Correspondence.

Dividing Circles.

To the Editor of the Scientific American:

From reading the articles by Mr. Joshua Rose, entitled "Practical Mechanism," I know that he is one of the best and most practical mechanics that have seen fit to impart their knowledge to their fellow craftsmen through the medium of any scientific paper; and his articles are the first I turn to upon opening the SCIENTIFIC AMERICAN.

In elucidation of a method of dividing a circle into a given number of parts, spoken of by him on page 84 of your current volume, let me remind your readers that a correct way of doing this is to divide 360° by the requisite number of sides in the polygon, find the chord of the quotient, and multiply by the radius. I have calculated the following table by the above rule, which, upon inspection, will be found to give correct results.

Table of Chords and Angles of Figures Described in a Circle, from Triangles to Polygons with 100 Sides.—Calculated to 1 Minute of the Arc and to 0·0001 of Radius.—Radius =1·0000.

No. of sides.	Angle.	Chord.	No. of sides.	Angle.	Chord.	No. of sides.	Angle.	Chord.
3	120°00′	1·7321	36	10°00′	0·1743	69	5°13′	0·0910
4	90 00	1·4142	37	9 44	0·1697	70	5 09	0·0898
5	72 00	1·1756	38	9 28	0·1651	71	5 04	0·0884
6	60 00	1·0000	39	9 14	0·1610	72	5 00	0·0872
7	51 26	0·8678	40	9 00	0·1569	73	4 56	0·0861
8	45 00	0·7654	41	8 47	0·1531	74	4 52	0·0849
9	40 00	0·6840	42	8 34	0·1495	75	4 48	0·0838
10	36 00	0·6180	43	8 22	0·1460	76	4 44	0·0826
11	32 44	0·5636	44	8 11	0·1427	77	4 41	0·0816
12	30 00	0·5176	45	8 00	0·1395	78	4 37	0·0806
13	27 42	0·4787	46	7 50	0·1365	79	4 33	0·0795
14	25 43	0·4451	47	7 40	0·1336	80	4 30	0·0785
15	24 00	0·4158	48	7 30	0·1308	81	4 27	0·0776
16	22 30	0·3902	49	7 21	0·1282	82	4 23	0·0766
17	21 11	0·3676	50	7 12	0·1256	83	4 20	0·0756
18	20 00	0·3473	51	7 04	0·1232	84	4 17	0·0747
19	18 57	0·3292	52	6 55	0·1207	85	4 14	0·0739
20	18 00	0·3129	53	6 48	0·1185	86	4 11	0·0730
21	17 09	0·2981	54	6 40	0·1163	87	4 08	0·0722
22	16 22	0·2847	55	6 33	0·1142	88	4 05	0·0714
23	15 39	0·2723	56	6 26	0·1121	89	4 03	0·0706
24	15 00	0·2611	57	6 19	0·1102	90	4 00	0·0698
25	14 24	0·2507	58	6 12	0·1083	91	3 57	0·0690
26	13 51	0·2411	59	6 06	0·1064	92	3 55	0·0683
27	13 20	0·2322	60	6 00	0·1047	93	3 52	0·0675
28	12 51	0·2239	61	5 54	0·1029	94	3 50	0·0669
29	12 25	0·2163	62	5 48	0·1013	95	3 47	0·0661
30	12 00	0·2091	63	5 43	0·0997	96	3 45	0·0654
31	11 37	0·2024	64	5 37	0·0981	97	3 43	0·0648
32	11 15	0·1960	65	5 32	0·0966	98	3 40	0·0641
33	10 55	0·1901	66	5 27	0·0952	99	3 38	0·0634
34	10 34	0·1843	67	5 22	0·0937	100	3 36	0·0628
35	10 17	0·1792	68	5 17	0·0922			

Helena, Montana Ter. GEORGE B. FOOTE, C. E.

Sailing Faster than the Wind.

