SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIX.—No. 6. [NEW SERIES.] | NEW YORK, AUGUST 10, 1878. | [$3.20 per Annum. [POSTAGE PREPAID.]

THE PARIS EXHIBITION.—A SKETCH IN THE PARK.

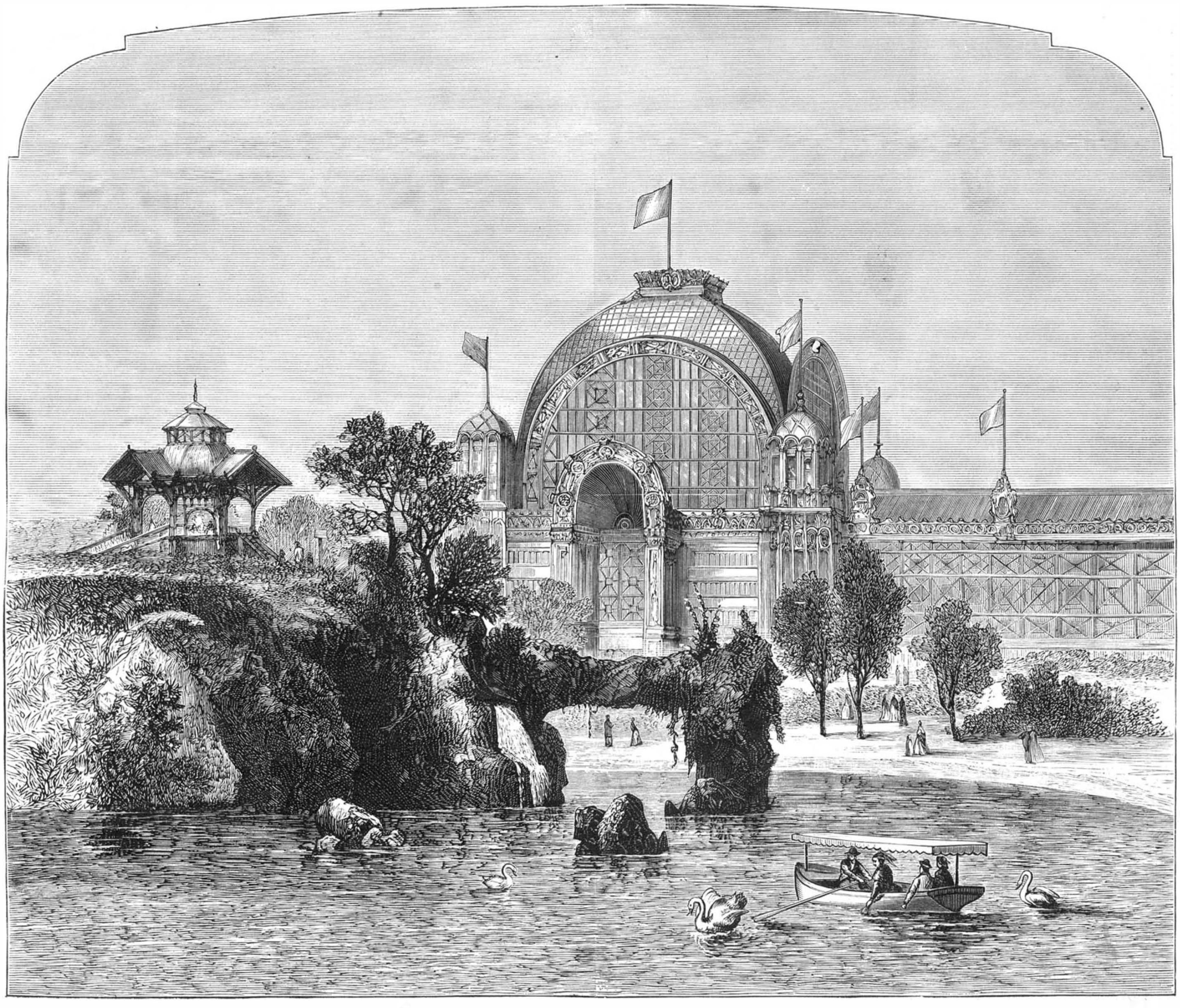
Our engraving, which represents a portion of the park at the Paris Exhibition grounds, needs little mention beyond that it is one of those delightful retreats so refreshing to the weary visitor, who, tired out with tramping about the buildings and grounds, is only too pleased to refresh his eyes with some of that exquisite miniature water scenery which is scattered about the grounds. We take our illustration from the London *Graphic.*

Improvements in Silk Worm Breeding.

Galignani states that a very curious discovery has just been made, which, if found as practicable in application as it seems to promise, may create a very considerable change in the production of silk. It is nothing more nor less than the possibility of obtaining two yields in the year of the raw material instead of one, as at present. The moth lays its eggs in May or June, and these do not hatch before the spring of the following year. But sometimes they are observed to hatch spontaneously ten or twelve days after they are laid. It was such a circumstance as this coming to the attention of M. Ducloux, Professor of the Faculty of Sciences at Lyons, that led him to undertake a series of experiments on the subject, by means of which he has found that this premature hatching can be produced at will. The means for effecting the object are very simple—rubbing the eggs with a hair brush, subjecting them to the action of electricity, or more surely still by dipping them for half a minute in concentrated sulphuric acid. M. Bollé, who has also turned his attention to the same subject, states that the same effect is produced by hydrochloric, nitric, or even acetic and tartaric acid. Finally, a submersion of a few seconds in water heated to 50° Cent. (122° Fah.) is equally efficacious. However, M. Ducloux states that the operation must be performed while the eggs are quite young, the second or third day at the outside. When this new hatching is accomplished the mulberry tree is in its full vigor, and the weather so favorable that the rearing of the worm is liable to much less risk than during the early days of spring, when the sudden atmospheric changes are very detrimental, and frequently fatal to the growing caterpillars.

The Natural History of the Eel.

According to the reports of shad fishermen, the chief enemy of the shad is the eel, which not only follows that fish up the streams and devours the spawn, but often attacks the shad after they are caught in the nets. Entering the shad at the gill openings the eels suck out the spawn and entrails, and leave the fish perfectly clean. The finest and fattest shad are the ones selected. It is a curious circumstance that of a fish so well known as the eel so many of its life habits should be in dispute. An animated discussion has been going on in Germany quite recently with regard to the natural history of this fish, and in a late number of a scientific journal the following points are set down as pretty well substantiated. Though a fresh water fish which passes the greater part of its life in rivers, the eel spawns in the sea. That it is viviparous is extremely improbable. The eel found in the upper waters of rivers is almost always female. At the age of four years it goes down to the sea to spawn and never returns to fresh water. The spawning process is somehow dangerous to the eel, thousands being found dead near the mouths of rivers, with their ovaries empty. The descent of the fish to the sea does not appear to take place at any definite period, but is probably dependent on the season for spawning. The male is always much smaller than the female, and never exceeds half a yard in length. The males never ascend to the head waters of rivers, but keep continually in the sea or in the lower reaches of the river. Nothing is definitely known about the spawning season, though it is probable that the eggs are deposited in the sea not far from the mouths of rivers.



THE PARIS EXHIBITION.—A SKETCH IN THE PARK.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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VOL. XXXIX., No. 6. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, AUGUST 10, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 136,

For the Week ending August 10, 1878.

Price 10 cents. To be had at this office and of all newsdealers.

PROGRESS OF IRON MAKING.

The success of the Dank's puddling furnace fired with pulverized coal seems to be no longer a matter of doubt in England. It is stated that Messrs. Hopkins, Gilkes & Co., the well known iron makers of the North of England, have succeeded in turning out from it from Cleveland pig alone iron capable of bearing tests which Staffordshire iron has not yet surpassed. The English iron manufacturers in their struggle with us are wisely taking advantage of every improvement in their line to keep ahead of us, and are likely to be successful unless our manufacturers arouse from their fancied security.

We are now underselling the English at home and abroad in many articles of manufacture, because so much of our work is done by machinery, and is consequently better and cheaper than can be produced by hand labor at the lowest living rate of wages; but so soon as the English masters and workmen shall fully appreciate this fact, the same machines run there with cheaper labor will deprive us of our present advantages.

Already we notice several instances in which the workmen, renouncing their prejudices, have willingly consented to the substitution of machine for hand work, and we doubt not that the success of these innovations, conjoined with the pressure of the times, will ere long create a complete revolution in the ideas of the British workmen, so that instead of longer opposing they will demand the improved appliances and facilities for work, converting them from rivals or opponents to allies. Such a radical change is not necessarily far in the future, for the logic of it has long been working in the brains of both masters and men and may reasonably bear fruit at any time. We fear that when this time arrives our makers of iron, especially, will wake up to the consciousness that they have not kept up with the advance.

THE TELEPHONE AS A PROMOTER OF SCIENCE.

Every new thing, whether it be in the realm of mind or matter, has an influence on whatever existed before, of a similar kind, to modify, develop, and improve it, or to doom it to oblivion. Whatever is new necessitates a better knowledge of the old, so that the world gains not only by the acquirement of the new thing, but also by a better understanding of things already known.

A discovery, published, sets a thousand minds at work, and immediately there is a host of experimentalists who, in their desire to make and try the new thing for themselves, begin without a knowledge of the science or art to which the discovery pertains, and inevitably fail. After failure comes research, which to be of value must be extended. Every investigator can recall the novelty that induced his first experiments, and can recount his trials in his search for information.

Among the inventions or discoveries that have induced extended experiment, the telephone may, without doubt, be mentioned as the chief, for no sooner was the first speaking telephone brought out than here and there all over the country it was imitated. Persons who never had the slightest knowledge of electrical science had a desire to see and test the telephone. To do this first of all requires a degree of mechanical skill. Acoustics must be understood, and a knowledge of the four branches of electrical science is requisite, as the telephone involves galvanism, magnetism, electrical resistance, induction, and many of the nicer points which can be understood by investigation only, and this not only in the direction indicated, but in the allied branches of physics and also in chemistry. Familiarity with these things develops a scientific taste that will not be easily satisfied. The characteristic avidity with which the American people seize upon a novelty has been wonderfully exemplified by the manner in which the telephone mania has spread. In consequence of this science has received an impetus, and now we have everywhere embryo electricians and experimentalists, where before were only the unscientific.

LETTER FROM PROFESSOR HUGHES.

We print in another column a letter received from Mr. D. E. Hughes concerning the distinction he finds between his microphone and Mr. Edison's carbon telephone. Mr. Hughes is very confident that the two inventions have nothing in common, and that they bear no resemblance to each other in form, material, or principles.

We would not question Mr. Hughes' sincerity in all this. No doubt he honestly believes that the invention of Mr. Edison "represents no field of discovery, and is restricted in its uses to telephony," whilst the "microphone demonstrates and represents the whole field of nature." But the fact of his believing this is only another proof that he utterly fails to understand or appreciate the real scope and character of Mr. Edison's work.

To those familiar not only with Mr. Edison's telephone but with the long line of experimental investigation that had to be gone through with before he was able to control the excessive sensitiveness of the elements of his original discovery, it is very clear that Mr. Hughes has been working upon and over-estimating the importance of one phase, and that a limited phase, of Mr. Edison's investigations.

We propose shortly to review at length the evidence of Mr. Edison's priority in the invention or discovery of all that the microphone covers; this purely as a question of scientific interest. For the personal elements of the controversy between Mr. Edison on the one side and Messrs. Preece and Hughes on the other we care nothing.

THE SCIENTIFIC AMERICAN EXPORT EDITION.

The inquiry for American manufactured products and machinery abroad seems to grow in volume and variety daily. And though, in comparison with our capacity to produce, the foreign demand is yet small, its possibilities are unlimited. To increase the demand the immediate problem is to make known throughout the world in the most attractive fashion possible the wide range of articles which America is prepared to furnish, and which other nations have use for. As a medium for conveying such intelligence the monthly export edition of the SCIENTIFIC AMERICAN is unequaled. The table of contents of the second issue, to be found in another column, will give an idea of the wide range and permanent as well as timely interest of the matter it circulates. It is a magazine of valuable information that will be preserved and repeatedly read. The handsomely illustrated advertising pages supplement the text, and make it at once the freshest, fullest, and most attractive periodical of the sort in the world. An examination of the index of advertisers will show how widely its advantages for reaching foreign buyers have been appreciated by leading American houses. In the advertising page xxv. appears a list of some eight hundred foreign commercial places in which the circulation of the paper is guaranteed, as evidence that it reaches those for whom such publications are intended.

FOUNTAIN PENS.

For several days we have had in use in our office examples of the Mackinnon Fountain Pen, and find it to be a very serviceable and effective instrument. This is a handsome looking pen, with a hollow handle, in which a supply of ink is carried, and the fluid flows from the point in the act of writing. The necessity of an inkstand is thus avoided. One of the difficulties heretofore with pens of this character has been to insure a free and certain delivery of the ink, and also to bring the instrument within the compass and weight of an ordinary pen. The inventor seems to have admirably succeeded in the example before us. The ink flows with certainty, and there is no scratching as with the ordinary pen; it writes with facility on either smooth or rough paper; writes even more smoothly than a lead pencil; may be carried in the pocket; is always ready for use; there is no spilling or blotting of ink. The construction is simple, durable, and the action effective. One filling lasts a week or more, according to the extent of use. These are some of the qualities that our use of the pen so far has seemed to demonstrate; and which made us think that whoever supplies himself with a Mackinnon Pen will possess a good thing. The sole agency is at No. 21 Park Row, New York city.

THE SUN.

BY S. P. LANGLEY, ALLEGHENY OBSERVATORY, PA.*

When, with a powerful telescope, we return to the study of the sun's surface, we meet a formidable difficulty which our first simple means did not present. This arises from the nearly constant tremors of our own atmosphere, through which we have to look. It is not that the tremor does not exist with the smaller instrument, but now our higher magnifying power exaggerates it, causes everything to appear unsteady and blurry, however good the glass, and makes the same kind of trouble for the eye which we should experience if we tried to read very fine print across the top of a hot stove, whence columns of tremulous air were rising. There is no remedy for this, unless it is assiduous watching and infinite patience, for in almost every day there will come one or more brief intervals, lasting sometimes minutes, sometimes only seconds, during which the air seems momentarily tranquil. We must be on the watch for hours, to seize these favorable moments, and, piecing together what we have seen in them, in the course of time we obtain such knowledge of the more curious features of the solar surface as we now possess.

The eye aches after gazing for a minute steadily at the full moon, and the sun's light is from 300,000 to 600,000 times brighter than full moon light, while its heat is in still greater proportion. The object lens of such a telescope as the equatorial at Allegheny is 13 inches in diameter, and it is such light, and such heat, concentrated by it, that we have to gaze on. The best contrivance so far found for diminishing both, and without which our present acquaintance with the real appearance and character of sunspots would not have been gained, depends upon a curious property of light, discovered by a French physicist, Malus, in the beginning of this century. Let A (Fig. 10) be a piece of plane unsilvered glass, receiving the solar rays and reflecting them to a second similar one, B, which itself reflects them again in the direction C. Of course, since the glass is transparent, most of the rays will pass through A, and not be reflected. Of those which reach B again most will pass through, so that not a hundredth part of the original beam reaches C. This then, is so far a gain; but of itself of little use, since, such is the solar brilliancy, that even this small fraction would, to an eye at C, appear blindingly bright. Now, if we rotate B about the line joining it with A, keeping always the same reflecting angle with it, it might naturally be supposed that the light would merely be reflected in a new direction unchanged in quantity.

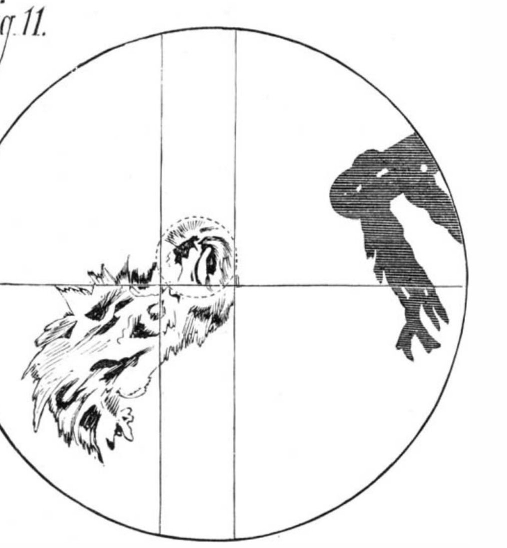
But according to the curious discovery of Malus this is not what happens. What does happen is that the second

* For parts 1 and 2 see SCIENTIFIC AMERICAN for July 20 and July 27.

glass, after being given a quarter turn (though always kept at the same angle), seems to lose its power of reflection almost altogether. The light which comes from it now is diminished enormously, and yet nothing is distorted or displaced; everything is seen correctly if enough light remains to see it by at all, and the ray is said to have been "polarized by reflection." It would be out of place to enter here on the cause of the phenomenon; the fact is certain, and is a very precious one, for the astronomer can now diminish the sun's light till it is bearable by the weakest eye, without any distortion of what he is looking at, and without disturbing the natural tints by colored glasses. In practice, a third and sometimes a fourth reflector, each of a wedge shaped, optically plane piece of unsilvered glass, are thus introduced, and by a simple rotation of the last one the light is graded at pleasure, so that with such an instrument, called "the polarizing eyepiece" (Fig. A), I have often watched the sun's magnified image for four or five hours together, with no more distress to the eye than in reading a newspaper.

With this, in favorable moments, we see that the sun's surface away from the spots, everywhere, is made up of hundreds of thousands of small, intensely brilliant bodies, that seem to be floating in a gray medium, which, though itself no doubt very bright, appears dark by comparison. What these little things are is still uncertain; whatever they are, they are the immediate principal source of the sun's light and heat. To get an idea of their size we must resort to some more delicate means of measurement than we used in the case of the watch. The filar micrometer consists essentially of two excessively fine strands of cobwebs (or, rather, of spider's cocoon), called technically "wires," stretched parallel to each other and placed just at the focus of the telescope. Suppose one of them to be fixed and the second to be movable (keeping always parallel to the first) by means of a screw, having perhaps one hundred threads to the inch, and a large drum shaped head divided into one hundred equal parts, so that moving this head by one division carries the second "wire" $\frac{1}{10000}$ part of an inch nearer to the first. Motions smaller than this can clearly be registered, but it will be evident that everything here really depends upon the accuracy of the screw. The guide screw of the best lathe is a coarse piece of work by comparison with "micrometer" screws as now constructed (especially those for making the "gratings" to be described later), for recent uses of them demand perhaps the most accurate

Fig. 11.

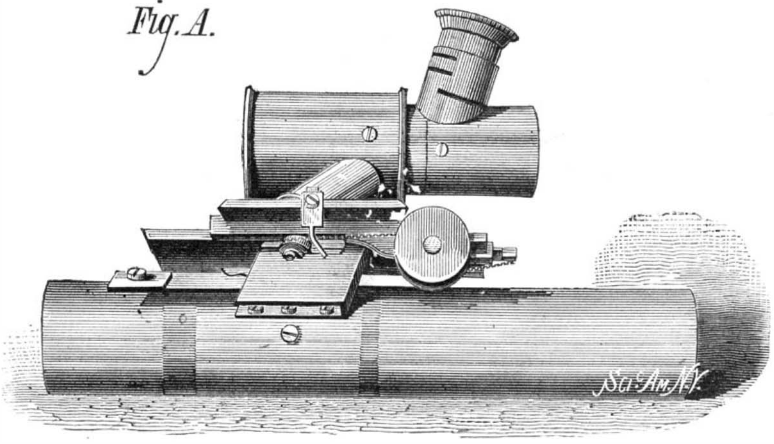


workmanship of anything in mechanics—the maker of one which will pass some lately invented tests is entitled at any rate to call himself "a workman."

Since the "wires" are stretched precisely in the focus, where the principal image of the sun is formed, and move in it, they, and the features of the surface, form one picture, as magnified by the eye lens, so that they appear as if moving about on the sun itself. We can first set them far enough apart, for instance, to take in the whole of a spot, and then by bringing them together measure its apparent diameter, in ten thousandths of an inch. Then, measuring the diameter of the whole sun, we have evidently the proportion that one bears to the other, and hence the means of easily calculating the real size. A powerful piece of clockwork, attached to the equatorial, keeps it slowly rotating on its axis, at the same angular rate as that with which the sun moves in the sky, so that any spot or other object there will seem to stay fixed with relation to the "wires," if we choose, all day long. The picture of "wires," spots, and all, may be projected on a screen if desired; and Fig. 11 shows the field of view, with the micrometer wires lying across a "spot," so seen on the 6th of March, 1873. Part of a cambric needle with the end of a fine thread is represented also as being projected on the screen along with the "wires" to give a better idea of the delicacy of the latter.

