drachms of developer. All came up to printing density without any intensification. No. 1 was wanting in detail; 2, 4, and 5 were fair negatives; 3 (30 seconds), perfection; 6, spoiled from over-exposure. The lens used was Dallmeyer's medium angle rectilinear for quarter plates, and the stop was the smallest of the five. These ordinary pellicle plates, then, require rather more than half the exposure requisite for a wet plate. I do not recommend any one to deviate from the directions as to developers and the methods of using them supplied by Mr. Kennett. In my own practice, however, I prefer, after washing a plate well till the water flows everywhere upon the film, to soak it for a time in three-grain pyro, and to bring out the picture with one drop of ammonia to a quarter ounce of developer, gradually and cautiously adding the alcohol till printing density has been obtained. If intensification is necessary, no process can compare for safety and certainty with the chloride of copper. The negative is placed in a solution of chloride of copper (the strength seems to matter very little) until the image has disappeared, and then, after abundant washing, a strong alkaline developer brings up the picture to any amount of intensity. I use one drachm of a one-in-sixteen solution of strong ammonia to one ounce of three-grain pyro.

The golden rule to be adopted throughout the development of these plates is: "Give them abundance of water." Nearly all the ills that gelatine films are heir to after exposure are due to insufficient washing. I have found no advantage from backing gelatine plates, save in the case of negatives of interiors. In these it is absolutely necessary to use it if it is desirable to avoid blurring round windows, etc.

Since the above paper was written, the discovery has been made that greater brilliancy and beauty may be obtained from gelatine negatives by substituting mild ale for the water in preparing the emulsion.

[Chemical News.]

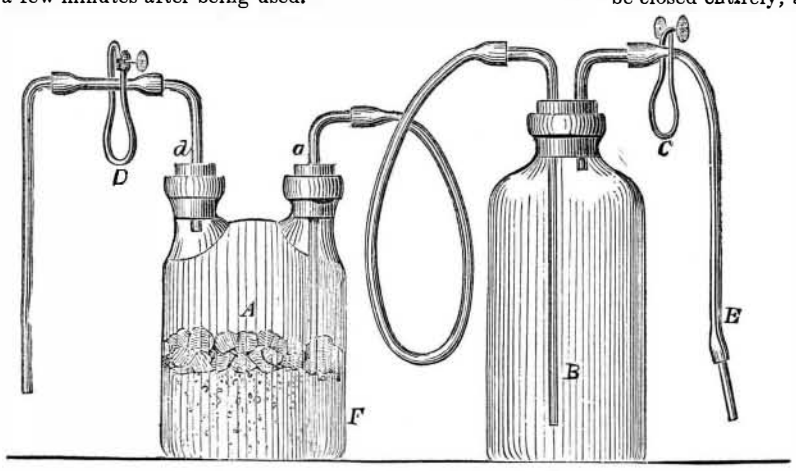
NEW SULPHURETTED HYDROGEN GENERATOR.

By P. CASAMAJOR, Brooklyn, N. Y.

THIS gas-generator possesses two important characteristics in any apparatus suitable:

1. That it gives sulphuretted hydrogen immediately whenever it is wanted.

2. That it does *not* give it when it is *not* wanted, except for a few minutes after being used.



NEW SULPHURETTED HYDROGEN GENERATOR.

Kipp's apparatus, which is the one most generally used for the production of sulphuretted hydrogen, fulfils the condition of being ready to give off the gas at any time, but it has the drawback of being an almost constant generator of gas, which defect is inherent to its construction. One cause of this is that the sulphuret of iron is placed on a wire gauze directly over the dilute sulphuric acid in the lowest globe, and that it keeps falling through and around the wire-gauze, causing a constant production of gas, which must eventually escape either through the glass stopcock, or through the safety-tube on top of the highest globe.

Another cause of the constant production of gas is that, when the stopcock is closed, the dilute sulphuric acid is driven back to a height of about 15 inches. This maintains a pressure in the apparatus which forces the gas out at some part of the ground joints. After a certain portion of the gas has escaped, the dilute sulphuric acid rises in the lowest globe so that it reaches the sulphuret of iron on the sieve, and a fresh supply of gas is produced, driving the liquid to the upper globe as before, and re-establishing the pressure in the apparatus.

