Bleaching Ostrich Feathers.

1. Wash the feathers with Castile soap and rinse *them thoroughly with lukewarm water* in order to remove all the grease and soap which may stick to the flue.

2. Soak feathers in a bath composed of one gallon of ammonia, 20° Be., to every eight gallons of plain water, for about 8 to 10 hours.

3. Take feathers out of this bath, and squeeze out the excess of ammonia which is in the flue by passing feathers through a wringer.

4. Put feathers in a bath composed of 5 gallons peroxide of hydrogen, with addition of 12 to 16 ounces of ammonia, let it work slowly, stirring feathers from time to time for about 6 hours; after 6 hours' working, put feathers in one side of the bath and add 5 gallons peroxide of hydrogen and 3 to 4 ounces of ammonia. Stir the bath well so as to insure the mixture of the peroxide with the ammonia. Then let the bath work for 9 to 12 hours more, after that time add again 2 or 3 ounces of ammonia. The peroxide will work yet for 12 hours more until it gets exhausted, and you may ascertain the fact by the following process:

Take a small quantity of the bath in a tumbler and throw in a few crystals of permanganate of potash; should bubbles of gas appear, it is proof that the peroxide is working; yet if none appear, the peroxide is exhausted.

Then the feathers have to be rinsed 3 or 4 times in lukewarm water, and then to be put in a second bath of peroxide of hydrogen, which has to be prepared as follows:

To 2½ gallons peroxide of hydrogen add 2½ or 3 gallons plain water and 8 ounces of ammonia, and put in the feathers. Let the bath work so for 10 hours, and after add again 2 ounces of ammonia as before, and it will then work 12 hours more until it is exhausted.

It is claimed that every one who will follow carefully the above directions will succeed to make white the darkest gray feathers, say 10 pounds of feathers by using about 7 to 7½ gallons of peroxide.

After the feathers have been taken out of the peroxide bath they must be rinsed thoroughly with lukewarm water 2 or 3 times, and after soaking them again in a soap solution for 6 to 8 hours, rinse them in lukewarm water, in order to remove all soap and dirt remaining in the flue.

ARTIFICIAL EAR DRUM.

The object of the invention herewith illustrated is to provide an artificial ear drum to be used by deaf persons. It is constructed of a magnetized steel rod, provided with a gold or silver covering, carrying a soft rubber disk on each end; the disks are held in place by gold washers, and are formed with ventilating apertures and notches. The magnetized steel rod, *b*, is surrounded by a closely fitting gold or silver tube, and at one end is the head or button, *a*, against which rests a rubber washer. Between this washer and a gold one the disk, *e*, is held. On the opposite end of the rod a thin soft rubber disk, *d*, is held by two gold washers, *c*. That end of the device carrying the soft rubber disk, *e*, is inserted in the auditory channel (Fig. 1) of the ear until the head, *a*, adjoins the delicate organs of the ear. The magnetized rod receives the impulses of the air wave, and carries them along and discharges them to the nerve of the ear with slight magnetic force, causing the organs to assume increased action. The disks hold the device in position, and protect the organs from coming in contact with the gold parts. The front washers, *c*, or disk receive the sound waves, and convey them to the rod. The outer disk is held on the outside part of the ear, just out of sight but within reach of the fingers, to permit inserting and withdrawing the instrument.

This invention has been patented by Mr. John H. Nicholson, of 93 Clinton Place, New York City.

NICHOLSON'S ARTIFICIAL EAR DRUM.

TCHEBICHEF'S WALKING MACHINE.

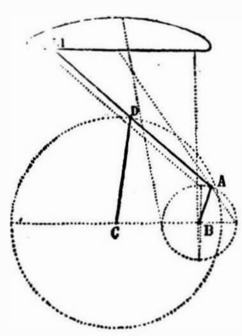

FIG. 1.

