Push or Being Pushed.

As we have said repeatedly, there is nothing in the world like energy. In order to succeed, it is required that the aim in view be pursued with unwavering determination. It is the persistent effort to advance which we commonly designate by the term *push*. A business man without push might as well shut up shop and save his money, for sooner or later he will be swamped by the irresistible onward rush of progress.

Quite different, however, from this faculty of push, exerted in a particular direction for individual advancement, is the being pushed by others. He who is awake to his own interests, who is possessed of push, needs no pushing from others, and, on the other hand, no amount of pushing will benefit the weak and the laggard. Constant spurring will only induce stubbornness and sulkiness, and we all know how the mule will act if urged against his will.

We believe that he who does not feel that diligence and earnestness and a constant striving for improvement (be it in his own business or in that of another, if he is not his own master) will pay best in the end, cannot be brought to it by compulsion.

Compulsion, force, driving, moreover, is unworthy of the spirit of our age. Let him who will not move his arms and legs to keep himself afloat go to the bottom, the sooner the better. It is a deed of charity to such a being and in the best interests of others.

We have no patience with men who are like *dumb, driven* cattle, and who work solely because they must have their earnings in order to fill the stomach, whose chief prayer is

"*Come day, go day,*
God send pay day."

They are not *men*, but *machines*, and in the case of machines we expect a certain amount of work from the expenditure of a certain amount of fuel, and we take steps to get it. But a *man*, be he employer or employe, will do his best; what he may lack to-day, he will make up to-morrow. He will have *push*, but will object to being *pushed*.

Push is absolutely a requisite in this world; *pushing* is unnecessary, and may result in the very opposite of that which it was intended to accomplish.—*Lithographer and Printer.*

Petrifaction of Organic Bodies.

At a recent meeting of the Italian Medical Society at Perouse, Prof. Angelo Corni, of Rome, made known the processes of preserving anatomical specimens and of petrifying corpses, the secret of which he has kept to himself for more than fifty years. These processes are two in number, and are as follows:

1. *Process of Making Organic Bodies as Hard as Stone.*—The substances employed are boiled linseed oil and dentochloride of mercury, which are to be stirred up in a mortar until a soft paste is formed. In this oily paste is immersed the corpse or any anatomical specimen that it is desired to render unalterable by giving it the consistency of stone. The immersion is prolonged for several months, according to the bulk of the body which is to absorb the above-named substances.

When the induration seems sufficient, the objects are washed with turpentine, and exposed to the air until they become thoroughly dry. Then they are polished with an agate, and burnished as is done in the silvering and gilding of wood, but without the use of water or soap. These operations necessarily require considerable practice combined with a certain dexterity.

If the objects to be preserved contain cavities, the latter must be previously filled with a mixture of equal parts of finely powdered cement and dentochloride of mercury. Finally, if it be desired to preserve the body with its eyes open, artificial eyes must be substituted for the natural ones before immersion in the paste.

2. *Process of Preserving Bodies in a Soft and Flexible State.*—For preserving organic bodies in a soft and flexible state for several months, and permitting them to be dissected without any danger to the preparator or the anatomist, they are placed in some sort of a receptacle or other and covered with a layer of the thickest and purest honey that can be found in the market. If it be desired to preserve an entire cadaver by this simple and cheap process, we begin by carefully filling the encephalic, thoracic, and abdominal cavities with a sufficient quantity of tannin. This process, when applied with care, gives remarkable results, and a corpse thus prepared appears for several months to be asleep. One might say that the alcoholic fermentation that occurs under these circumstances serves it as food while preserving its softness and flexibility. When the fermentation ceases, a hardening of the parts occurs and renders the artistic forms of the body still more marked. —*Revue Scientifique.*

A CURIOUS ICE FORMATION.

The accompanying illustration represents a photograph of an air bubble found near the center of a cake of ice by one of our correspondents at Eau Claire, Wis. The beautiful shapes which ice often assumes in such formations are sometimes quite notable, but it is very rare, we think, to find a specimen of nature's work in this direction where the idea of some design seems to be so well suggested as here. The whole may indeed

CURIOUS FORMATION IN ICE CAUSED BY AN AIR BUBBLE.

be taken as a shadowy representation of a beautiful flower stand, most delicately carved in crystal, suspended above which, and partly seeming to spring from it, are formations which give no bad suggestion of flowers and vines, while tapestry and bric-a-brac of rare excellence can be evoked, with but little effort of the imagination, from various other details of the representation.

