# SCIENTIFIC AMERICAN

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## PERREAUX'S MICROMETER MACHINE.

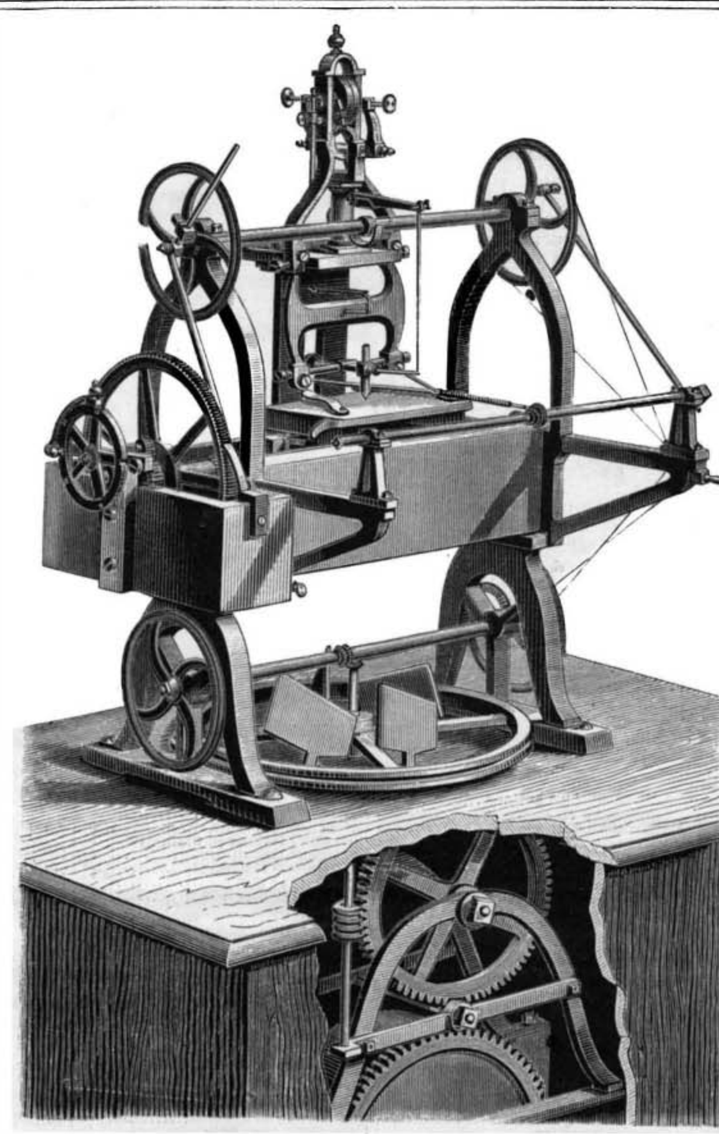
The elegant little apparatus which is shown in the accompanying cut, about one-half the natural size, is designed for ruling micrometer scales, and permits of dividing the millimeter into 1,500 parts.

The machine, which is automatic, is actuated by a clockwork movement through the intermedium of very fine silk threads. An endless screw, that engages with a wheel, moves a fly wheel carrying four vanes, which, when the velocity of the wheel reaches its maximum, spread out through centrifugal force and offer a resistance to the air, and thus cause the apparatus to run with regularity. Motion is transmitted to the horizontal axle by two bevel wheels, one of them belonging to the axle of the endless screw, and the other to the intermediate driving axle, which latter carries to the right a very small pulley, that communicates a slow motion by means of a cord to the upper driving axle. To the left of the latter there is a slot arrangement that performs the part of an eccentric, permits of increasing or diminishing the travel, and produces a backward and forward motion in a connecting rod articulated with the slot. The latter, through a click, causes the large ratchet wheel to revolve by fractions, thus bringing about a revolution in the endless screw corresponding to the spacing required in the scale.

The pitch of the screw that moves the carriage by means of a nut is one-tenth of a millimeter. The ratchet wheel has a periphery of 30 centimeters, divided into 300 teeth of 1 millimeter, which gives 3 meters of periphery, or 3,000 teeth for each millimeter of its travel.

