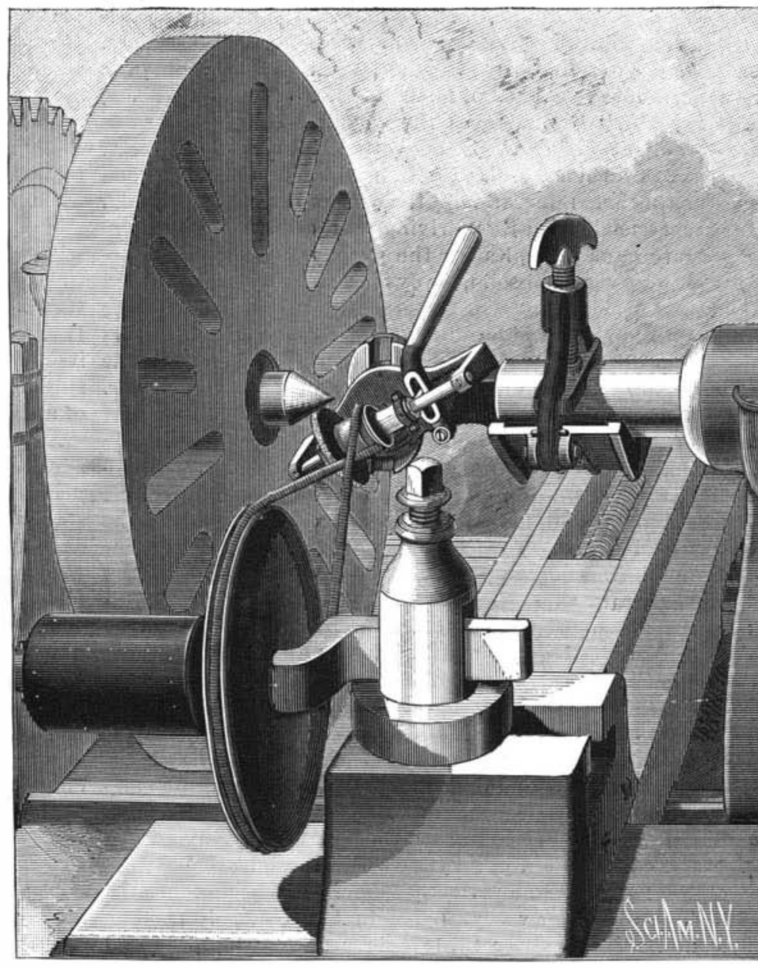
LATHE CENTER GRINDING MACHINE.

The frame carrying the grinding device has at one end a V-shaped socket, applied to which is a detachable clamp yoke, provided with a set screw bearing upon a clamp plate. The frame is held firmly upon the puppet head spindle, which enters the socket, when the set screw is tightened. As the socket is drawn up against the under side of the spindle, the true centering of the frame is insured, irrespective of the diameter of the spindle. Pivoted to the main frame by a bolt is a second frame, having end lugs, in which is mounted a spindle provided with a sleeve carrying a pulley and grinding wheel, the latter being made of emery, and being secured to the sleeve by a nut. Adapted to a groove in the sleeve is a two part ring formed with a pin projecting into a slot in a lever pivoted to the second frame. This lever has a handle by means of which a longitudinal movement can be imparted to the sleeve. Rotation of the ring with the sleeve is prevented by the projection of the pin into a slot formed in the frame. This frame can slide vertically on the other, which is formed with suitable grooves and a slot for the passage of the pivot bolt. In the second frame is a segmental slot, through which passes a bolt screwing into the first frame. The construction permits the second frame to be adjusted on the pivot bolt to different angles, depending upon the taper of the center being ground. The extent of the vertical movement of the frame is governed by the diameter of the center pin.

The grinding wheel is driven from the face plate in a very simple and efficient way. On a spindle, having a projecting arm adapted to the usual slotted tool post secured to the slide rest of the lathe, is a V-shaped pulley, having a long hub carrying a friction drum which is in contact with the periphery of the face plate. A belt passes around this pulley and the one on the sleeve. By turning the usual transverse feeding screw controlling the slide rest, the friction wheel can be moved into or out of contact with the face plate, the rotation of the grinding wheel being thus started and stopped at the will of the operator without stopping the lathe. It will be seen that the adjustment of the grinding disk to the diameter and angle of the center pin is effected without any corresponding adjustment of the driving device. It is apparent that the attachment can be readily applied to the lathe. It is properly centered when the clamp is tightened on the projecting spindle of the puppet head, and no further adjustment is required except that necessary to bring the grinding spindle to bear on the conical end of the pin and regulate the angle of traverse of the grinding disk to agree with the angle of the pin.

