test new "principles, until now buried in the depths of human ignorance," as some of the reporters of the daily papers have done, is, to say the least, rather premature.

We will here call attention to the fact that at present three principal forms of electricity are known, and they vary so much in their nature that formerly some investigators inclined to consider them as separate forces or fluids. First we have the so-called static electricity, possessing great tension; it is developed on a small scale by friction, and on a large scale by evaporation and induction, as manifested in thunder storms. For this form of electricity, not only all kinds of metals, but water and the human body are good conductors, even the dry skin of the hands forming no obstacle. Secondly, we have the voltaic or galvanic electricity, originated by chemical action, and developed in our galvanic batteries. For this form of electricity, only some metals are good conductors, others poorer, while water and the human body are bad conductors; its effects on the latter cannot be studied without wetting the skin, as the dry skin is a non-conductor of it. This form of electricity is used for telegraphy, while, as is well known, the static electricity (as obtained by friction) is not so useful for this purpose, its great tension causing it to escape too easily. Thirdly, we have the thermo-electricity, discovered in 1820, by Seebeck in Berlin, which differs as much from the galvanic electricity as the latter does from static electricity. For this thermo-electricity, water or the human body is an absolute non-conductor, and a thin metallic wire is but a poor conductor; so that it can scarcely pass through the whole length of the coil of a common galvanometer, and does not act on this instrument, but is powerfully indicated by one made with very thick and short wire, even if the galvanometer consists of one single, heavy, and uninsulated wire, in a coil of one turn or only half a turn.

Now it appears to us that the form of electricity discovered by Mr. Edison, may be:

1. A fourth kind of electricity, requiring as little or less insulation than the thermo-electricity of Seebeck. It is said to pass over the ordinary gas pipe, and can equally well be drawn from several of the chandeliers in a house, or even in other houses, if one of them is connected with the source of the new electricity.

2. It may consist of a continually reversing current of inductive electricity of a form in quality between the static and galvanic kinds. This appears the more probable as its source is said to be a vibrating armature, in which of course there are continuous interruptions, the induced currents formed by the interruptions running in an opposite direction from those formed at the making of the contacts, as is well known by all electricians. Such continually reversing currents of course cannot act on the galvanometer, gold leaf electroscope, or Leyden jar, as their rapid reversion neutralizes all possible charge, the only manifestation being the sparks, of which, however, the rapidity of the succession causes an abundance, little affected by imperfection or even absence of insulation.

At the same time, this would explain why one end of a long wire, bent over the other end connected with the electric generator, will produce a spark. Electricity is present in such abundance that branch currents are easily supplied; while at the same time the two polarities are continually and so perfectly balanced as to exactly counteract one another, so as to be unable to charge any conductor, or to manifest the results of such charge, as in an electroscope, or to establish a polar current and manifest its results, as with a galvanometer. It is undoubtedly a manifestation of electricity; and being neither positive nor negative, as is the case with all the forms of electricity thus far known, it might be called neutral electricity.

The sparks investigated by Dr. Reiss, the well known German electrician, and called by him weak sparks, have polarity, being either positive or negative; and although they have certain resemblances to the electricity obtained by the method of Mr. Edison, they appear to be of a different nature, having a very different origin.

The most remarkable feature of this new form of electricity, which proves its perfect neutrality, is that it has no apparent effect on the human body, and none on even that most delicate of all electric tests, the properly prepared frog's leg, unless an exceedingly strong galvanic current is used around the magnet.

Two New Street Engines.