By means of the slot above mentioned, which may be varied and regulated at will, this wheel may be caused to revolve by as many teeth as may be required, say 2 teeth for $\frac{1}{1500}$, 15 for $\frac{1}{200}$, 20 for $\frac{1}{150}$, 30 for $\frac{1}{100}$.

In the center of the table of the apparatus there is a carriage which carries a plate of glass fixed by two springs. The tracer, which is placed above this, carries a diamond set into a copper rod, which rises or falls according to the motion of the machine. When this rod is lifted by a second eccentric located in the center of the upper shaft, the ratchet wheel revolves and causes the carriage to move forward; and when the wheel ceases to revolve, the diamond at once falls with extreme precision on the glass, and traces thereon a groove which corresponds in length and depth to the distances traversed. In order to obtain such marks of varying depth, a counterpoise, capable of approaching or receding from the rod supporting the diamond, balances the latter, and, so to speak, grazing the surface of the glass, makes a line corresponding to the ideal, while by carrying the center of gravity more and more toward the diamond, the lines become stronger and stronger. In measure as this counterpoise acts upon the diamond, the lines must, therefore, be further apart.



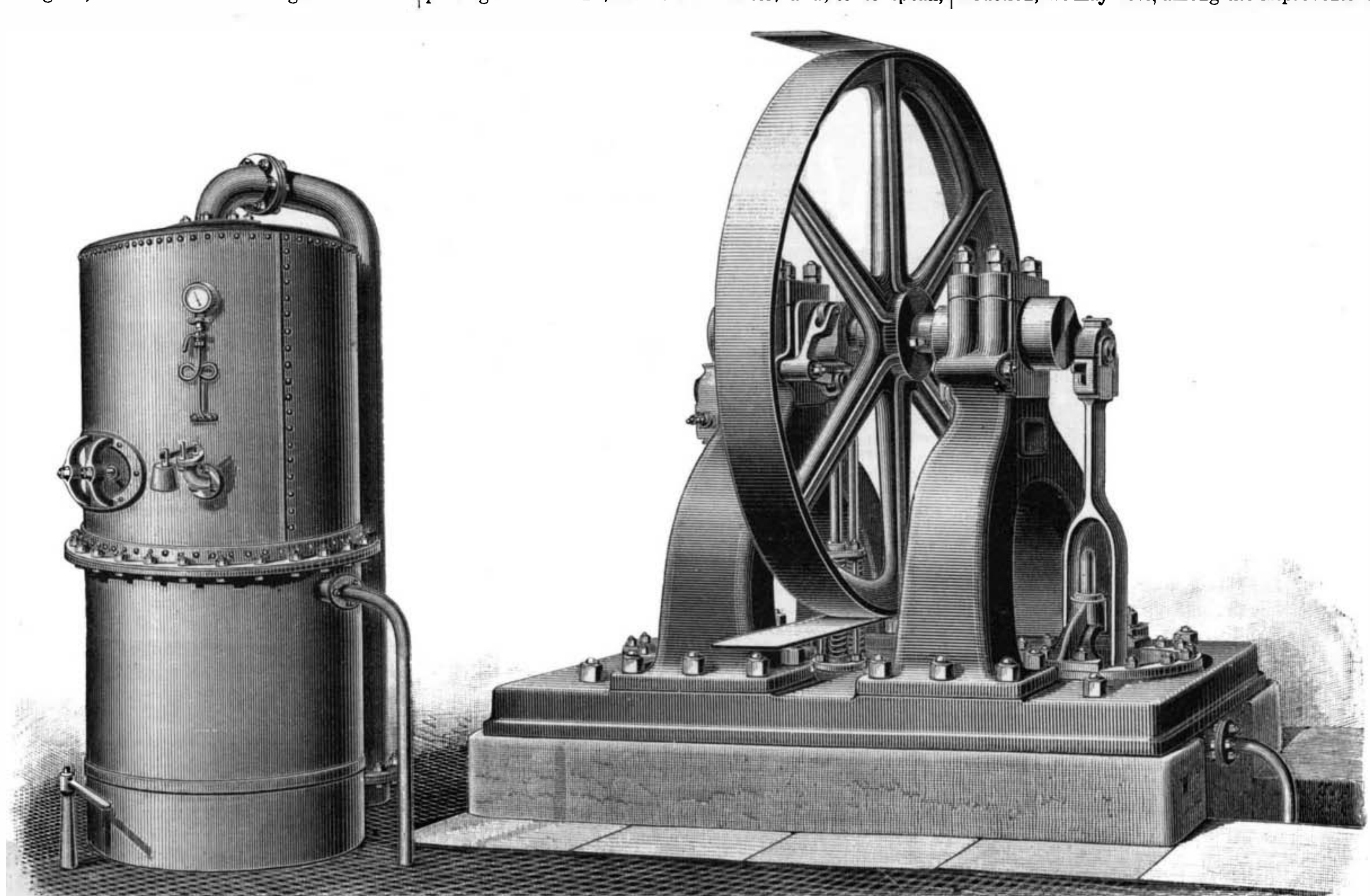
PERREAUX'S MICROMETRIC MACHINE.