Now we may measure, if we please, the size of one of those bright objects, which have just been spoken of as being countable by hundreds of thousands. These "little things" are then seen to be really of considerable size, measuring from one to three seconds of arc, so that (a second of arc here being over 400 miles) the average surface of each individual of these myriads is found to be considerably larger than Great Britain. Near the edge of the disk, under favorable circumstances, they appear to rise up through the obscuring atmosphere, which darkens the limb, and gathered here and there in groups of hundreds, to form the white cloudlike patches (*faculæ*), which may sometimes be seen even with a spy-glass—"something in the sun brighter than the sun itself," to employ the expression by which Huyghens described them nearly two hundred years ago. They are too minute and delicate objects to be rendered at all in our engraving; but this is true also of much of the detail to be seen at times in the spots themselves. The wood cuts make no pretense to do more than give an outline of the more prominent features, of which we are now about to

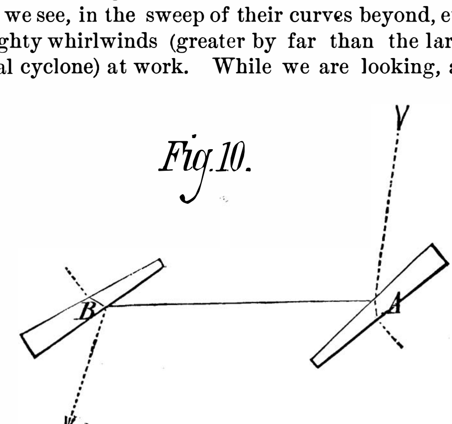
Fig. A.



speak. The wonderful beauty of some of their details must be taken on trust, from the writer's imperfect description of what no pencil has ever yet rendered and what the photograph has not yet seized.

Bearing this in mind, let us now suppose that while using the polarizing eyepiece on the part of the spot distinguished by the little circle, we have one of those rare opportunities when we can, by the temporary steadiness of our tremulous atmosphere, use the higher powers of the telescope and magnify the little circle till it appears as in Fig. 12. We have now nearly the same view as if we were brought close to the surface of the sun, and suspended over this part of the spot. All the faint outer shade, seen in the smaller views (the *penumbra*) is seen to be made up of long white filaments, twisted into curious ropelike forms, while the central part is like a great flame, ending in fiery spires. Over these hang what look like clouds, such as we sometimes see in our highest sky, but more transparent than the finest lace vail would be, and having not the "fleecy" look of our clouds, but the appearance of being filled with almost infinitely delicate threads of light. Perhaps the best idea of what is so hard to describe, because so unlike anything on earth, is got by supposing ourselves to look *through* successive vails of white lace, filled with flower-like patterns, at some great body of white flame beyond, while between the spires of the flame and separating it from the border are depths of shade passing into blackness. With all this, there is something crystalline about the appearance, which it is hard to render an idea of—frost-figures on a window pane may help us as an image, though imperfect. In fact the intense whiteness of everything is oddly suggestive of something very cold, rather than very hot, as we know it really. I have had much the same impression when looking into the open mouth of a puddling furnace at the lumps of pure white iron, swimming half-melted in the grayer fluid about them. Here, however, the temperature leaves nothing solid, nothing liquid even; the iron and other metals of which we know these spot-forms do in part at least consist are turned into vapor by the inconceivable heat, and everything we are looking at consists probably of clouds of such vapor; for it is fluctuating and changing from one form into another while we look on. Forms as evanescent almost as those of sunset clouds, and far more beautiful in everything but color, are shifting before us, and here and there we see, or think we see, in the sweep of their curves beyond, evidences of mighty whirlwinds (greater by far than the largest terrestrial cyclone) at work. While we are looking, and try-

Fig. 10.



ing to make the most of every moment, our atmosphere grows tremulous again, the shapes get confused, there is nothing left distinct but such coarser features as our engraving shows, and the wonderful sight is over. When we consider that this little portion of the spot we have been looking at is larger than the North and South American continents together, and that we could yet see its parts change from minute to minute, it must be evident that the actual motion must have been rapid almost beyond conception—a speed of from 20 to 50 miles a *second* being commonly observed and sometimes exceeded. (A cannon ball moves less than $\frac{1}{4}$ of a mile per second.) I have seen a portion of the photosphere, or bright general surface of the sun, drawn into a spot, much as any floating thing would be drawn into a whirlpool, and then, though it occupied by measurement over 3,000,000 miles in area, completely break up and change so as to be unrecognizable in less than twenty minutes.

When we come to discuss the subject of the sun's heat, we shall find that the temperature of a blast furnace or of the oxyhydrogen blowpipe is low compared with that which obtains all over such a vast region, and remembering this, it is evident that its disappearance is a cataclysm of which the most tremendous volcanic outburst here gives no conception. We cannot, by any terrestrial comparison, describe it, for we have no comparison for it in human experience. If we try to picture such an effect on the earth, we may say in another's words that these solar whirlwinds are such as, "coming down upon us from the north, would in thirty seconds after they had crossed the St. Lawrence be in the Gulf of Mexico, carrying with them the whole surface of the continent in a mass, not simply of ruin, but of glowing vapor, in which the vapors arising from the dissolution of the materials composing the cities of Boston, New York, and Chicago would be mixed in a single indistinguishable cloud."

These vast cavities then in the sun we call spots are not solid things, and not properly to be compared even to masses of slag or scoria swimming on a molten surface. They are rather rents in that bright cloud surface of the sun which we call the photosphere, and through which we look down to lower regions. Their shape may be very rudely likened to a funnel with sides at first slowly sloping (the *penumbra*), and then suddenly going down into the central darkness (the *umbra*). This central darkness has itself gradations of shade, and cloud forms may be seen there obscurely glowing with a reddish tinge far down its depths, but we never see to any solid bottom, and the hypothesis of a habitable sun far within the hot surface, suggested by Sir William Herschel, is now utterly abandoned. We are able now to explain in part that mysterious feature in the sun's rotation before insisted on, for if the sun be not a solid or a liquid, but a mass of glowing vapor, it is evidently possible that one part of it may turn faster than another. *Why* it so

Fig. 12.

turns, we repeat, no one knows, but the fact that it does is now seen to bear the strongest testimony to the probable gaseous form of the sun throughout its mass—at any rate, to the gaseous or vaporous nature of everything we see. We must not forget, however, that under such enormous temperature and pressure as prevail there the conditions may be—in fact, must be—very different from any familiar to us here, so that when we speak of "clouds," and use like expressions, we are to be understood as implying rather an analogy than an exact resemblance.

We must expect, with the great advances photography has lately made, to know more of this part of our subject (which we may call solar meteorology) at the next spot maximum than ever before, and by that time it may be hoped that some of the wonderful forms described above so imperfectly will have been caught for us by the camera.

IN the notice in our issue for July 27 of a new screw cutting lathe made by Messrs. Goodnow & Wightman, the address should have been 176 Washington street instead of 128, and the diameter of the tail spindle, which was given as $\frac{5}{16}$, should have been $\frac{15}{16}$ inch.

THE Olympia (Wyoming Territory) *Standard* announces that a company has been formed there to bring ice from a glacier. The deposit covers a number of acres, is seventy or eighty feet deep, and is supposed to contain a hundred thousand or more tons, some of which may have been there as many years. The ice can be cut and sold at one and one half cents a pound, and by the ship load at five dollars a ton.

MECHANICAL PUDDLING IN SWEDEN.

The accompanying engravings which we take from *Iron*, give plan and section of the puddling apparatus invented by Mr. Oestlund, as used at the Finspong Ironworks. The gas generator, A, is of the common Swedish type, as used for charcoal. The tube, *k*, conducts the gases into the refining pot, *a*. This pot has a lining of refinery slag, which is melted, as the apparatus revolves, to get it to adhere to the sides. The revolution of the pot, *a*, on its axis, *d*, is effected by the action of the beveled wheels, *b* and *b'*, and the pulley, *c*, which takes from an iron chain the power given off by a turbine. The spindle, *d*, is supported in the bearings, *e* and *e'*, *c* carrying a pair of trunnions which form the axis of oscillation, and allow the apparatus to rise or fall, the whole of this mechanism being supported on the plummer blocks, *f f*. One of the trunnions, *e''*, is prolonged so as to form the axis of the beveled wheel, *b*, and the pulley, *c*, the latter sliding along the trunnion so as to put *b* in or out of gear. The bush, *e*, is tied by means of the stay, *g'*, to the upper end of the toothed segment, *g*, the lower extremity of which is connected with the second bush at the end of the spindle. By means of the pinion, *h*, revolving on standards, *i i*, and the segmental rack, *g*, the pot can be raised or lowered without interfering with the action of the beveled wheels.

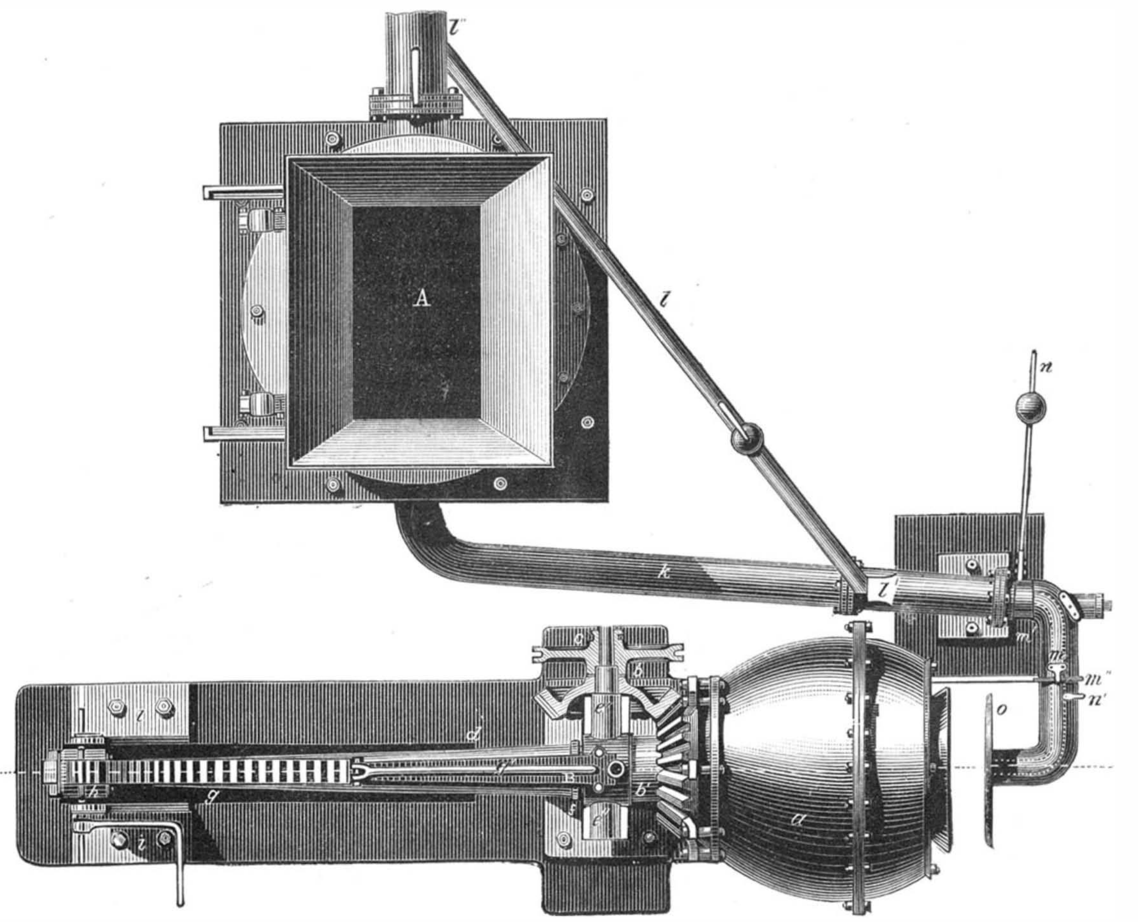
The gas from the generator is brought to the mouth of the pot by the tubes, *k* and *m*. The air necessary for the combustion of the gas is brought in by a tube, *l*, branching from the air main, *l''*. The air tube, *l*, passes into the gas tube and is continued concentrically within the latter. The gas and air tubes both have joints at *m'* and *m''*. By means of the bar, *n*, which has a counterpoise to keep the moving parts in position, the tubes can be brought from or toward the mouth of the pot, so as to make it free of access to the workman. With a key fitting on the stem, *n'*, the tubes can be turned in *m'*, so as to give the currents of gas and air a more or less oblique direction. To screen the workmen from the heat of the pot a disk of iron, *o*, lined with fire clay on the side next the pot, is fitted to the end of the tubes.

Before running the metal into the pot, the latter must be heated, to such a degree that the slag lining is pasty or semi-fluid at its surface. Generally an hour and a half will be spent in heating with gas to this point. There should be sufficient live coal in the pot when the gas is first let in to keep up its combustion; should it be extinguished by excess of air or gas, it must be relit. As soon as the pot begins to get red hot the full heat can be put on.

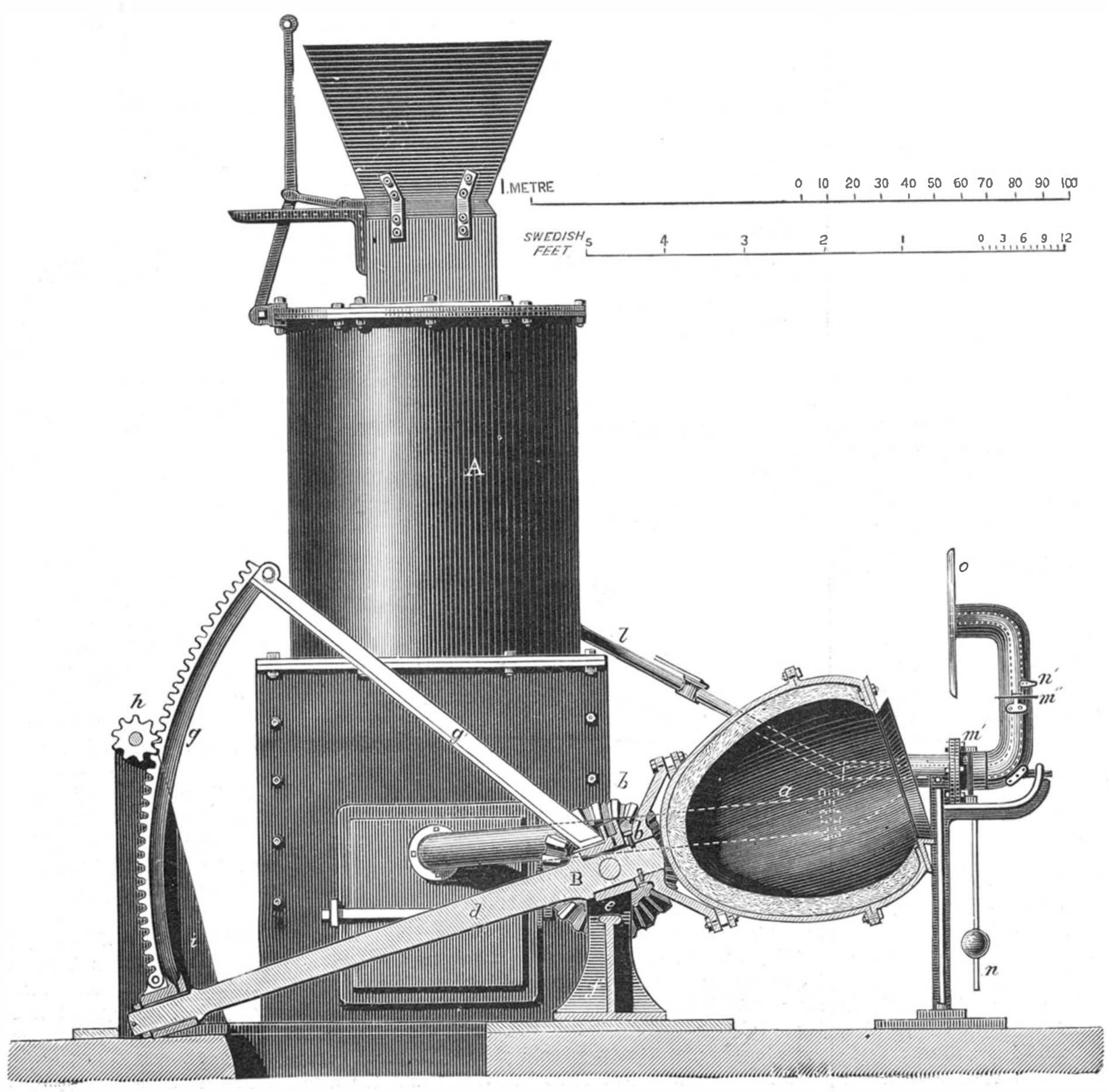
The gas generator is tended in the usual way with the ordinary precautions. To keep ashes and dust out of the gas tube, lumps of charcoal are heaped up to the height of the top of the flue. The wind pressure for the generator was 33 to 41 millimeters of mercury, that of the wind for the combustion of the gas (at Finspong the blast is not heated) being only 16½ millimeters. The pressure of the gas in the tube near the pot was 6·2 millimeters of mercury. The method of working, viewed chemically, does not sensibly differ from puddling; although giving as good, perhaps better, results at a much less cost. There are three principal periods in the operation: 1. The period before boiling. 2. The boiling itself. 3. The end of the boiling, and the formation of balls. When cast metal is poured into the pot a shovelful or two of refinery slag is added. The temperature of the bath is thus brought down; it thickens and boils, the pot revolving at the rate of 30 or 40 revolutions a minute. The metal is worked with a rabble, either to cool it or to get the slag to incorporate with it, as is done in puddling. Note must be taken of the temperature of the melted metal and that of the pot, at the moment of charging, the heat during working being regulated accordingly by increasing or diminishing the inflow of air and gas. When circumstances are favorable, boiling begins five minutes after the metal is run into the pot, and it lasts about ten minutes.

Boiling having begun, the batch swells, the iron forms, granulates, and seems to cling to the rabble and the sides of the pot The rotation of the pot is continued, as well as the working, to separate out parts which are not yet refined; but no more cold cinder is put in. While boiling goes on the temperature is regulated so that the pig does not cling to the side of the pot during a complete revolution, but so that the particles next the side fall back into the bath when the side comes uppermost in the revolution. The heat is raised a little when the iron can be felt by the rabble to be completely refined, when shining lumps make their appearance in the bath, and the iron begins to cling to the walls. At the moment, therefore, that the temperature is brought to its highest point, and the iron begins to agglutinate, the rotation of the pot should be stopped, and either immediately, or after the delay of a couple of minutes, it is removed. If the iron does not ball well, it is not completely refined, and the pot may be started again. If the iron is firm enough already, the isolated particles are exposed to the hottest flame possible, the blast being carried to its maximum. The refining is thus completely finished, and all the particles are agglomerated. The mobility of the gas tube at *m''* is of advantage in this operation. It is sometimes useful to start the pot again to round up the puddled ball, but it is best if this has been formed with the rabble.

The iron from a charge of 75 kilos. of pig may be divided with advantage into a couple of balls; a third may be made of the iron separated from the walls of the pot. To get out the balls the pot is lowered, and the workmen use tongs, pointed rabble, and hooked bar. If things have gone well the balls ought to come out soft at a welding heat, filled with cinder like puddled balls, but a little more resisting and solid under the hammer. They are forged into bars, and these are at once passed to the rolls. If nothing hinders the balling and shingling, these operations will not consume more than fifteen minutes.



APPARATUS FOR MECHANICAL PUDDLING.



APPARATUS FOR MECHANICAL PUDDLING.

Photographic Engraving.

Scamoni's process is as follows: The original drawings are carefully touched up, so that the whites are as pure and the blacks as intense as possible, and then the negative is taken in the ordinary way, the plate being backed in the camera with damp red blotting paper, to prevent reflection from the camera or back of the plate. The negative is developed in the ordinary manner, intensified by mercuric chloride, and varnished. A positive picture is taken in the camera, the negative being carefully screened from any light coming between it and the lens. This is intensified by pyrogallic acid, and afterward washed with a pure water to which a little ammonia has been added. It is then immersed in mercuric chloride for half an hour, and again intensified with pyrogallic acid. This is repeated several times. When the intensity of the lines is considerable, the plate is well washed, treated with potassium iodide, and finally with ammonia, the image successively appearing yellow, green, brown, and then violet brown. The plate is then thoroughly drained, and the image is treated successively with a solution of platinic chloride, auric chloride, ferrous sulphate, and finally by pyrogallic acid, which has the property of solidifying the metallic deposits. The metallic relief thus obtained is dried over a spirit lamp, and covered with an excessively thin varnish. This varnish, which is evidently a special preparation, retains sufficient tackiness to hold powdered graphite on its surface (the bronze powder now used may be employed instead), which is dusted on in the usual manner. After giving the plate a border of wax, it is placed in an electrotyping bath, and a perfect facsimile in intaglio is obtained, from which prints may be taken in a printing press.

