Communications.

Rapid Locomotive Building.

To the Editor of the Scientific American:

In your issue of the 23d ult. you invite a communication from some one interested in the fast engine building at this place. As I was one of the workmen I will endeavor to give you the facts. As to the time given by the papers, 3 hours, it is correct. Our master mechanic, S. H. Edgerly, through the daily papers invited all railroad men and others to come to the shop the evening before and inspect the work, which a great many did, and in the morning over 200 strangers were in the shop to see us commence. Most of them remained till the finish, and they can vouch for the time.

Our system of doing work in this shop I think is not surpassed in the world, as every hole in the boiler is not only drilled, but tapped at the same time by a tap with a drill point before the sheet is rolled or flanged, and every hole in the frame, cylinders, boxes, and in fact everything, is drilled and reamed by machine work before the parts come to the erection shop. So we have nothing to do but drive the bolts. D. Z. A.

Jackson, Mich.

Corroded Cannon Primers.

To the Editor of the Scientific American:

A box of corroded cannon primers was lately sent from the U. S. Arsenal, at West Troy, for examination. The corrosion presented a white powdery appearance, dotted in a very few places with green. On examining the cross-section, the metal was found to have altered in color in those portions corresponding to the white coating; the sheet brass, of which the primer cases were made, in such spots taking a deep copper color. That this change in the metal began on the interior was evident from some sections giving two distinct layers, with the unaltered brass on the outside. The white coating gave the usual reactions for oxide of zinc, while the green spots (very few in number) proved to be basic carbonate of copper. The primers having been stored since the war in an exceedingly damp building, the basic carbonate of copper is easily accounted for; and in all probability the white incrustation takes its origin from the action of the niter in the gunpowder (aided by moisture) upon the zinc in the brass, niter being a powerful oxidizer. This is rendered more probable by the fact that the powder is badly caked under those areas most corroded. The zinc being thus removed from the alloy, the metal necessarily becomes too brittle to allow of the primers being used.

Troy, N. Y. WILLIAM P. MASON.

A Question for Locomotive Experts.

To the Editor of the Scientific American:

Referring to my question in your columns of the 9th, and to Mr. Holmes' answer in your issue of the 30th inst., of course we all know that by reducing the piston area one half and doubling the length of the cranks of a locomotive, we do not gain or lose in power theoretically.

The question involves simply the durability and efficiency of the machinery. Our present large pistons impose a stress of 16 to 20 tons upon each crank pin at each alternate impulse of the pistons, and a proportionate stress upon the main bearings and guides. Now the question is, would it not be better practice to reduce this stress just one half, provided it could be done, as indicated in your issue of the 9th inst.? Would not this change increase the efficiency and durability of locomotives?

Mr. Holmes should have taken one half of the area instead of one half the diameter in his figuring (this was an oversight probably); by doubling the result, however, we have the correct answer. F. G. WOODWARD.

Worcester, March 31, 1878.

A Remarkable Galvanic Battery.

At a recent meeting of the Society of Telegraph Engineers, London, Dr. Burns' pneumatic battery was exhibited. This remarkable battery, as described in *Engineering*, is a peculiar form of the ordinary bichromate of potash cell. The negative pole is a zinc plate; but the positive pole instead of being a carbon plate is, in this form, a compound metallic plate formed by coating a copper plate with lead and facing one side with a plate of platinum. A section across such a plate would, therefore, pass through lead, copper, lead, and platinum in succession. The backing of copper to the platinum plate diminishes the resistance of the positive pole, while the lead protects the copper and solder from the acid solution. This is made by adding 12 ounces of bichromate of potash and 1 pint of sulphuric acid to 5 pints of water. The peculiarity of the cell, however, consists in an arrangement by which air can be pumped into the liquid. This is effected by having a perforated tube running along the bottom of each cell, and a hand syringe or bellows in connection with it, so that air forced into the tube escapes through the perforations into the liquid. This circulation of air gives rise to an extraordinary strength of current in the circuit of the cell, and to an equally extraordinary development of heat within the cell. Ten of the cells exhibited heated a stout platinum wire, 30 inches long and No. 14 B.W. G., to a glowing heat on pumping. The heating took place gradually as the pumping went on, and the wire cooled again to its dark state when pumping was left off. Some idea will be formed of the great heating power here displayed, when it is remembered that it takes 70 or 80 Grove's elements to heat a similar length of No. 18 or 24 B. W. G. platinum wire. The battery was, in consequence of its heating effect, introduced by Dr. Burns for the actual cautery, and an important operation has recently been successfully performed in London by its means. The same 10 cell battery even yielded a small but beautifully brilliant electric light with two carbon points. The electromotive force of each cell is about 1·7 volts, and the internal resistance, according to Mr. Preece, is by the ordinary instruments immeasurably small.