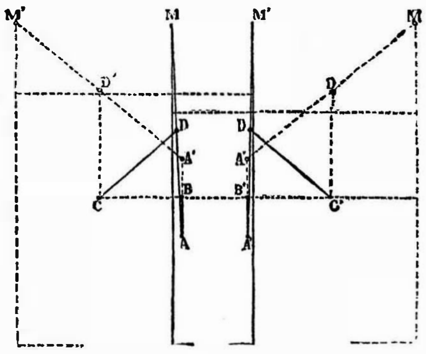

FIG. 2.

The idea of a walking machine is not entirely new, since as many as forty patents have been taken out in France for such a device, which is one that may be put to profitable use. In the season of snow and hoar frost, locomotives run with difficulty on the rails, and the idea has occurred that it would be well to add to them a temporary mechanism after the manner of feet as a substitute for wheels. Thus, we find in the galleries of the Conservatoire des Arts et Metiers three samples of locomotives with feet, devised by Mr. F. Hermann. One of these, with a single motive cylinder, is a small model that may be made to move forward by pressing a rubber bulb; another is provided with four cylinders, and the third is arranged for curves of short radius. It will be understood that this kind of a locomotive may be very usefully employed under other circumstances.

The principal mechanism of Hermann's walking machines consists either of eccentrics or of jointed parallelograms. The object of this article, however, is to make known a mechanism that has just been devised by Mr. Tchebichef. We ought to say that it is a question here principally of a theoretical solution. It is for professionals to study the results of the experiments from the data given by the illustrious professor of the University of St. Petersburg. What we usually call a jointed parallelogram in mechanics is a quadrilateral, or figure formed of four sides of invariable length, one of which remains fixed. The extremities of this latter (which is the base) are the centers of revolution of the two adjacent sides, and the side opposite the base is balanced in a more or less complicated manner, according to the respective sizes of the quadrilateral's sides. Watt's parallelogram is a well known example of such a mechanism. It is often applied in steam engines for directing the rod of a piston which must effect as rectilinear a motion as possible. Mr. Tchebichef long ago demonstrated that with the jointed parallelogram it was impossible to obtain a motion that was absolutely mathematically rectilinear. It is to Mr. Peaucellier that we owe the first accurate solution of the problem of constructing a straight line; but this, although published in 1864, has remained unnoticed.

In 1870, a student in the University of St. Petersburg, a Mr. Lipkine, presented to Mr. Tchebichef a jointed apparatus that permitted of tracing a straight line mathematically. But this in nowise affected the conclusions of Tchebichef, since the jointed apparatus was not a parallelogram, but contained seven rods or sides instead of three. The student received the encouragement of his professor, his university, and his government for this admirable discovery, which was but the Peaucellier apparatus revived. As for General Peaucellier, he was rewarded later on, the French Academy having given him a fine prize.

In order to draw a straight line, a ruler is made use of; but this in the first place must be verified. While we are purchasing it of the dealer, we place our eye at

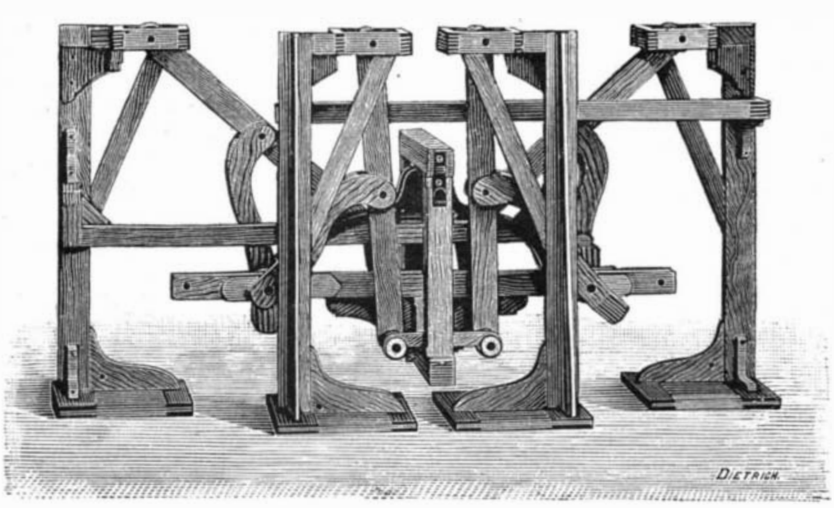

Fig. 3.—POSITION OF REST.