This invention has been patented by Mr. Alfred H. Randall, of 607 Franklin St., Philadelphia, Pa. This patent is for sale.



RANDALL'S LATHE CENTER GRINDING MACHINE.

ELECTRICAL TRANSMISSION OF POWER TO A DISTANCE.

The question of the transmission of motive power to a distance has recently deeply engrossed the attention of the scientific world and of the public, and a new element has been added to the study of this interesting problem by the late experiments of Mr. Hippolyte Fontaine. Before making known the results of these, we shall give a historic summary of the question from the standpoint of the applications made.

We cannot give the exact origin of the *idea* of transmitting power to a distance by electricity, but the first experiment in this line dates back to 1873, and was performed at the Vienna Exposition. The projector of this experiment, Mr. Fontaine, thus describes it in the *Revue Industrielle* (1873, p. 658): "The Gramme machines gave rise at Vienna to an experiment that will possibly be followed some day by very important applications. The first machine was actuated by a gas motor, and the electricity produced was sent into a second machine, which actuated a small centrifugal pump. As we had no measuring apparatus, it was not possible to determine the useful effect. Yet these first experiments have demonstrated not only the possibility of transmitting power to a long distance, but have shown that the performance is notably greater than that given by other apparatus."

Mr. Fontaine thinks that the power transmitted was one-third horse and the distance about 7 ohms.

On the 3d of December, 1886, the same gentleman gave an account, as follows, of the progress of this then nascent industry before the French Society of Physics:

"At Philadelphia, in 1876, the Gramme Society exhibited a transmission of from 2 to 3 horse power traversing a distance of 20 ohms.

"At Paris, in 1878, the same house exhibited a genuine distribution of power, where the same generator actuated, simultaneously or separately, a pump, a blower, and a printing press.

"None of these public demonstrations succeeded in attracting the attention of manufacturers to the new method of transmitting power; and it required the great experiments in plowing by electricity at Sermaize, in 1879, by Messrs. Chretien and Felix, to bring the question into the domain of practice. The Gramme machines used by these gentlemen revolved 1,400 times per minute, and produced a current of 20 amperes and 400 volts.

"Starting from 1879, the industrial applications rapidly increased, and, at the Exhibition of Electricity in 1881, there were to be seen more than fifty machines employed in electrical transmission."

Dating from the exhibition of 1881, we no further count the applications made in different quarters (always with the concurrence of the Gramme machine, or machines of that type), with the object of transmitting power to medium distances.

The difficulty increases with the distance of the transmission, or, more accurately, with the resistance of the line which connects the generators and receivers. It becomes necessary, therefore, in order that all the electrical energy shall not be spent in the line, to reduce the intensity of the current and increase the initial tension, as was pointed out as long ago as 1879 by Messrs. Thomson and Houston, in the *Journal* of the Franklin Institute for January of that year. After well explaining the necessity of using these high tensions, Messrs. Thomson and Houston conclude thus:

"Divested of these theoretical considerations, the important fact remains that with a cable of very limited section an enormous mechanical power can be transmitted to a considerable distance. The combustion of coal at the threshold of the mine, and the transmission of the mechanical power produced by rivers, may, then, be considered as applicable, the fact always being remembered, however, that a loss of 50 per cent will be almost inevitable."