A NEW DEEP SEA THERMOMETER.

Perhaps some of our readers may have seen a description of a form of thermometer devised by MM. Negretti and Zambra for the purpose of ascertaining the temperature of the ocean at great depths. This consisted of a tube bent into the shape of a siphon, which when it had reached the desired depth was made, by means of an ingenious arrangement, to pour all the mercury found above a certain point near the reservoir into the second arm of the siphon. This second arm, which, like the other, was a capillary tube, carried a scale of divisions on which might be read the temperature of the depths to which the instrument had been lowered. This thermometer gave all the results that might have been expected. The ship Challenger during its polar expedition had on board a certain number of these instruments. The report of Capt. G. S. Nares made to the English Admiralty describes all the benefits that we may hope to reap from a serious study of the temperature of the ocean at different depths, and not the least of these are those that pertain to the fishery interest. Notwithstanding the good results given by this instrument, its inventors have endeavored to render it still more practical and more within the reach of all by diminishing the cost of construction, and increasing its compactness.

Fig. 1 represents the thermometer isolated from its case. It is an ordinary thermometer furnished at A with a little device that M. Negretti has already made use of in the construction of his larger instrument, and which allows the liquid to run from the reservoir into the capillary tube when the temperature rises, without letting it flow back when it lowers, if moreover the precaution has been taken to incline the tube slightly, reservoir upward. At B there is a bulge in the tube in which a certain quantity of mercury may lodge; this bulge is placed in such a way that the mercury resulting from the dilatation of the reservoir may come to it and continue its ascension in the capillary tube when the reservoir is down (the thermometer being vertical), but cannot get out when the reservoir is upward.

We should add that these thermometers are constructed so as to give the variations of temperature within determined limits.

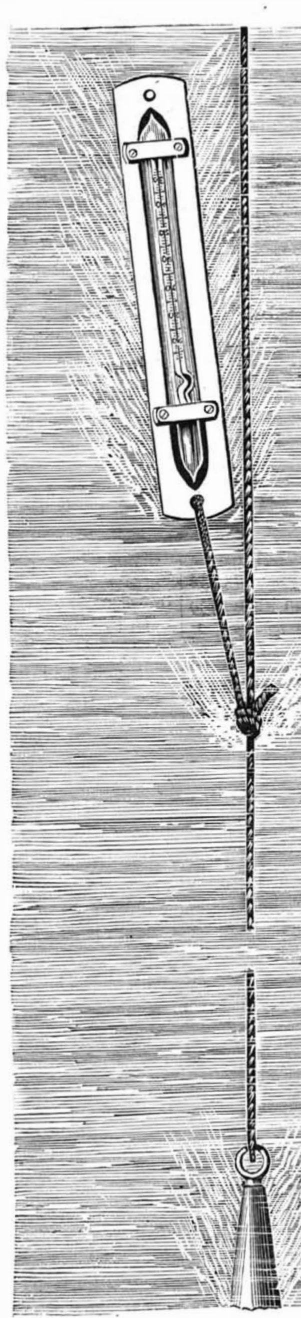


Fig. 2.

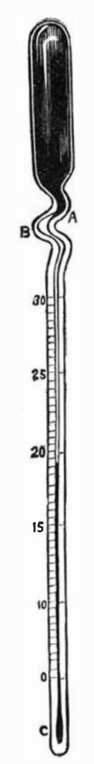


Fig. 1

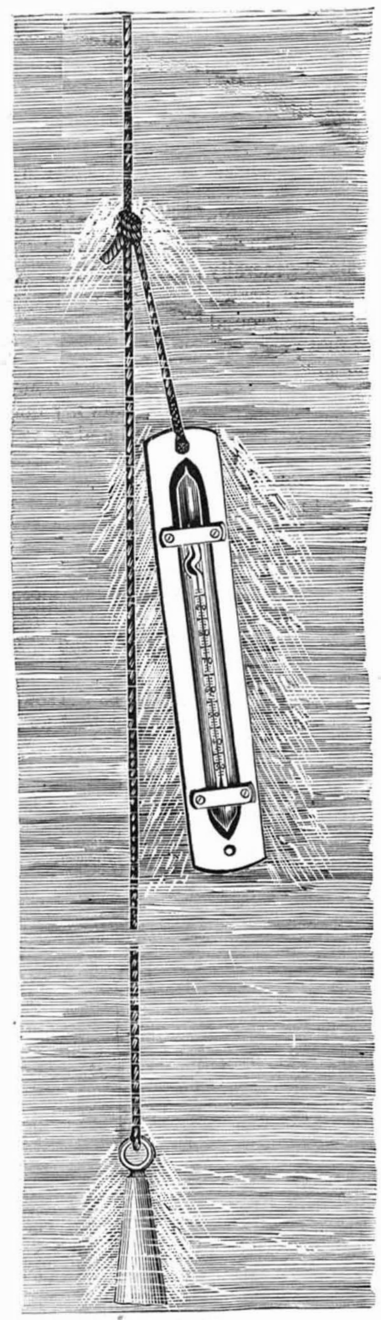


Fig. 3.

NEW THERMOMETER FOR OBTAINING THE TEMPERATURE OF THE OCEAN AT GREAT DEPTHS.

The small reservoir, B, is indispensable to the well working of the apparatus; for in seeking the temperature at a certain depth the instrument may, on being drawn up, pass through warmer strata, and it is necessary, therefore, to provide the reservoir with a means of diffusing the small quantity of mercury resulting from this excess of temperature. The tube has also a small bulge at its upper extremity at C.

The thermometer is placed in a small wooden case having a double bottom throughout its length. In this double bottom are placed a certain number of lead balls that can run from one end of the case to the other, and of sufficient weight to render the instrument buoyant in sea water. To use the apparatus, one end of a cord is passed through a hole in the case under the reservoir of the thermometer, and the other end is tied to the sounding line at a certain distance from the lead (Fig. 2). While the line is descending the thermometer will remain reservoir downward (Fig. 2); but when it is again drawn up the thermometer case will take the position indicated in Fig. 3, and the column of mercury breaking at A will fall into the capillary tube, the divisions of which, as will be seen at Fig. 1, are reversed.

As to the thermometer itself, it is important to protect it against the pressure which becomes so considerable at great depths; to do this the reservoir is surrounded by an envelope of thick glass about three quarters full of mercury. The mercury serves to transmit the temperature to the reservoir, and should the exterior envelope yield to the effects of pressure, the reservoir proper would not be affected, the mercury not exactly filling the annular part which surrounds it.

New Inventions.

George E. Palmer, of Cedar Rapids, Iowa, has patented an improved Ironing Board, on which the garments may be held in stretched state while being smoothed with the irons, and readily adjusted thereon to any required degree of tension by a simple attachment.

William B. Rutherford and Joel T. Hawkins, of Rockdale, Texas, have patented an improved Bale Tie, which is formed of the plate provided with a longitudinal groove and cross ribs or loops, and having projections or keys to adapt it to receive and hold the notched ends of the bale band.

An improvement in Composition Pavements has been patented by John C. Russell, of Kensington, Eng. This invention relates to the treatment of peat and spent tan for the manufacture of an improved product or material suitable for paving roads and other places and for roofing, etc. The most important steps in making the composition consist in drying bruised or finely ground peat or spent tan, heating the same *in vacuo* to degree of 150° Fah., and adding sulphur and gas tar, gas pitch, and stearine pitch in the proportions specified, then kneading the mixture while heated and adding carbonate of lime and furnace slag.

Louis Blanck, of New York city, has patented an improved Safety Brake or attachment for locomotives and railroad cars, by which the entire train, either by a collision with another train or by contact with any obstruction, is first raised from the rails, and then moved in backward direction for the distance of a few feet, so that all danger of accident is avoided, and no other sensation than that of a slight rocking motion exerted. The attachment is constructed so as to admit of being worked by the engineer from the cab of the locomotive, or, if desired, from any car of the train.

An improved Evaporating Pan has been patented by Andrew D. Martin, of Abbeville, La. This invention consists in a tapering sheet metal tank having transverse partitions and longitudinal tapering flues that extend through all of the partitions and terminate at the ends of the tank.

Lloyd Arnold, of Galveston, Texas, has patented an improved Bale Tie, which is formed of a block of iron, with a space or opening running longitudinally through its breadth from one end nearly to the other, and having the alternate edges of the two plates thus formed notched, the notch of the lower plate being square and of a width equal to or a little greater than the bale band, and the notch of the upper plate being narrower at its bottom than the bale band, and with its sides inclined and beveled to an edge, to adapt it to receive and hold the bale band.

An improved Tie for Letter Packages has been patented by John Mersellis, of Knowersville, N. Y. The object of this invention is to provide a tie by means of which letter packages may be quickly and securely fastened or tied. It consists in a plate apertured to receive one end of the string and also to receive the hook upon which the tie is hung when not in use, and having a button and clasp spring for engaging the string in the process of tying.

Fred P. Hammond, of Aurora, Ill., has patented an improved Inking Pad, which consists in a novel arrangement of layers of cloth or felt, chamois skin, oiled silk, and printing roller composition, which enables a clean impression of the stamp to be made. The pad retains the desired rounded surface and proper degree of softness, and is easily manipulated when necessary to replenish the supply of ink.

William J. Clark and Thomas W. Roberts, of Coffeeville, Miss., have patented an improved Trap for Catching Fish in streams, which will allow the fish to be conveniently taken out without taking up the trap.

John W. Cooper, of Salem, Ind., is the inventor of an improved Alcohol Lamp for soldering and similar purposes; and it consists in a reservoir pivoted in a supporting frame, and provided with two wick tubes, and an extinguisher secured to a spring support, and capable of closing the larger wick tube when it is in a vertical position. It has an ndependent extinguisher for the smaller wick tube, and is provided with a novel device for projecting the wick from the larger tube as it is moved out of a vertical position.

Benjamin Slater, of Attica, N.Y., has invented a simple and effective device for Renovating Feathers by the combined action of steam and hot air. It consists of a cylindrical receptacle, partly surrounded by a steam jacket, and having a hot air box, a perforated bottom, a cover or damper for the same, and an aperture in the top, to which is fitted a perforated cover and a close cover.

An improved Blind Fastening has been patented by George Runton and John Runton, of Hoboken, N. J. This fastening is so constructed as to fasten the blind or shutter automatically when swung open, and in such a way as to prevent all rattling or shaking of the blind or shutter from the action of the wind.

David R. Nichols, of Alexandria Bay, N. Y., has patented an improved Animal Trap, which is so constructed as to set itself after each animal has been caught, and leave no trace of the trapped animal to frighten away those that may come afterward.

William A. Doherty, of Fall River, Mass., has patented an improved Loom Shuttle Attachment, by which the weaving of bad cloth is prevented, and in case any false shed is made by any irregularities in the warp, and that part of the shed carried lower than usual, the attachment is released and thrown over the spindle point, so as to render it impossible to draw out the filling from the shuttle, and thus break it and stop the loom.

Jonas Bowman, of Somerset, O., has patented an improved Vehicle Spring, which permits of dispensing with side bars, thus taking less space to turn on, and by which the tilting and pitching motion usual with springs as heretofore constructed is avoided.

Hiram Unger, of Germantown, O., is the inventor of an improved Gate Latch, which is so constructed that the gate cannot be opened accidentally by being lifted or by rebounding of the catch or latch.

Madison Calhoun, of Ocate, Ter. of New Mex., has patented an improved Hame Fastening, which is not liable to become accidentally unfastened, and is easily and quickly fastened and unfastened, even with cold or gloved hands.

THE Downer well at Corry, Pa., is now down over 1,300 feet, and an oil bearing sand has been struck of about five feet thickness.

Communications.

Our Patent Law.

To the Editor of the Scientific American:

While I cannot handle this subject with any master talent, nor afford to devote the time which should be given to so important a subject before expressing an opinion, yet I can less afford to keep quiet and allow shrewd avarice to manipulate or titled ignorance to legislate my property out of existence. "Property! There is no property in patents," I often hear said. And how about the invention covered by a patent? Is that property? A large majority of people may say no, and deny the justice of a patent law. On the contrary, I, as an inventor, think an invention is genuine property, and as such should be under the same protection in common law as all other property, instead of requiring a special law by which the people magnanimously grant me the privilege for a short time of using what was never theirs, what they never knew of until I brought it into existence.

But what is real property, and by what title is it held? Mother earth, from which we sprung, by which we exist, and to which we return, is, without question, real estate. How is it obtained; how held? History answers, By conquest, by subjugation. But these words, conquest and subjugation, have a more significant meaning than the spoiling of one people by another; they are the actual price of possession. He who, toiling, subjugates the soil, is undoubted owner of its production, by virtue of the highest blessing on record—"By the sweat of thy brow shalt thou obtain bread." And this principle is so far acknowledged that the laborer holds a lien on the product of his labor, even though the property belongs to another.

Mr. A has an unpromising piece of land on which he would like to raise corn. He analyzes the soil, experiments upon it chemically, reads up on the properties and components of corn, the effects of fertilizers and acids upon the soil, and makes himself a fool and laughing-stock generally among his neighbors because he steps out of the beaten track by which they have succeeded in making the ground barren. He does not have much success the first year, and is sympathizingly consoled with "I told you so." But he perseveres and wins the reputation of being "visionary" and "as stubborn as a mule." In the meantime he becomes more familiar with his subject, sees more clearly the requirements of the case, finds he must post himself more thoroughly in certain branches of science in order to conduct his experiments, wrestles with this obstacle and that, and finally discovers a fertilizer based on some natural law of rotation, and produces a crop of corn never before equaled. Now his neighbors come out with this very intelligent question, "How did you happen to think of it?" And they further very condescendingly remark, "That is a rousing crop; I guess I'll try the same thing myself. How did you say you mixed the stuff?" This man is the true conqueror. He has endured privation and scorn, fought obstacles, and in subduing them has eliminated a new principle in agriculture that is an engine of power to all generations. Shall his crops be his only reward? Shall they who laughed him to scorn step into his reward without sharing the labor that produced it?

This is a simile for thousands of inventions, only that the inventor is seldom situated to plant the corn on his own land and reap the harvest. Then which of you will say that he has not a just lien on every man's crop raised by his process for a per cent of the gains thereby? There is a bill before Congress favoring a periodical taxation of patents under the pretext of removing useless patents from the path of later inventors. Let me show you how one inventor looks at that. My neighbor has a vacant lot on which he is unable to build; but joined to mine it would increase the value of my property vastly. Now can't you legislate that old heap of rubbish into my possession somehow? Of course he is waiting for the rise of property around him to sell his lot well; but can't you make that appear unnatural, and that he is a dog in the manger? It is also said that sharpers get control of old patents and lay an embargo on legitimate business. I reply, first, no one could be damaged by the owner of a patent unless he infringed that owner's right; second, if he does infringe, it shows that said patent is valuable, otherwise he need not infringe; and if valuable why should not he pay for it? Mr. B, in the employ of Mr. C, watches the machine he uses, and spends his leisure hours in working out an improvement, which he patents and offers to C for sale; but as the invention is useless except as attached to C's machine, he thinks B can't help himself, and adopts the improvement without paying for it. When a few years have built up a great industry, and C is rich from his spoils, B steps in with a few friends at his back, incorporated especially to make C shell out.

Of course this is bad and ought to be legislated against. If it were not valuable C need not use it. It is not becoming to the Congress of a great nation to spend its time in legislating worthless patents out of existence. All such will die a natural death. And if there is sufficient worth in any patent to claim your consideration, the inventor is entitled to its price, whether he waits four years or fifteen for his pay.

I speak of myself, not as an individual, but as representing in this letter a class, without whose achievements America, in her proud length and breadth, could not to-day have been. For the last half of my past life, over twenty years, I have been an inventor. Schooled in adversity, accustomed to disappointment, sometimes successful, enjoying no luxuries but the conquest of obstacles, and often forced to simple pursuits to keep the pot boiling, yet I expect to spend the rest of my life inventing, feeling strong in the school of experience, and hoping for such prosperity as will enable me to work out some of the larger problems in view.

If those in power would really aid the inventor, let them increase his facilities for information. Circulate the Patent Office *Gazette* at one dollar a year, a nominal subscription to insure *bona fide* readers, and pay the balance out of the Patent Office surplus now accumulated. This both to educate and to save inventors from going over old ground, bringing more talent up to the standard of to-day. Lessen rather than increase Patent Office fees. Enable the Commissioner to give the strictest possible examination on every application for a patent, that when issued it shall bear a *bona fide* value, by retaining the most competent examiners at a salary adequate to keep them. Reduce the cumbrous machinery of patent litigation to about this text, in two headings: First, Is plaintiff the first inventor? Allow one month to find that out. If not disproved in that time, allow it. Second, Does defendant infringe? Allow one month to decide that. If not proven, discharge the case, with cost to plaintiff. If proved, cost and damage to be settled by defendant in thirty days.

The ability of wealthy corporations to absorb with impunity the product of all talent within their reach, and put off the day of reckoning until plaintiff is swallowed in cost, is the greatest present discouragement to inventors. Our patent law is now better than any amendment yet proposed will leave it. If you must tinker over it, remember all laws are for protection of the weak. The bulldog does not need law to take the bone from the spaniel. Just in proportion as you damage the patent law, you destroy the accomplishments and purpose of my life. Therefore I have spoken; so could a thousand more. W. X. STEVENS.

East Brookfield, Mass.

The Edison Carbon Telephone and Hughes' Microphone.

To the Editor of the Scientific American:

Mr. Edison finds a resemblance between his carbon telephone and my microphone.

I can find none whatever; the microphone in its numerous forms that I have already made, and varied by many others since, is simply the embodiment of a discovery I have made, in which I consider the microphone as the first step to new and perhaps more wonderful applications.

I have proved that all bodies, solid, liquid, and gaseous, are in a state of molecular agitation when under the influence of sonorous vibrations; no matter if it is a piece of board, walls of a house, street, fields or woods, sea or air, all are in this constant state of vibration, which simply becomes more evident as the sonorous vibrations are more powerful. This I have proved by the discovery that when two or more electrical conducting bodies are placed in contact under very slight constant pressure, resting on any body whatever, they will of themselves transform a constant electrical current into an undulatory current, representing in its exact form the vibrations of the matter on which it reposes; it requires no complicated arrangement and no special material, and to most experimenters the three simple iron nails that I have described form the best and most sensitive microphone. But these contact points would soon oxidize, so naturally I prefer some conducting material which will not oxidize.

Mr. Edison's carbon telephone represents the principle of the varying pressure of a diaphragm or its equivalent on a button of carbon varying the amount of electricity in accordance with this change of pressure; it represents no field of discovery, and its uses are restricted to telephony.

The three nails I have spoken of will not only do all, and that far better than Edison's carbon telephone in telephony, but has the power of taking up sounds inaudible to human ears, and rendering them audible, in fact a true microphone; besides it has the merit of demonstrating the molecular action which is constantly occurring in all matter under the influence of sonorous vibrations.

Here we have certainly no resemblance in form, materials, or principles to Mr. Edison's telephone. The carbon telephone represents a special material in a special way to a special purpose.

The microphone demonstrates and represents the whole field of nature; the whole world of matter is suitable to act upon, and the whole of the electrical conducting materials are suitable to its demonstrations.

The one represents a patentable improvement; the other a discovery too great and of too wide bearing for any one to be justified in holding it by patent, and claiming as his own that which belongs to the world's domain.

London, July 2, 1878. D. E. HUGHES.

New Industrial Enterprises.

The increasing wealth of a nation, as well as the profitable and steady employment of its capital and people, depends upon a continual increase of the producing power. Whenever there are latent resources undeveloped or opportunities for establishing the first foundation of an industry, leading as it will to the originating of hundreds of auxiliary ones, an unusual effort should be made to bring it into existence. If in the power of individuals to accomplish, so much the better; if needing an association with State or national influence, then this association should be formed. It is incumbent upon individuals that they possess a sufficient pride in the prosperity of the country to give every possible attention and assistance to a careful practical demonstration of the feasibility of all the new industrial enterprises which may be presented with reasonable assurance of final success.

Not in a great expenditure of money: influence is better than money, and a potential interest in a new enterprise is often better than capital. The industrial resources of the United States are by no means worked to their full capacity. The people by no means make all they consume. The finer articles of use, and requiring much labor and often the highest skill, are imported from foreign nations. A premium of $10,000 offered for an improved method in any known present process of production or manufacture would be almost sure to be called for.