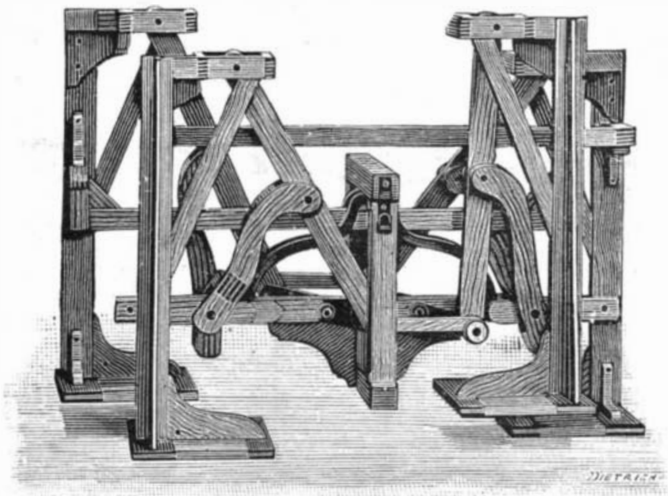

Fig. 4.—THE RIGHT FORE FOOT AND THE LEFT HIND FOOT RISING IN ORDER TO ADVANCE TO THE RIGHT.

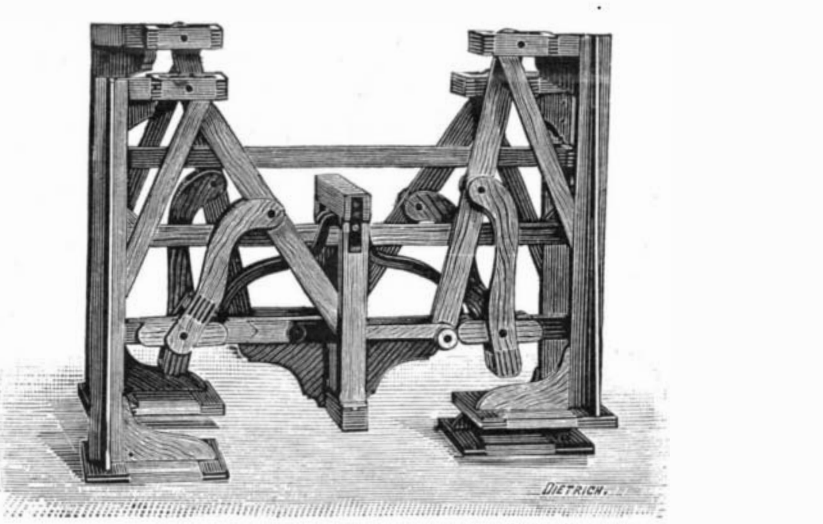

Fig. 5.—A FURTHER ADVANCE.

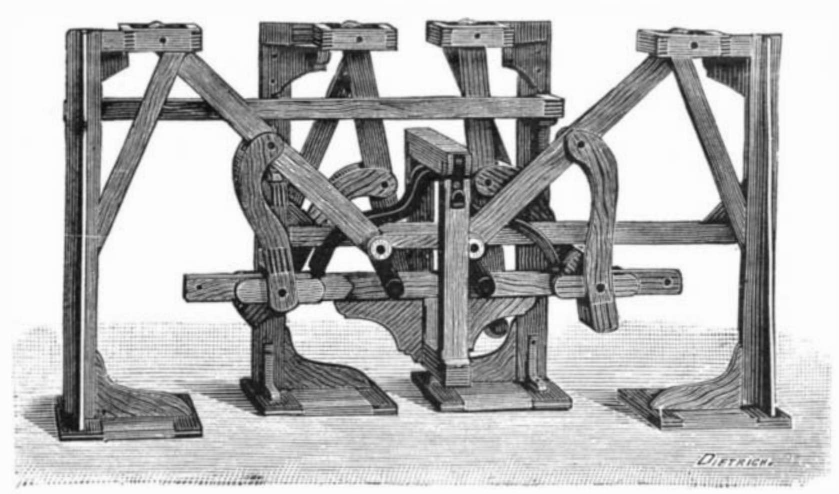

Fig. 6.—SECOND POSITION OF REST.