The use of Kipp's apparatus having been found inconvenient, I adopted for several years the plan of putting up an apparatus when one was wanted, emptying it out again when not required for use. This generator was merely a bottle with two tubes, one for the egress of the gas and the other for the introduction of dilute sulphuric acid, which latter served also as a safety tube.

This plan is troublesome and inconvenient. If particular care is not taken to wash the sulphuret of iron with water and weak carbonate of soda, and drying it well before putting it away, it will be found oxidized and useless when wanted.

Besides these two generators, which are in general use, others have been proposed, of which I can say that those which have come under my notice have either failed in the important requisite of ceasing to give sulphuretted hydrogen when it is *not* wanted, or are ill-adapted to the production of gas in any considerable quantity.

The new apparatus for generating sulphuretted hydrogen is represented in the woodcut accompanying this article. The bottle marked A is provided with two tubulures, through one of which passes a glass tube, ending at its lowest part in an enlarged portion F, which must, however, be narrow enough to pass through one of the tubulures of the bottle A. This tube must pass through a rubber cork capable of closing the tubulure *a* perfectly.

Before introducing the tube through the tubulure *a*, the enlarged portion is filled with some coarse fibrous material, such as coarse tow. After the tubulure *a* shall have been perfectly closed by the rubber cork, a quantity of shot (about No. 3) is poured into the other tubulures so that it will rise in the bottle to a height of two or three inches. After levelling the shot, pieces of sulphuret of iron are introduced in the bottle, where they will lie on top of the shot.

The presence of shot in contact with the lower part of the tube before mentioned accounts for the necessity of providing this tube with an enlarged portion F, as by this means sufficient space is left for the passage of liquid between the grains of shot, which otherwise would close almost entirely the lower end of the tube. The object of stuffing the enlargement F with tow is to prevent the shot from rising up to the narrow portion of the tube.

After the shot and sulphuret of iron have been introduced, the other tubulure *b* is closed tightly with a rubber cork provided with a tube to lead the gas generated to a wash-bottle. The two portions forming the outlet-tube are united by a rubber tube, which may be entirely closed by means of the screw pinchcock D.

The bottle B is provided with a wide mouth, bearing a rubber cork with two tubes, one of which extends down to the bottom of B and communicates by means of a flexible rubber tube to the glass tube which enters into the bottle A through the tubulure *a*. The other glass tube of bottle B terminates in a flexible rubber tube which may be tightly closed by means of the pinchcock C. The bottle B is filled to about two thirds of its height with dilute sulphuric acid, which is allowed to go to the bottle A whenever the gas is to be generated, and which returns to the bottle B when the apparatus is not in use.

To generate sulphuretted hydrogen with this apparatus, we may observe that if the tubes by which the bottle A communicates to the bottle B are full of liquid, it will merely be necessary to open the screw pinchcock D, which will remove the pressure from the bottle A and allow the dilute sulphuric acid in bottle B to flow into bottle A. If these tubes of communication, including the flexible tube, are not full of liquid, the screw-pinch D should be kept open, and air be driven into the bottle B from the mouth through the tube E by opening the pinchcock C. The pressure exerted in this way on the surface of the bottle B drives the liquid it contains into the tubes of communication, and, after the blowing of air through the tube E has ceased, the liquid continues to flow into A until it reaches the sulphuret of iron, when sulphuretted hydrogen is given off.

On account of the offensive nature of the gas, care should be taken not to draw air from the bottle B into the mouth. This is easily avoided by filling the mouth and lungs with air before blowing into the bottle B. If care is not taken to open the screw pinchcock D before blowing, the gas in the bottle will not be driven forward, but will be mixed with the air from the lungs, and partly find its way into the mouth of the operator. This screw pinchcock D is specially useful in regulating the outlet of sulphuretted hydrogen, and consequently its production.

When no more gas is wanted, the screw pinchcock should be closed entirely, after which a certain pressure is produced in the apparatus from the gas which continues to be formed. After a minute or two the pinchcock C should be opened to remove the pressure from B, and allow not only the liquid in A to flow back into B, but also a certain quantity of gas, by which means the liquid connection between the two bottles is interrupted, and remains so while the apparatus is not in use.