While America exports $175,000,000 worth of raw cotton annually to be worked up by other people, is it not possible to so increase the manufacture in America as to keep the greater part of that raw material and to export the cloth instead? Is it not practicable to establish great numbers more of sugar estates in the same tropical climate? Is it not practicable to lay the foundation of half a dozen beet sugar mills in the country? To begin the weaving of linen goods, and to teach our farmers that they may produce all the flax fiber as fast as required? To start a ramie industry in a small way and teach the process to those who will engage in it?

Will not our silk men put a velvet industry into operation as a germ from which a future industry may grow? And we might name a hundred other lesser enterprises which have hardly name in this country, but every one of which is needed and will add to the wealth of the people.

Replanting and Transplanting Teeth.

Dr. G. R. Thomas, of Detroit, in the current number of the *Dental Cosmos*, states that this operation of "replanting" has become so common with him, and the results so uniformly satisfactory, that he does not hesitate to perform it on any tooth in the mouth, if the case demands it; and he finds the cases that demand it, and the number that he operates upon, continually multiplying.

He makes it a point to examine the end of the roots of nearly all his cases of abscessed teeth; and a record of more than 150 cases, with but one loss (and that in the mouth of a man so timid that he utterly refused to bear the pain which nearly always follows for a few minutes, therefore necessitating re-extraction), convinces him that the operation is not only practical, but decidedly beneficial to both patient and operator. For one sitting is all that he has ever really found necessary to the full and complete restoration of the case.

In the present article, however, Dr. Thomas states that it is his object not so much to speak of replanting as of transplanting, which he has reason to believe is just as practical, so far as the mere re-attachment is concerned, as is replanting. He details, in illustration, a case in which he successfully performed the operation; inserting in the mouth of a gentleman, who had lost a right superior cuspidate, a solid and healthy tooth that he had removed from a lady's mouth four weeks previously. He opened into canal and pulp chamber of the tooth, from the apex of the root only; cut the end off one eighth of an inch (it being that much too long), reduced the size somewhat in the center of the root (it being a trifle larger than the root extracted), filled and placed it in position. He states that the occlusion, shape, and color were perfect, so much so that several dentists who saw the case were not able to distinguish the transplanted tooth from the others. The two features in the case that he calls particular attention to are: first, that although the tooth had been in his office four weeks, there is to-day no perceptible change in color; and second, that the re-attachment is as perfect as though it had been transplanted or replanted the same day of extraction. The operation was performed about three months ago. Dr. Thomas knows of but two obstacles in the way of the perfect practicability of "transplanting:" first, the difficulty of obtaining the proper teeth at the proper time; and second, the possibility of inoculation. The latter is the more formidable of the two, and, to escape the ills that might follow, the greatest caution is necessary. The first difficulty is more easily gotten over, for it is not necessary that the tooth transplanted should correspond exactly in shape and size to the one extracted; if it is too large, it may be carefully reduced; or if too small, new osseous deposit will supply the deficiency. Neither is it necessary, as we have seen, that the transplanted tooth should be a freshly extracted one.

As a demonstration of what modern dental surgery is capable of performing Dr. Thomas' statements are very interesting; it is doubtful, however, whether popular prejudice will allow this practice of "transplanting" to become of much use.

American Institute Exhibition.

For forty-seven years the American Institute of New York has opened its doors and invited American inventors and manufacturers to exhibit their productions; and again this year it renews its invitation to all. To such as wish to reach the capitalist and consumer, they must admit that New York is the place. For details apply to the General Superintendent by mail or otherwise.

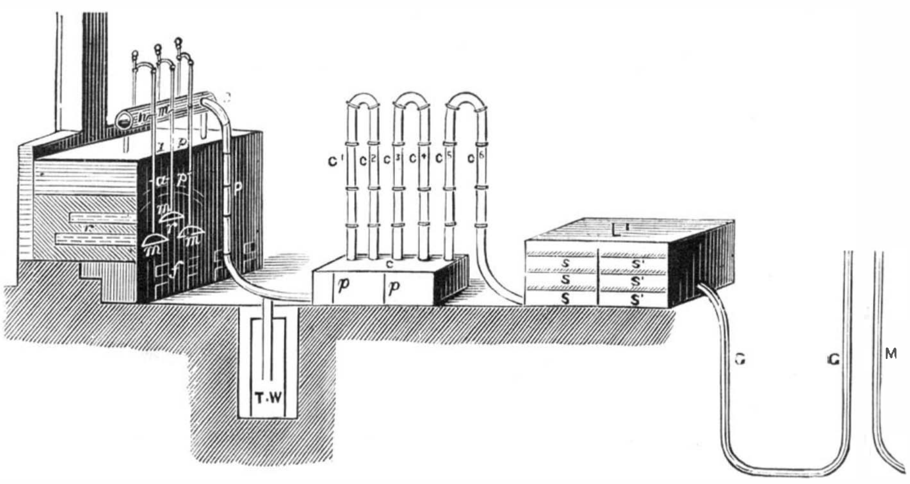
ON the 22d of June, cloud bursts occurred in the mountains northeast of San Buenaventura, Cal., causing the Ventura river to pour down such a volume of muddy water that the ocean was discolored for a distance of six miles.

THE DISTILLATION OF COAL.

Bituminous coal, of which there are several varieties, is the best suited for the production of coal gas. The Newcastle coal is principally used in the manufacture of London gas. Scotch parrot coal produces a superior gas, but the coke produced is of inferior quality. Boghead coal is also used for gas making—in fact, every kind of coal, except anthracite, may be used for this purpose. The bituminous shale produces a very good gas, and it is used partly to supply the place of cannel or parrot coal. As carbon and hydrogen, principally with oxygen, are the elements from which gas is formed, most substances containing these elements can be partially converted into gas. And gas has been made from grease or kitchen waste, oil peat, rosin, and wood, besides coal. A ton of Newcastle or caking coal yields about 9,000 cubic feet of gas, Scotch coal about 11,000, English cannel about 10,000, and shale about 7,000, with illuminating powers in the ratio of about 13, 25, 22, and 36 respectively. The coal is put in retorts, *r*, commonly made of fire clay and often of cast iron. These retorts are from 6 feet to 9 feet long, and from 1 foot to 1 foot 8 inches in breadth. They are made like the letter D, elliptical, cylindrical, or bean shaped. They are built into an arched oven, and heated by furnaces, *f*, beneath. One, three, five, seven, or more are built in the same oven. The mouthpieces are of cast iron, and project outward from the oven, so as to allow ascension pipes, *a p*, to be fixed, to convey the gas generated from the coal to the hydraulic main, *h m*. After the coal has been introduced into the retorts, their mouths are closed with lids luted round the edges with clay, and kept tight by a screw. The retorts are kept at a bright red heat. If the temperature be too low, less gas and more tar are produced, less residue being left; while, should the temperature be too high, the product is more volatile, more residue remaining. And should the gas remain for any length of time in contact with the highly heated retort, it is partially decomposed, carbon being deposited, thereby lessening the illuminating power, and choking up the retort, and more carbon disulphide is produced at a high temperature. The object is to maintain a medium temperature, in order to obtain a better gas having the greatest illuminating power. In about four or five hours the coal in the retort will have given off all its gas. The mouth of the retort is opened, and the coke is raked out into large iron vessels, and extinguished by water. A fresh charge is immediately introduced by means of a long scoop in the cherry-red retort, and the door luted to. The ascension pipes, which convey the gas from the retorts, pass straight up for a few feet, then turn round, forming an arch, then pass downward into the hydraulic main, beneath the level of the liquid contained in it, and bubble up through the liquid into the upper portion of the main. On commencing the main is half filled with water, but after working some time, this water is displaced by the fluid products of distillation. In this way, the opening into each retort is closed, so that a charge can be withdrawn and replaced without interfering with the action of the other retorts and pipes. The liquid tar, ammoniacal water, and gas pass from the end, *e*, of the hydraulic main, down through the pipe, P, and the liquid falls down into the tar well, T W, while the crude gas goes on into the chest, C, partially filled with the liquid, so that the plates, *p p*, from the top dip into it to within a few inches of the bottom. These dip plates are placed in the chest, so as to separate the openings into each pair of condensing pipes, *c c*, so that the gas passing into the chest finds no exit except up c_1, and down c_2; and there being no dip plate between c_2 and c_3 it passes up c_3, and down c_4, and as there is no dip plate to prevent its progress, it passes up c_5, and down c_6, into the lime or iron purifiers, L I. The condensers are kept cool by exposure to the atmosphere, and are often cooled by a stream of water from a tank above. The gas cools quickly, and liquids passing along with the gas in a state of vapor are condensed and fall into the chest, and pass by an overflow pipe into the tar well. The purifier is a cast iron vessel, L I, containing a number of perforated shelves, s_1 s_1 s_1, on which slaked lime, to the depth of about 4 inches, or much greater thickness of iron oxide and sawdust, is placed. The gas passes up through the shelves, *s s s*, and down through the shelves, s_1 s_1 s_1, through the pipe, G, into the gas holder, and from thence through the pipe, M, to the main pipe. The lime abstracts carbonic anhydride, sulphuretedhydrogen, cyanogen, naphthalin, and a portion of the ammonia, but not carbon disulphide, which latter may be absorbed by passing the gas through a solution of sodic hydrate and plumbic oxide, mixed with sawdust. Gas containing CS_2, on burning, produces H_2SO_4, which injures books and furniture in rooms. However, the quantity of CS_2 in gas is generally so minute as to be practically uninjurious. By a proper regulation of the temperature during distillation, the quantity produced is infinitesimal. When the lime is saturated it is removed, and fresh supplied; but the iron, after use, can be reconverted into oxide by exposure to the atmosphere, and used repeatedly. When iron is used a separate lime purifier is necessary to remove carbonic anhydride. The last traces of ammonia are removed before passing to the gas holder, by passing the gas through dilute sulphuric acid, or up through the interior of a tower having perforated shelves covered with coke in small pieces, through which a constant supply of fresh water percolates. This washing removes some of the more condensable hydrocarbons, and lessens the illuminating power of the gas. Before the gas passes from the condensers into the purifiers, it passes through a kind of pump, termed an exhauster, driven by steam power. This action relieves the retorts from the pressure of the gas passing through the hydraulic main, etc. It diminishes the deposit of graphite in the retorts, and lessens leakage in them, should there be any flaws. It also has the beneficial effect of producing a gas of a higher illuminating power, since the relief of pressure in the retorts produces a more favorable condition of combustion.

The following are some of the bodies produced in the manufacture of gas, namely, acetylene, *g*, the carbonate, *s*, chloride, *s*, cyanide, *s*, sulphide, *s*, and sulphate, *s*, of ammonium; aniline, *l*, anthracene, *s*, benzine, *l*, carbonic oxide, *g*, carbonic anhydride, *g*, carbonic disulphide, *l*, chrysene, *s*, cumene, *l*, cymene, *l*, ethylene, *g*, hydrogen, *g*, leucoline, *l*, methyl-hydride, *g*, naphthaline, *s*, nitrogen, *g*, paraffine, *s*, phenylic alcohol, *l*, picoline, *l*, propene, *g*, quartene, *g*, sulphureted hydrogen, *g*, toluene, *l*, water, *l*, xylene, *l*, etc.

The most of the above solid and liquid substances, with the letters *s* and *l* written after, are removed by cooling the gas in the condensers, and the gaseous substances marked *g*, that are injurious in the consumption of the gas, are removed by purification. The impurities in the gas may consist of ammonic carbonate and sulphide, carbonic anhydride and disulphide, nitrogen, oxygen, sulphureted hydrogen, and water in the form of vapor; and acetylene, ethylene, and the vapors of the acetylene, ethylene, and phenylene series of hydrocarbons are the illuminating ingredients diluted with carbonic oxide, hydrogen, and methyl-hydride. The



THE DISTILLATION OF COAL.

approximate percentage composition of coal gas is: H, 45·6; Me, 34·8; CO, 6·5; C_2H_4, 4; CO_2, 3·6; N, 2·4; C_4H_8, 2·3; SH_2, 0·3, etc.—*Hugh Clements in English Mechanic.*

A Short History of Petroleum.

The *Lumberman's Gazette* gives the following short history of petroleum: The production of petroleum as an article of trade dates from the 28th of August, 1859, when Colonel Drake, in a well 69½ feet deep, "struck oil," and coined a phrase that will last as long as the English language. From that beginning it has increased to an annual production of 14,500,000 barrels of crude oil. The first export was in 1861, of 27,000 barrels, valued at $1,000,000, and the export of petroleum in the year 1877 was, in round numbers, $62,000,000. The annual product of petroleum to day—crude and refined—is greater in value than the entire production of iron, and is more than double that of the anthracite coal of the State of Pennsylvania, and exceeds the gold and silver product of the whole country. As an article of export it is fourth, and contests closely for the third rank. Our leading exports are relatively as follows: Cotton annually from $175,000,000 to $227,000,000; flour from $69,000,000 to $130,000,000; pork and its products (bacon, ham and lard) from $57,000,000 to $82,000,000; and petroleum from $48,000,000 to $62,000,000. The total export of petroleum from 1861 to and including 1877 (16 years) has been $442,698,968, custom house valuation. From the best sources of information there are at this time 10,000 oil wells, producing and drilling, which, at a cost of $5,000 per well, would make an investment of $50,000,000 in this branch of the business. Tankage now existing of a capacity of 6,000,000 barrels cost $2,000,000, and $7,000,000 has been invested in about 2,000 miles of pipe lines connected with the wells. The entire investment for the existing oil production, including purchase money of territory, is something over $100,000,000, which amount cannot be lessened much, if any, for as wells cease to produce new ones have been constantly drilled to take their place.

Minute Forms of Life.

The Rev. W. H. Dallinger lately delivered a lecture at the Royal Institution, descriptive of the recent researches of Dr. Drysdale and himself. The object of the lecture was mainly to explain the method of research which had been employed. The first essays of the opticians to produce "high powers" were, as might be expected, feeble. These powers amplified, but did not analyze; hence it began to be questioned whether "one could see more really with a high power than with a moderate one." And this was true at the time. But it is not so now. The optician has risen to the emergency, and provided us with powers of great magnifying capacity which carry an equivalent capacity for analysis. They open up structure in a wonderful way when rightly used. The lecturer began by projecting upon the screen the magnified image of a wasp's sting—an object about the 1-20th of an inch in natural size—and beside it was placed a piece of the point of a cambric sewing needle of the same length, magnified to the same extent. The details of the sting were very delicate and refined, but the minute needle point became riven and torn and blunt under the powerful analysis of the lens, showing what the lecturer meant by "magnifying power;" not mere enlargement, but the bringing out of details infinitely beyond us save through the well made lens. This was further illustrated by means of the delicate structure of the *Radiolaria*, and still further by means of a rarely delicate valve of the diatom known as *N. rhomboides*. With a magnification of 600 diameters no structure of any kind was visible; but by gradually using 1,200, 1,800, and 2,400 diameters, it was made manifest how the ultimate structure of this organic atom displayed itself.

But this power of analysis was carried still further by means of the minutest known organic form. *Bacterium termo.* The lecturer had, in connection with Dr. Drysdale, discovered that the movements of this marvelously minute living thing were effected by means of a pair of fine fibers or "flagella." These were so delicate as to be invisible to everything but the most powerful and specially constructed lenses and the most delicate retinas. But since this discovery, Dr. Koch, of Germany, had actually photographed the flagella of much larger bacteria, such as *Bacillus subtilis*, and expressed his conviction that the whole group was flagellate. Mr. Dallinger determined then to try to measure the diameter of this minute *flagellum* of *B. termo* that the real power of magnification in our present lenses might be tested. This was a most difficult task, but 200 measurements were made with four different lenses, and the results were for the mean of the first 50 measurements 0·00000489208; for the second 0·00000488673; for the third, 0·00000488024; for the fourth, 0·00000488200, giving a mean value for the whole, expressed in vulgar fractions, of the $\frac{1}{204700}$ of an inch as the diameter of the flagellum of *B. termo.*

With such power of analysis it was manifest that immense results might be expected from a good use of the "highest powers." The proper method of using them was next dwelt on, and then the apparatus was described, by means of which a drop of fluid containing any organism that was being studied might be prevented from evaporating while under the scrutiny of the most powerful lenses, and for an indefinite length of time. The importance of studying such organisms in this way—by continuous observation—was then plainly shown, some of the peculiar inferences of Dr. Bastian, as to the transmutation of bacteria into monads, and monads into amœbæ, etc., being explained by discontinuity of observation.

Wages in England.

Consul General Badeau reports that during the past five years wages have increased gradually about 10 per cent, while the cost of living has increased about 25 per cent. Clothing is about 30 per cent higher, while fuel has not risen in price. Agricultural laborers get from $2 to $3 per week, including beer; building laborers and gardeners from $4.40 to $5.10 per week; bricklayers, carpenters, masons, and engineers from $6.80 to $11 per week; cabinetmakers, printers, and jewelers from $8 to $12.30 per week, although the best marble masons and jewelers receive $14.75. Bootmakers and tailors get from $4.86 to $7.65 per week, and bakers from $4.65 to $7.25, with partial board. Women servants are paid from $70 to $240 per annum. Railway porters and laborers on public works get from $4.45 to $12 per week. Rents have risen some 30 per cent, and are, for artisans in London, from $1.20 to $2.40 per week for one or two rooms.

The Treatment of Cancer by Pressure.

M. Bouchut has recently introduced to the notice of the members of the Académie des Sciences a cuirasse of vulcanized caoutchouc, which he has used with success for the treatment of cancerous and other tumors of the breast. In this country there has been much division of opinion upon the utility of pressure in the treatment of cancer, some surgeons regarding it as harmful, or but rarely useful, others attributing to it great retardation of the rapidity of growth of the tumor, or even cure. The surgeons of Middlesex Hospital studied it systematically some years ago, and gave an unfavorable report. The theory of the plan is certainly good: a neoplasia, like a healthy tissue, is dependent upon its blood supply for vitality and growth, and complete anæmia causes the death of a tumor, as it does of a patch of brain substance. It will be remembered that Mr. Haward last year related at the Clinical Society a case in point. He ligatured the left lingual artery for a recurrent epithelioma of the tongue; the tumor sloughed away, and a fortnight before the patient's death from blood poisoning the tongue was quite healed. In just the same way ischæmia will impair the vitality and so lessen the growth of a tumor. The difficulty is rather in the practical application of this theory. The knowledge that we now possess of the mode of growth of cancers gives us at least one important indication. If we have to deal with a neoplasia that grows at the periphery by gradual infiltration of the surrounding tissues, it is plain that, for pressure to be useful, it must be applied around the tumor rather than over it, where, by compressing and obstructing the capillaries, it would cause overfullness of those at the circumference. It is the periphery of a cancer that is its active part, and we must, therefore, produce ischæmia around and not in the tumor. In the application of the treatment this must be obtained by the careful adjustment of elastic pads or cotton wool, and as the whole success of the plan depends upon the skill with which this is done, too much attention cannot be given to it. We cannot regard pressure as a substitute for removal of a cancer; but in the frequent cases where this is impracticable it appears to be the best substitute at present open to the surgeon. M. Bouchut's cuirasse would seem to be an improvement upon the spring pads and other appliances in use in this country.—*Lancet.*

NEW CUTTING AND BORING ATTACHMENT FOR LATHES.

Our engraving represents a useful little machine which is intended for attachment to lathes. Although it is exceedingly simple it is capable of performing a great variety of work.

The machine is used in two ways, either by attachment to a rigid support, as shown in Fig. 1, or by suspending it by a belt, so that it is capable of universal motion, as shown in Fig. 2.

The supporting frame, A, has three boxes for the spindle, B, and on the shaft at one side of the middle box there are planing knives, C, on the opposite side there is a balance wheel, and a pulley for receiving the driving belt. The spindle, B, extends beyond the ends of the frame, A, and has at each end a socket for receiving interchangeable cutting and boring tools. One end of the spindle is externally threaded to receive a face plate, to which may be attached a disk of wood for receiving sandpaper for smoothing and polishing wood or metal.