The machine is also provided with what is termed a "counter," which is designed to regulate (1) the length of the tenth divisions; (2) of the ordinary lines; (3) of the fifth divisions; and, finally, to render the reading of the lines in the microscope as easy as in ordinary measurements.

In order to obtain very perfect results with this apparatus, it is necessary to guard it against the very feeblest vibrations from the exterior, such as those resulting from the passage of carriages, etc. For this reason it should be used only at certain hours of the night, when all is quiet.—*La Nature.*

## GIFFARD'S ICE AND COLD AIR MACHINE.

Among the systems that have been devised for the production of ice and cold air, one of the simplest is that of Mr. P. Giffard, which employs absolutely nothing but air and water, to the exclusion of all those inconvenient and dangerous chemical products that are used in other systems. The apparatus which is shown in the accompanying cut is based upon the principle of compression and expansion of air. It consists of two cylinders in which move pistons actuated by any sort of motor that may be preferred. One of these cylinders, called the compressor, compresses the air and forces it into the reservoir shown to the left in the figure. This reservoir is in two parts, one bolted to the other, the lower one being tubular, and its system of tube being surrounded by cold water, as is the compressing cylinder. The air, compressed to two or three atmospheres, is heated by the compression, according to a well known law. The disengaged heat is absorbed by the cold water, and the air, carried under pressure to the second cylinder (called the expansion cylinder), restores, on dilating, the work due to compression, and produces an extreme lowering of the temperature. Cold air is thus obtained at a temperature varying with the applications that are to be made of it, and which may reach 60 degrees below zero. Such is the machine in general. As for details of construction, we may note, among the improvements devised by



GIFFARD'S IMPROVED ICE AND COLD AIR MACHINE.

Mr. Giffard, the application of pistons of a special kind which are extremely solid, which work very smoothly, and which are absolutely hermetical. The cold air produced by this machine is utilized directly, thus obviating all those complications that are met with in ordinary systems. In the manufacture of ice and the freezing of carafes, this air is sent into a brick chamber containing the water, etc., to be frozen.

The No. 3 size of these apparatus, which requires an 18 horse power and burns 360 kilogrammes of coal in ten hours, produces in this space of time at least 1,000 kilogrammes of ice. The ice, then, costs about one centime per kilogramme, with coal at 30 francs per ton. This price may be reduced one-half, since there are steam engines that do not burn more than one kilogramme of coal per horse and per hour. This same size of machine furnishes 650 cubic meters per hour of cold air at a temperature of 0 degree. The production of ice is still more economical with more powerful apparatus than type No. 3; and if a hydraulic motor be employed, the cost will become almost insignificant. Moreover, the ice being produced at excessively low temperatures, acquires great hardness, and a frigoric power much greater than that obtained with other systems.—*Chronique Industrielle.*

### FEVER CAUSED BY LEMONADE.

A remarkable outbreak of enteric fever occurred in Evesham, England, last summer. Fifty-one households were invaded with sixty-eight cases, forty-six of the patients falling ill during the fortnight ending August 8. The houses in which the patients lived were in many instances several miles apart, their sanitary circumstances varied widely, sewers and water supply were entirely different, and the milk supply was derived from several independent sources.