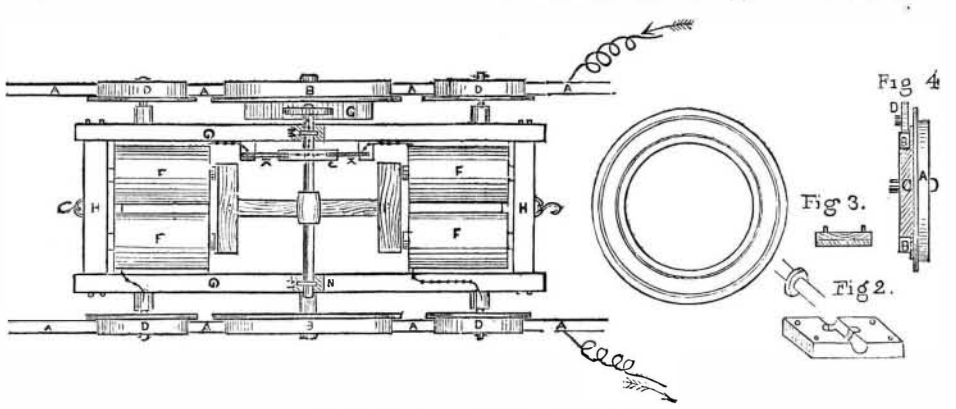
[English Mechanic.]

HOW TO MAKE AN ELECTRIC LOCOMOTIVE ENGINE.

By G. F. CHUTTER.

REFERRING to Fig. 1 the reader will see that on the shaft I of a revolving armature E is fixed a small pinion, which runs against a toothed wheel on inside of driving-wheel B; hence the motion. HH are the two ends of frame into which are screwed or riveted the poles of electro-magnets FF. The sides of frame GG, made of thoroughly dry mahogany or boxwood, are screwed on to HH, so as to just allow the armature E to revolve between the poles of opposite magnets; the armature has six spokes (two only being shown in Fig. 1). A small brass disk J, having six slots in outside edge, is firmly fixed on the shaft I; KK are two springs pressing lightly on disk J.

C is the toothed wheel on same centre as driving-wheel B. The wire best suited for magnets is No. 34, silk-covered (well insulated with paraffin wax), which must be very carefully wound on cardboard or extremely thin boxwood bobbins that fit tightly on cores. The brass springs KK must be so adjusted that, when the armature is level with magnet, they will be over the slots in the disk, thus cutting off current. The wheels must be made of brass, and by allowing the small ones DD to have a play on axles, the engine will run smoothly round the sharpest curves. M is a small brass bearer, let into the wooden sides, into which the shaft I should fit easily, but have no play. Fig. 2 shows a section of shaft with small guide which runs into groove in bearer to keep armature in a right position. There being no rule as to measurements, I have given none, leaving it to the amateur to please his own ideas.



ELECTRIC LOCOMOTIVE ENGINE.

AA are circular rails for engine, which may be made of slips of brass bent round and fastened on to a circular piece of wood (the larger the better—say 6 ft. diameter), or may be as Fig. 3, which is a difficult job, but is much lighter and looks better. Two circles of ¼-in. wood should be made and glued together so that no joint in one shall lie over joint in other; the inside rail should be a little lower than outside one; the driving-wheel should be placed on outside rail.

Section 2. The battery may be any thing to the strength of 6-cell Groves, but bichromates are the best. If the engine is on a table, put the battery underdeath, with a wire fastened to each rail; the current will then travel, as shown by dotted lines on Fig. 1, along rail, up driving-wheel, through pinion, brass disk, and springs, then along a wire let into wooden sides of frame, round magnet, and down wheels on other side. The power of this engine lies in the springs being properly regulated, so that the current may pass round magnets at exactly the right time; this engine ought to make (even if it is no larger than Fig. 1) about ten revolutions of a circle 6 ft. diameter per minute.