To the Editor of the Scientific American:

If the ice boat question still debatable? Experienced raftsmen tell us that a log sent adrift outruns the stream that carries it, that a single log will outrun a raft of logs, which, in turn, outruns a raft of boards. If these are facts, they indicate the possibility of the ice boats outspeeding the wind. All streams of considerable length have points of slow and rapid flow. Assuming the mean rate to be one mile an hour, the rapids may have a four-mile rate and the slack water a half-mile rate. A log passing each rapid partakes of its speed, and the increased momentum causes it to outrun the more sluggish water below, and thus gain upon the mean rate of the current. A twenty-mile wind may have its thirty-mile gusts, and slack wind to correspond; and an ice boat, by the aid of the former, may gain upon the mean rate. On the other hand, aeronauts in a fifty-mile wind experience a perfect calm, that is, they move no faster nor slower than the wind. A balloon, like the ice boat, has momentum; but it moves without friction, and it is difficult to understand why it should be distanced by an ice boat if both are driven by the same wind.

Rochester, N. Y. E B. WHITMORE.

The Wisconsin Ten Thousand Dollar Reward.

To the Editor of the Scientific American:

I would like to answer, through the columns of your valuable paper, the numerous letters I am receiving from all parts of the country concerning the bounty of $10,000 offered by this State for a steam wagon that will fill certain requirements. To fill the bill, the machine must travel 200 miles north and south over very poor roads that are often sunk or worn down—in the wheel and horse tracks—six inches to a foot below the common level, but with a ridge in the center, the ridge being impassable for a horse: more so for the wheel of a steamer, when we take into account the stumps and stones, avoided by a double team and left in the center ridge. Our wagon track is about 4 feet 6 inches outside, and that must be the gage of a steamer, which machine should not weigh more than two tuns and must be so arranged that it will climb steep sand hills, cross poor bridges, run easily over bogs, stones, and grubs, and out of ruts, etc., just as a loaded lumber wagon does; and it must travel at the average rate of 5 miles per hour, and, in the language of the law, "be a cheap substitute for horses and other animals on the highway and farm."

On the subject of amending the law so as to admit citizens of other States to compete for the prize, I can say that the law will never be so amended, neither should it be, of right. Rather let the public-spirited men of other States elect to their legislatures one or more mechanics and inventors, who are alive to the importance of the class of inventions and who have the courage and persistance to introduce and to fight a bill similar to ours through, as this was fought. It was the opinion of the originator of the law that no machine has yet been produced that will fill the bill, that inventors have failed to bring out a really practical machine; and it was for the especial purpose of encouraging inventors, to persevere until complete success was obtained, that the bounty was offered. C. M. MARSHALL.

Wisconsin Legislature, Assembly Chamber, Madison. February, 8, 1876.

To Find the Side of a Polygon of any Number of Sides.

To the Editor of the Scientific American:

In the given circle draw a diameter, and produce it a distance equal to the radius, as A B, in each of the following

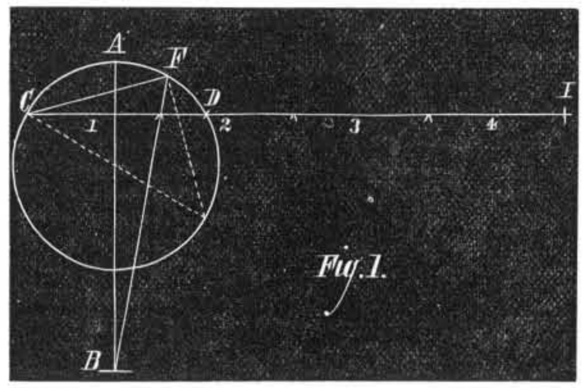


Fig. 1.

figures. With the same radius, on A as a center, cut the circle in C and D. Draw C D, and produce it to E, making C E, equal to three times C D. Divide C E into as many equal

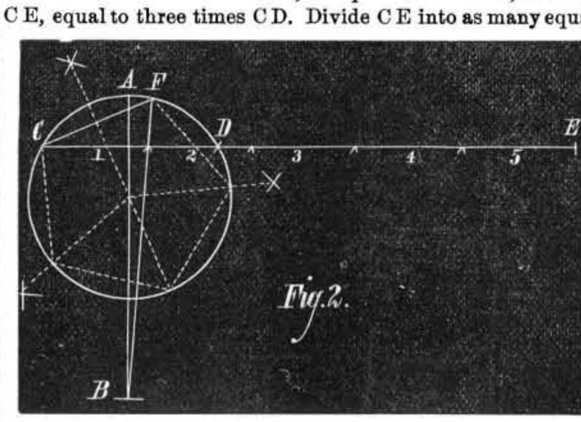


Fig. 2.

parts as the required polygon has sides. Draw B T, cutting C E, in the first point of section and touching the circle in F. Draw C F, which is the side required.