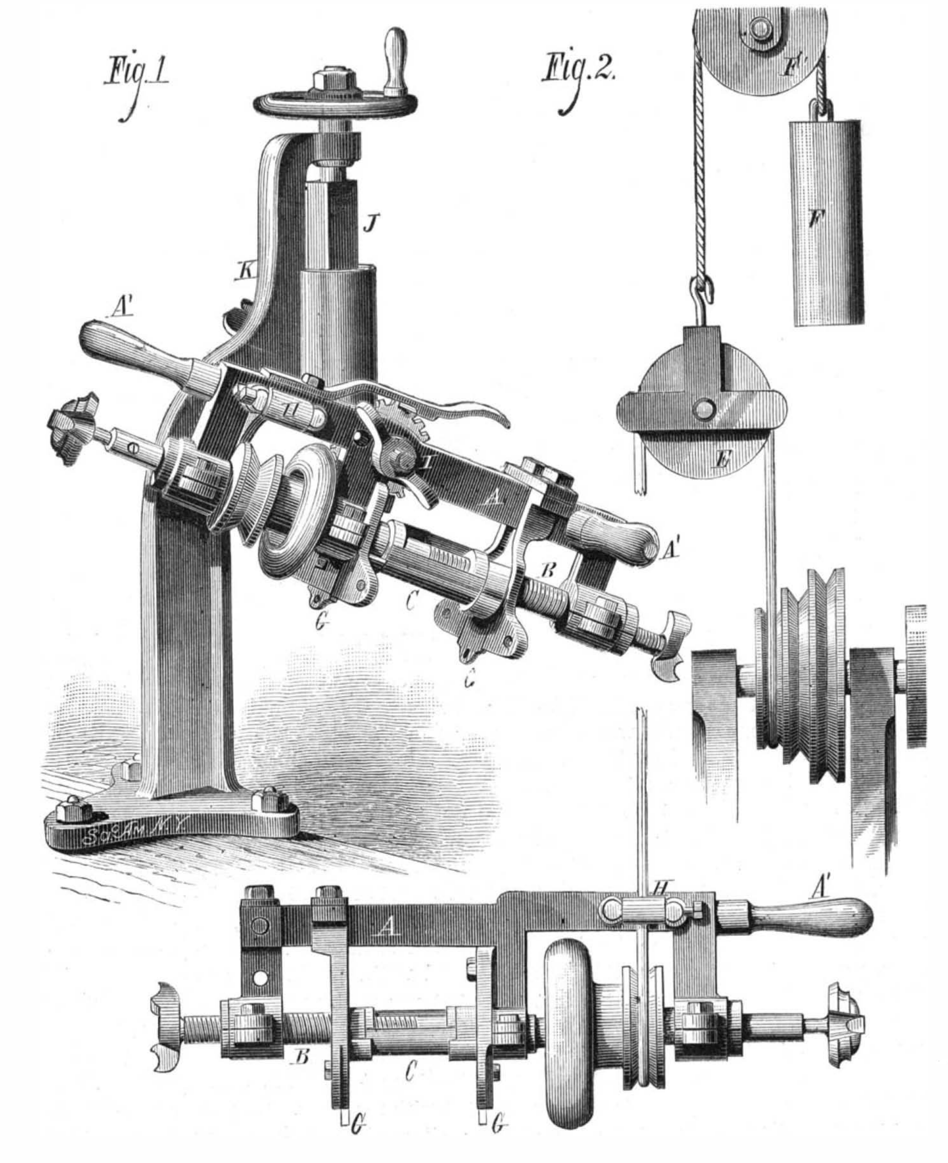
The frame, A, is held to its work by means of handles, A', and the spindle is driven by a round belt that passes over a suspended pulley, E, and also over the pulley on the lathe mandrel.

The entire attachment is balanced by a weight, F, attached to a cord that passes over a fixed pulley, F', to the pulley, E, to which it is secured by a swivel hook that permits of turning the belt in any direction. The belt is guided by small pulleys, H, so that the device may be turned without running the belt from the pulley on the spindle.

Guides, G, are attached to the frame, A, for guiding the material being operated upon by the planing knives. The frame, A, may be supported by attachment to an arm, I, at the lower end of the screw-acted follower, J, which slides in a rigid support, K. The arm, I, has a notched disk which is engaged by a spring detent which holds the frame at any desired inclination.

Among the kinds of work that may be done on this machine may be mentioned shaping and edging, fluting and beading table legs, balusters, etc.; dovetailing, boring, carving, paneling, shaping or friezing mouldings, scroll or fret work, inlaying and engraving, blind stile mortising and blind slat planing. By changing the inclination of the spindle different varieties of mouldings may be produced by the same cutter.

The machine may be used as an emery grinder, and it may also be used for drilling and shaping metals. For further information address Mathew Rice, Augusta, Ga.



CUTTING AND BORING ATTACHMENT FOR LATHES.

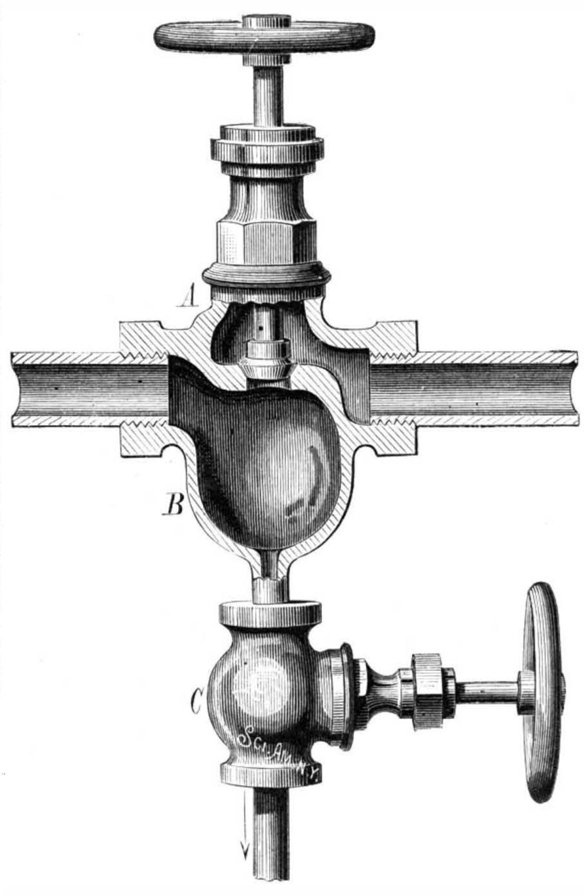
Decrease of the New York Rainfall.

In his report for 1876, Director Draper, of the New York Meteorological Observatory in Central Park, showed that a careful examination of the records in his office proved that there had been, in late years, a change in the rainfall of New York and its vicinity, affecting seriously its water supply. The decrease had been steady since 1869, previous to which there had been an increase. In his report for 1877, Mr. Draper discusses the question whether the change continues, or is likely to continue, in the same direction, and comes to the conclusion that the rainfall of New York will, most probably, continue to decrease by fluctuations for several years to come; also, that the variations are very nearly the same in the two portions of the year, the division date being July 1.

NEW STEAM VALVE.

The improved valve shown partly in section in the engraving is designed for removing the water of condensation from steam pipes, so that dry steam may be furnished.

In the engraving, the globe valve, A, is of the usual form,



SAUNDERS' STEAM VALVE.

except that the casing below the valve seat is enlarged, forming a pocket, B, which communicates through an aperture at the bottom with a small valve, C.

The steam, in passing through the valve, fills the pocket and there deposits any water that may have condensed from the steam in its passage through the steam pipe. The increased depth of the lower portion of the valve prevents siphoning, which takes place in valves of the ordinary form. The valve, C, is kept slightly open to discharge the water at the moment it collects in the pocket; the water is thus prevented from passing onward to the engine or other point of use.

This valve affords a ready means of supplying dry steam to sulphuric acid chambers. We are informed that by its use a chamber in ordinary working order will produce acid 3° to 5° Baumé stronger than can be obtained with ordinary globe valves. Thirty steam pipes, arranged at different points, are found to deliver into a chamber in the space of five minutes from 4 to 16 ounces of condense water (according to the circumstances of distance, temperature of the air, size of pipe, etc.). These valves, being placed close to the chamber separating all the condense water, deliver with certainty uniformly dry steam, without the inconvenience of ordinary steam traps or other expensive appliances.

This valve was patented through the Scientific American Patent Agency, May 21, 1878. For further particulars address Mr. Joseph Saunders, 975 Third avenue, Brooklyn, N. Y.

A Hint from the Mormons.

Ex-Governor Hendricks, in a recent industrial address, alluded to the highly prosperous condition of the Mormons as existing previous to the influx of the Gentiles into Utah, saying that "to the fact that they produced all they consumed I attribute their wonderful prosperity." This remark, associated with the prosperity of other communities in different parts of the country, would suggest the query of "Why the principle cannot be more largely applied to the whole nation?" Certainly the resources of the whole country would indicate a much greater diversity of production, and if there was the same regard for a uniform building up of our industrial system there would seem to be need of but little importation, certainly of goods which can be readily made, and which our people need the labor to produce.

New Agricultural Inventions.

Joseph George, of Springfield, Greene Co., Mo., has patented an improved form of Cultivator or Shovel Plow, designed to be convertible into either a single, double, or triple shovel plow as occasion may require. It consists in two detachable clamping plates, which hold the plow beams, and their arrangement with respect to the said beams and the handles of the plow, whereby a single bolt is made to secure the forward ends of the handles and clamp the plates to hold the plow beams in place.

Russel O. Bean, of Macedonia, Miss., is the inventor of an improved Seed Planter for planting cotton and other seeds, and for distributing fertilizers. The details of the construction of this planter cannot be explained without engravings.

Rutus Sarlls and Alexander Kelman, of Navasota, Texas, have invented an improved combined Planter, Cultivator, and Cotton Chopper, which may be readily adjusted for use in planting seed, cultivating plants, and chopping cotton to a stand, and is effective and reliable in operation in either capacity.

William H. Akens, of Penn Line, Pa., is the inventor of an improved Dropper, for attachment to the finger bar of a reaper, to receive the grain and deliver it in gavels at the side of the machine, so as to be out of the way when making the next round. It is so constructed that when attached to the finger bar of a mower it will convert it into a harvester.

James Goodheart, of Matawan, N. J., has devised an improved machine for Distributing Poison upon potato plants to destroy the potato bug. It may also be used for sowing seeds.

William V. McConnell and Charles M. Dickerson, of Crockett, Texas, have invented an improved Fruit Picker, having cup-shaped self-opening spring jaws attached to its handle, and operated by a cord to close upon and clamp the fruit. It also has a hollow extensible adjustable handle and a fruit receiver.

Quick Work.

Two years ago a farmer-miller and his wife, at Carrolton, Mo., furnished some invited guests with bread baked in eight and a quarter minutes from the time the wheat was standing in the field. This year it was determined to make still better time. Accordingly elaborate preparations were made to reap, thrash, grind, and bake the grain with the least possible loss of time.

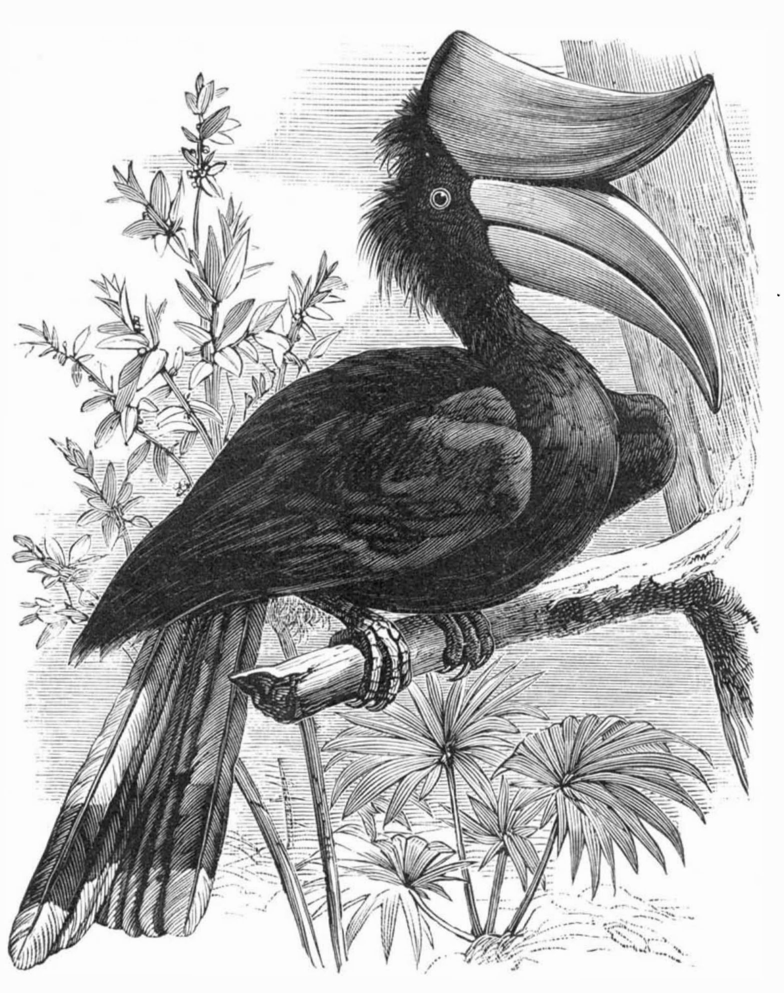
In 1 minute 15 seconds the wheat, about a peck, was cut and thrashed, and put on the back of a swift horse to be carried to the mill, 16 rods away. In 2 minutes 17 seconds the flour was delivered to Mrs. Lawton, and in 3m. 55s. from the starting of the reaper the first griddle cake was done. In 4 minutes 37 seconds from the starting of the reaper, a pan of biscuits was delivered to the assembled guests.

After that, according to the Carrolton *Democrat*, other pans of delicious "one minute" biscuits were baked more at leisure, and eagerly devoured, with the usual accompaniment of boiled ham and speech making.

THE RHINOCEROS HORNBILL.

There are many strange and wonderful forms among the feathered tribes; but there are, perhaps, none which more astonish the beholder who sees them for the first time than the group of birds known by the name of hornbills. They are all distinguished by a very large beak, to which is added a singular helmet-like appendage, equaling in size the beak itself in some species, while in others it is so small as to attract but little notice. On account of the enormous size of the beak and helmet, the bird appears to be overweighted by the mass of horny substance which it has to carry, but on closer investigation the whole structure is found to be singularly light and yet very strong, the whole interior being composed of numerous honeycombed cells with very thin walls and wide spaces, the walls being so arranged as to give very great strength when the bill is used for biting, and with a very slight expenditure of material.

The greatest development of beak and helmet is found in the rhinoceros hornbill, although there are many others which have these appendages of great size. The beak varies greatly in proportion to the age of the individual, the helmet being almost imperceptible when it is first hatched, and the bill not very striking in dimensions. The beak gains in size as the bird gains in strength. In the adult the helmet and beak attain their full proportions. It is said that a wrinkle is added every year to the number of the furrows found on the bill. The object of the helmet is obscure, but the probability is that it may aid the bird in producing the loud roaring cry for which it is so celebrated. The hornbill is lively and active, leaping from bough to bough with great lightness, and appearing not to be in the least incommoded by its huge beak. Its flight is laborious, and when in the air the bird has a habit of clattering its great mandibles together, which together with the noise of the wings produces a weird sound. The food of the hornbill seems to consist of both animal and vegetable matters. We take our illustration from Wood's "Natural History."



THE RHINOCEROS HORNBILL.

Saw Tempering by Natural Gas.

Beaver Falls, Pa., contains several gas wells at an average depth of eleven hundred feet, yielding about 100,000 cubic feet of gas every twenty-four hours. This gas has been introduced into a large saw tempering furnace at that place in the works of Emerson, Smith & Co. The furnace is 8 feet wide by 14 feet long. It is said to be a perfect success, giving a uniform heat, and there being no sulphur or impurity in the gas the steel is not deteriorated in the operation of heating.

THE JAPANESE BUILDING AT THE PARIS EXHIBITION.

Japan, on the terrestrial globe, lies furthest away in that direction beyond the Far West of America, and beyond the wide Pacific. The Japanese structure has a simple and solid aspect, resembling the portal of a half-fortified mansion, with massive timber frames at the sides; but it is adorned with two handsome porcelain fountains, and each of these is designed to represent the stump of a tree supporting a shell into which the water is poured from a large flower. Before entering the porch a large map of Japan and a plan of the city of Tokio are seen displayed on the walls to right and left.—*Illustrated London News.*

Machinery for New York State Capitol Building.

The Buckeye Engine Company of this city have been awarded the contract for a pair of condensing engines, cylinders 14 inches diameter, stroke 28 inches, for the State Capitol Building at Albany, New York. The engines will be of the company's usual horizontal type with automatic cut off, and will be elaborately finished.

The Explosiveness of Flour.

Professors Peck and Peckham, of the University of Minnesota, have been making an extensive series of experiments to determine the cause of the recent flour mill explosion at Minneapolis. The substances tested were coarse and fine bran, material from stone grinding wheat; wheat dust, from wheat dust house; middlings, general mill dust, dust from middlings machines, dust from flour dust house (from stones), and flour. When thrown in a body on a light, all these substances put the light out. Blown by a bellows into the air surrounding a gas flame, the following results were obtained:

Coarse bran would not burn. Fine bran and flour dust burn quickly, with considerable blaze. Middlings burn quicker, but with less flame. All the other substances burn very quickly, very much like gunpowder.

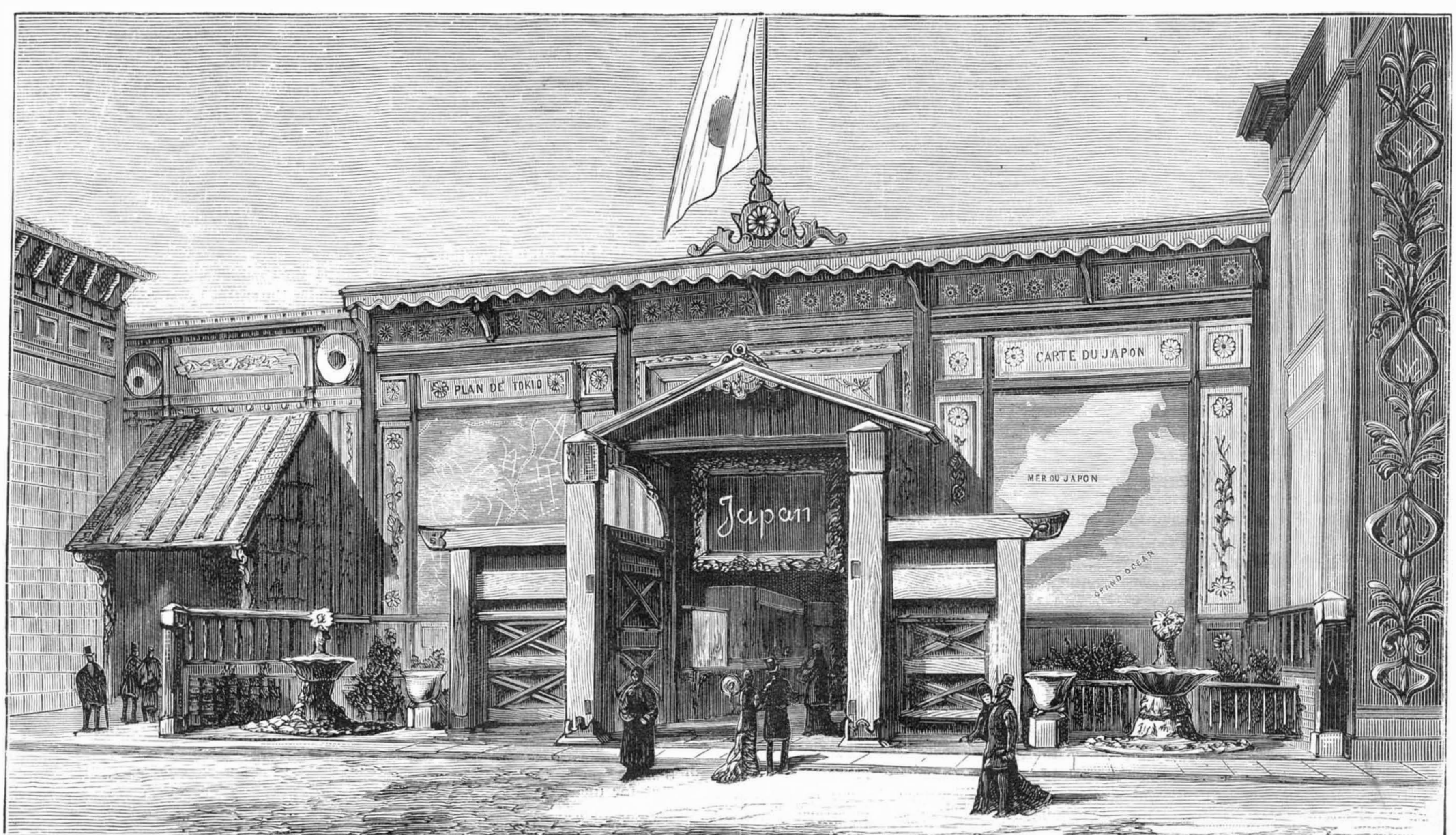
In all these cases there was a space around the flash where the dust was not thick enough to ignite from particle to particle; hence it remained in the air after the explosion. Flour dust, flour middlings, etc., when mixed with air, thick enough to ignite from particle to particle, and separated so that each particle is surrounded by air, will unite with the oxygen in the air, producing a gas at high temperature, which requires an additional space, hence the bursting.

