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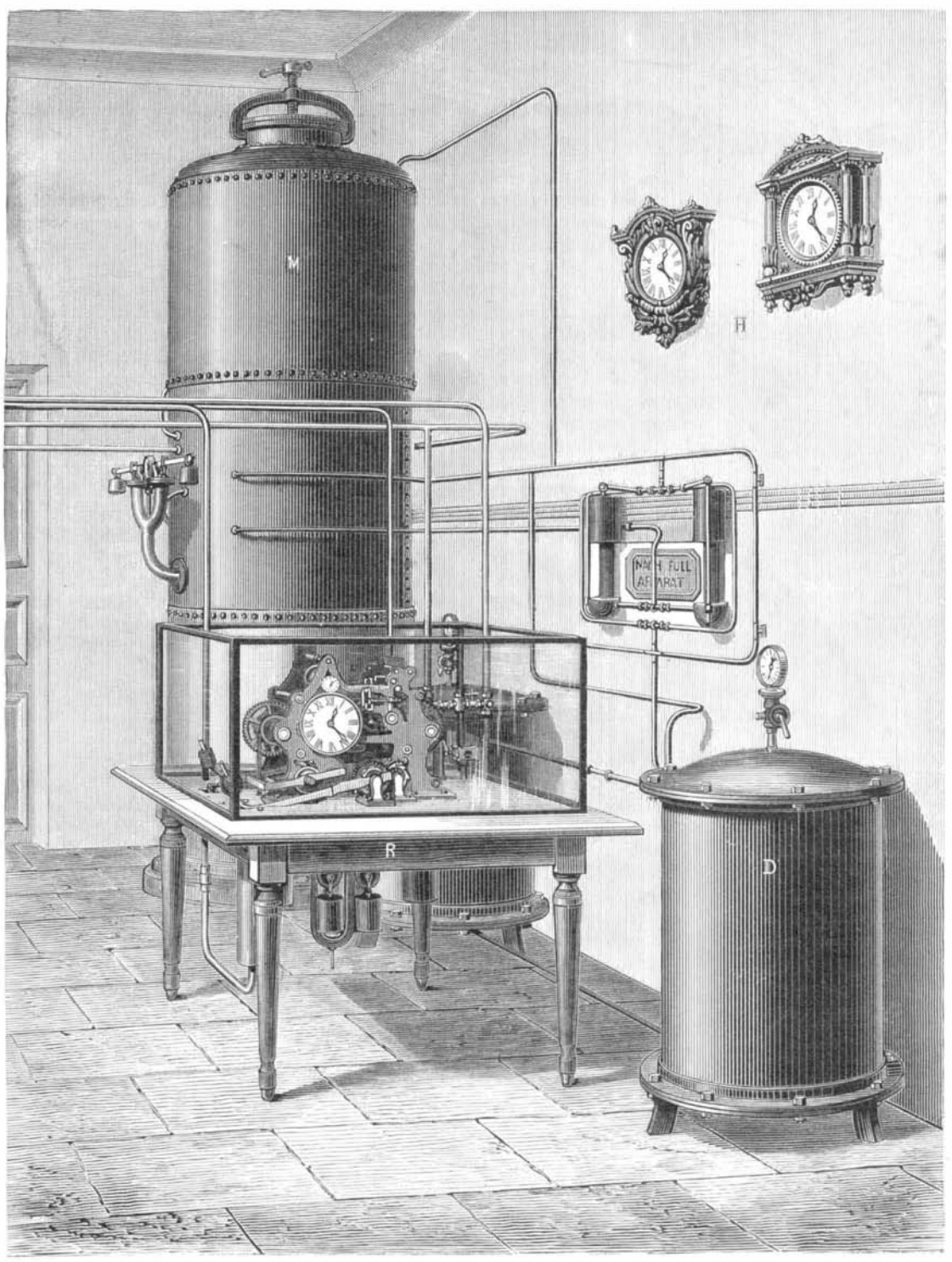
THE PNEUMATIC CLOCK.

Among the many wonderful pieces of mechanism to be seen at the Paris Exhibition, the pneumatic clocks exhibited in the Austrian section are not the least interesting. These clocks give exact time to all the clocks of a city simultaneously, whether the distance of the latter from them be six miles or sixty. The system has now been in operation for about two years in Vienna, where the time is sent in this way from the Imperial Observatory, through tubes laid along the gas mains in different parts of the city, to all the public clocks, the hands of which all move by this arrangement at the same time. The city of Paris has recently authorized the "Société des Horloges" to make a public trial of this pneumatic apparatus, with a view to the possible adoption of the system.