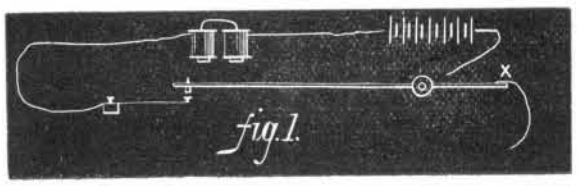
A new traction engine for street usage has recently been tested in Brussels, Belgium, with satisfactory results. Exteriorly it resembles an ordinary street car, with the exception of the chimney which projects through the roof. The body is placed quite low, and the wheels, which run on rails, are concealed to within a short distance from the ground. The boiler is tubular and inexplosible, and is heated by coke. The engine is one of the Brotherhood three-cylinder pattern. The exhaust is condensed in a tubular condenser, and the boiler is fed by a separate steam pump. The machine traveled without smoke or escape of steam, made no more noise than an ordinary horse omnibus, and turned sharp curves very easily. Another engine has been introduced in Paris; but instead of running on a tramway like the above, it is a kind of omnibus or steam carriage. It accommodates 12 passengers and weighs about 5 tuns. A vertical engine supplies the motive power and occupies a space in the rear of but 39 inches high by 31 inches broad. A Giffard injector forces in the feed water, which is taken from the gutters or any other convenient source. The machine will travel at the rate of 9 miles per hour. About 13 horse power is utilized, requiring 600 quarts of water, and 110 lbs. of coal per hour.

THE NEW PHASE OF ELECTRIC FORCE.

In our number for last week, we called attention to what we at first supposed to be a similarity between the prior experiments of Professor Reiss and those of Mr. Edison. A further examination of the Reiss reports satisfies us that the results obtained by Mr. Edison are novel, and have little or nothing in common with those of Professor Reiss.

We have had an opportunity of closely examining the apparatus by which Mr. Edison and his assistants obtained the evidences of the supposed new kind of electricity which has lately elicited so much inquiry and speculation, and we present herewith three diagrams of some of the apparatus used by Mr. Edison during his experiments.

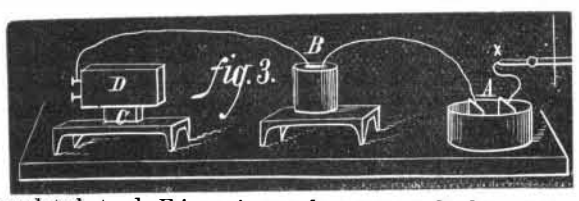
The first recognition of the distinctive character of the spark occurred on the evening of November 22. Mr. Edison and his assistants, as we have already stated, were experimenting with a vibrator magnet, consisting of a bar of Stubb's steel, fastened at one end and made to vibrate by means of a magnet, when they noticed a spark coming from the core of the magnet. They had often noticed the same phenomenon in connection with telegraphic relays, in stock printers when there were iron filings between the armature and the core, and in the new electric pen, and had always supposed it to be due to inductive electricity. On this occasion the spark was so bright that they suspected something more than induction. On testing the apparatus they found that, by touching any portion of the vibrator or magnet with a piece of metal, they got the spark. They then connected a wire to the end of the vibrating rod (the wire leading nowhere), and got a spark by touching the wire with a piece of iron. Still more remarkable, a spark was got on turning the wire back upon itself and touching any part of the wire with its free end. The end of the vibrating rod was then connected by means of the wire to a gas pipe overhead, whereupon a spark could be drawn from any part of the gas pipes in the room, and subsequently it was found that the spark could be drawn from any part of the whole system of city gas pipes. The vibrator and battery were next placed



on insulated stands, and the wire, connected with x, Fig. 1, was carried over to the stove, about 20 feet distant. On rubbing the end of the wire against the stove, splendid sparks were observed. With the wire permanently connected with the stove, sparks could be drawn from any part of the stove with a piece of metal held in the hand. Again, while the vibrator was in action, a block of iron was placed near x, but not touching the bar, nor connected with it in any way except by the wood of the base through the table, and sparks could be drawn from the iron.

These and other experiments which we have had the pleasure of witnessing show conclusively that the new force is not amenable to the laws of voltaic or static electricity.

An experiment made with the apparatus figured in the large engraving (Fig. 2) will satisfy any electrician that the force in action is not induced electricity. All the parts are insulated except the gas fixture. A is the battery; B, a common telegraphic key; C, an electro-magnet; D, a bar of cadmium (or other metal, cadmium being the best) supported by an



insulated stand; E is a mirror galvanometer; F, the gas pipe; G, a dark box enclosing pencils with graphite points (common lead pencils). The unknown current passes from the bar of cadmium through the galvanometer, without causing the slightest deflection, and—notwithstanding the gas pipe connection, which would drain the wire of induced electricity, if there were any—bright sparks are visible between the graphite points in response to the motion of the telegraphic key.