one extremity of it, in order to see whether it is true. We further verify it in a surer manner by drawing a line at one side, and turning it over upon the other surface in order to see whether the second line coincides with the first. For the more than forty centuries that geometry has been studied, no one has perceived that we are ignorant of the method of drawing a straight line. Meanwhile the professor of geometry has been teaching only exact constructions! Even at the present day, although the Peaucellier apparatus and its congeners have replaced the Watt parallelogram, our elementary works are silent in regard to this discovery—this mechanism—which is explained with the square of the hypothenuse by a clear demonstration given by Colonel Mannheim, professor at the Polytechnic School.

But to return to our subject. We must not abuse theoretical solutions beyond measure, since they are data and guides for the professional man; but it is necessary to take account of the operation of the machine, of the friction, and of the performance. By means of a new kind of calculation, due to Mr. Tchebichef and founded upon arithmetical methods whose germ is found in the work of Euler, the learned professor set out to find dimensions such that one of the points of the movable side (opposite the fixed side) should describe a straight line as accurately as possible.

Fig. 1 represents the new parallelogram. The points B and C, which are fixed, are the centers of rotation. The opposite side A D is of constant length, and its extremities describe the two circles shown by dotted lines. If the line A D be prolonged an equal length, that is to say, if D M = A M, the point M will describe a curve, which is here not the *curve of long inflexion* of Watt, but one of which a certain part very nearly approaches a straight line—as nearly as possible with the conditions imposed—provided the dimensions of the parallelogram be as follows, in taking the side A B as a unit of length:

$$CD = AD = AM = \frac{3+\sqrt{7}}{2}, \text{ and } BC = \frac{4+\sqrt{7}}{3}$$

In this case, as may be easily proved by constructing such a parallelogram with four wooden rulers, the point M will describe a trajectory that is sensibly rectilinear, when the apex A is describing its semicircle to the right. After passing over this part of the trajectory, the point M will rise, and effect its return in gradually mounting as far as to the center of its travel, and in descending according to the same law after getting beyond the said center.

Let us now suppose (Fig. 2) that such systems are applied to two cranks soldered to an axle, and directly opposite. In this case we obtain a mechanism in which the revolution of the axle is converted into a motion of two points, which, in turn, run over the same straight line, and one of which rises successively above such line after having passed over it when the other was descending upon it in order to do the same. Let us place at the side, as a balance, an apparatus that is symmetrical with respect to a central point (the navel, so to speak) of the machine, and let us connect it with the first by a fixed bar; and let us support the extremities of the four levers M by four feet, like those of an elephant. Now, if we pull towards the right with a cord, all this apparatus will begin to move, and will walk like a quadruped (Figs. 3 to 6).

If we cover this wooden apparatus with cardboard to imitate skin, and give it the form of an elephant, with tusks of ivory, we shall have, according to the dimensions, a plaything for the child or an object for use in spectacular dramas in theaters. If a clock or spring be placed inside of it, the apparatus may be made to walk automatically. With the leg of a giraffe, it might be utilized as a velocipede in the department of Landes; but the addition of so long legs would very naturally increase the cost. It would be more interesting to experiment with the apparatus on locomotives.

In conclusion, we may say that Mr. Tchebichef's apparatus gives the solution of a very important problem in mechanics. In considering only the rectilinear parts of the trajectory of the points M, we find that they produce with sufficient approximation the same effect as the equal arcs of the circumference of a revolving wheel, when the radius of the latter is very great. In other words, this mechanism performs the role of an infinitely large wheel.—*Science et Nature.*

The Gas Engine.

A gas engine, rated at 2 horse power, developing about 1·5 horse power, and running ten hours per day, will cost 10 cents per hour, including all items of expense of operation. These are: For interest, 5 per cent on first cost, credited to ten hours of actual running per day, 0·80 cent per hour; for repairs and depreciation, 5 per cent on first cost, similarly credited, 0·80 cent per hour; for oil, 0·40 cent per hour, and for gas 8 cents per hour. The current expense of operating such a gas engine will be about 6·7 cents per horse power per hour. Its first cost approximates $475. No charge for attendance need be allowed. Additional advantages are the cleanliness of the machines, the ease with which they are started, and the absence of risk from fire.

