severe explosion in a district in which there is no fire damp. The burns which workmen sustain from the combustion of coal dust are also less serious than those of a true fire damp explosion

M. Pinel thinks that the intensity of an explosion of coal-dust suspended in air varies according to the intensity of the source of heat that ignites it. If it is originated by a lamp, as in the case cited by M. Baretta, the flame does not extend far; if by a shot, it may be drawn out to 13 yards (12 meters), as was the case at the Béraudière mine, or to 38 yards (35 meters), as at Campagnac; if by an explosion of fire damp, the source of heat being more active and of greater magnitude, the deflagration of the coal-dust is much more considerable, and might become imposing. It is not, therefore, fair to conclude, from the small importance of an explosion of coal-dust initiated by a lamp or a shot, that in an event of the same kind, initiated by an explosion of fire damp, the coal-dust would still play an unimportant part.

EXPERIMENTS OF THE COMMITTEE.

At the monthly meeting of February 3d, 1872, a committee was appointed to study the three following hypotheses:

(1) Coal-dust alone, even in the absence of inflammable gas, is susceptible of producing an explosion under the influence of any source of heat whatever.

(2) Coal-dust alone is not susceptible of producing an explosion, but it ignites under the influence of the heat set free by an explosion of fire damp, and serves only to propagate the explosion by carrying the flame to other reservoirs of gas.

(3) The influence of coal dust is *nil*, or nearly so.

The work of the committee consisted, therefore, in making direct experiments to ascertain whether coal-dust is inflammable, and under what conditions; whether ignited coal-dust can propagate inflammation in a gallery charged with coal-dust, and under what conditions.

Although the experiments of the committee were not completed, and did not lead to very conclusive results, we believe that the manner in which they were conducted, and the results obtained, ought to be indicated.

It was agreed that the first experiments be made without gas, and those afterward with a larger or smaller proportion.

The Saint-Etienne Colliery Company placed a piece of ground at the disposal of the committee, and caused an artificial gallery, about 33 feet (10 meters) long, to be constructed along the side of a wall. This gallery was formed of beams of sawn timber, 6½ feet (2 meters) long, placed with one end against the wall and the other against the ground, so as to form a right-angled triangle with sides of 4 feet 7 inches to 4 feet 11 inches (1·40m. to 1·50m.); sufficient stability was given to the whole structure by piling sods on top of the beams. A movable panel was reserved in the middle of the length, of such a kind that, when it was in position, the whole formed one gallery, 33 feet long, whereas, when it was removed, two galleries, each 13 feet (4 meters) long, were obtained. A ventilator was connected with the end of the first gallery, in which a bed of fine coal-dust, 1½ to 2 inches (4 to 5 centimeters) thick, was laid down. It was intended to ignite this dust by means of the detonation of a cartridge containing 1¾ oz. (50 grammes) of powder. The cartridges were made with paper or with lead, as was necessary; in the latter case a small piece of lead pipe was employed, having a diameter of ¾ inch (0·02m.); and after the powder and fuse were introduced, its two ends were flattened. In this manner an explosion was obtained.

The following series of experiments were made on the 29th of February, 1872:

First Experiment.—A leaden cartridge placed in the second gallery, which did not contain coal-dust, produced a small explosion, accompanied with a clear white flash, exactly like that which bursts from the barrel of a gun and disappears immediately.

Second Experiment.—A similar cartridge was placed in the first gallery at a distance of 6½ feet (2 meters) from the open end, which was closed with a wooden door. The match was ignited, the ventilator set in motion, and fine coal-dust was thrown upon its blades. At the moment of explosion the door was overturned, and a large outburst of red flame, resulting evidently from the combustion of coal-dust, was seen to take place from below upward.

Third Experiment.—Two paper cartridges of 1¾ oz. (50 grammes) were placed in the first gallery; the ventilator was set in motion; and, again, there was a considerable quantity of red flame produced.