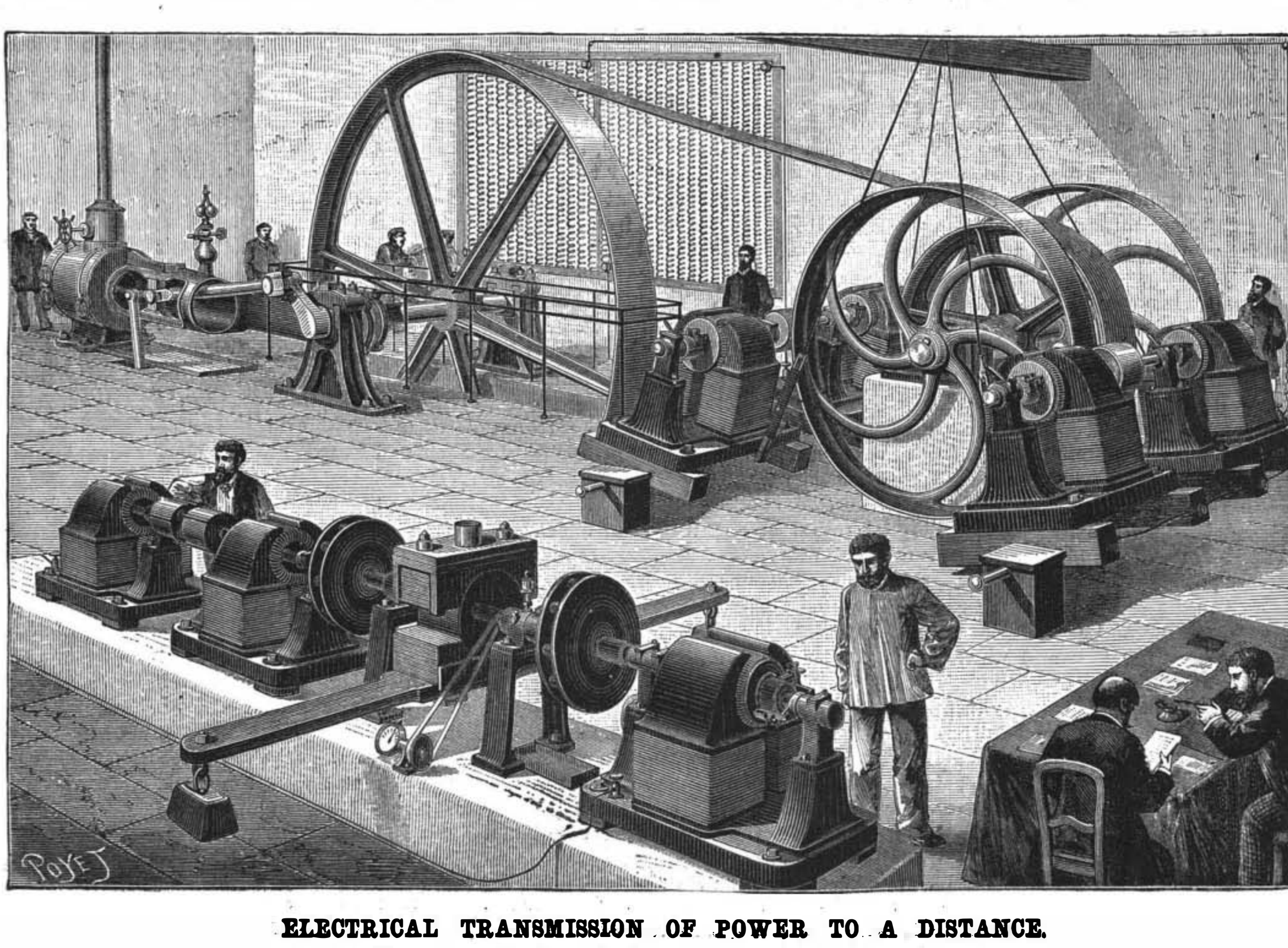
This prophetic figure of 50 per cent is to be remarked, for it makes its appearance approximately in most of the experiments that have been performed up to the present, without any one being able to sensibly exceed it.

But the error of Messrs. Thomson and Houston that we think it well to dwell upon, since it is still too widespread, is relative to the utilization of rivers, waterfalls, and, in a word, of natural motive powers, to a distance; and our opinion upon this point agrees with that of Mr. Fontaine, who cannot be accused of not having a certain amount of practical knowledge of the subject. We continue to cite:

"Mr. Hippolyte Fontaine does not believe that the utilization of waterfalls to a distance is as advantageous as has been often said. Taking into account the expense of setting up the hydraulic motors and dynamos, of the construction of dams and sluices, and of keeping in repair, and the interest on the capital invested, and the performance of the dynamos, etc., we quickly reach a total expense that is greater than that occasioned by a steam engine of the same power, especially when we reckon in the cost of the fall itself, which rarely wants an owner. The question, when looked at from the standpoint of transmission, is entirely another affair. In this case, the intervention of electricity presents numerous advantages over the systems now in use."