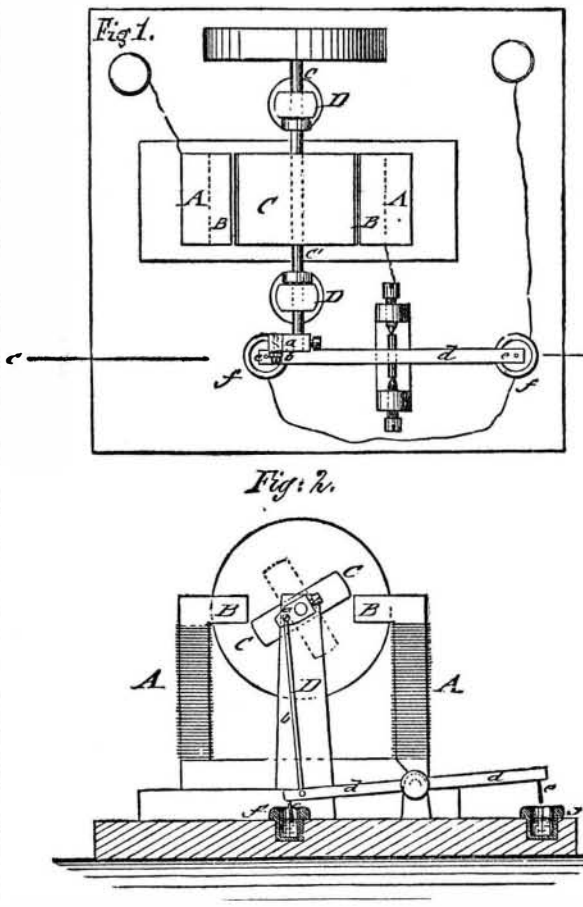
If more power should be wanted, a pinion may be fixed on the other end of shaft I, working against toothed wheel as on other side, but a break must be made with some non-conducting material, or the current would run up one wheel and down the opposite one direct. The best way to overcome this is to have the centre of toothed wheel made of ebonite, as Fig. 4. A is a brass wheel, B section of toothed wheel, C ebonite, D small pinion on shaft. Care should be taken to keep the lines and cogs clean, as the spark that follows wheels soon forms a layer of oxide. An engine about one foot long and large in proportion will carry its own battery or drag it behind in "tender."

NEW ELECTRO-MAGNETIC ENGINE.

By W. E. SAWYER, New-York.

THE armature revolves between pole-extensions of a fixed magnet, both the poles of the magnet and the centrifugal surface of the armature consisting of long, narrow edges running parallel to the axis of the armature. The current is interrupted and established by points, dipping into quicksilver or other fluid conductor, and suitable connecting mechanism.

A represents an electro-magnet of U-shape, whose pole-ends are made with rectangular, curved, or other extensions, B, that face each other, and the symmetrical axis of the magnet, to present a long surface to the armature C, whose shaft C' turns in bearings of pillars, D. The armature C is thus placed between the poles of the magnet in the magnetic field



NEW ELECTRO-MAGNETIC ENGINE.

of the same, the surface or edge of the ends of the armature being equal in length and width with the faces of the poles, but slightly curved for passing closely to the same when revolving.

A fly-wheel on the armature shaft regulates the motion of the armature, and carries the same over the dead points.

The shaft is connected at the other end by crank *a* and rod *b* with a walking-beam, *d*, centrally fulcrumed and provided with pins *e*, at the ends, that dip alternately into cups, *f*, filled with mercury, or other fluid conductor. The cups are connected to the battery and the fulcrum to the magnet, which is excited at each dipping of the pins, the current being interrupted at the moment when the walking-beam is balanced and both points are outside of the conducting fluid. The armature faces at this moment fully the pole-ends, and is then carried by the fly-wheel away from the same to be again exposed to magnetic attraction on the dipping in of the circuit-closing point.

PHOTOGRAPHS OF THE BLOOD.

PHOTOGRAPHS of both healthy and diseased blood-corpuscles magnified have been recently taken in Boston, Mass., under the supervision of Drs. Cutter and Harriman. The objectives employed were a $\frac{1}{50}$ and a $\frac{1}{75}$. The red and white corpuscles are shown, the white being nearly ¼ of an inch across the disks.