EXTENSIVE soda works have been begun at Owens Lake, in California. A portable engine is employed, and as soon as a vat is filled the engine is moved to another, and the water is left to evaporate from the one that had been filled. This process will be repeated at all the vats until the soda sediment in the water accumulates in the pit until it reaches the surface. It will take about a year to get a crop of soda by this method, which will bring $35 per ton. They expect to gather fifty tons of soda to the acre annually. The number of vats will be increased till they hold an area of 50,000 acres of soda, the income from which is expected to be nearly $2,000,000 a year.

THE CALIFORNIA ROADRUNNER (*Geococcyx Californianus*).

JOHN R. CORYELL.

A very singular and yet a very little known bird is the roadrunner chaparral cock, or, as it is known in Mexico and the Spanish sections of the United States, the paisano.

It belongs to the cuckoo family, but has none of the bad habits by which the European cuckoo is best known. It is a shy bird, but is not by any means an unfamiliar object in the southwestern portions of the United States and in Mexico. Sometimes it wanders up into middle California, but not often, seeming to prefer the more deserted, hotter, and sandier parts of southern California, and from there stretching its habitat as far east as middle Texas.

It is not by any means a brilliantly colored bird, although some of its hues are very beautiful. The prevailing color of the roadrunner is olive green, which is marked with brown and white. The top of the head is black blue, and is furnished with an erectile crest. The eyes are surrounded by a line of bare skin.

It is not a large bird, being seldom twenty-four inches long, with a tail taking more than half of that length. The tail, indeed, is the most striking feature of the bird, being not only so very long, but seemingly endowed with the gift of perpetual motion, since it is never still, but bobs up and down, and sidewise, too, into every possible angle, and almost incessantly.

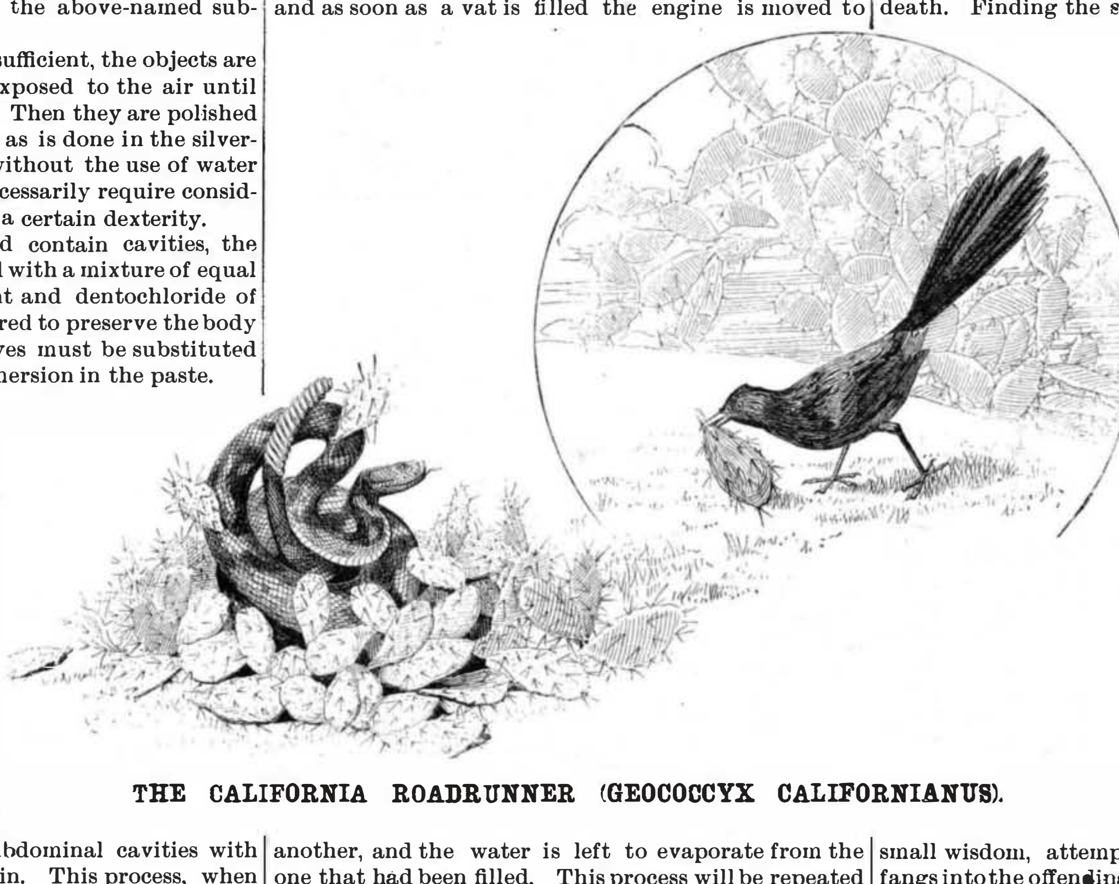
But while its tail is most striking, its legs are most remarkable, being not only long and stout, but wonderfully muscular. How muscular nobody would be able to imagine who had not put them to the test.

