fine development of water-spouts. About 9 A.M., occasional whirls of spray were seen on the surface of the sea, at points bearing between south-south-west and west-south-west. These whirls, and the subsequent water-spouts in that region, were all on the north-easterly side of a region of cloud and rain, the interior of which constituted a veritable rain-squall. The north-easterly side of this region, as seen from the vessel looking south-westward, was bordered by rolls of low scud upon which the sun shone; but beyond and below this the clouds, being mostly in the shade, had the dark-blue tint that belongs to the rain-cloud and the rain. The water-spouts apparently originated in the scud-clouds, which, as I have just said, formed the north-easterly border of the squall proper. These scud-clouds were

[1] From Bulletin No. 6, by Cleveland Abbe (Nov. 7, 1889), of the United States Scientific Expedition to West Africa, 1889 (David P. Todd, director).