There is no gas which comes from flour or middlings that is an explosive; it is the direct combination with the air that produces gas, requiring additional space. Powerful electric sparks from the electric machine and from the Leyden jar were passed through the air filled with dust of the different kinds, but without an explosion in any case. A platinum wire kept at a white heat by a galvanic battery would not produce an explosion. The dust would collect upon it and char to black coals, but would not blaze nor explode.

A piece of glowing charcoal, kept hot by the bellows, would not produce an explosion when surrounded by dust, but when fanned into a blaze the explosion followed. A common kerosene lantern, when surrounded by dust of all degrees of density, would not produce an explosion, but when the dust was blown into the bottom, through the globe and out of the top, it would ignite. To explode quickly the dust must be dry. Evidently when an explosion has been started in a volume of dusty air, loose flour may be blown into the air and made a source of danger.

New Engineering Inventions.

Erskine H. Bronson, of Ottawa, Ontario, Canada, has patented an improvement in Automatic Switches for Railways, which consists in an arrangement of sliding cams for moving the switch rails, and in treadles to be operated by the pilot wheels of the locomotive, and in intermediate mechanism for connecting the treadles with the switch operating cams, the



THE JAPANESE BUILDING AT THE PARIS EXHIBITION.

object being to provide a switch will be operated by the pilot wheels of the locomotive as it approaches the movable switch rails.

An improved Refrigerator Car has been patented by Michael Haughey, of St Louis, Missouri. The object of this invention is to ventilate and cool railway cars used in the transportation of perishable articles. This car has a novel ventilator and ice box and is provided with a new form of non-conducting walls.

CROOKED JOURNALISM.

In the English scientific journal *Engineering*, of June 21, 1878, appears a six column article on "Edison's Carbon Telephone," illustrated with ten engravings from Mr. Prescott's recent work on "The Speaking Telephone, Talking Phonograph, and other novelties." The descriptions of the cuts, and the rest of the information given, so far as correct, obviously come from the same source.

So far as correct: unhappily for the honor of scientific journalism, the writer's desire is plainly not so much to do justice to truth as to exalt Mr. Hughes at the expense of Mr. Edison. To this end he has studiously suppressed from Mr. Prescott's description of the carbon telephone the points which establish Mr. Edison's claim to the prior invention or discovery of everything involved in Mr. Hughes' microphone, while he has as studiously dwelt upon those same points as constituting the peculiar merits of Mr. Hughes' work.

For example, while he uses Fig. 21 of Mr. Prescott's book, he leaves out the very important little diagram numbered 20. It represents one form of the apparatus to which Sir William Thomson refers in the letter in which he says: "It is certain that at the meeting of the British Association at Plymouth last September, a method of magnifying sound in an electric telephone was described as having been invented by Mr. Edison, which was identical in principle and in some details with that brought forward by Mr. Hughes."

The figure looks altogether too much like one form of Mr. Hughes' microphone to allow of its use in an article intended to establish the novelty of Mr. Hughes' discovery.

The omissions from the text are quite as significant. Under the first cut used in *Engineering*, Mr. Prescott says: "In the latest form of transmitter which Mr. Edison has introduced the vibrating diaphragm is done away with altogether, it having been found that much better results are obtained when a rigid plate of metal is substituted in its place. . . The inflexible plate, of course, merely serves, in consequence of its comparatively large area, to concentrate a considerable portion of the sonorous waves upon the small carbon disk or button; a much greater degree of pressure for any given effort of the speaker is thus brought to bear on the disk than could be obtained if only its small surface alone were used."

The *Engineering* writer coolly suppresses this important statement. He does worse: he puts in its place the false statement that "the essential principle of Mr. Edison's transmitter consists in causing a diaphragm, vibrating under the influence of sonorous vibrations, to vary the pressure upon, and therefore the resistance of, a piece of carbon," and so on.

A little further on, while repeating Mr. Edison's account of the experiments which led to the abandonment of the vibrating diaphragm (page 226 of Mr. Prescott's book), the *Engineering* writer drops out the following remark by Mr. Edison: "I discovered that my principle, unlike all other acoustical devices for the transmission of speech, did not require any vibration of the diaphragm—that, in fact, the sound waves could be transformed into electrical pulsations without the movement of any intervening mechanism."

Worse yet, in the very face of Mr. Edison's assertion to the contrary—an assertion which he could not by any possibility have overlooked—this most unscientific journalist says: "Mr. Edison finds it necessary to insert a diaphragm in all forms of his apparatus, that being the mechanical contrivance employed by which sonorous vibrations are converted into variations of mechanical pressure, and by which variations in the conductivity of the carbon or other material is insured. . . . On the other hand, Mr. Hughes employs no diaphragm at all, the sonorous vibrations in his apparatus acting directly upon the conducting material or through whatever solid substance to which they may be attached."

In this way throughout the offending article, the writer persistently robs Edison to magnify Hughes, giving credit to Mr. Hughes for exactly what he has suppressed from Mr. Prescott's book. To insist as he does, that, because Mr. Edison covers his carbon button with a rigid iron plate, in his very practical telephone, therefore a vibrating diaphragm is an essential feature of Mr. Edison's invention, is a very shallow quibble in the face of Mr. Edison's and Mr. Prescott's statements that the carbon button acts precisely the same in the absence of such covering, though not so strongly. Mr. Edison's laboratory records show a great variety of experiments in which the carbon was talked against without "any intervening mechanism." In a telephone for popular use, however, to be held in the hand, turned upside down, talked into, exposed to dust and the weather, it was obviously necessary to use some means for holding the carbon in place, and to prevent its sensitiveness from being destroyed by dirt and the moisture of the breath when in use. For this purpose a rigid iron partition seemed at once convenient and durable. It is not in any sense a "vibrating diaphragm."

With a persistence worthy of a better cause, the *Engineering* writer returns to the point he seems especially anxious to enforce. Toward the end of the article he says: "In every instrument described by Mr. Edison the diaphragm is the ruling genie of the instrument. Professor Hughes, however, has through his great discovery been enabled to show that variations of resistance can be imparted to an electrical current not only without a diaphragm, but with very much better results when no such accessory is employed."

The animus of all this is only too apparent. Altogether the article is the most dishonest piece of writing we have ever seen in a scientific periodical; and although the article appears in the editorial columns of *Engineering*, we prefer, for the honor of scientific journalism, to think that the management of that paper was not party to the rascally act. It is more credible that a gross imposition has been practiced by some trusted member of the *Engineering* staff, or by some contributor whose position seemed to justify the acceptance of his utterances without any attempt at their verification. It is well known here to whom, in London, at Mr. Edison's request, Mr. Prescott sent proofs of the matter abused, together with electros of the cuts used, in *Engineering*. Accordingly the burden of dishonor lies upon or between a prominent British official on the one hand, and on the other a journal which cannot afford to leave the matter unexplained. Whoever is hurt, we sincerely hope that the fair fame of scientific journalism for candor and honesty may come off unstained.

A More Perfect Production.

The highest skill in manufacture or in production of any kind is not yet the prevailing characteristic of American industry. Uniformity of production, of whatever kind, is of much greater importance than to attempt the manufacture of any grade for which the material or the tools, the machinery or the knowledge of the workmen is not fitted. The highest condition of product in any nation is to produce the finest or highest cost articles in the most perfect manner, and to have material and machinery adopted, and the skilled workmen, so as to be able to so produce economically. But until the master hand is satisfied of all the requisites for producing fine goods, he should confine production to the best his facilities will make in the most perfect, uniform manner.

Samples of fine goods are shown all over the country every day, and were consumers or merchants sure that the product would be the same, there would be much less difficulty in introducing and more home made goods used where now importations are depended upon. The Stevens crash mills import raw flax because it is to be had according to sample, perfectly classified, and saves the employment of skilled labor to assort and classify, and of purchasing a great deal not wanted. The manufacturers of edge tools and knives use imported steel because it is warranted and the warrant proves good, while the uncertainty of American steel is such that a knife will often crack in tempering and cause the loss of labor worth ten times the difference in the price of the steel. Samples of alpacas and other dress goods are shown in our jobbing houses fully equal to any imported goods, but the goods when received are quite often of various grades and imperfections of character.

The imperfect or second quality productions find sale, but at a much lower price, and are to be found at second rate places, the imperfections slight and the goods perhaps generally quite as serviceable, but not absolutely so, and first class houses, catering to those who pay highest prices, cannot afford to have any other house carry better articles than they do. The use of perfect appliances and the best material and the employment of the highest skill are not yet the first step and an absolute necessity, as it should be, in America. The supply of such machinery, material, and labor can be had if those who propose to enter the production of first class articles will insist upon it, and if such supplies are appreciated by the payment of their higher value. The American standard of production is not the highest, and it can be materially elevated, and while, as at present, too many common articles are supplied, the leading manufacturers should turn to producing finer, the finest, and in smaller quantities, to take the place of many articles now imported, and to supply the new market which such productions will always create in any country.

The Wool Product of the World.

From an interesting article on the wool trade of the Pacific coast, published in a recent number of the San Francisco *Journal of Commerce*, we learn that the number of sheep in the world is now estimated at from four hundred and eighty-four to six hundred millions, of which the United States has about 36,000,000, and Great Britain the same number. From 1801 to 1875 the wool clip of Great Britain and Ireland increased from 94,000,000 to 325,000,000 pounds. That of France has increased almost as rapidly, though the wool is finer, as a rule, and hence the superiority of French cloths. Australia produces nearly as much wool as the parent country—Great Britain. The United States product increased from very little at the beginning of the century to about 200,000,000 pounds at the present time. Of this California has produced about one fourth, and the Pacific coast as a whole almost one third. If the ratio of growth shown in the past prevails in the future, the day is not far distant when the Pacific coast will produce at least one half the wool produced in the United States, as not only California and Oregon, but also Washington, Idaho, Montana, Utah, and New Mexico are well adapted to its production. The wool clip of Australia is about 284,000,000 pounds; that of Buenos Ayres and the river Plata, 222,500,000 pounds; other countries not previously given, 463,000,000 pounds. The total clip of the world last year was about 1,497,500 000 pounds, worth $150,000,000. This when scoured would yield about 852,000,000 pounds of clean wool.

Street Main Joints.

At the annual meeting of the New England Association of Gas Engineers, Mr. Thomas, of Williamsburg, made the following remarks on this subject: "In my early experience with the Williamsburg Gaslight Company, with which I became connected in the year 1854, I found pretty nearly all the street mains that were laid were connected with cement joints. While there is no doubt in my own mind that a joint can be made perfectly tight with cement, I much prefer the lead joint. Another thing to be taken into consideration to keep tight joints is that the mains should be laid a sufficient depth under the surface to protect them from the action of severe frosts. A great many of the mains were not more than 18 inches or 2 feet below the surface of the streets, and at this depth in our climate it is a matter of impossibility to keep joints tight, as the action of the frost in winter will displace the mains and cause the joints to leak. From the bad manner in which our mains were laid, and the cement joints leaking so much, we could not afford to turn gas on during the day. Had we done so we should not have had any to supply the city at night, and we were thus compelled to shut off the gas just as soon as there was any apology for daylight, and keep it shut off as late as possible in the evening.

"With the most careful working in this manner, for a period of nine or twelve months, our losses from leakage amounted to about 52 to 55 per cent of the gas manufactured. A great part of this loss was caused by the cement joints leaking, and also a part due to the fact that the mains were not at sufficient depth under the surface to protect them from the action of the frost. As soon as we possibly could I went over the whole of our mains (there was about 17 miles in all), stripping them, cutting out the cement, and rejointing them with lead. In one season we got the loss from leakage down to 20 per cent, and this with the gas turned on during the 24 hours of the day.

"One great objection to cement joints is the rigidity of them; in cases where pipes have been disturbed by other excavations and settled, I found in all cases that the mains were broken. In a leading main from our old works, with cement joints, the main, a 10-inch one, was broken entirely off and fractured lengthwise besides, by the upheaval of the ground from frost. In some of the same mains that we had rejointed with lead the mains were drawn apart, drawing the lead out, but with very little loss of gas, as the gasket being driven in tight prevented any great leakage. In cases of this kind the lead was easily driven back, and the joint made perfectly tight again. I have never in our city put in any street mains that I have not used lead in the joints, and in laying mains we always make them gas tight with the gasket used.

"At the present time we have over 90 miles of street mains laid, and outside of our loss from street lamps (we get paid for three foot burners and they average about 3¼ foot) our loss from leakage will not exceed 6 per cent. We have suffered severe loss of gas from sewering in our city. In some cases where there are railroad tracks in the streets, the sewers have been run on both sides of the street, alongside and parallel with our pipes; these excavations are much deeper than our mains lie, and the earth is always filled in loosely and left to settle.

"In cases of this kind, whole blocks of mains were dragged down, the pipe broken, and the joints partially pulled apart; at the same time the leakage from the joints was not so great, the gasket preventing the leakage. In laying street mains, what you want particularly to attend to, and especially in the East here, where you have colder weather than we have (we have not seen much winter until we came on here), is to get them down under the surface a sufficient depth to protect them from the frost. With us the least depth is 2 feet 9 inches under the surface of the street, and I am confident, could our mains remain in the ground as we put them down, our loss from leakage by them would be very small indeed. While, as I stated in the beginning, I have no doubt that a cement joint can be made tight, I can see no benefit in using cement for the purpose, as I consider lead far superior in accommodating itself to any upheaval or settling of the earth where the mains are laid down."

Successful Shad Hatching.

Professor J. W. Milner, who has charge of the shad hatching operations under the direction of the United States Fish Commissioner, Professor Baird, is now engaged in the preparation of the report of the work for the season just completed. Speaking of the work on the Atlantic seaboard, and the distribution of young fish, the report says that at the Salmon Creek Station, on Albemarle Sound, they obtained 12,730,000 eggs, and turned out 3,000,000 young fish. At the Havre de Grace Station 12,230,000 eggs were obtained, and 9,575,000 young fish were turned out. About 6,000,000 young shad have been distributed in the rivers emptying into the Atlantic and Gulf of Mexico during the season. The distribution of shad during the past season has been carried on on a much larger scale than in any previous year, and with great success. The restocking of the rivers of the Atlantic is only the work of a few years.

New Use for Lemon Verbena.

The well known fragrant garden favorite, the sweet-scented or lemon verbena (*Lippia citriodora*), seems to have other qualities to recommend it than those of the fragrance for which it is usually cultivated. The author of a recent work, entitled "Among the Spanish People," describes it as being systematically gathered in Spain, where it is regarded as a fine stomachic and cordial. It is used either in the form of a cold decoction, sweetened, or five or six leaves are put into a teacup, and hot tea poured upon them. The author says that the flavor of the tea thus prepared "is simply delicious, and no one who has drunk his Pekoe with it will ever again drink it without a sprig of lemon verbena." And he further states that if this be used one need "never suffer from flatulence, never be made nervous or old-maidish, never have cholera, diarrhea, or loss of appetite."

A VELOCIPEDE FEAT EXTRAORDINARY.

Two intrepid velocipedists, M. le Baron Emanuel de Graffenried de Burgenstein, aged twenty years and six months, and a member of the Society of Velocipede Sport, of Paris, has accomplished, with M. A. Laumaillé d'Angers, the greatest distance that has been made with a velocipede in France.

Leaving Paris on March 16, they returned on the 24th of April, after having traveled a distance of more than three thousand miles.

Their route extended through a part of the west, the middle, and the south of France, Italy, and southern Switzerland. They traveled through Orléans, Tours, Poitiers, Angoulême, Bordeaux, Montauban, Toulouse, Montpellier, Marseilles, Toulon, Nice, Menton, San-Remo, Genoa, Turin, Milan, the Simplon—where they barely escaped destruction by an avalanche—Vevay, Berne, Lausanne, Geneva, Dijon, Troy, and Provins. The longest distance that they accomplished in a single day, was between Turin and Milan, a distance of 90 miles, which they made in 9½ hours.

Superior Excellence of American Goods.

The *Post*, of Birmingham, England, remarks with regard to American competition, that "perhaps the most humiliating feature of the business for British manufacturers is the fact that their competitors are prevailing, not through the cheapness, but through the excellence of their goods. Time was when English workmanship ranked second to none, and the names of our great manufacturing firms were a guarantee for the sterling quality of the goods they turned out; but competitions, trades unions, piece work, short hours, and other incidents of the 'march of progress' have altered all that. Complaints, received by hardware merchants from their customers abroad, are not confined to the goods of second class firms. Manufacturers who have obtained a world-wide reputation for their products are frequently convicted of sending out scamped and unfinished work, and they do not venture to deny the impeachment, pleading only that the most vigilant must be sometimes at fault, and that their men, unfortunately, are not to be depended upon. In other cases it is the merchants or their customers who are to blame for the inferior quality of the articles by cutting prices so low as to preclude the possibility of honest work, thinking, probably, that anything is good enough for a foreign or colonial market. But whatever the cause, the fact is now undeniable, that a great deal of the manufactured produce shipped from this country of late years has been of a very low standard, and that the American manufacturers have consequently had an easy task in beating it."

Petroleum Oils as Lubricators.

Oils from petroleum are now produced suitable for nearly every mechanical process for which animal oils have heretofore been used, not excepting those intended for cylinder purposes. A serious objection attaching to the animal oils is present in petroleum. If, through the exhaust steam, some of the oil be carried into the boiler, foaming or priming is the consequence, but the same thing happening in the case of petroleum is rather a benefit than otherwise, for it not only does not cause foaming, but it prevents incrustation or adhesion of the scale or deposit, and this aids in the preservation of the boiler, and is perhaps the best preventive of the many everywhere suggested.

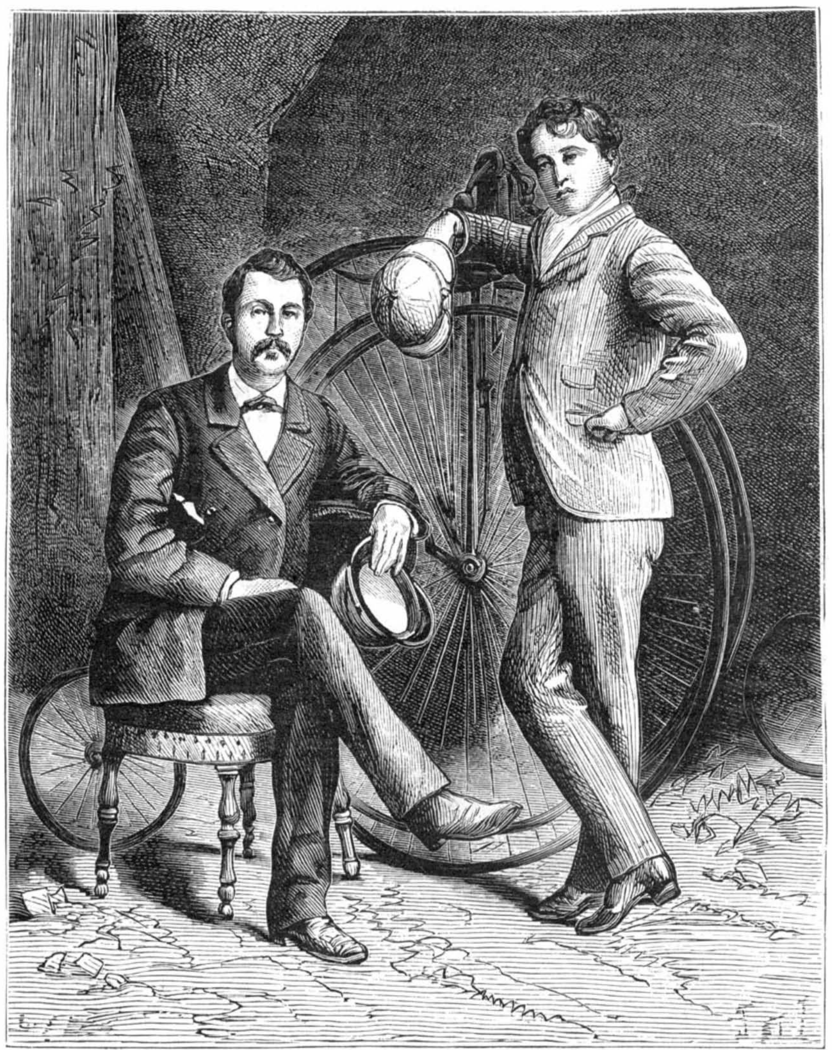
Often, in removing the cylinder head and the plate covering the valves of an engine, we see evidences of corrosion or action on the surfaces, differing entirely from ordinary wear, and the engineer is generally at a loss how to account for it. According to the general impression grease or animal oil is the preservative of the metal, and is the last thing suspected of being the cause of its general disintegration. The reason of this is that vegetable and animal oils consist of fatty acids, such as stearic, magaric, oleic, etc. They are combined with glycerin as a base, and, under ordinary conditions, are neutrals to metals generally, and on being applied they keep them from rusting by shielding them from the action of air and moisture. But in the course of time the influence of the air causes decomposition and oxidation, the oils become rancid, as it is called, which is acid, and they act on the metals. What happens at the ordinary temperature slowly goes on rapidly in the steam cylinder, where a new condition is reached. The oils are subjected to the heat of high pressure steam, which dissociates or frees these acids from their base, and in this condition they attack the metal and hence destroy it.