We may naturally ask, then, why the experiments that we are to describe were undertaken, seeing that their projector did not himself believe in their industrial success. Another extract from his communication will explain this:

"Although Mr. Fontaine undertook some new experiments on transmission to a great distance, it was merely to



ELECTRICAL TRANSMISSION OF POWER TO A DISTANCE.

demonstrate that the machines constructed by Mr. Gramme are lighter, cheaper, and better, from every point of view, than those recently experimented with on the Railway of the North."

These reservations made (and we see how necessary they were), we may go on to describe the experiment performed by Mr. Fontaine, with the concurrence of Messrs. Nysten, Dehenne, and Chretien, at the Electric Company's laboratory.

The transmission was effected by means of seven machines of a unique type called "Superior," manufactured by the inventor, Mr. Gramme. Four of these served as generators and three as receivers. Each of them developed, at its normal angular speed of 1,400 revolutions per minute, an electromotive force of 1,600 volts and a current of 10 amperes. The four generators, excited in series, were mounted for tension, with three receivers mounted in the same way with a resistance of 100 ohms. The resistance of the armature was 4·75 ohms and that of the inductor 6·5 ohms, say about 179 ohms for the resistance of the circuit.

The four generators (in the back part of the engraving) received their motion through the intermedium of two friction pulleys mounted on a shaft actuated by the engine belonging to the works. These machines oscillated upon an axle placed beneath their base; and springs regulated the pressure of the friction rollers against the driving pulleys. It was an improvement on the system employed at Sermaize in the experiments in electric plowing.

At the receiving station (foreground of engraving) the three Gramme machines were mounted in a line and connected by coupling plates of the Raffard system. The mechanical power developed was measured by means of a Prony brake placed between the first and second machines. The total weight of the seven machines was 18,480 pounds, and their total cost was $3,300.

The following table summarizes the chief conditions of the experiment performed on the 19th of October, 1886:

Speed of Gramme generators, 1,298 revolutions per minute.

Difference in potential at the origin of the conducting line, 5,996 volts.

Intensity of the current, 9·34 amperes.

Power received by the driving shaft, 95·88 horses.

Speed of receivers, 1,120 revolutions per minute.

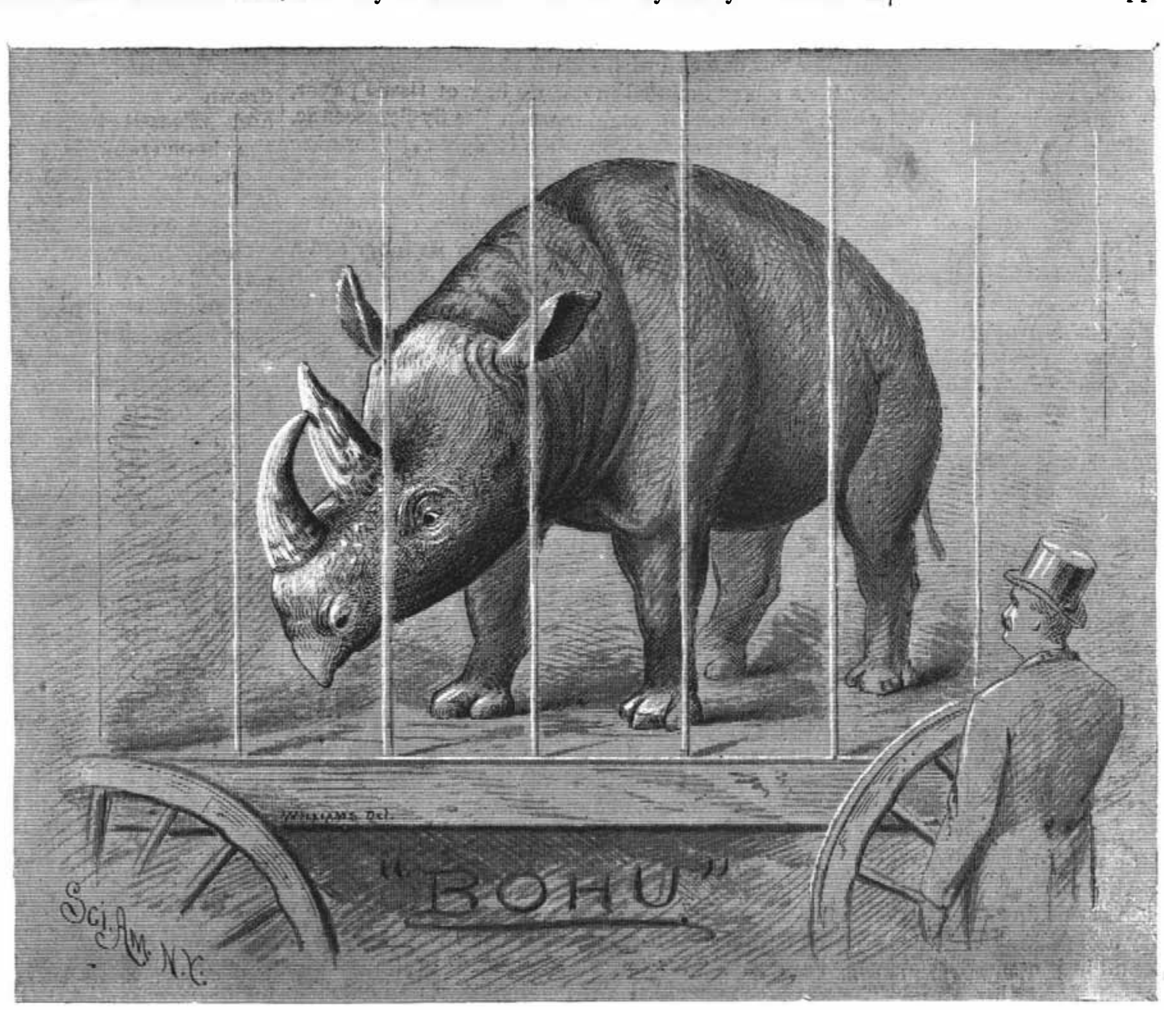
Power collected at the brake, 49·98 horses.