A traveler in Mexico tells of going out with his ranchero host to hunt hares with a brace of very fine hounds. Going over a long stretch of sandy plain, relieved only by pillars and clusters of cactus, the Mexican called the attention of his guest to an alert, comical-looking bird, some distance from them.

With the remark that the gentleman should see some rare coursing, the Mexican slipped the leashes of the straining hounds, which sprang off as if used to the sport, and darted after the bird. For a moment it seemed to the stranger a very poor use to put the dogs to, but he was not long in changing his mind.

Instead of taking wing, the bird tilted its long tail straight up into the air in a saucily defiant way, and started off on a run in a direct line ahead. It seemed an incredible thing that the slender dogs, with their space devouring bounds, should not at once overtake the little bird; but so it was. The legs of the paisano moved with marvelous rapidity, and enabled it to keep the hounds at their distance for a very long time, being finally overtaken only after one of the gamest races ever witnessed by the visiting sportsman.

The roadrunner, however, serves a better purpose in life than being run down by hounds. Cassin mentions a most singular circumstance among the peculiarities of the bird. It seems to have a mortal hatred of rattlesnakes, and no sooner sees one of those reptiles than it sets about in what, to the snake, might well seem a most diabolical way of compassing its death. Finding the snake asleep, it at once seeks out the spiniest of the small cacti, the prickly pear, and, with infinite pains and quietness, carries the leaves, which it breaks off, and puts them in a circle around the slumbering snake. When it has made a sufficient wall about the object of all this care, it rouses its victim with a sudden peck of its sharp beak, and then quickly retires to let the snake work out its own destruction, a thing it eventually does in a way that ought to gratify the roadrunner if it have any sense of humor. Any one watching it would say it was expressing the liveliest emotion with its constantly and grotesquely moving tail.



THE CALIFORNIA ROADRUNNER (GEOCOCCYX CALIFORNIANUS).

The first impulse and act of the assaulted snake is to coil for a dart; its next to move away. It quickly realizes that it is hemmed in, in a circle, and finally makes a rash attempt to glide over the obstruction. The myriad of tiny needles prick it and drive it back. The angry snake, with small wisdom, attempts to retaliate by fastening its fangs into the offending cactus. The spines fill its mouth.

Angrier still, it again and again assaults the prickly wall, until, quite beside itself with rage, it seems to lose its wits completely, and, writhing and twisting horribly, buries its envenomed fangs into its own body, dying finally from its self-inflicted wounds. After the catastrophe, the roadrunner indulges in a few gratified flirts of its long tail and goes off, perchance to find its reward in being run down by hounds set on by men.

Steam Engineering.

In the September number of *Wood and Iron* were propounded to the engineers of the Northwest fifty questions on steam engineering. Replies were received from a large number of correspondents. The winner of the prize gave the following replies to the queries propounded, which, whether beyond criticism or not, contain many points of interest and instruction:

1. Steam is an elastic fluid, generated by the action of heat upon water.

2. Steam, when separated from the water from which it is generated, follows the law of all other gases, expanding 1·459 of its volume for each additional degree of heat while the pressure remains the same; and while the temperature remains the same, the pressure is in inverse proportion to the volume.

3. The temperature of steam is equal to that of the water from which it is formed, and its elastic force is equal to the pressure under which it is formed.

4. Total heat of steam at 212° is 1,178°.

5. Latent heat of steam is found by subtracting its sensible heat from 1,202°.

6. Heat in steam becomes latent heat whenever there is a change in the temperature; then the heat produces the change, but does not raise the temperature.

7. To find the amount of water to condense a given quantity of steam: Subtract temperature of hot well from total heat of steam. Divide difference by difference between temperature of injection water and that of hot well. Divide first by second. Result is the number of times the injection water must exceed its weight in steam.

8. Low pressure is pressure not exceeding one atmosphere.

9. To find average pressure in a cylinder, divide length of stroke in feet by distance that steam follows before being cut off, which gives the ratio of expansion. Multiply pressure by corresponding number in some reliable expansion table. Result is average. This is the most expeditious method, provided the table is reliable.

10. Superheated steam is steam which has a greater temperature than that due to its pressure.

11. Formulæ for estimating power of engines: Non-condensing engine—Power (average pressure—counter pressure) × area of piston in inches × piston speed in feet per minute. Condensing—Power = (average pressure × vacuum) × piston area in square inches × piston speed.