The principle upon which these clocks work is this: "If a column of air, inclosed in a tube at a given tension, be subjected to pressure, it immediately transmits that pressure to all its parts, even the most remote." But the compressed air, after having exerted its force, must be expelled from the tube and replaced by a fresh column; because, if the tube were not alternately opened and closed, this column would act precisely like an elastic spring; consequently the mechanical effect on the pistons would be insignificant, and the hands of the clock would remain at a standstill, powerless to move. The pneumatic clocks are at once simple and perfect; they are not likely to get out of order, and the escape of air, even, from the distributing pipes cannot alter their movement. This mechanism is extremely simple, and may be described as follows: Air is injected into a metallic cylindrical reservoir, M, by means of a hydraulic motor; from thence this air is led into another large cylinder or distributer, D; it is only used, however, as fast and in such quantities as needed by the regulator. At every minute the air from the regulator enters the lead or iron distributing pipes, and acts on a leather piston inclosed in a small cylinder attached to a lever; and the latter determines the movement of an escapement that moves the hands of the receiving dial, H. This lever receives the pressure communicated by the central motor, R, and at every movement causes an escapement wheel to advance one notch, marking one minute of time. At every unlocking of the escapement wheel, the air from the distributer ceases communication with the distributing pipes, and escapes into the atmosphere. The regulator of the central motor, R, is an endless chain clock as perfect as possible, furnished with a compensating pendulum. This receives astronomical time from the public observatory, and transmits it to the dials, distributed in different quarters of the city, as well as to those of private dwellings. In order to prevent any accident, and as a simple measure of precaution, each central station is provided with twin motors, each complete in all its parts, and only one of which is in operation at a time. These two motors are connected automatically, in such a way that if, through an accident, the working machine suddenly stops, the other one at once begins operation, thus preventing the least retardation in the movement of the clocks. These clocks are so constructed that they must work perfectly or not at all; there is no alternative. The invention is due to Mayrhope, an Austrian engineer; but the merit of perfecting it belongs to M. Victor Popp, who during the last two years has attentively watched the working of these clocks at Vienna, correcting and modifying the apparatus day by day, until at length he has been able to present a system which is complete and perfect at every standpoint from which it may be regarded. As well known, the experiments made with the electric system have proved impracticable. Electric clocks are among the most unreliable of chronometers, electricity by its very nature being the most capricious of physical agents, and the intensity of the current varying with the nature, species, and charge of the battery, and with the resistance of the conductors, media, exterior temperature, etc. However, by means of ingenious, complicated (and consequently very costly) mechanisms, certain very accurate electric clocks have been constructed, but their high price places them beyond the reach of any but the wealthiest institutions, and they are consequently unable to respond to a public demand. The invention of pneumatic clocks, then, appears to be of such real utility, and supplies such a pressing necessity, that we may expect to see them gradually adopted by all large cities.



PNEUMATIC CLOCK AT THE PARIS EXHIBITION.

Depth to which Roots Penetrate.

Mr. Foote, in Massachusetts, has traced the tap root of a common red clover plant downward to the perpendicular depth of nearly 5 feet. The Hon. J. Stanton Gould followed out the roots of Indian corn to the depth of 7 feet, and states that onions sometimes extend their roots downward to the depth of 3 feet; lucerne, 15 feet. Hon. Geo. Geddes sent to the Museum of the New York State Society a clover plant that had a root 4 feet 2 inches in length. Louis Walkhoff traced the roots of a beet plant downward 4 feet, where they entered a drain pipe. Professor Schubart found the roots of rye, beans, and garden peas to extend about 4 feet downward; of winter wheat, 7 feet in a light subsoil, and 47 days after planting.

Transferred Engravings.

If dirty, the print may be cleaned by means of bread crumb; then, to soften the ink, the print is put to soak in a 3 per cent solution of strontic oxide, kept at a temperature of about 83° C.; the necessary time for soaking can be found by experimenting on a piece of margin or extraneous matter, cutting off a small piece, drying it, then damping with nitric acid as hereafter described, and then observing whether it gives a set off on being rubbed against another piece of paper with the thumb nail. The length of time may vary from ten minutes to an hour and a half. When the print is removed from the solution it is thoroughly and carefully washed with hot water, superfluous moisture being absorbed by blotting paper; it is then laid face downward on a few layers of blotting paper, and the back well brushed with a 20 per cent solution of nitric acid until the paper is evenly and thoroughly soaked; it is then dried between successive sheets of blotting paper. The zinc plate is prepared much the same way as for zincography, with the exception of graining; instead of this it is rubbed with Water of Ayr stone, and finally polished with pumice powder. In transferring, much stronger pressure is required than for zincography; indeed, theoretically, a copperplate printing press should be used, but in practice a good litho press will be found to answer almost as well. After having adjusted the pressure, place the print face downward on the plate, and immediately pull it firmly and evenly through the press. An intervention of 30 seconds after the print is put on the plate would be fatal to success.

After the print is peeled off the plate is sponged over with unsoured gum water; water is then sprinkled on, and it is gently washed with a clean rag to remove any adherent particles of paper; the transfer on the plate is then rubbed over with a mixture of lithographic ink, thin varnish, and gum water, by means of a fine sponge, care being taken to have an excess of gum water to prevent "blacking up." When sufficient ink has adhered to the lines the plate is flushed with water under the tap, and is then slightly etched with phosphoric acid and gum water solution, diluted with its bulk of water; the plate is next rolled up with printing ink and re-etched with the normal solution. It is now ready for use, and can either be printed from in a litho press, or it can be etched by acid, and then printed typographically.

In preparing freshly printed matter the print is at once saturated with the nitric acid solution, all further manipulation being the same, with the exception, perhaps, of rather less pressure in transferring.