Industrial performance, 52 per cent.

The information gained from these experiments is that with seven Gramme machines of an ordinary type, weighing together about nine tons, and costing $3,300, it is possible to transmit a utilizable mechanical power of 50 horses through a resistance of 100 ohms, with an industrial performance of 50 per cent. But to conclude from this that material forces can be utilized to a distance of 30 miles is another matter. In fact, it does not suffice to produce this motive power at a distance, it is also necessary to distribute it, if we may be pardoned the expression, in several distinct packages, each operating independently of the others, and with a satisfactory performance.

Up to the present the problem remains intact. We do not by this mean to say that it is insoluble (the rational use of accumulators would cause many difficulties to disappear), but that it is not yet solved; and none of the experiments made in recent years shows an acceptable solution of it, since we cannot admit as practical the system that consists in actuating through the general transmission an electric generator, which in its turn sends the current into other receivers, thus interposing four transforming apparatus between the first motor and the utilizing apparatus, and reducing the performance to 15 or 20 per cent.

It is therefore necessary to make a distinction, and an important one too, between the transmissions and distributions to a slight or medium distance that have passed into industrial practice, and of which numerous applications may be cited, and transmissions to a great distance, with high tensions, for the purpose of utilizing those natural motive powers so improperly styled gratuitous. It is not necessary to enter into any great calculation to demonstrate that, in most cases, the best transmission, from an economical standpoint, is that by coal. This is the material that, for the many years still in store for it, will most simply and cheaply effect the transmission and distribution of motive power to great distances.—*E. Hospitalier, in La Nature.*



THE RHINOCEROS IN THE PARK.—[For description see next page.]

[For description see next page.]

EXPANSION OF SOLIDS, LIQUIDS, AND GASES.