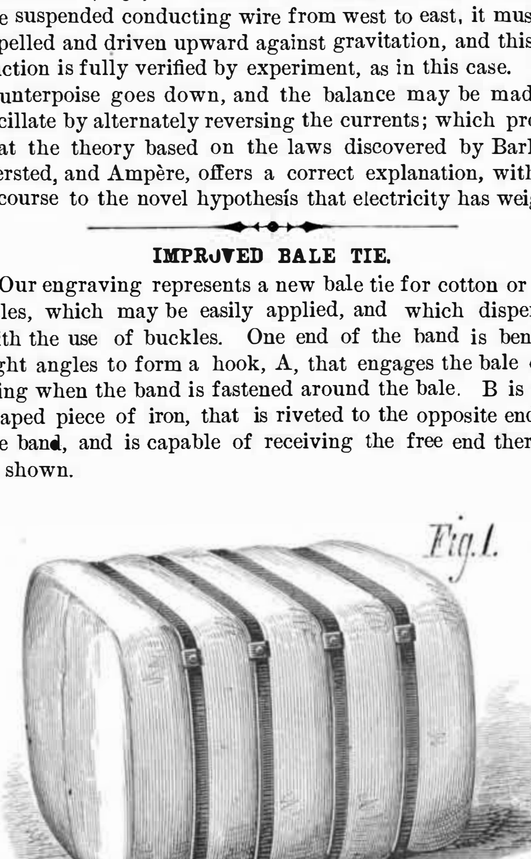
It could be concluded from these trials that coal-dust, suspended in air, is ignited under the influence of an explosion of gunpowder; and it was important to ascertain whether dust inflamed in this way could communicate combustion to any considerable distance.

Has Electricity Weight?

Mallet has come forward with an experiment, apparently corroborative of that of Pirani, described in the SCIENTIFIC AMERICAN of February 9. 1878, purporting to show that electricity has weight, or at least is under the influence of gravitation. He takes a straight copper wire three feet long, bends the ends downward, and suspends it at the middle to one of the arms of a delicate balance, while the bent ends dip in mercury. When the current of a moderately strong battery (say ten Grove cells) is passed through the wire by the intervention of the mercury, the arm to which the wire is attached, although accurately balanced by a counterpoise, will sensibly tend downward, notwithstanding the resistance produced by the buoyancy of the mercury. The conditions of the experiment, however, demonstrate that gravitation has nothing to do with it, and that it is merely due to the law of attraction of electric currents. These conditions are that the wire must be placed in an east and west direction, and that the current is sent in the same direction. According to Barlow's theory, electric currents travel in the earth's crust from east to west, and are the true cause of the direction of the compass needle, which, according to the law discovered by Oersted, places itself always at right angles to electric currents, while magnetic declination and variation are due to the direction and changes of these currents. Ampère discovered that currents passing in the same direction attract one another, and therefore that the subterraneous earth currents exert an attractive effect on all conductors through which electric currents pass from east to west; hence the conducting wire goes down, while the electric action is added to the gravitation which was balanced by the counterpoise. But Ampère also discovered that electric currents running in opposite directions repel one another; *ergo*, when the electric current is passed through the suspended conducting wire from west to east, it must be repelled and driven upward against gravitation, and this deduction is fully verified by experiment, as in this case. The counterpoise goes down, and the balance may be made to oscillate by alternately reversing the currents; which proves that the theory based on the laws discovered by Barlow, Oersted, and Ampère, offers a correct explanation, without recourse to the novel hypothesis that electricity has weight.

IMPROVED BALE TIE.

Our engraving represents a new bale tie for cotton or hay bales, which may be easily applied, and which dispenses with the use of buckles. One end of the band is bent at right angles to form a hook, A, that engages the bale covering when the band is fastened around the bale. B is a V shaped piece of iron, that is riveted to the opposite end of the band, and is capable of receiving the free end thereof, as shown.



IMPROVED BALE TIE.

The manner of using the tie is as follows: The bale being pressed in the usual way, the hook, A, is placed against the side of the bale at some distance from the point of fastening. The end, B, is then carried around the bale and over the hook, and is placed under the band. The hook, A, assists in holding the band as it seizes fast upon the bale covering, enabling the band to be drawn tightly over. The device forms a strong, easily applied, and reliable fastening.

Patented January 29, 1878. For further information address Messrs. Rodecker & Lenard, Waco, Texas.

Water Filters.

At a recent meeting of the Society of Engineers, London, a paper was read by Mr. J. Walter Pearse, on "Water Purification, Sanitary and Industrial." In his opening remarks, the author observed that, until the metropolis was furnished with a supply of water from pure sources, private filtration was necessary, and chemical purification was required, as well as mere mechanical filtration. Great diversity of opinion existed as to the value of the various substances used as purifying media, and also as to the form of filter.

The first record of a water filter was in 1790, when Johanna Hempel employed porous vessels; and in the following year the ascending principle was first mentioned. Vegetable charcoal as a filtering medium was first named in 1802, animal charcoal in 1818, and solid blocks in 1834. Turning to the modern practice of filtration, the author observed that Atkin's system embodied the last named principle, finely divided charcoal being agglomerated into porous blocks. The advantage of employing carbon in that form was that the impurities were arrested on the surface, and were easily removed.