Under these conditions it was no easy matter for the health officers to discover the source of the epidemic. It was elicited however, that all the patients attacked before August 8 had attended Evesham regatta, and that they had all been present in one particular meadow. Further investigation developed the fact that thirty-two of the forty-six had certainly, and eleven had most probably, partaken of refreshments at a certain stall. The other three were in doubt. In one instance two of a party of three drank lemonade, while the third took nothing; the two had the fever, the other escaped. The water used in the refreshment stalls had been drawn from a well near the meadow, the water of which was found to be so contaminated that it was at once closed; the belief of the health officer being that this polluted well had been the immediate source of the epidemic.

Two very obvious inferences may be drawn from this occurrence. One is the propriety of carrying refreshments from home when going on a day's pleasure seeking; the other, the necessity of more critical supervision of the water supplies of pleasure resorts. This should cover not only the water used for drinking or in the preparation of beverages, but also that used in making ice cream and water ices, and in washing drinking vessels and the like. The ice used in beverages is a further source of peril, since the ponds from which it is cut are—as the Newport inquiry demonstrated—too frequently foul, if not infected. The theory that water in freezing clears itself of noxious germs has been shown by careful trial to be untrue. Contaminated water yields impure ice, no matter how slowly the freezing is accomplished.

### Face Powders.

It is necessary to raise a warning cry against a most mischievous statement which has recently been circulated, and has already done harm, to the effect that "arsenic in small doses is good for the complexion." It is not difficult to imagine the risks women will incur to preserve or improve their "good looks." No more ingenious device for recommending a drug can be hit upon than that which the authors of this most baneful prescription of "arsenic for the complexion" have adopted. Suffice it to recall the fact that for many years past chemists and sanitarians have been laboring to discover means of eliminating the arsenical salts from the coloring matter of wall papers, and certain dyes once largely used for certain articles of clothing. It is most unfortunate that this hopelessly antagonistic recommendation of arsenic to improve the complexion should have found its way into print. Those who employ the drug as advised—and there are many either already using it or contemplating the rash act—will do so at their peril. So far as they are able, however, it will be the duty of medical men to warn the public against this pernicious practice, which is only too likely to be carried on secretly. It is not without reason that we speak thus pointedly, and urge practitioners to be on the *qui vive* in anomalous or obscure cases.—*Lancet.*

### Telephone Statistics.

It is stated that there are 12,325 subscribers in Boston, 4,060 in New York, 2,422 in Paris, 1,600 in London, 600 in Vienna, and 581 in Berlin. It is estimated that there are upward of 100,000 in the whole of the United States, certain small towns, with a population less than 1,000, having 30 to 50 subscribers. Consequently, in these latter places, there is a telephone to every 20 inhabitants; while in Zurich it is 1 to 200; in New York, 1 to 500; Brussels, 1 to 800; Paris, 1 to 1,000; Berlin, 1 to 2,000; London, 1 to 3,000; and St. Petersburg, 1 to 4,000.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(Illustrated articles are marked with an asterisk.)



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## No. 369,

**For the Week ending January 27, 1883.**

Price 10 cents For sale by all newsdealers



### SHELLAC FOR IMITATIONS OF HORN, IVORY, ETC.

The employment of shellac for the manufacture of various useful articles is now very extensive. Among the most curious applications of this gum are its combinations with woody and fibrous substances, under pressure, in moulds, whereby ornamental and other forms of articles may be cheaply produced. The composition fills the mould with great sharpness, and the most rich and elaborate designs cost no more for their production than plain or commonplace pieces, except in the first cost of the mould. It is of course more expensive to design and carve a mould that shall yield an article that is attractive to the eye by reason of its artistic qualities. But the improved goods thus wrought will sell more readily at higher prices than the ordinary styles.