Why the pumping of air into the cell should increase its current strength so much, is a problem not yet decided. In order to determine whether it was due to some chemical action of the air, or to its merely mechanical action, Mr. Ladd pumped air, oxygen, and hydrogen one after another into the cell, but no difference was observable in the action of the cell. It was all the same which gas was pumped in; and hence he concluded that the effect was due to a mechanical cause. Since either an increase of electro-motive force or a diminution of resistance will produce an increase of current strength, Mr. Preece measured its electro-motive force when quiescent and also on pumping; but no difference could be detected. He then attempted to treat its resistance in the same way, but failed to obtain a measure of it by ordinary means, it being so small. It was the opinion of Dr. Burns that the effect was due to a depolarizing influence of the air on the plates of the cell, but Mr. Preece's experiments veto that explanation. A notable point about the cell is the high temperature developed in it by the pumping; it being impossible, after a time, to handle the cell because of its hotness. The explanation offered by Mr. Preece is that this heating of the cell reduces its internal resistance; but may it not rather be that the heating itself is due to the abnormal chemical action going on in the cell, and necessary to produce the powerful current?

Professor Adams suggested that it might be due to a circulation of the liquid, promoted by the air, so that fresh acid came into contact with the zinc plate. This would have the double effect of increasing the chemical action and diminishing the resistance. Mr. Preece argued against this explanation, that if it were due to fresh acid it would be an instantaneous effect, whereas we had seen the heating of the platinum wire, *i. e.*, the rise of current strength, keep pace with the pumping.

Mr. Ladd was inclined to attribute the effect principally to the positive pole of the cell, and the diminished resistance it offered; and Mr. H. Edmunds, Jr. (who exhibited the battery on behalf of Dr. Burns), said that Dr. Burns also referred a great deal of the efficacy of the cell to the positive pole. He mentioned that Dr. Burns had obtained remarkable results by using dilute sulphuric acid as the exciting solution, and dispensing with an air pump, but retaining the compound plate.

Wheat Analysis.

The following is an analysis by Boussingault, the celebrated French chemist, on the ashes of wheat. Fifteen hundred pounds of wheat having been reduced to ashes, and subsequently weighed, there was found to be thirty-three pounds of ashes, which on analysis yielded the following substances:

	lbs.
Phosphoric acid	15·51
Sulphuric acid	0·33
Chlorine	trace
Lime	0·95
Magnesia	5·25
Potash	9·73
Soda	trace
Silica	0·44
Moisture and loss	0·79
Total	33·00

There is no better way to test wheat than to grind it into flour, and turn this flour into bread. An analysis, therefore, of good sound bread will doubtless prove interesting:

Water	32·5
Gluten and nitrogenous substances	8·8
Modified starch, sugar, gum, etc	57·6
Mineral salts	1·1
Total	100·0

The small proportion of mineral constituents in this analysis is due to the absence of bran in the flour with which the bread examined was made. The nutritive properties of bran are little understood by the general public. We know that gluten is the chief constituent of nourishing bread, and also that mineral matter is necessary to our system; and we find too often that bran is richer in both gluten and mineral constituents than flour itself, as shown by the following analysis:

	Wheaten flour.	Bran.
Gluten	11·46	13·80
Starch	73·52	53·20
Oil	0·00	2·50
Woody fiber	0·68	11·50
Mineral matters	0·84	6·14
Water	13·50	12·86
Totals	100·00	100·00

Of course this is caused by defective grinding, the larger part of the gluten escaping in the bran, the very thing that should be guarded against—the presence of 11·50 of woody fiber is certainly much against its being retained in wheaten flour for the purpose of bread making, and it is a matter of congratulation not only to the consumer, but miller as well, that means have been devised for separating the greater part of this woody fiber from bran, and thus rendering the latter better available for more general use. The mineral constituents in which flour is so poor and bran so rich are precisely those which it is essential we should absorb, inasmuch as we find them present in the human body. It is therefore necessary, in order to make good nutritious flour, that only the woody fiber, or outer bran, should be removed from the berry in the process of grinding, so as to retain all the nutritive constituents of the grain. This woody fiber is the chief cause of the sudden blunting or glazing of the millstones, and the process which will entirely remove or loosen it, by decortication or any other means, is a desideratum in milling at the present time and would make a fortune for the inventor.

Coal-Dust Explosions.

We have on several occasions chronicled in the SCIENTIFIC AMERICAN accounts of the burning of lumber-working factories, by the ignition and, as it were, sudden explosion of fine particles of wood floating in the apartments or flues of such establishments; also the burning of flour mills by the ignition and explosion of fine flour floating in the chambers or passages of such mills. Mr. W. Galloway, an English writer, gives the following in relation to coal-dust explosions.

Some facts have been brought forward which prove that, in certain cases, coal-dust has been ignited under the influence of an incandescent furnace, or, simply, by a lamp; but the effects have been of an unimportant nature. There have been several instances in which sudden inflammation, or even true explosion, has been produced by emptying a basketful of very dry coal-dust near a fire of live coal like that of a steam boiler; and likewise, when a handful of coal-dust has been thrown into the fire, not only combustion, but instant conflagration, has taken place. We believe that this circumstance is not conclusive, and that it is more intimately connected with the ordinary conditions of combustion.