Major Crease, R.M.A., compressed loose animal charcoal in a granular state, between plates, by means of a screw, the amount of compression being determined by the degree of impurity in the water to be filtered. Major Crease's system is adopted in the army and royal navy.

The chief characteristic of Mr. F. H. Danchell's filter was that the ascending principle was used, so that impurities, instead of lodging on the top, fell back on to the bottom of the tank. The Sanitary Engineering and Ventilation Company use mineral carbon as a filtering medium, and cause their cistern filter to be cleansed by the inrush of the supply, and also by reversing the flow. In the Silicated Carbon Filter, mineral charcoal is used as the filtering medium, the main supply filter having three slabs with layers of coarse and fine granular carbon between. In Professor Bischoff's spongy iron filter, the iron exerts a powerful influence on the water, impregnating it with iron, which is afterwards oxidized and arrested, leaving the water pure.

M. Le Tellier's hydrotrimetric purifier was described as removing the hardness from water by throwing down the lime, which was afterwards intercepted by filtration through charcoal. A jet of lime water is made to mingle with the stream from the supply pipe, and the precipitated lime is afterwards arrested by filtration. M. Le Tellier has also invented a high pressure apparatus on the same principle, for dealing with large bodies of water used in manufacturing processes, and for purifying the feed water of steam boilers above 20 horse power. On the same bed plate are fixed two close vessels, the smaller containing the lime water or other reagent, and the larger the mechanical filter for arresting the precipitate, the two vessels being connected by an injector. The supply, which must have a pressure due to a column of at least 10 feet in height, enters by an inlet pipe, and most of it passes through the injector into the filtering chambers. A portion, however, descends another pipe, and issues through perforations at its lower end, keeping a disk, which is supported by a spiral spring, in a state of continual trepidation, and thus assisting the combination of the water with the reagent, previously inserted. The rush of the main supply through the injector draws alongs with it the lime water from a small pipe, and the two pass together into a vertical tube, which is traversed by pins set alternately at right angles to each other, for bringing about a more intimate union. A valve also admits atmospheric air for aiding in the process. Arrived at the filtering chamber, the lime is thrown down, to be removed periodically through a cleaning pipe, and the pure water passes through the filter tubes into the purified water reservoir below, whence it is drawn through a pipe by a pump or injector in connection with the engine and the boiler.

The filter proper consists of wrought iron tubes, perforated with holes, and covered by disks of felt which are compressed between cast iron plates screwed up with a gun metal nut. The lower ends of the tubes are conical, and fit into sockets screwed into the plates which separate the unfiltered water chamber from the filtered. The number of the tubes varies with the size of the apparatus; but the filtering area of each tube is very large in comparison with the space it occupies, being equal to the height multiplied by its circumference. Each tube may be lifted out of its socket for cleaning or replacing. A cleansing of the whole apparatus is also effected by turning steam into the outlet pipe, which heats the water in the lower chamber and forces it through the tubes and felt, expelling any impurities which may have collected there, to be washed away by rinsing with clean cold water. This apparatus is largely employed by manufacturers on the Continent; and when used for potable water a second filtering medium of vegetable charcoal is added. Mr. A. Durand Claye, director of the laboratory of the Ecole des Ponts et Chaussées, Paris, made some experiments with the Le Tellier filter purifier in 1875, and found that water of 24° of hardness was reduced to 5° after passing through the apparatus, while the solid residue was reduced from 3·31 grammes to 0·92 gramme, a gramme being equal to 15 grains.

Improved Propagation by Cuttings.

Peter Henderson described last winter, in the *Agriculturist*, an improved mode he was then using for the propagation of geraniums. His object was, in the first place, to avoid the exhaustion of the parent plants by the removal of cuttings abruptly; and, secondly, to make sure work. He takes the young shoot which is to be used as a cutting, and snaps it short, leaving it hanging by a small portion of the bark.

This shred is sufficient to sustain the cutting, without any material injury from wilting, until it forms a callus, which precedes the formation of roots. In from eight to twelve days it is detached and potted in two and three inch pots. It is rather less shaded and watered than ordinary cuttings, and forms roots in about eight to twelve days more. Last fall Mr. Henderson propagated about 10,000 plants of the tricolor class without losing one per cent. With the common method he thinks he would have lost fifty per cent. This mode is applicable to the abutilon, begonia, carnation, cactus, lantana, oleander, etc., by using young unripened shoots. If the shoot does not break, but simply bends to a knee, a knife may be used for cutting about two thirds through.