Fig. 1 shows the side of a square; Fig. 2 the side of a pentagon; Fig. 3 a triangle and a hexagon. It will be noted that, in the triangle, C F coincides with C D, and in the hexagon, B F coincides with A B. Fig. 4 shows a heptagon.

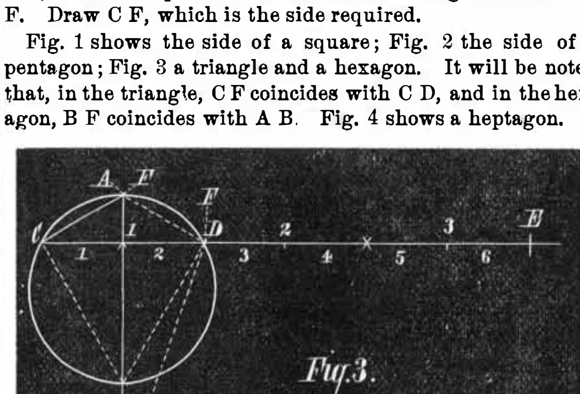


Fig. 3.

Demonstration:—When the side, C F, is found, place other lines equal to it in the circle with their ends in contact, until the polygon is complete; then, if it has an even number of sides, a diameter which bisects a side or an angle on one side of the center does the same on the opposite side. If it

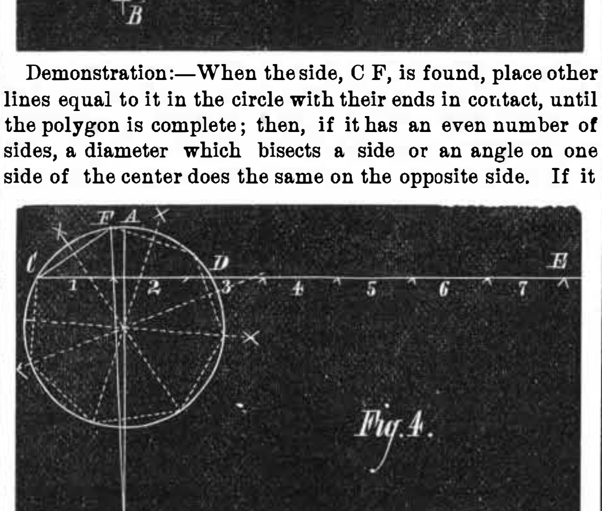


Fig. 4.

has an odd number of sides, a diameter which bisects a side on one side of the center bisects an angle on the opposite side; thus proving that the sides are regular, and consequently equal. ALBERT BONDELI.

Philadelphia, Mo

The Azoic Period and the Glacial Epoch.

To the Editor of the Scientific American:

In one of his lectures on glaciers, Agassiz said: "If it can be demonstrated that such was the condition of our earth (covered with glaciers), it will follow that the doctrine of transmutation of species and of the descent of animals that live now from those of past days is cut at the root by this winter, which put an end to all living beings on the surface of the globe." Now as glacial action is everywhere visible on the surface of the globe as it now is, it is evident that the glacial period was after the earth had assumed its present form. But if the glacial epoch was before the appearance of animal life upon the earth, then it must have been during the azoic age or before it; and there can be no evidence of a universal glacial epoch in these formations succeeding the azoic, since they would all be covered up by the subsequent formations.

There seems to be a slight confusion here; can any one throw any light on this subject?

Franklin, N. Y. P.

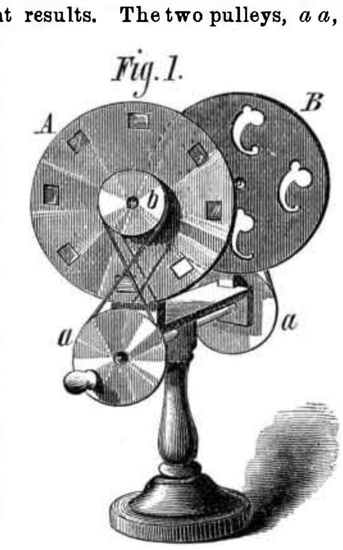
[For the Scientific American.]

THE CHROMOSTROBOSCOPE.

BY PROFESSOR A. RICCO, OF MODENA, ITALY.