THE NEW YORK TRADE SCHOOLS.

Sir William Siemens, in describing the apprenticeship system which controlled the principal trades in German cities half a century ago, says that "every journeyman, in commencing, had to be bound as an apprentice for three or four years—the master engaging to teach him the trade; before the young man could leave his apprenticeship, he had to pass an examination as journeyman; he had then to travel four years, working in different places, and remaining not longer than four months under one master, but could not settle as a master in his trade until he had produced a master piece of work which would pass examination by the guild masters' committee: he was then pronounced a master, and allowed to marry."

The guild system in Germany was abolished in 1869, but the apprenticeship system, under which boys are regularly indentured to trades, still furnishes most of the skilled artisans yearly added to the ranks of industrial workers throughout the Continent of Europe and in the British Isles. This European apprenticeship system is also largely supplying the demand for skilled labor in our own workshops, for our trades unions do not encourage the employment of apprentices, although they are ever ready to admit to membership, as quick as he reaches our shores, the carpenter, bricklayer, plasterer, or stonecutter who has served his time under a foreign master. The old system of apprenticeship has, in fact, almost ceased to exist in America, and there is nothing yet to take its place. The demand for skilled workmen is only to be supplied by these foreign accessions, by the fast thinning out ranks of those who learned their trades in a former generation, and by those who have picked up only a "smattering" of a trade.

To partially take the place of the old apprenticeship system, trade schools have been recommended, where instruction and actual practice in the handling of tools could be obtained, and an institution of this kind forms the subject of our first page illustrations this week. It is situated on First Avenue, between Sixty-seventh and Sixty-eighth Streets, occupying a plat of land 200 by 114 feet, the buildings being of brick, one story high, with a large percentage of glass surface. Three of the workshops are 30 by 72 feet each, and 18 feet high, one being used for a plumbing shop, one for the plasterers, and another divided into three parts for the fresco painters, pattern makers, and wood carvers. In the rear is a building 40 by 120 feet used for the bricklayers and stonecutters, and adjoining this is a structure 30 by 50 feet used as a carpenters' shop. The bricklaying room has an earthen floor, the plastering room floor is concreted, with a Portland cement top, and the other shops have wooden floors, every part being thoroughly lighted at night with gas.

These schools were first opened in November, 1881, by Colonel R. T. Auchmuty, an architect, only plumbing and fresco painting being taught the first season, to a total of 33 students. In the season of 1882-83, bricklaying, and pattern making for moulders and machinists, were added, and the pupils numbered 88. In the season of 1883-84, instruction was also given in wood carving, stone cutting, and plastering, the classes then numbering over 200, and during the present season (1884-85) carpentering has been added.

Although it is a part of the scheme on which these schools are organized to give day instruction in the several trades, there has not yet been sufficient demand for such lessons to justify the organization of day classes, and the instruction now given is confined to a course of three evenings a week—Monday, Wednesday, and Friday—for the five months from October to April. The institution is not intended to be either a charitable or a money-making one, a charge being made for instruction based on what it is expected will ultimately cover the outlay, but the receipts for tuition have not thus far met the cost of running expenses. The charges for the different courses, five months each, are as follows: Bricklaying, $17; plastering, $15; plumbing, $12; and all the other branches $10 each, these figures covering also the use of tools and materials.

In the school for plastering, shown in one of our views, one side of the room is partitioned off to form a number of alcoves, nearly all of which are now plastered and hard finished by this season's class. The course includes scratch coating, brown coating, and hard finishing, and running cornices and mouldings, and the work now on the walls is such as would do no discredit to many of our city journeymen.