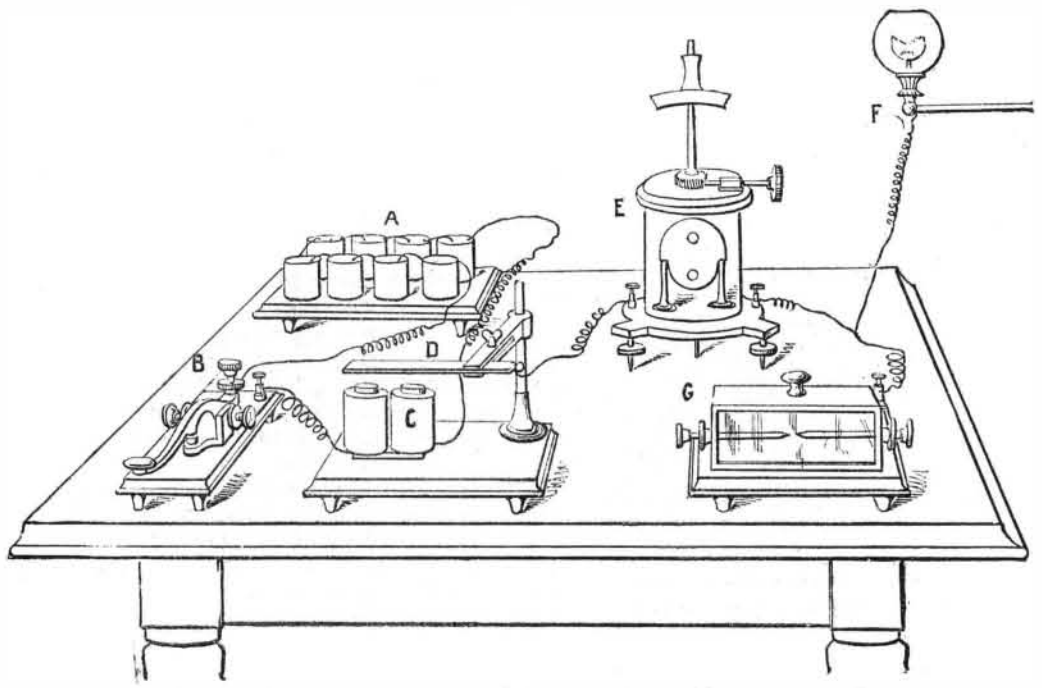
Standing on an insulated stool, the experimenters draw sparks from the following arrangement (Fig. 3), in which x is the end of the vibrator (which, as well as the battery, is insulated); A, a secondary battery; B, a 200 ohm coil of copper wire; C is a block of iron, and D, a condenser, all well insulated except A, which is of glass, and stands on the table.

In another experiment a glass rod, four feet long, with a piece of carbon fixed to one end, was well rubbed with a silk handkerchief over a hot stove, and the carbon point presented to the apparatus, the other end of the rod being held in the hand with the handkerchief: sparks were drawn, yet the galvanometer chemical paper, the sense of shock in the tongue, and a delicate gold leaf electroscope were not in the least affected by the mysterious current.

Tested in whatever way the experimenters have been able to devise, the new current refuses to obey any of the established laws of electricity further than that it traverses metallic conductors, manifests itself as light, and can be controlled by making and breaking connection. Among its observed peculiarities may be noticed its lack of polarity, indifference to the earth (and consequently its capability of transmission through uninsulated wires), its power of producing action when turned back upon itself, its independence of electric non-conductors, and seeming lack of mechanical and physiological effect.

Mr. Edison has proposed the name "etheric force."

Since the above was put in type, Mr. Edison has sent us a variety of additional particulars pertaining to his new and interesting discovery, which we shall give to our readers in our next number.



MR. EDISON'S APPARATUS, EXHIBITING THE NEW PHASE OF ELECTRIC FORCE.—Fig. 2.

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