The following simple device, which I have invented, is productive of very brilliant results. The two pulleys, *a a*, are made to turn together by means of the crank, and communicate their motion by means of endless cords to the wheels, *b*, to which are attached two disks of cardboard, A, B. In the anterior disk are eight holes, containing little glass windows of different colors. The disk, B, has a white design on black ground. The best way to make the design is to cut it out of the black cardboard and to place oiled white tracing paper behind the latter. On keeping the eye at a point which the apertures successively pass, and looking at the design through them, a colored image will be produced by each one as it passes, and this image will remain on the retina, by persistence of vision, long enough to make the design appear multiplied symmetrically about the center with great brilliancy of colors. If now the figures, of which the design consists, are made to change successively in form and position, as in Plateau's phenakistoscope, the surprising effects of the graceful motions of the images in that apparatus will be combined with a splendid coloration.

Fig. 1.



Even by simply putting colored glasses in the apertures of the phenakistoscope, and using white designs on a black ground, similar results are obtained; they are less brilliant, however, because, as is well known, the design in that instrument is placed on the perforated disk itself, and we look through the latter at the reflection of the design in a mirror in front of the apparatus. Of course light is lost by the reflection.

If it is desired to project the images of the chromostroboscope on a screen, the arrangement represented in Fig. 2 may be employed.

By turning the wheel, A, we set in rotation the disk, B, which contains sectors of colored glass. Together with this disk, the wheel, C, turns, on the circumference of which rests a disk, D, which may be either perforated or painted black on colorless glass. The wheel, C, and the disk, D, turn together by friction gearing. The pulley, E, which, together with two others, keeps the disk in place, is movable so that the disk can be taken out and replaced by another, like the slides of a magic lantern, while the other parts of the apparatus may remain in undisturbed connection with the lantern.

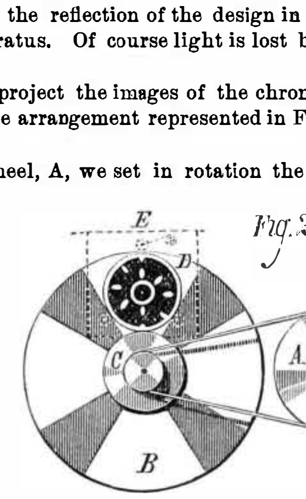


Fig. 2.

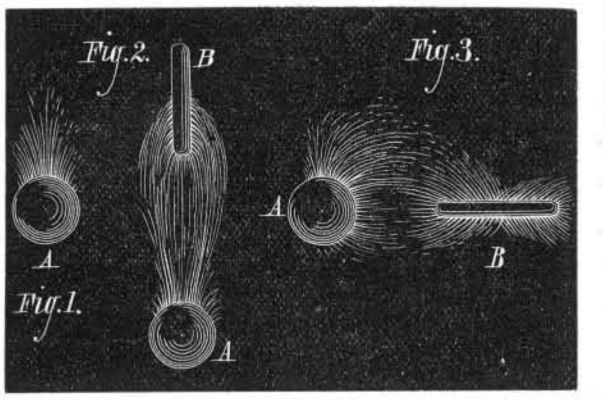
Modena, January, 1876.

[Evidently this apparatus has a certain analogy to the new chromatrope of Professor Morton, described on page 344, volume XXXIII, of the SCIENTIFIC AMERICAN.—EDS.]

SINGULAR ELECTRICAL EXPERIMENTS.

BY PROFESSOR A. RICCO, OF MODENA, ITALY.

In studying the effects of electricity, it is interesting to note the curves or trajectories passed over by particles of electrified powders. In order to observe them conveniently, they may be illuminated by a ray of sunlight. On putting a little lycopodium or other powder on an insulated conductor, A (Fig. 1), and charging the latter, a jet will be produced which will diffuse a little of the powder in the air; after some time, when the jet has ceased and a non-insulated conductor, B (Fig. 2), is brought near, the jet is reproduced, and appears formed of an infinity of beautiful similar curves, the extremities of which are almost normal to the surface of the conductors. If now B is electrified and brought near A, in communication with the earth and carrying lycopodium powder, a similar jet will be produced; but if A is then insulated, the jet disappears, and is renewed only when the communication with the earth is restored, by which the electricity of the same kind as that in B is carried off. If a cylindrical, not charged, and not insulated conductor, carrying lycopodium at its extremity, is placed opposite a charged conductor, a jet will arise at that extremity, by which electricity of the same kind will pass off, repelled by the electrified body. And if we sprinkle lycopodium powder on the strongly charged conductor, A (Fig. 3), and on B, containing an induced current, three systems of curves or jets will be formed: one from A to B, another from B to A, and a third from B into the air. Similar, although fainter, curves are observed under the conductors. In all these experiments the particles have a rapid motion to and fro between the two conductors, because the moment they touch one, and are charged with the same electricity, they are repelled. Sometimes a few particles vibrate without touching them (like Franklin's gold fish) and move in the same trajectories.