12. The "dead center" is the point in the stroke where the crank and piston rod are in the same right line. To find dead center, turn engine in the direction it runs until crosshead is within a short distance of its limit of motion. Mark guide at end of cross head shoe. Mark some revolving circular part of engine, as disk crank or flywheel, and place one point of a fixed tram in this mark and the other on some fixed object in line. Now turn engine past the center in the direction she runs until end of crosshead shoe passes mark on guide. Turn back till shoe reaches mark. Holding tram still on the fixed object, place other point on selected revolving part and mark as before. Bisect distance between marks on revolving part, and turn engine till point of tram rests on central mark, and the engine is on "dead center."

13. To find diameter of cylinder for a given power: Multiply horse power of engine by 33,000. Divide product by the product of cylinder area × steam pressure × piston speed in feet per minute.

14. Rule for finding contents in cubic feet of a cylinder of any given diameter: Multiply the square of diameter in inches by 0·7854, and this product by length of stroke in inches. Divide last product by 1,728, and result is contents of cylinder in cubic feet.

15. The diameter of the valve rod should be from 1-10 to 1-12 of the cylinder diameter, or from 1-350 to 1-300 of unbalanced area of slide valve. This last is considering the valve as a piston. Steel rods, of course, will bear being made smaller.

16. The function of the steam engine crank is to change reciprocating rectilinear motion of the piston rod to the constant rotary motion of the crank shaft.

17. The steam engine governor controls the speed of the engine within certain limits, by regulating the supply of steam to the cylinder, either by means of a throttle valve in the steam pipe, as in the case of all throttling engines, delivering a uniform supply of steam at the pressure necessary for the speed, or as all automatic cut-off governors, delivering steam at boiler pressure at the beginning of a stroke for a sufficient distance to maintain the speed, then cutting it entirely off.

18. The most common causes of heating in the journals of steam engines are: Insufficient lubrication, tightness of journals, faults in the alignment, and the action of foreign substances, such as dust.

19. To ascertain lap and lead of a slide valve without opening chest, we should disconnect drip pipes, so that steam would appear at them as soon as it entered the cylinder; then opening the throttle a very little, watch drip pipes while the engine is being slowly turned by hand in the direction it runs. When steam appears in front of the piston near the end of the stroke, mark valve rod at edge of stuffing box or some other convenient point. Then turn engine on center, mark rod again and measure distance again, which is the lead. The lap is found by marking rod when steam ceases flowing from one end, and again when it commences flowing from the other, measuring between marks, as for lead. Proceed the same for other end of valve.

20. The amount of lubrication required for any engine is influenced by the quality of lubricant, speed of engine, amount of work in proportion to size of engine, tightness of journals, correctness of alignments, finish of journals, truth of valve face, perfection of cylinder bore, and fit of piston.

21. The functions of the steam engine indicator are to show by its diagrams the pressure of steam at every part of the stroke, the amount of lap and lead of the valve, point of cut-off, average pressure, counter pressure, point of exhaust opening, point of exhaust closure, and amount of cushion, enabling the happy possessor to calculate the power of his engine, amount of work it is doing at the time diagrams are taken, frictional load, and theoretical rate of water consumption.

22. A close approximation to the theoretical diagram, high initial pressure, early cut-off, and low terminal pressure indicate good construction and performance.

23. Indicator diagrams show the pressure in the cylinder by the relation of their lines to the atmospheric line, which is a line drawn when the indicator piston is in equilibrium, having the pressure of the atmosphere on both of its sides.

24. The diagram shows by the changes of direction of its lines the exact time, in relation to the stroke of the piston, that each event of the valve stroke, admission, cut-off, etc., occurs.

25. "Compression" is confinement of steam by closing the exhaust opening before the return stroke is ended, thus causing a rise in pressure and assisting to stop the motion of the reciprocating parts. "Cushion" is steam used to stop the motion of reciprocating parts, and may be steam entrapped by exhaust closure or admitted from boiler. "Clearance" is the name given to space between piston follower and face of valve.

26. The term "energy" originally meant capability to produce motion, but has become nearly obsolete in a mechanical sense, being used chiefly in connection with men and animals.

27. A pound of pure carbon is capable of liberating, if perfectly burned, about 14,500 heat units, which if used in one hour = 5·65 × horse power.

28. The usual friction of a large engine is about five per cent of its power.

29. Part of the wasted heat might be saved by placing a heater in the chimney, and feeding injection water, having a good condenser, as a matter of course.

30. The value of any kind of fuel is determined by the number of heat units produced by its combustion.

31. A horse power is a power sufficient to raise 33,000 pounds one foot in one minute.

32. To determine the power of an engine, multiply the area of the piston in square inches by the average pressure of steam in cylinder, and this product by piston's speed in feet per minute.