In the carpenter shop, door and window framing, and general carpenters' and joiners' work, is being carried on by a class of young men, the most of whom handle their tools so deftly that one has to look for some minutes to determine who are the instructors and who the pupils. There are some samples of work here ready for exhibition at the next fair of the American Institute. The manual of "How to use Wood-working Tools," prepared under the direction of Mr. George L. Cheney, President of the Industrial School Association of Boston, Mass., is used in this class with marked success.

In the department of wood carving, and in that devoted to pattern making, the work is all done from drawings. Some very elaborate work in wood carving is now to be seen well advanced on the young workmen's benches, and patterns which present considerable difficulty to experienced pattern makers are shown as part of the work of this season's class. The patterns made are always tested in actual practice, to explain the management and setting of the cores, a four-blade propeller, two feet in diameter, being cast last week from a pattern made in this shop.

The instruction in bricklaying covers the laying of eight, twelve, and sixteen inch walls, the building of piers, arches, flues, fire-places, setting sills and lintels, etc. In this, as in all the other departments, the instructors are practical workmen of exceptional skill, who go around among the young beginners, correcting faults and explaining how the work should be done, occasionally taking the trowel themselves to illustrate their comments. The work done evenings is torn down by laborers in the day time, the mortar made and the brick cleaned for relaying, so that there will be no unnecessary waste of material and no frittering away of time by the evening classes. Besides this manual instruction, the properties of mortar and cement, the principles governing the stability of walls and the thrust of arches, as well as the construction of flues, are explained.

Stone cutting is taught on plain and ornamental work in brown stone, and the specimens of work already done by members of this season's class, who never before had a stone cutter's tool in their hands, would do credit to many an old hand.

In the fresco painting department, a view of which takes up the center of our first page, are shown some fine oil and water color designs of the students, for ceilings of rooms, which are to be exhibited at the next Fair of the American Institute.

The instruction in plumbing is both practical and scientific. The practical part includes dressing pipe, making lead joints, wipe joints, sand bends, lead safes, etc.; and the scientific instruction covers lectures and verbal directions upon the proper arrangement of service and water pipes, and upon drainage and ventilation. Three teachers are employed in this room, which is fitted up with all the appliances of a first-class shop. Work done in this class has received two medals at the American Institute Fair, and at the request of the U. S. Commissioner of Education, an exhibit of work done here has been forwarded for display at New Orleans.

Col. Auchmuty states that although none but first-class mechanics have, from the first, been employed as instructors, he has found it of great importance to have a clearly defined course of instruction laid out for each class, showing the ground that it is most necessary to cover during each season, otherwise the sufficient consideration of many essential points would be too much a matter of accident. His ideas in this respect have been admirably worked out in a series of seven question papers for the guidance of the class in plumbing. They cover, respectively, the following subjects: "Soil pipes," "Trapping and ventilation of soil pipes," "Cold water supply pipes," "Boilers," "Tanks," "Fixtures," and "Trapping or Fixtures." Accompanying the first one of these papers is a direction which it would be better for society if every plumber would scrupulously heed, viz.: "Do not use inferior material to secure a job, or even to oblige the owner; a leak in a soil pipe may cause death, or the ruin of a life through sickness."

At the lectures the students are given the printed questions on the subject to be discussed, and under each question is a blank space in which the student is expected to write his answer, as the matter is being explained by the lecturer. The following are among the questions on soil pipes, which is the subject of the first lecture in the plumbing course:

Of what materials are the different kinds of soil pipe made?

Why is cast iron used exclusively in New York city?

Why is cast iron considered the best?

What material is used for soil pipes in England?

Why is lead objected to in this country?

What should be the thickness of 2, 3, and 4 inch cast iron pipe?

Give the weight per foot of 2, 3, 4, 5, and 6 inch cast iron pipe, in 5 foot lengths, with hub and spigot?

Is there any way of testing the uniform thickness of soil pipe?

What is meant by sand holes and flaws?

Describe how cast iron pipes should be calked at the joints.

What is the least depth the ring of lead formed by calking should have?

What is a rust joint?

Is there any objection to its use?

Why are putty, mortar, and cement joints objectionable?

What is the usual size of a soil pipe in New York?

Is it usual to make the horizontal soil pipe in the cellar larger than the vertical soil pipes?