I have made a great many other experiments with these powders, and I believe they may be useful to the study of that mysterious agent, electricity. The analogy of the curve of Fig. 3 to the magnetic spectrum of a pole of lodestone, A, inducing magnetism in a piece of soft iron, B, is evident.

Modena, January, 1876.

Coal Tar.

Its general properties vary with the coal used as well as with the temperature employed in the distillation of the gas. That obtained at rather high temperature varies from 1·120 to 1·150 in specific gravity. It cannot be burnt in ordinary lamps. If obtained at a lower temperature, it is lighter, and generally is combustible in common lamps. In England the yield is from nine to fifteen gallons per tun of coal.

The distillation is conducted on a large scale in some of our cities. The plan and operations with some are as follows: The liquid is poured into large iron retorts holding several hundred gallons. Heat is then applied. The first portions passing over consist chiefly of ammonia, and a few of the lighter hydrocarbons. As the distillation proceeds, heavier matters pass over, such as water containing a fetid brown oil which collects on its surface. After a little while, the water has all passed over and more oil comes, growing gradually heavier until its specific gravity exceeds that of water. This oil generally amounts to from five to ten per cent of the tar. It is purified by agitation with sulphuric acid and redistillation. The oil before purification contains several easily oxidizable substances, which are converted into a tenacious, dense mass by the action of the acid. The purified oil is called coal naphtha. On continuing the distillation after the naphtha has ceased to come over, a heavy, fetid dark oil, known as dead oil, comes. This usually amounts to about thirty per cent of the tar. In the latter part of the distillation, considerable naphthalin passes over and solidifies in the oil. The operation is usually stopped here, as the mass in the retort will solidify on cooling, and is used to form a black varnish for iron work.

If desired, however, a still higher heat will decompose the matters left in the retort, and a product may be obtained which when cool has the consistence of butter, and is called anthracene. At a still higher temperature, the distilled matters look like resin, and finally the substance passing over at a red heat condenses as a bright orange-colored powder, and is composed principally of chrysene and pyrsene. The residue in the retort is a coke which is very hard and difficult to burn.

The naphtha obtained as above is usually rectified with sulphuric acid again, and is separated into still lighter compounds and heavy oil. The distillate from this is free from naphthalin, does not change color on exposure, and is called "highly rectified." It varies in specific gravity from 0 860 to 0·900, and contains several oils which may be separated from each other by proper caution in distilling.

Mansfield succeeded in separating this into at least five different substances. No. 1 boiled between 140° and 158° and smelt like onions: probably a mixture of alcohol radicals. No. 2 boiled at 176° and consisted of benzol. No. 3 boiled at about 235° and consisted of toluol, mainly. No. 4 boiled between 288° and 293° and resembled cumol. No. 5 boiled between 338° and 342° and resembled cymol.

The dead oil is seldom purified. It consists mainly of carbolic acid, aniline, quinoline and several other bodies, mostly hydrocarbons, which boil 290° and 570°, and usually have considerable anthracene in solution. This oil is valuable for its antiseptic properties, and is used to preserve railroad ties in some places. It has been used in common lamps but is chiefly used to make lampblack. Probably the time is coming when this oil will be used for fuel in steam boiler and allied furnaces.

By a slight change in the order of collecting the products of distillation, a green oil may be obtained after the dead oil. This is used principally as a lubricant for railway engines and cars. In some cities the only use to which this tar is put is for roofing purposes. It is then boiled in the open air in pots holding comparatively but a few gallons. When enough of the more volatile products have passed off, the the whole is run into barrels to cool. When wanted the barrel is knocked apart and the mass remelted.—*Professor H. Poole, in Scientific Commercial.*

The Sun's Atmosphere.