This applies as well to vegetable as to oils of animal origin, fish or sperm oil included. Petroleum and oils derived therefrom (generally called mineral oils) are entirely free from this objection. Petroleum contains no oxygen, and hence it cannot form an acid, and therefore cannot attack metal It is entirely neutral, and so bland that it may be and is used medicinally as a dressing to wounds and badly abraded surfaces where cerates of ordinary dressing would give pain.—*Coal Trade Journal.*

Influence of Light on Plants and Animals.

Professor Paul Bert, who has recently devoted a great deal of attention to the study of the influence of light on animals and plants, denies that the leaves of the sensitive plant close on the approach of evening, the same as if they had been touched by the hand. On the contrary, he finds that from 9 in the evening, after drooping, they expand again and attain the maximum of rigidity at 2 in the morning. What is commonly called the "sensitiveness" of plants is but the external manifestations of the influences of light. Professor Bert placed plants in lanterns of different colored glass; those under the influence of green glass drooped in the course of a few days as completely as if placed in utter darkness, proving that green rays are useless, and equal to none at all. In a few weeks all plants without exception thus treated died. It has been proved by the experiments of Zimiriareff that the reducing power of the green matter of plants is proportionate to the quantity of red rays absorbed, and Bert shows that green glass precisely intercepts these colored rays, and that plants exist more or less healthily in blue and violet rays. In the animal world phenomena of a directly opposite nature are found, and of a more complex character. Here the light acts on the skin and the movements of the body, either directly or through the visual organs. M. Pouchet has shown the changes in color that certain animals undergo, according to the medium in which they live. For instance, young turbots resting on white sand assume an ashy tint, but when resting on a black bottom become brown; when deprived of its eyes the fish exhibits no change of color in its skin; the phenomenon, therefore, seems to be nervous or optical. Professor Bert placed a piece of paper with a cut design on the back of a sleeping chameleon; on bringing a lamp near the animal the skin gradually became brown, and on removing the paper a well defined image of the pattern appeared. In this case the light acted directly, and without nervous intervention. If, however, the eye of the chameleon be extracted, the corresponding side of the animal becomes insensible to the influence of the light.

Professor Bert's conclusion, therefore, is that the circulation in the transparent layers of the skin must be affected by light. According to Dr. Bouchard a sunstroke is the effect of the direct action of light upon the skin, produced by the blue and violet rays. The heat producing rays have no part in such accidents, as proved by the fact that workmen exposed to intense heats do not feel their fatal effect. Professor Bert, in a series of experiments on a variety of animals, found that none avoided light, but all rather sought it; and the lowest forms, like the highest, absorbed the same rays. As regards intensity of color, however, there was a difference, some being more partial to one ray than another. Thus the microscopic daphne of the pond preferred yellow; violet was less in request; spiders seemed to enjoy blue rather than red rays—so resembling people suffering from color blindness. No two persons are sensible to the same shades or tones, while absorbing the same light; and this would seem to indicate that the retina possesses a selective power.



A VELOCIPEDE FEAT EXTRAORDINARY.

New Mechanical Inventions.

An improved Weighing Scale has been patented by Hosea Willard, of Vergennes, Vt. The object of this invention is to economize time in ascertaining the weight of an article by avoiding the necessity for shifting the poise on the scale beam. It consists in providing a scale beam with a number of dishes suspended from different points on said beam, and representing or corresponding with different weights, so that the weight of an article may be ascertained by placing it in one or more of said dishes and observing which dish is depressed.

William John, of Rigdon, Ind., has patented an improved Tire Setting and Cooling Apparatus, by which the tire may be set by one person, easily and quickly, without burning the fellies, and without straining the wheel by the unequal cooling of the tire.

Joseph A. Mumford, of Avondale, Nova Scotia, Canada, has patented an improved machine for Sawing and Jointing Shingles. This machine cannot be properly described without engravings. It has an ingenious feeding device, and its flywheel carries the jointing knives.

Ill-balanced Production.

The Philadelphia *Record* sensibly remarks that the popular complaint of over-production is a mistake. Though of a few things we make or mine too much, our main trouble arises from not producing enough, in variety if not in quantity.

"The wants of mankind never can be satisfied. Every new means of supplying a want creates new wants. They grow by what they feed on. As long as humanity is so constituted, over-production, in a general and enlarged sense, is impossible. It is this impossible thing with which the reformers would deal who propose to work fewer hours each day, or fewer hours in the week. The trouble they deplore does not exist; the remedy they propose defeats itself. A man cannot get rid of his load by shifting it from his right hand to his left hand. Production will not be stopped by making men their own employers certain hours in the day or certain days in the week, instead of allowing them to pursue their usual avocations.

"The real trouble, which the labor reformers seem incompetent to fathom, is that there is not enough diversity in employments. What is desired is more work in productive enterprises, a more diffused industry, and a closer commercial connection with those countries wherein we can make desirable exchanges both of our raw material and our manu factured products. Every miner that drops his pick and takes up a hoe, every idle man that turns himself into an earner of wages, every person that picks up some loose thread of employment, every capitalist that takes advantage of stagnating industry and cheap material to build a house or beautify or improve a country seat, or set on foot some new process of manufacture, does something toward working out the problem which is puzzling the economists. In good time the surplus iron and coal will be sold; new populations will want new railroads; recuperated capital will gather confidence and take hold of new enterprises, and the whole nation will move forward again to more assured prosperity and to vaster undertakings."

Labor in Germany.

The consul at Barmen reports that for agricultural labor the pay varies greatly, according to the proximity to or remoteness from manufacturing centers; and ranges from fifty-six cents a day in the neighborhood of Barmen to thirty-one cents a day in the lower Rhine valley, and as low as eighteen cents in parts of Silesia. At Barmen, Crefeld and Düsseldorf, carpenters, coppersmiths, plumbers, machinists and wagonsmiths earn fifty-one to seventy-five cents daily; saddlers and shoemakers forty-seven to fifty-two cents daily; bakers and brewers, with board and lodging, from $1.42 to $2.14 weekly, and without board from sixty cents a day to $4.28 a week; farm hands are paid from $107 to $215 yearly, with maintenance; railroad laborers from fifty-six to eighty-three cents per day, and as high as ninety-five cents daily for piece work on tunnels; silk weavers can earn $2.15 to $2.85 a week per loom; factory women $2.15, and children $1 a week. Business and wages are very low. In good times wages are eighty per cent higher. The cost of the necessaries of life has increased some fifty per cent in thirteen years, although it is now but little higher than five years ago. A man and wife with two or three children can live in two or three rooms in a poor and comfortless manner for $275 a year, and to support such an establishment all the members have to work ten or twelve hours daily. For a family of six persons the cost is about $7 per week—an amount but few families can earn, as the depression of trade and the reduction of time allow few to do a full week's work, although wages are nominally a trifle higher than five years ago.

Petroleum June Review.

DRILLING WELL ACCOUNT.

The low price of oil and large accumulation of stock in the producing regions have had the effect to lessen operations in this department during the month of June.

The total number of drilling wells in all the districts, at the close of the month, was 266, which was 110 less than in the preceding month. Rigs erected and being erected 243, against 309 last month. The number of drilling wells completed during the month was 269, being 151 less than in May. Aggregate production of the new wells was 3,788 barrels, against 6,851 barrels in May. The total number of dry holes developed in the month was 22, against 42 in May.

The operators in the great northern field (Bradford district) have curtailed operations to an extent which will compare favorably with the operators in the other portions of the producing regions, as will be seen by the following statement, namely:

Number of wells drilling at the close of the month, 187, against 284 at the close of the previous month. Number of drilling wells completed in June, 193, against 346 in May. Number of rigs erected and being erected, 196, against 234 in May.

PRODUCTION.

The daily average production for the month was 40,575 barrels, being a decrease of 227 barrels. The new wells completed in June failed to make good the falling off of the old ones, by decreasing the daily average 227 barrels. Bradford district shows a daily average production of 16,000 barrels, being an increase of 1,280 barrels over last month.

The aggregate production in June of all the other districts combined, with the aid of 76 new wells, decreased the daily average 1,507 barrels.

SHIPMENTS.

The shipments in June, out of the producing regions, were 174,225 barrels larger than in the preceding month. The total shipments of crude, and refined reduced to crude equivalent, by railroad, river and pipes to the following points, were 1,135,119 barrels:

New York took	555,794 bbls.
Pittsburg "	153,182 "
Cleveland "	239,389 "
Philadelphia "	73,426 "
Boston "	29,266 "
Baltimore "	26,623 "
Richmond "	7,000 "
Ohio River refiners took	5,200 "
Other local points took	45,239 "
Total shipments	1,135,119 "

Included in the above shipments there were 140,299 barrels of refined from Titusville and Oil City, which is equal to 187,065 barrels of crude.—*Stowell's Petroleum Reporter.*

Remarkable Poisoning of a Lake.

A contributor to *Nature* describes the remarkable poisoning of Lake Alexandrina—one of the bodies of water which form the estuary of the Murray river, Australia. This year the water of the river has been unusually warm and low, and the inflow to the lakes very slight. The consequence has been an excessive growth of a conferva which is indigenous to these lakes and confined to them. This alga, *Nodularia spumigera*, is very light and floats on the water, except during breezes, when it becomes diffused, and being driven to the lee shores, forms a thick scum like green oil paint.

This scum, which is from two to six inches thick, and of a pasty consistency, being swallowed by cattle when drinking, acts poisonously and rapidly causes death. The symptoms of the poisoning are stupor and unconsciousness, falling and remaining quiet (as if asleep), unless touched, when convulsions are induced, the head and neck being drawn back by a rigid spasm, subsiding before death. The poison causes the death of sheep in from one to six or eight hours; of horses, in from eight to twenty-four hours; of dogs, in from four to five hours; and of pigs in three or four hours. A *post mortem* shows the plant is rapidly absorbed into the circulation, where it must act as a ferment, and causes disorganization. As the cattle will not touch the puddle where the plant scum has collected and become putrid, all they take is quite fresh, and the poisoning is therefore not due to drinking a putrescent fluid full of bacteria, as was suggested.

When the scum collects and dries on the banks it forms a green crust. When, however, it is left in wet pools it rapidly decomposes, emitting a most horrible stench, like putrid urine; but previous to reaching this stage it gives out a smell like that of very rancid butter.

A blue pigment exudes from this decomposing matter, having some remarkable properties. It is remarkably fluorescent, being red by reflected and blue by transmitted light; it appears to be a product of the decomposition, and allied to the coloring matter found in some lichens.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, August 10, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury sets	8 03 eve.	Saturn rises	8 59 eve.
Venus rises	2 42 mo.	Saturn in meridian	2 58 mo.
Jupiter in meridian	10 52 eve.	Neptune rises	10 27 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	6 54 eve.	Regulus sets	7 29 eve.
Algol (var.) rises	8 34 eve.	Spica sets	9 24 eve.
7 stars (Pleiades) rise	10 53 eve.	Arcturus sets	0 08 mo.
Aldebaran rises	0 17 mo.	Antares sets	11 24 eve.
Capella rises	9 40 eve.	Vega in meridian	9 15 eve.
Rigel rises	2 23 mo.	Altair in meridian	10 27 eve.
Betelgeuse rises	2 08 mo.	Deneb in meridian	11 19 eve.
Sirius rises	4 24 mo.	Fomalhaut rises	9 34 eve.
Procyon rises	3 59 mo.		

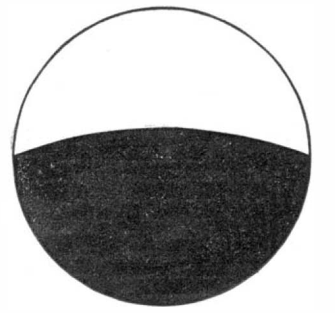
REMARKS.

Mercury is brightest this date, and furthest from the sun August 13. Venus will be at her descending node August 17. Jupiter will be near the moon August 17, 4h. 20m. morning, being the moon's apparent diameter north; this will be an occultation south of the equator. Saturn will be near the moon August 16, being about 7° south.

There will be a partial eclipse of the moon August 16, in the evening. The moon will rise more or less eclipsed east of Kansas, west of which no eclipse will be visible.

	Middle. H. M.	End. H. M.
Boston	7 24 eve.	8 50 eve.
New York	7 12 eve.	8 38 eve.
Washington	7 00 eve.	8 26 eve.
Charleston	6 48 eve.	8 14 eve.
Chicago	———	7 44 eve.
St. Louis	———	7 33 eve.
New Orleans	———	7 34 eve.

The following shows the appearance of the moon when the eclipse is greatest —7·1 digits, or 0·596 of the moon's diameter.

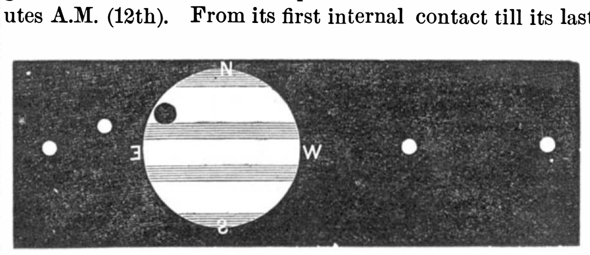


The size of the eclipse will be the same for all places. The time of middle and end for any other places may be obtained by applying the difference of longitude from Washington, converted into time, to the Washington time of middle and end, adding if east of Washington, and subtracting if west.

An Interesting Astronomical Observation.

To the Editor of the Scientific American:

While viewing the planet Jupiter, at about 5 minutes past 10 o'clock P.M., a very strange sight presented itself to the observers, who were looking for a transit of one of the satellites. A very dark spot much larger than a satellite was seen on the eastern edge of the disk, as shown in the above diagram. It moved rapidly westward along the upper margin of the northern belt and passed off at 1 o'clock 24 minutes A.M. (12th). From its first internal contact till its last



external contact was just 3h. 19m., Pittsburg time. It appeared to be a solid opaque body, truly spherical, very sharply defined, and most intensely black. The transit of the satellite occurred at 15 minutes after 11 o'clock, and had no unusual appearance. Now what was that dark body? We are constant observers of the heavenly bodies, though not deeply versed in the science of astronomy, and are anxious to know if any one can give us some light on the subject. The telescopes used were a 2½ inch and 5 inch achromatic, magnifying 154 and 216 diameters, but the 154 was chiefly used.

JOSEPH WAMPLER.
JAMES R. GEMMILL.

McKeesport, Pa., July 11, 1878.

Some of Professor Marsh's Recent Discoveries.

Mr. S. W. Williston, the assistant of Professor Marsh, has been giving to the Omaha *Bee* some interesting facts with regard to the great reptilian fossils recently discovered in Wyoming and Colorado. The bones found represent reptiles of many sizes, from that of a cat up to one sixty feet high. The latter, found at Como, Wyoming, belonged to the crocodile order; but the remains give evidence that the animal stood up on its hind legs, like a kangaroo. Another found in Colorado is estimated by Professor Marsh to have been 100 feet long. A great many remains of the same general class, but belonging to different species, have been collected and sent East. Among them from three to four hundred specimens of the dinosaur, and about a thousand pterodactyls, have been shipped from Colorado, Wyoming, and Kansas. The wings of one of the latter were from thirty to forty feet from tip to tip. Seventeen different species of these flying dragons have been found in the chalk of western Kansas. There have also been found six species of toothed birds. Comparatively little has been done toward classifying the late finds, the task is such an enormous one. Great importance is attached to them, however, since nothing of the kind had been found in America until a little over a year ago and great stress had been laid by certain geologists on their absence. Another remarkable feature of the discovery was that the fossils which had been reported as not existing in this country had hardly been brought to light in one locality before thousands of tons of them were simultaneously discovered in half a dozen different places.

Trying to Save a Hundred and Fifty Million Dollars a Year.

Professor Riley, recently appointed Government Entomologist and attached to the Agricultural Department, reports that specimens of insects injurious to agriculture are constantly being sent to the department from all parts of the country, with requests for information. In every instance, if a proper examination could be made, an effectual remedy could be found, and not less than $150,000,000 saved to the country annually. Recently a worm entirely new to science was sent to the department by an Iowa farmer, whose orchard of several thousand apple trees had been rendered unproductive for several years by the new depredator. For the interests of Western fruit growers this insect should immediately be investigated. Professor Riley asserts that the $5,000 recently voted by Congress for the investigation of the cotton worm, which has sometimes damaged the cotton crop of the South as much as $20,000,000 in a single fortnight, might have been used to better advantage by the department; the salary of the entomologist will use up all the money, leaving next to nothing for experiments for the eradication of the pest.

Industrial Education.

All are agreed that some education is necessary; but what? The great proportion of those having the direction of our educational system and facilities in charge still cling to a system which was established long before the first mechanical operation came into existence. Before the present system of man's relation to man, socially, industrially, politically, or commercially, was heard of, and notwithstanding the revolutions and advancement in all other things, there is a determined resistance to any attempt at revolution in what shall be considered education.

There is an effort to establish compulsory education; but what is the child to be taught? As if in league with the false theories of the rights of labor, these efforts take the apprentices from the shops, force them away from where they would learn something, and confine them inside a school house to learn—what? Certainly nothing of the materials, or tools, or pursuits by which they are to obtain their livelihood. The child knows nothing of when or by whom the compass was discovered, the printing press, the use of powder, electricity, of steam, or of any one of the thousand mechanical operations now controlling every department of life. Does any school boy know how many kingdoms there are in the natural world, or whether an animal, a vegetable and a mineral all belong to the same or to different ones? Will he know that from instinct the young of animals seeks its food and expands its lungs, as by the same instinct the root of a seed sucks up its nourishment from the soil and sends its leaves up to breathe the air? Will he know anything of the nature or requirements of the soils or the plants that grow in them? Will this compulsory education teach the boy anything of the iron furnace, the foundry or rolling mill, or the uses or handling of any of their products? Will it teach him anything of woods and their value, or for what and how they are useful to man?

Will this knowledge, for which the powers of the State are to be required to force him to know it—will it teach him anything of the nature or uses of metals, of metal working, or the business depending upon them? Will it teach him anything of gold or silver, copper or brass? Anything of pottery, of bone, ivory, celluloid, etc.? Will he learn anything of hides, leather, or the production of these necessary articles? Will he know whether the word textile applies to anything but a spider's web or the wing of a butterfly? Whether the United States make, import, or grow cotton, wool, silk, flax, and hemp?

Will he know anything of commerce, railroads, telegraphs, printing, and the great number of clerk labors in the larger towns? Will he have learned a single thing which will assist him in his work of life? Will not every boy thus taken out of the shop and placed at the compulsory schooling find after he has mastered all it has to give him that he yet knows nothing; that he must then commence where he was and serve his apprenticeship; that instead of compulsory education his past years have been wasted in obtaining but a compulsory ignorance?

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

METALS AND THEIR CHIEF INDUSTRIAL APPLICATIONS. By Charles R. Alder Wright. London: Macmillan & Co. 12mo; pp. 191. Price $1.25.

In this neat little volume we have the substance of a course of lectures delivered at the Royal Institution of Great Britain in 1877, with thirty or more engraved illustrations of various metallurgical operations. The author discusses briefly, yet with sufficient fullness for popular purposes, the principal processes for reducing metals from their ores, the natural sources of metals, the metallurgy of the different metals, the physical properties of metals, and their thermic, electric, and chemical relations. The style is simple and the matter well chosen.

DOSIA. A Russian Story. Translated from the French of Henry Greville, by Mary Neal Sherwood. Boston: Estes & Lauriat. Price $1.50.