33. Law of movable pulleys: The power is doubled by each movable pulley.

34. A 3 inch pipe is nine times the area of a 1 inch pipe. For $3^2 = 9$, $1^2 = 1$, $1 \times 0·7854 = 0·7854$, $9 \times 0·7854 \div 0·7854 = 9$; 3 inch pipe has nine times area of 1 inch pipe.

35. If a non-condensing engine, having an initial pressure of fifty pounds above atmosphere, cuts off at half stroke, the mean pressure in the cylinder will be 42·35 pounds per square inch.

36. Automatic engines use twenty-eight to thirty pounds of water per horse power per hour, and throttling engines from forty to sixty pounds per horse power per hour.

37. Consider one inch below water level the best place to introduce feed pipe to boiler.

38. Steam gauge pipe should be taken from the highest part of boiler.

39. About 156 cubic feet of air must pass through the grate to burn one pound of coal.

40. A ready method of testing a steam gauge is to raise the pressure until the gauge indicates point at which safety valve should commence blowing. If it commences blowing at the proper pressure as indicated by gauge, it is fair to conclude that both are right. If they do not show the same pressure, one is wrong; most probably the gauge.

41. Good anthracite coal makes 3·89 per cent of ashes. Hence, 2,000 pounds would produce about 80 pounds of ashes.

42. It is a disputed point whether coal is improved by wetting or not; but as most furnaces supply from 1¼ to 1⅜ as much air as is necessary for the perfect combustion of coal, it is safer to conclude that oxygen resulting from the separation of water (if possible) would be of no benefit.

43. The best time to remove clinkers from furnace walls is while they are hot, as the clinkers are then soft and will come off without injuring the walls.

44. If two pulleys on opposite shafts are twenty feet from center to center, the length of a belt to fit around them is 46¼ feet. Rule: Add to twice the distance between centers of shafts the product of half the sum of the diameters of the pulleys and 3⅛.

45. A unit of heat is the amount of heat required to raise a pound of water 1° Fah., from 39° to 40°.

46. The principle involved in the working of the injector is that steam occupies more space than its weight of water, so that there is less volume returned to the boiler than is taken from it, as the steam used in working the injector is condensed and enters in the form of water, occupying at sixty pounds above atmosphere but 1-353 of former volume.

47. I consider its latent heat, and the manner in which it varies, the most remarkable property of steam.

48. A cubic foot of fresh water weighs 62½ pounds at 60° Fah., and contains 7½ gallons nearly.

49. A perfectly aligned and firmly built engine, set on a solid foundation, having perfectly fitted yet easy moving piston, tight shutting, balanced, light running valves, high and dry steam, reliable automatic cut-off, cutting off early, good condenser, and run at moderately high speed, will effect the economical use of steam.

50. I would suggest the universal adoption of a key on each side of crank pin box to equalize clearance and lessen it.

The Atlantic and Pacific Ship Railway Company.

A bill for the incorporation of the Atlantic and Pacific Ship Railway Company was introduced by Mr. Vest in the Senate on December 15, 1885, and after being read twice has been referred to the Committee on Commerce. In addition to the act of incorporation, by which Captain Eads and his associates are empowered to build a ship railway across the Isthmus of Tehuantepec, the bill outlines the position of the United States in connection with the enterprise. The Government of Mexico having, in addition to land grants amounting to 2,700,000 acres, guaranteed that one-third of the annual net revenues of the company shall, for the period of fifteen years after the completion of the railway, amount to $1,250,000, the United States shall, it is proposed, guarantee that the remaining two-thirds of the annual net revenues shall amount to $2,500,000. Fifty per cent of the gross earnings are assumed to represent the net revenue. The guarantee is only to go into effect when a loaded vessel, weighing not less than 3,000 tons, has been safely transported from one ocean to another at an average speed of at least six miles an hour. The speed requirement does not apply to such distance as may be made by canal. Whenever moneys are advanced by the Government, in fulfilling this guarantee, it is to receive corresponding bonds, payable in fifteen years from the date of issue. In default of such payment, the company is to receive these bonds at ten per cent premium in payment of tolls on American vessels.

In consideration of the accommodation, the company binds itself to transport all Government vessels, property, mails, and officials, and to transmit all messages, for the annual sum of $500; to accept from American coasting vessels, for a period of thirty years, seventy-five per cent of the regular tolls charged other nations, except Mexico; and to transport no war vessels, troops, or supplies of any nation at war with the United States or Mexico. The Government is to be represented by two-ninths of the total directorship, and when the revenue of the company amounts to over ten per cent on its total indebtedness, may, in connection with the directors appointed by Mexico, establish a reduced tariff.