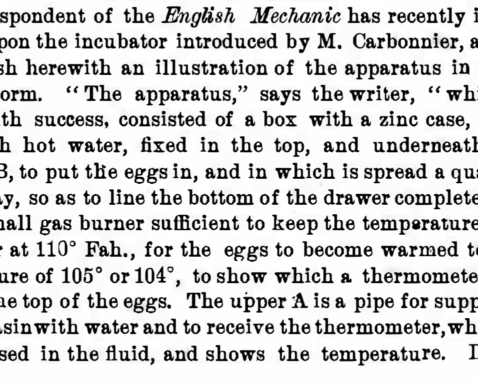
Professor Langley, of Alleghany Observatory, has lately published some results of his steady observations of the solar atmosphere, which, he states, is a thin stratum which cuts off one half the heat which otherwise would reach us. From this it appears that the existence of living beings upon the earth is directly dependent upon the sun's atmosphere, for should that envelope be increased twenty-five per cent in thickness, the mean surface of our globe would, it is estimated, be reduced 100° Fah., in temperature. It has been suggested that the glacial epoch through which the earth passed many ages ago might have been due to a fluctuation in the solar atmosphere.

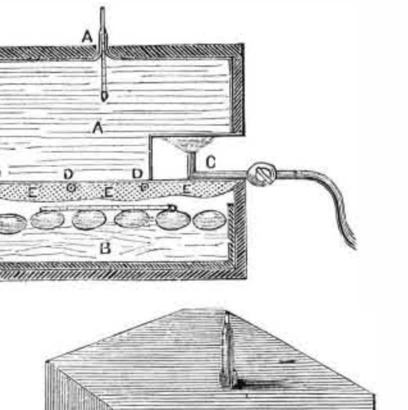
A Telegraph Cable Pierced by Grass.

At a meeting of the Asiatic Society of Bengal, in Calcutta, says *Chambers' Journal*, a piece of telegraph cable was exhibited, showing that the india rubber covering had been pierced by grass. The piercing was so complete and the contact of the grass with the copper core was so perfect that "dead earth," as it is technically called, was produced, and the efficiency of the cable destroyed. The species of the grass, owing to its dried-up condition, could not be determined. It was suggested as a probable explanation "that the seeds had become attached to the core when under water, and had afterwards germinated when the core was stored."

IMPROVED INCUBATOR.

A correspondent of the *English Mechanic* has recently improved upon the incubator introduced by M. Carbonnier, and we publish herewith an illustration of the apparatus in its present form. "The apparatus," says the writer, "which I used with success, consisted of a box with a zinc case, A, filled with hot water, fixed in the top, and underneath a drawer, B, to put the eggs in, and in which is spread a quantity of hay, so as to line the bottom of the drawer completely. C is a small gas burner sufficient to keep the temperature of the water at 110° Fah., for the eggs to become warmed to a temperature of 105° or 104°, to show which a thermometer is laid on the top of the eggs. The upper A is a pipe for supplying the basin with water and to receive the thermometer, which is immersed in the fluid, and shows the temperature. D D



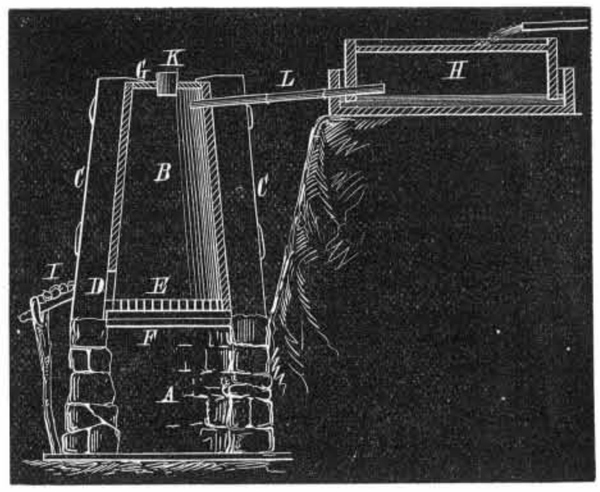


D are three iron rods fixed in from back to front of the box as a support for the zinc case. E is a layer of sawdust, suspended by a piece of muslin (or some such thin material) fastened by a few tacks to the inner side of the box, through which the heat passes, and is at the same temperature and as moist as that which would emanate from the body of a natural mother. The drawer is opened once or twice every day to turn the eggs; and after an incubation of twenty-one days, the chickens will be hatched without any further assistance."