It may be of interest if we present here some of the well known processes for producing shellac goods. These processes are now free to the public, the patents thereon having long ago expired. The Peck mixture, of 1854, by which the beautiful daguerreotype cases were made, also buttons, handles, etc., was composed of gum shellac and woody fibers, or other suitable fibrous material, dyed to the color that might be required, and ground with the shellac and between hot rollers, so as to be converted into a mass which, when heated, became plastic, so that it could be pressed into a mould or between dies and made to take the form that might be imparted to it by such dies.

John Smith's composition (of 1860) was for the manufacture of buttons and other dress fastenings, the object of the patentee being to attain greater tenacity density, lightness, and delicacy of tint in coloring. He states that he takes one pound of shellac, dissolves it by heat on a flat iron slab, and then mixes with it an equal quantity, by bulk, of ebony dust, or other wood dust; that he then introduces coloring matter and amalgamates the ingredients until the mass appears thoroughly homogeneous in its nature throughout. These components having been well mixed upon a slab or stone while the lac is in a plastic state and under heat, the composition is then to be placed in sufficient quantities in dies of any description prepared and designed for the form of the article to be produced. He suggests that in cases in which it may be desirable that the composition should possess greater density of material, such density may be obtained by the addition of mineral substances, the proportions of which must be governed by the requirements of the case, and when greater tenacity may be desired, that quality may also be obtained by the admixture of a due proportion of vegetable fiber other than wood dust, as, for instance, the shearings of cottons, velveteens, or hemp, flax, or other such like materials.

In 1857 Charles Westendarp, Jr., succeeded in manufacturing a material which was intended to imitate ivory, bone, horn, coral, or other similar substances, natural or artificial; he said it might be used in preference to ivory on account of cheapness and adaptability for billiard balls, knobs, finger plates, piano forte keys, rulers, paper knives, etc. He states that he takes any certain quantity of small particles of ivory, bone, wood, glass, cotton, wool, or other similar articles, either in a coarse or fine powder or in shavings, according to the imitation intended, and combines them, or any of them, or all of them, or as many of them as he sees fit, according to the purpose required, with gums or other resinous materials—such as gum copal, gum shellac, resin, wax, or other glutinous or resinous materials—also using which of the said gums he sees fit for the purpose the materials are required for, either the whole of the said gums or part or any of them.

In 1870 W. M. Welling obtained an American patent for an imitation of horn. In manufacturing it he uses shellac and vegetable or animal fiber, mixed together by well known means—taking "about one part, by weight, of shellac to one-half part, by weight, of cotton, wool, or other animal or vegetable fiber." He finds that it is best to mix the ingredients together in a dry state, the fiber being in short pieces, or in the form of flock, and according to the fineness of the fiber and the extent to which they are ground together, so the materials formed from such a composition will be more or less mottled in appearance similar to horn, and various colors may be produced by the color previously given to the fibrous material. Different pigments may be mixed in the composition to give the desired color or to impart more or less weight as desired. The chief characteristic of the composition is its great strength. The U. S. Circuit Court of New Jersey, Judge Nixon presiding, has lately adjudged the Welling patent to be invalid, and therefore free to the public, on the ground that the subject matter of the patent was old and well known to the public, long prior to the alleged invention of Welling. The court holds that the specification of the alleged invention of Welling does not describe such an advance in the art as should exist to sustain a patent. The patentee selected certain well known materials and combined them in proportions that were within the range of the common knowledge of the art. Such a selection did not, in the absence of a new result, involve invention, and could not properly be made the subject of a patent.

AT the Massachusetts Institute of Technology an alternative course in physics has been established for the benefit of students wishing to enter upon any of the branches of electrical engineering, such as the practical application of electricity to land and submarine telegraphy, the telephone, electric lighting, and the electrical transmission of power. Prof. Charles R. Cross will have the charge of this new department.