Such are the main provisions of the bill, and in expressing our own favorable attitude toward it we are inclined to believe that we are but voicing the sentiment of a very large majority. While the Government would make itself liable for a considerable sum of money, it is not probable that it would ever be called upon for more than an unimportant fraction of that amount. The benefits to be derived from the enterprise seem to us more than a compensation for any possible losses.

Heat and Pressure of Explosives.

If a charge of gunpowder be placed in the chamber of a gun, the gravimetric density of the charge being unity, and if it be completely exploded before the shot be allowed to move, the state of things immediately prior to the shot being permitted to move in the powder chamber, roughly speaking, is as follows: The products of explosion are divided into two classes of substances, about two-fifths, by weight, of the powder being in the form of permanent gases and three-fifths solid matter, the solid matter being perfectly liquid at the moment of explosion and in an extremely fine state of division. By the combustion is generated some 730 units of heat. The temperature of the explosion is about 2,200 deg. C., or about 4,000 deg. F., and the exploded powder exercises a pressure of about 6,500 atmospheres, or about 43 tons per square inch, or about 90,000 pounds per square inch, against the walls of the chamber and against the projectile.

The Barometer as a Guide to Health.

Dr. M. A. Veeder, of Lyons, N. Y., has been led by his observations to believe that the barometer may become an instrument of as great value in saving life as it is now in saving crops or ships. It is a familiar fact, he says, that many persons who are afflicted with rheumatism are able to foretell changes of the weather by means of the aches and pains that they experience. Persons who are subject to headache, also, are apt to suffer most when the mercury in the barometer is changing its level rapidly, as, for instance, before a thunder storm. The cause of these symptoms appears to be a difficulty in the adjustment of the volume and rate of the circulation of the blood to the varying atmospheric pressure upon the surface of the body. Ordinarily, the results are not serious, and but little attention is given to the subject. The question arises, however, as to whether there may not be a class of cases in which the movements of the mercury in the tube may become of great prognostic import. Dr. Veeder says that he has noted the occurrence of several deaths from apoplexy at times when rapid fluctuations of atmospheric pressure were indicated by the barometer; and he believes that at such times over-excitement, over-eating, improper clothing, and the like may induce consequences most disastrous to those who are predisposed to apoplexy, the weakened blood vessels being already subjected to unusual strain by reason of the unfavorable atmospheric conditions. Although the cases observed by the writer thus far are not numerous, yet he maintains that the probabilities with regard to the matter are such that it is the part of wisdom that those who are advanced in years, or subject to symptoms that indicate an apoplectic tendency, should be warned to exercise great moderation in all things, whenever the mercury is seen to be unusually active in its movements.—*Medical Record.*

Treatment of Diabetes.

Contrary to the general practice followed, Dr. Boucheron, in a note to the Academy of Sciences, advises diabetics to abstain from albuminoid food and alcohol, as well as from hydrocarbonized food. By this means, according to him, the sugar will disappear in three or four months. The boulimia and polydipsia are the first symptoms to give way, and strength will return with the general improvement.

SQUEAKY boots having proved a source of annoyance at pharmaceutical meetings, the *Chemist and Druggist* suggests their cure by the injection of powdered French chalk through a perforation in the inner sole, and adds that the free use of the same substance between the soles when boots are being made will effectually prevent any trouble of this nature.

PARENTY'S SMOKING MACHINE.

We reproduce herewith, from *La Nature*, an illustration of a novel apparatus, called by its inventor, Mr. Parenty, a "smoking machine." Tobacco manufacturers make their cigars out of quite a large number of different leaves, whose physical and chemical qualities have to be so combined as to yield an article that gives out an agreeable odor and burns well. Combustibility, then, is a physical quality that must be estimated for each variety of leaf. Such estimate is made by measuring the time during which a certain style of cigar, made solely from the tobacco to be tested, holds its fire without drawing on it a second time. In this comparative determination the intensity of the lighting is the element that has to be determined and regulated. To accomplish this is the object of the machine under consideration, which is so constructed as to imitate all the motions of a smoker, who, at regular intervals, would inhale a definite volume of air with a definite and constant force of suction.