IT is stated, upon German authority, that the unpleasant taste imparted to milk and butter by feeding turnips, etc., may be removed by simply throwing into each pan of milk of 4 or 5 quarts as much saltpeter as will lie on the point of a knife, when a gelatinous mass will separate from the milk and settle to the bottom

The Manufacture of Camphor in Japan.

Dr. A. von Roretz, of Otanyama, Japan, states that the only tree which yields the commercial camphor of Japan and Formosa is the *laurus camphoratus*, which the natives call *tsunoki*. It is very widely distributed in Japan, being equally common on the three islands Niphon, Kinshin, and Sikok; but it thrives best in the southern portion of the kingdom, namely, in the provinces of Tosa and Sikok. The sea coast, with its mild, damp air, agrees with it best; and



hence the chief production of camphor is in these provinces.

Camphor is collected the whole year through, but the best results are obtained in winter. When the camphor collectors find a spot with several camphor trees in the vicinity, they migrate thither, build a hut to live in, and construct a furnace for making the crude camphor. When that place is exhausted, the hut is torn down and carried to another place. The method observed in obtaining camphor is very simple. The workmen select a tree, and with a hollow-ground, short-handled instrument begin to chop off regular chips. As soon as the huge tree falls, the trunk, large roots, and branches are chopped up in the same way, and the chips carried to the furnace in baskets. The furnaces are mostly built on the side of a hill near a stream of water, and serve for the wet distillation of the chips. The furnace is of very simple construction. A small circular foundation, A, is built of stone, and upon this is placed a shallow iron pan, F, two feet in diameter, covered with a perforated cover, E, luted on with clay. This cover forms the bottom of a cylindrical vessel, B, forty inches high and tapering to eighteen inches at the top. Near the bottom of this vessel is a square opening, D, which can be tightly closed with a board. The whole vessel is covered with a thick coating of clay, C, held in place by strips of bamboo. The cover of this vessel, G, which is also luted on with clay, has an opening, K, closed with a plug. Passing through the side of the vessel near the top is a bamboo tube, L, leading to the condenser, H. This condenser is merely a quadrangular box, open below and divided up by four partitions into five compartments communicating with each other. The open side of this box dips into water and is kept cool by water drizzling over it.

The manipulations in the preparation of the camphor are as follows: The cylindrical vessel, B, is filled, after removing the cover, G, with chips of camphor wood; the lid is then luted on, and a definite quantity of water poured in through the hole, K, which moistens the chips and collects in the pan, F. It is now heated gently for twelve hours, a small fire being kept up as soon as the water in the pan begins to boil. The ascending vapors, passing through the chips, carry off all the camphor and oil in the wood, and both are deposited on the surface of the water in the condenser, H. At the end of twelve hours, the exhausted chips are removed through the square hole, D, and fresh chips and fresh water put in. At the expiration of twenty-four hours the process is interrupted, the whole apparatus cleaned, and the camphor collected in H is packed in barrels. Here it is very lightly pressed; and the oil, which amounts to at least 25 per cent, and is as clear as water, is poured off from the solid camphor, and both products are sent to market. At certain places the crude camphor is again pressed somewhat harder, when quite a good deal more oil runs through the crevices in the vessels. The tolerably dry product is sent mostly to Osaka, the chief export town for this important article of commerce. The camphor oil, called by the Japanese *shono abura*, is used by very poor people only as an illuminating oil; and in spite of its strong smell and smoke, it is burned in open lamps. Perfectly pure camphor is not exported, but the crude country product is first freed from the still adherent oil by further distillation in Europe. The exhausted chips are dried on a scaffold, I, by the side of the furnace, and are then used as fuel.—*Dingler's Polytechnisches Journal.*

The Planing Mill Controversy.

The *Northwestern Lumberman*, of Chicago, says; "Planing mill owners throughout the country will be interested to learn that the National Planing Machine Company, of Boston, Mass, recently negotiated in this city the sale of their substitutes for the Woodbury bar, for nine States of the West and South. The consideration we understand to have been $250,000. The purchasers are capitalists of this city and St. Louis; and they have organized a corporation for the purpose of putting the business of the manufacture and sale of their devices upon a sure and permanent basis."

A LITTLE common soap lather mixed with starch gives linen a good gloss.