At the meetings of January 2 and February 6, 1875, M. Baretta stated several instances of the inflammation of coal-dust without a shot, and without the presence of fire damp. No trace of fire damp had ever been observed during the twenty-two years in which workings had been carried on in the great seam of No. 1 Pit, Montmartre. Two accidents happened there in different places in 1869, in consequence of the inflammation of coal-dust. The temperature of these two places was not more than 64·4° Fah. (18° Cent.); they were very dry, and had been cut through coal reduced to a state resembling priming-powder—one was in the ninth, the other in the tenth slice. The lagging, or garniture, of the timbering consisted of closely joined planks, with their joints carefully stuffed with hay, being similar in this respect to that of many of the other places. A thick smoke, due to the particles of dust suspended in the air, filled the working place while the hewers were at work, and long afterwards; it had a disagreeable smell, and produced a very distressing dryness in the throat, so that the hewers could hardly work for ten minutes at a time, and then they were obliged to come out to breathe the pure air at the entrance of their stall, in the haulage level, where there was a strong air-current. Naked lights were used at a distance of 3 or 4 feet (1m. to 1·50m.) from the face. A sudden fall of small coal took place at the face where the hewers were at work; it was not of much consequence in itself, but sufficient to cause an eddy in the air of the stall. The coal-dust took fire at the lamps, produced a slight detonation, and the conflagration extended to a distance of 7 or 8 yards (7 or 8 meters), with a red flame. The hewers were slightly burnt about the arms, and had the hair of their heads and beards singed.

The circumstances were identical in the two cases.

Again, in 1871, at the same pit, on the surface, coal-dust was kindled by contact with a fire grate at a distance of 13 feet 1½ inch (4 meters) from a sieve on which a basket of coal was being emptied. A sorter was slightly burned about the hands and body.

Another explosion occurred under the coal-tips on the surface at Montmartre pit in October, 1874. A tub, or tram, full of very small coal was being overturned on the screen while a light current of air carried away the dust, which took fire at a small fire grate at a distance 5 feet (1·50m.) from the foot of the screen; an explosion followed, and the red flame burnt a sorter so severely about the hands as to incapacitate him from work for eight days. This man was standing about a yard (1 meter) further from the screen than the fire grate, and in the direction towards which the wind was blowing. A wagoner who was standing 7½ feet (2·50m.) still further off, in the same direction, had his hair slightly singed.

We could not here recount all the discussions that have taken place at the monthly meetings about these different communications, but we shall quote the two following opinions as a kind of summary of them:

M. Gonthier holds the opinion that all the facts concerning the explosion, or rather, sudden combustion of coal-dust, that have been related for some time past, far from supporting the opinion that coal-dust greatly aggravates an explosion of fire damp, and propagates it to a distance, tends rather to demonstrate the contrary proposition, since the whole of such explosions have been of a very feeble nature. He admits, certainly, that coal-dust suspended in the air, or deposited on the walls, will, in taking fire, augment the intensity of an explosion of fire damp to a certain extent, and even transmit the flame of one reservoir of fire damp to another situated at a short distance off; but all the facts brought forward show that coal dust cannot produce a 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.

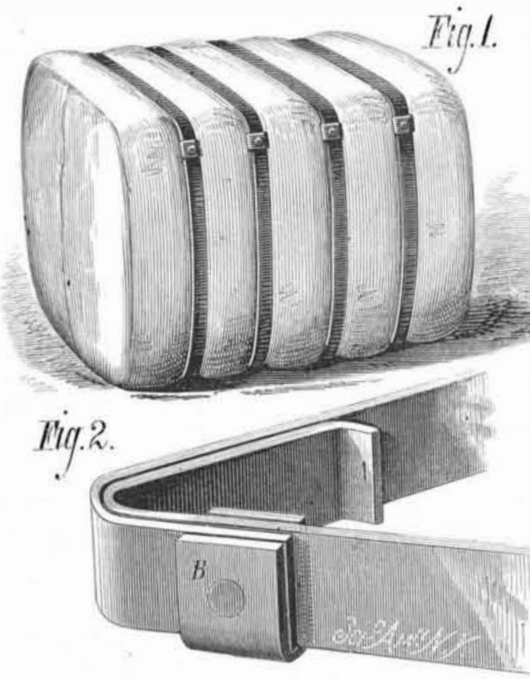
It could be concluded from these trials that coal-dust, suspended in air, is ignited under the influence of an explosion of gunpowder; and it was important to ascertain whether dust inflamed in this way could communicate combustion to any considerable distance.

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.

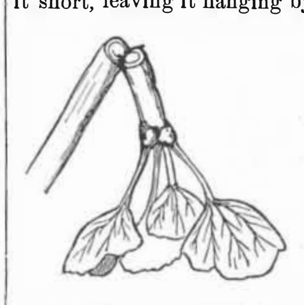
The chief characteristic of Mr. F. H. Danchell's filter was that the ascending principle was used, so that impurities, instead of lodging on the top, fell back on to the bottom of the tank. The Sanitary Engineering and Ventilation Company use mineral carbon as a filtering medium, and cause their cistern 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.