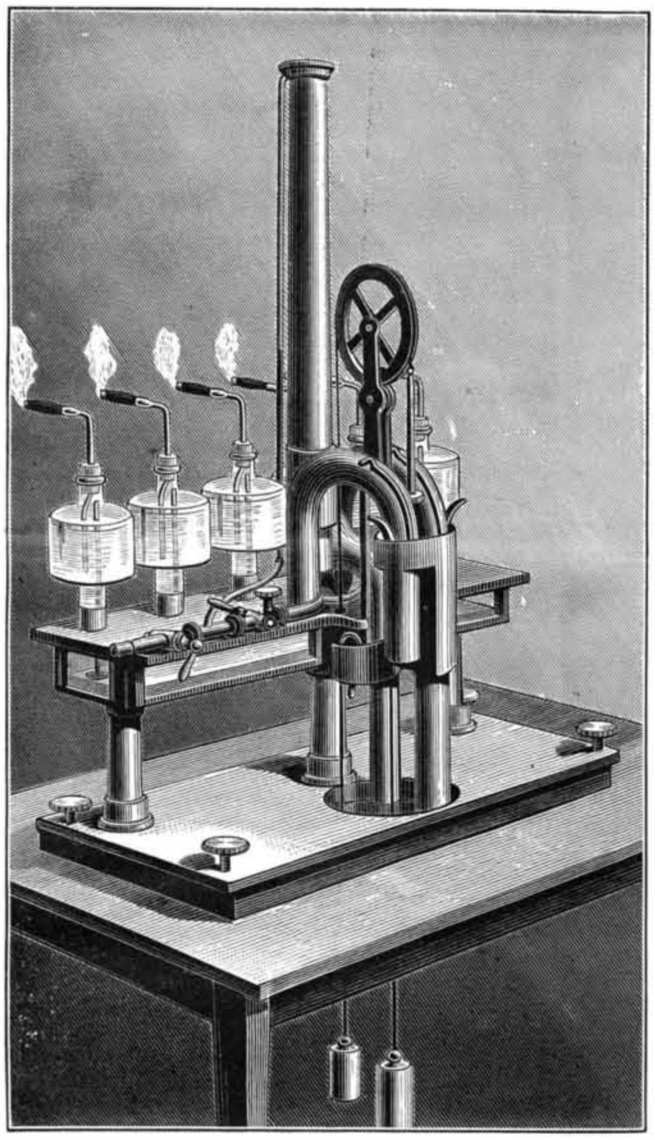


Fig. 1.—PARENTY'S SMOKING MACHINE.

The apparatus (Fig. 1) is fed by a constant level reservoir. The liquid enters continuously through an orifice whose narrow section, ω (Fig. 2), may be modified by means of a small regulating cone, V. The feed-pipe is provided with two cocks, R and R', with gauges, one of them graduated from one to three minutes and the other from three to ten, to show the interval between the beginning of two successive suctions. From the orifice, ω, the water enters the aspirator, *a*, which rests upon a reservoir, *b*, fed by the same orifice. When the water lowers in this system of communicating vessels, the smoke is sucked through the cigar holder tube, A; and, when it rises, the smoke is expelled through the tubes, B, which are alternately opened and closed by the water contained in the collector, C. This latter collects the smoke that comes from the aspirators, and holds the water designed for closing the bottom of the tubes, B. It is closed above by the aspirator box, and this latter is provided with a hydraulic joint that arrests the smoke and allows it to make its exit through the chimney, *g*, only. The variations in level that produce the successive inspirations and expirations are effected by means of two movable reservoirs, D and E, which are connected with the preceding parts by siphons, S_1 and S_2. These reservoirs are balanced by counterpoises, whose cords pass over pulleys, and they rise or fall according to the weight of water that they contain. One them, D, is divided into two compartments by a vertical partition, the first of which, D_1, communicates with the aspirator box through a siphon, S_1, while the second, D_2, connects the collector and the reservior, E, through a siphon, S_2.

The complete operation comprises four periods:

1. The aspirator, A, and the compartment, D_1, are full of water, as is also the connecting siphon, S_1. The water flows over the partition into compartment, D_1, and then runs through the siphon, S_2, into the collector, C, where the liquid reaches the extremity of the tube, B. At this moment the reservoir, D, contains a sufficient weight of water to make it descend and cause a suction. At the same time, the collector stops filling, and expels through the chimney the smoke that has been previously sucked in.

2. The reservoir, E, has likewise filled with water, and descends through its own weight and empties the collector and compartment, D_1.

3. The reservoir, D_1, being relieved, rises. The aspirator begins to fill with water, and the smoke expelled therefrom through the tube, B, enters the collector.

4. The reservoir, E, resumes its initial position under the action of a small siphon, S, at its upper part, which primes itself and frees it from the excess of liquid.

The apparatus operates, then, through the establishing by the siphons, S_1 and S_2, of two levels, n, n', and n_2 n_2', whose variations produce the above described effects.