T. O'CONOR SLOANE, PH.D.

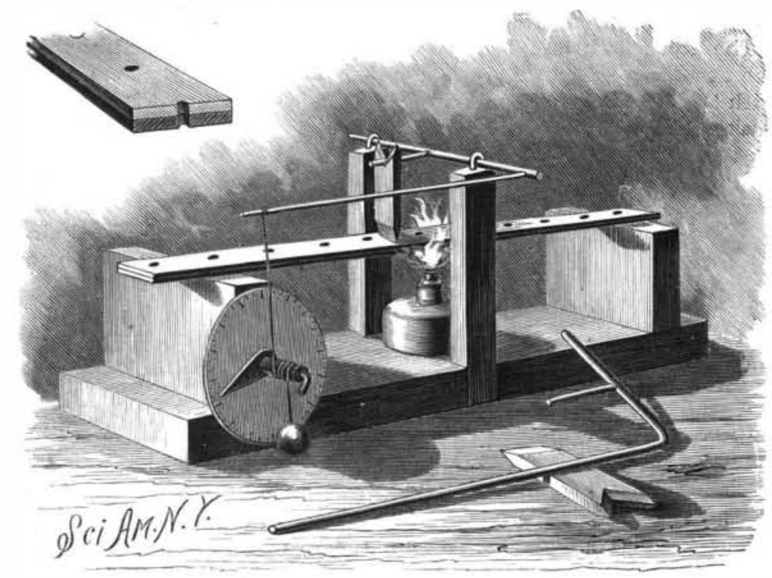
EXPANSION OF WATER.

The fact that solids expand when heated having been shown, the unequal expansion of different solids when subjected to the same degree of heat should next be illustrated. An old-fashioned piece of apparatus, the compound bar, is generally used for this purpose, composed of a strip of brass riveted to a strip of iron. Each piece may be ten inches long, five-eighths inch wide, and one-eighth inch thick. A rivet every inch holds them firmly together. If such a bar is heated, the brass expands about one-third more in lineal direction than iron. As the two are rigidly connected, the only way in which this condition can be fulfilled by the components of the bar is by bending. The iron and brass bend, the brass following the outside of the curve, or position corresponding to the outer and longer arc.

While this apparatus is very sensitive, owing to its absence of lost motion, all parts being solidly connected, its movements have the disadvantage of being very small in extent. After a high temperature has been reached by five minutes' heating in an alcohol lamp, a straight-edge has to be held upon the bar to show the curvature. This is always unsatisfactory. Not only is it hard to be seen by many observers at once, but, owing to the heat of the bar, it is far from pleasant to hold the straight-edge in contact with it.

In the cut, a modification, as it may be termed, of the apparatus used for illustrating the expansion of metals is shown adapted to the compound bar.

The base and two end standards are preserved. At the center of the base two higher upright pieces are placed. A bent wire runs across the top of the wooden uprights and is attached thereto by staples, or passes through holes bored through them. Instead of a bent wire, one of which is shown lying in front of the apparatus, a straight piece just long enough to reach across may be used. In that case, a longer piece passes through a hole drilled in its end, so as to represent the arm of the other piece. In the center of the transverse portion a hole is drilled, and a piece of wire is soldered therein. This piece should be about two inches long.



THE COMPOUND BAR.

The relative sizes of the wires are largely matters of judgment. The cross piece may be about one-eighth inch, and the others one-sixteenth inch thick. The long arm is provided with a thread and weight, which are attached to its end. The thread is wound two or three times around the tubular axis of the index.

The compound bar is placed loosely over the base, resting on the two end uprights. A small piece of metal or even of wood of the general shape shown in the cut is placed vertically, one end resting on the center of the bar and the other end supporting the short arm of the wire above it. Now, it is clear that the least elevation of the center of the bar will raise the end of the short as well as long arm of the wire, and so will move the index. The bar can be lifted by hand to prove this, when the index will immediately begin to rotate.

All being thus prepared, a light is held under the center of the bar. It may be a lighted match, or an alcohol lamp may be used to better advantage. The instant that heat is applied, the index begins to rotate, and continues for some time to do so until the bar has acquired the final temperature due to the heat applied. Then all remains at rest.

The great sensitiveness of what is usually regarded as a very sluggish piece of apparatus is thus well exemplified. An experiment that generally requires five to ten minutes' time for an unsatisfactory demonstration is here carried out in a most effective manner in a few seconds.

The expansion of liquids is shown in all alcoholic or mercurial thermometers. It may, by the very simple apparatus next illustrated, be shown to an audience.

A small round-bottom flask is provided; a perforated cork and long glass tube that fits it tightly are adapted to the neck of the flask. Now, if water is introduced into the flask, and is heated, bubbles will gradually appear, due to separation of dissolved gases, principally nitrogen or carbonic acid gas. These would interfere with the demonstration, which should be carried out with a perfect liquid. Some water, therefore, is boiled