For experimentation, we begin by making an approximate classification of cigars, each representing some variety of tobacco; this being done by lighting them at intervals of from 1½ to 2 minutes. As the resistance of the cigars to the passage of the air is unequal, the suction is made uniform before each lighting by means of a small cock, *v*, on the aspirator tube; and, in order to utilize the graduation of the gauges, the cock, R, is fixed in such a position that it shall be possible, though the cock, R', to bring about a coincidence between the two liquid levels at a common point of the graduations, this being three minutes.

After two successive suctions the cigar is fully lighted, and we then note by a chronometer the length of time that it burns. In a subsequent experiment, on grouping cigars of analogous combustibility, we endeavor to find out whether, after a determinate lighting, they are capable of holding their fire during an operation in which the suctions are regularly spaced at intervals fixed by the first classification. An identical motion may be communicated to any number of aspirators by the same motor. The apparatus shown in Fig. 1 is arranged for testing six cigars at once.

This ingenious apparatus, which does its inventor great credit, was presented to the Administration of Tobaccos in 1884, and excited great interest at the Anvers Exhibition.

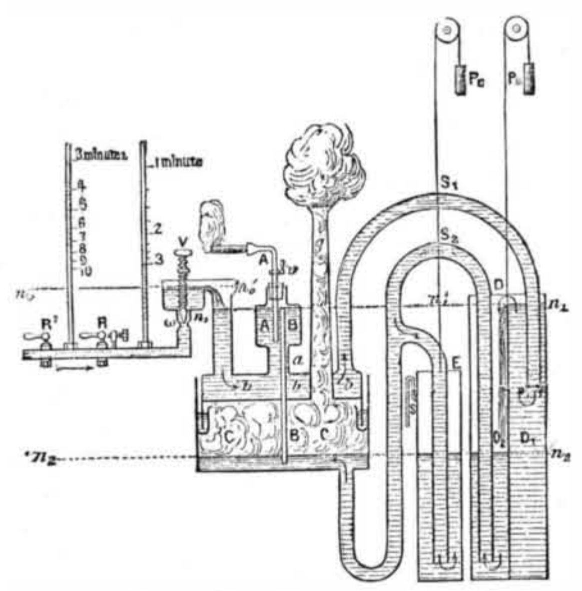


Fig. 2.—DETAILS OF THE APPARATUS.

Navigable Balloons.

The French Academy of Sciences received, at its sitting of the 23d of November, an interesting communication from Captain Renard on the subject of some experiments recently made by him with his navigable balloon. The memoir was received with great favor by the Academy, which decided that it should be inserted verbatim in the Transactions, although this is contrary to the general practice. The experiments described took place on the 22d of August and the 22d and 23d of September. The motor employed was a Gramme dynamo-electric machine making 3,000 revolutions a minute, and developing 9 horse power. The current actuating the machine was furnished by a battery, which constitutes the most interesting feature in the installation, but the arrangement of which is kept secret. To measure the velocities, Captain Renard employed a sort of aerial log formed of a small balloon of gold-beater's skin, and filled with 120 liters of common gas. This was held in equilibrium in the air, attached to the end of a silk thread 100 meters in length, and wound on a reel. To measure the speed, one end of the thread is wound round the finger, the time is noted when the balloon log is liberated, and the relative movement is recorded by the unwinding of the thread from the reel. When the distance of 100 meters is traversed, a slight shock is felt on the finger holding the silk, and the moment is noted when this shock is felt. The time is thus recorded that the balloon has required to traverse 100 meters. On the 22d of September the speed of the wind was from 3 meters to 3·50 meters per second. The balloon left Chalais, carrying three persons, at 4:25 P.M., the sky being cloudy. It was steered against the wind, and at 5 P.M. arrived over the Ile de Billancourt with a speed of 6 meters per second, the Paris fortifications being reached at 5:12 P.M. At this moment M. Renard gave the order to return, which was done, and the balloon reached its point of departure in 11 minutes, while the outward journey had occupied 47 min. The maximum height attained was 400 meters. The day following, the same voyage was repeated in the presence of the Minister of War and the President of the Committee of Fortifications. There appears little doubt that M. Renard's experiments, so far as they went, were a complete success. The Minister of War has ordered the construction of a much larger balloon, for conducting experiments on a more extensive scale; these will take place next year.

Glass Flooring.

The substitution of glass flooring for boards continues to increase in Paris, this being especially the case in those business structures in which the cellars are used as offices. At the bank of the Credit Lyonnais, the whole of the ground in front is paved with large squares of roughened glass embedded in a strong iron frame, and in the cellars beneath there is sufficient light, even on dull days, to enable clerks to work without gas. The large central hall at the offices of the Comptoir d'Escompte has also been provided with this kind of flooring; and, although its prime cost is considerably greater than that of boards, glass is in the long run far cheaper, owing to its almost unlimited durability.