This is the seventh of the Cobweb Series of choice fiction a bright, wholesome but rather thin story, as befits its associations. Novel readers will find it an amusing companion for a rainy day in the country, or for beguiling the tedium of a summer journey.

Notes & Queries

(1) H. P. says: Please inform me of some recipe for removing superfluous hair. A. Make a strong solution of sulphuret of barium into a paste with powdered starch. Apply immediately after being mixed and allow to remain for ten or fifteen minutes. See also p. 107 (8), vol. 38, and p. 25, current volume.

(2) M. A. C. writes: I would like to know how to dissolve bleached shellac, to make it a cement for stone. A. Dissolve it by digestion in 3 or 4 parts of strong alcohol, or by the aid of ¼ its weight of borax in about 4 volumes of boiling water.

(3) A. K. asks: 1. In rating substances as to hardness, diamond being No. 10, how do aluminum, osmium, iridium and steel as used in steel pens, number, also common and tempered glass? A. Aluminum about 3, iridosmine 6·5 to 7, steel 5·5 to 6, glass 5 to 5·5. 2. Can glass $\frac{1}{16}$ inch in thickness be ground to angles of 15 per cent or less, and points as fine as pins, without difficulty, and how? A. No.

(4) D. C. S. asks for a good recipe for cleaning and polishing dirty and tarnished brass. A. Dip for a short time in strong hot aqueous solution of caustic alkali, rinse in water, dip for a few moments in nitric acid diluted with an equal volume of water, rinse again, and finish with whiting.

(5) C. J. H. asks for the simplest way of producing a coating of the magnetic or black oxide of iron on iron plates 3 feet x 6 feet. I think it is called the Barff process. A. See pp. 1041 SCIENTIFIC AMERICAN SUPPLEMENT, and 232, vol. 36, and 4, vol. 37, of the SCIENTIFIC AMERICAN.

How can I make tissue paper impervious to air and water, and yet strong enough to confine gas? A. You may pass the fabric through a solution of about 1 part caoutchouc in 35 parts of carbonic disulphide, exposing it then to the air until the solvent has evaporated.

(6) J. H. J. asks how to use hyposulphite (?) of soda to neutralize chloride of lime in cotton and linen goods after bleaching the same. A. After washing from it the large excess of the hypochlorite, the fabric is passed slowly through a solution containing about 10 per cent of the hyposulphite, and then again thoroughly washed in clean water.

(7) Columbus asks for a recipe for making ink to rule faint lines, such as he is now writing on. He wants it to rule unit columns in books. A. Dissolve in a small quantity of warm water 20 parts of Prussian blue by the aid of 3 parts of potassium ferrocyanide, and dilute the solution with thin gum water until the proper degree of color is obtained.

(8) A. I. B. asks: Can I add anything to Arnold's writing fluid which will cause it to give a good free copy in my letter book? A. Try a little sugar.

(9) R. & C. ask for information in regard to the process of printing copies of drawings made on transparent materials, by using chemically prepared paper and exposing to the sunlight. A. It is based on the fact that an acid in the presence of potassium dichromate strikes a blackish-green color when brought in contact with aniline. The paper is prepared by floating it on a bath of aqueous solution of potassium dichromate and a trace of phosphoric acid, and then drying it in the dark. Aniline is dissolved in a little alcohol, and the mixed vapors allowed to come into contact with the sensitive paper that has been exposed to strong sunlight beneath the drawing, when the portions not changed by the sunlight assume the dark color mentioned. All that is requisite is that the paper or cloth original should be fairly penetrable by the light. A piece of paper sensitized as indicated, a sheet of glass to place over the drawing, and a box in which to place the exposed print to the aniline vapor are the only necessary plant.

(10) P. Y. P. writes: 1. To find the number of acres in a farm of valley and hillside land, is it by measuring the general contour of the land, allowing its actual surface, or by measuring and allowing only the imaginary face of the plane of it? A. The latter is the correct method. 2. Can more grain, say rye, be raised on a farm of valley and hillside land, as described above, than on a farm having a flat surface, the area of which is equal to the plane of the former, all other things supposed to be equal? A. No.

(11) Inventor asks: 1. Can you tell me of a book on sound boards? A. We do not know of a book especially devoted to the subject. 2. Also the best kind of wood to make them out of? A. Spruce.

(12) F. C. A. writes: I wish to construct a bar electro-magnet to go in a cylinder 1 inch in diameter and 1 inch long. 1. What size ought the core to be? What number of wire shall I use, and what number of Léclanché cells shall I use (not to exceed twelve) to obtain the greatest possible attractive power, distance $\frac{1}{16}$ of an inch? A. Make the core ⅜ inch, wind it with No. 24 silk covered wire. Use 6 or 8 cells. 2. In the same space, could a horseshoe magnet be used, with a gain of power over the bar magnet? A. A cylindrical magnet, which is substantially the same as a horseshoe, might be substituted with advantage for the bar magnet.

(13) W. C. H. writes: In turning a tapering shaft in an engine lathe, will the tool if raised above the centers of the lathe turn the taper true from end to end, *i. e.*, neither concave nor convex, the taper to be made by sliding the tail center the required distance? A. The taper will be concave.

(14) H. E. H. asks how to make lime light. A. The lime light is made by directing the jet of an oxyhydrogen blowpipe against a cylinder of lime. The blowpipe is contrived to take the proper proportion of oxygen and hydrogen gas, and the lime is placed in the reducing focus of the jet.

(15) L. F. asks: 1. How many Daniell's or Smee's cells would it require to produce the same effect as 50 Bunsen cells? A. About 100. 2. Is the diaphragm equally necessary in Bunsen's, Smee's and Daniell's cells, or can it be omitted in any one of them easier than in the others, and why so? A. The diaphragm or porous cell is required in Daniell's and Bunsen's batteries, but is not used in Smee's. The porous cell is used only in two fluid batteries; its object is to allow the current to pass, but to prevent the mixture of the two liquids. 3. Is the thickness of the zinc of any importance? A. Only that the thicker zinc lasts longer. 4. Which is the cheapest way to produce electric sparks and to charge a Leyden jar, and what will be the expense? A. By means of a frictional electrical machine. The machines cost from $10 upward.

(16) R. C. K. writes: I am an engineer by trade; have been at it 9 years. Am out of a position at present and want to learn mechanical draughting. How long would it take me to become a good draughtsman by taking a special course at some university? And with my knowledge of engineering and draughting, would my services be likely to be in fair demand? A. If you are familiar with mechanical operations, you might become a good draughtsman by close application under a competent instructor for one or two years. At present there are many excellent draughtsmen looking for positions.

(17) G. B. M. asks for the cause of the ribs or ridges on the surface of a piece of timber which has passed through a planing machine. A. They are frequently due to the intermittent motion of the feed.

(18) A. F. writes: Having a small quantity of gold and gold plated things, I would like to know the simplest way to melt it. A. Put it in a small crucible with a little borax and melt in a common kitchen fire.

(19) J. H. S. writes: I have three drawings each 21 x 30 inches, which I wish to mount upon cloth like a map, placing them end to end so as to make one whole sheet 90 inches long. The drawings are upon heavy Whatman paper. A. You should stretch wet canvas or factory cloth upon a frame, and while it is still damp apply paste to the backs of the drawings and lay them smoothly on the stretched cloth. When the paste becomes thoroughly dry cut the cloth from the stretching frame and paste a tape binding around the edges.

(20) P. M. asks: What is the difference between the inner and outer rails of a 10° curve 100 yards in length, gauge 4 feet 8 inches? A. If this 100 yards is measured on the center of the curve, whose radius in feet is R, the length of the inner rail is $\frac{R-2\frac{1}{3}}{R} \times 100$, and of the outer rail $\frac{R+2\frac{1}{3}}{R} \times 100$.

(21) W. B. K. asks how to make a shoe dressing for ladies' shoes. A. Soft water, 1 gallon; extract of logwood, 6 ozs.; dissolve at a temperature of about 120° Fah. Soft water, 1 gallon; borax, 6 ozs.; shellac, 1½ oz.; boil until dissolved. Potassium dichromate, ¾ oz.; hot water, ½ pint; dissolve, and add all together. It is preferred to add 3 ozs. of strong aqua ammonia to the liquid before bottling.

(22) J. D. asks: What chemicals can be put into water to increase its efficiency in extinguishing fire? A. Carbonic acid; sodium carbonate.

(23) H. P. writes: Please give me the advantages and disadvantages of substituting a galvanized iron tube 18 inches in diameter and 20 feet high for a wood tank, 5 feet wide and 6 deep, as a container of water in a dwelling house in the country. Would the narrower body of water keep fresh or sweet longer, etc.? Also the thickness of iron necessary to safety, and the number of gallons of water this tube would hold. A. The advantages are in favor of the wooden tank; zinc lined vessels (galvanized) are unsuitable for reservoirs for potable water. See p. 369, vol. 36, SCIENTIFIC AMERICAN. 0·3 inch iron would be stout enough. A pipe of the dimensions specified would contain about 327 gallons when full.

(24) F. L. M. asks: 1. What is the process by which wire is given a copper finish? A. Clean the wire by pickling it for a short time in very dilute sulphuric acid and scouring with sand if necessary. Then pass the clean wire through a strong bath of copper sulphate dissolved in water. 2. Can wire be thus finished and also annealed? If so, how? A. The wire should be annealed first. 3. What other finish can be put on iron wire (annealed), and by what process? A. Zinc—by passing the clean wire through molten zinc covered with sal ammoniac; tin—by drawing the wire through a bath of molten tin covered with tallow.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. H. McF.—A fine quality of kaolin.—F. C. H.—The floury powder consists chiefly, if not altogether, of calcium carbonate.—C. L. G.—They are all silicious limestones. We cannot judge fairly of their value for building purposes from the powders sent.—D. K.—Ferruginous earth or marl.—A. E.—It is a partially decomposed feldspar. The white powder is for the most part an impure, silicious, kaolin.—E.H.—It consists chiefly of basic carbonate and hydrated oxide of lead—poisonous.—J. B. V.—It is a fair quality of pipe clay—impure silicate of alumina—probably worth about $2 per ton in New York.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Religion. By W. M. E.
Cause of Explosion in Flouring Mills. By G. M.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

May 28, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city.

Acid, recovering waste sulphuric, A. Penissat.... 204,244
Axle box slide, car, G. Williams.... 204,178
Axle nut, adjustable, O. B. Thompson.... 204,399
Axles, sand guard for carriage, M. C. Nay.... 204,164
Baker and cooker, steam, J. A. McClure.... 204,353
Bale tie, L. Arnold.... 204,183
Bale tie, Wynkoop & Bloomingdale.... 204,409
Barrel and box, moth-proof, M. L. Thompson.... 204,263
Barrel for shipping bottled liquors, S. Strauss.... 204,259
Barrel washer, H. Binder.... 204,288
Bed bottom, T. & O. Howe.... 204,222
Bed bottom, G. S. Walker.... 204,401
Bedstead, wardrobe, Hand & Caulier.... 204,321
Bedstead, wardrobe, E. Kiss.... 204,340
Bedstead, invalid attachment for, T. T. Kendrick. 204,232
Belting, rubber, C. T. Petchell.... 204,368
Bending links, machine for, H. E. Grant.... 204,316
Boiler brooms, operating, A. C. Cock.... 204,200
Boilers, removing sediment from, T. C. Purves.... 204,250
Boots and shoes, making, Hurst & Miller.... 204,330
Bottle stopper, H. Martin.... 204,350
Bottle stopper fastener, L. Kutscher.... 204,341
Brake, car, J. Ramsey, Jr.... 204,372
Brake for railway carriages, R. D. Sanders.... 204,378
Brake for railway trains, safety, L. Blanck.... 204,186
Brake, horse, I. Spitz.... 204,258
Brake pipes on cars, coupling, F. A. Sheeley.... 204,383
Brake shoe, W. McConway (r).... 8,255
Brick kiln, E. F. Andrews.... 204,182
Bridge eyes, making, A. Schneiderlochner.... 204,381
Bridge, self-adjusting, B. Williams.... 204,407
Buckle, trace, Landon & Decker.... 204,342
Burial apparatus, Patterson & Wheeler.... 204,366
Burial casket, W. Hamilton.... 204,320
Can, fish, bait, and oyster, R. Roney.... 204,168
Can, refrigerating, transportation, W. A. Moore.. 204,239
Car coupling, L. Gasser.... 204,313
Car coupling, C. Gifford.... 204,212
Car coupling, C. A. Roberts.... 204,251
Car, sleeping, A. Jaeger.... 204,260
Cars, dust arrester for railway, A. Clarke.... 204,134
Carbureter, gas and air, Dusenbury & Winn.... 204,413
Carriage seats, corner iron for, W. B. C. Hershey.. 204,326
Carriages, reversible handle for, A. Shoeninger.. 204,385
Casting apparatus, J. Duff.... 204,307
Castings, moulding dovetails, Burdick & Easterly 204,129
Celluloid, etc., core and tube former, J. W. Hyatt. 204,227
Celluloid tubes and hollow articles, J. W. Hyatt.. 204,228
Celluloid bar or spring coater, Hyatt & Burroughs 204,229
Chair, convertible, M. V. Lunger.... 204,346
Chair, invalid, E. C. Jones.... 204,231
Chair, rocking, L. Rausch.... 204,373
Chuck, A. Saunders.... 204,254
Churn, Barrett & Smith.... 204,124
Churning apparatus, A. N. Myers.... 204,241
Churning apparatus, J. A. Perry.... 204,245
Clasp for ribbons on rolls, H. G. & C. G. Hubert.. 204,224
Clevis, double tree, A. Rosier.... 204,252
Clew line leader, S. R. Brooks.... 204,290
Clock case, G. & D. B. Hills.... 204.328
Clock, repeating, H. Thompson.... 204,175
Clod crusher, C. R. Polen, Sr.... 204,247
Clothes drier, W. F. Wilson.... 204,179
Clothes pounder, O. Schindler.... 204,379
Cock, stop, G. N. Munger.... 204,162
Cooler, beer, H. F. Schmidt.... 204,380
Corkscrew, A. W. Sperry.... 204,389
Corn sheller, J. W. Miller.... 204,161
Corpse preserver, Miller & Schneider.... 204,237
Cotton roving can, J. Hill.... 204,220
Cotton worm destroyer, G. Yeager.... 204,410
Cream, apparatus for raising, J. W. Brady.... 204,127
Cultivator, J. Young.... 204,412
Cultivator, harrow, E. Crane (r)....8,260, 8,261
Cutter, rotary, Mellor & Orum (r).... 8,265
Cutting board, F. Weed.... 204,176
Desk, school, J. Edgar.... 204,207
Draught equalizer, J. Branning.... 204,289
Drilling apparatus, well, J. B. & G. R. Elliote.... 204,143
Drilling machine, metal, D. W. Pond.... 204,248
Drills, spring hoe for grain, C. E. Patric.... 204,365
Drying kiln, E. T. Gennert.... 204,211
Engine cylinder, steam, G. E. Banner.... 204,282
Engine standard and cylinder, steam, G. E. Banner 204,283
Engine, wind, H. N. Hill.... 204,221
Engine, wind, Longyear & Clark.... 204,345
Envelope, Shade & Lockwood.... 204,256
Escapement, W. A. Wales.... 204,400
Excavator and plow, W. M. Smith.... 204,387
Eyeglasses, J. F. Traub.... 204,266
Fence, hedge, I. O. Childs.... 204,197
Fence, iron, F. R. Martin.... 204,236
Fence post, O. Allen.... 204,275
Fence post, H. A. Pierce.... 204,246
Fence, wire, W. H. H. Frye.... 204,312
Field roller, T. B. Rice, Jr.... 204,376
File, newspaper, D. H. King.... 204,233
Fire alarm signal box, R. N. Tooker (r).... 8,267
Firearm, revolving, B. F. Joslyn.... 204,334, 204,335
Firearms, extractor for, B. F. Joslyn....204,336, 204,337
Fire escape, I. D. Cross.... 204,299
Flour, manufacturing, R. L. Downton.... 204,302
Fruit pitting and cutting machine, C. P. Bowen... 204,189
Fruit pitting machine, A. T. Hatch.... 204,217
Furnace, brass melting, J. Fletcher.... 204,309
Furnace door, P. S. Kemon.... 204,339
Furnace, metallurgic, H. Swindell.... 204,392
Furnace, ore roasting, C. Stetefeldt (r).... 8,266
Game apparatus, M. Entenmann.... 204,208
Game counter, C. B. Wessmann.... 204,404
Gas, making illuminating, H. W. Adams.... 204,181
Gas burner, W. Anderson.... 204,278
Gas burners, attachment for, W. W. Batchelder.. 204,286
Gas meter, A. C. Blount.... 204,188

Gas, scintillator for lighting, W.W.Batchelder.... 204,28
Glass from lava, making, F. S. Shirley ... 204,384
Globe holder, Bayles & Hunter ... 204,184
Grain binder, G. H. Howe ... 204,329
Grain decorticating apparatus, A. Ames ... 204,277
Grain distributing machine, Fascher & Singer ... 204,308
Grinding machine, S. Trethewey ... 204,393
Gun, spring air, A. Pettengill ... 204,167
Harness, E. R. Cahoone ... 204,195
Harrow, H. F. Wasmund ... 204,268
Harrow, rotary, E. & E. H. McNiel ... 204,354
Harvester gearing, J. Harris ... 204,148
Hat and cap sweat, J. R. Terry, Jr ... 204,262
Head protector, F. P. Cummerford ... 204,204
Heaters, draught pipe for, M. A. Shepard ... 204,170
Hogs from rooting, preventing, J. M. Stansifer .. 204,171
Hoisting device, tobacco, C. F. Johnson ... 204,332
Horse power, Bettis & Heath ... 204,185
Ice, forming sheets of, J. Gamgee ... 204,210
Illuminating fluid, testing, S. S. Mann ... 204,235
Index tag for books, E. M. Capen ... 204,196
Indicator for vessels, roll and pitch, R. Chandler. 204,133
Inkstand, W. P. Speller ... 204,388
Iron for case hardening, preparing, S. A. Conrad. 204,202
Ironing apparatus, A. K. Brettell ... 204,128
Jewelry, wire trimming for, L. Heckmann ... 204,149
Labeling bottles, E. L. Witte ... 204,272
Ladder, F. A. Copeland ... 204,295
Ladder, step, J. J. Brady ... 204,191
Lamp, J. S. Butler ... 204,193
Lamp, E. S. Drake ... 204,303, 204,304, 204,305, 204,306
Lamp, F. G. Palmer ... 204,364
Lamp for cooking, H. S. Fifield ... 204,144
Lantern, C. J. Swedberg ... 204,261
Lap link, A. Perry ... 204,367
Lap ring, H. S. Wood ... 204,273
Latch, gate, H. Unger ... 204,267
Leather, compound for currying, E. S. Thayer ... 204,398
Lemon squeezer and shaker, H. L. Heaton ... 204,325
Lifting jack, T. J. Woods ... 204,408
Lightning conductor, H. W. Spang ... 204,257
Lightning rod, D. Munson ... 204,359
Lock, C. C. Dickerman ... 204,139
Lock, seal, F. G. Hunter ... 204,226
Lock, vehicle seat, D. Kirk ... 204,234
Log turner, C. & F. Strobel ... 204,391
Loom picker, C. T. Grilley ... 204,213
Loom picking mechanism, Terrell & Williams ... 204,396
Magnet, multipolar, A. K. Eaton ... 204,141
Manure spreader, J. S. Kemp (r) ... 8,254
Marble, composition for artificial, J. F. Martin ... 204,348
Meat chopper, E. W. Fawcett ... 204,209
Meat chopping machine, Meahl & Kwoczalla ... 204,355
Military accouterments, C. Harkins ... 204,322
Milking cows, apparatus for, W. F. George ... 204,314
Mordants and dyestuffs, S. Cabot, Jr ... 204,130
Mosquito bar frame, O'Sullivan & Bloom ... 204,243
Mosquito net frame, E. Bloom ... 204,187
Mower, lawn, F. G. Johnson ... 204,153
Mower lawn, A. P. Osborne ... 204,242
Mower, lawn, J. Shaw (r) ... 8,268
Music box, W. Meissner ... 204,356
Musical instrument, mechanical, M. J. Matthews 204,352
Mustache guard, C. H. Barrows ... 204,125
Nut cracker, F. A. Humphrey ... 204,225
Oatmeal machine, G. H. Cormack ... 204,137
Oatmeal machine, D. Oliver ... 204,165
Organ case, L. C. Carpenter ... 204,131
Paddle wheel, A. Wingard ... 204,180
Paddle wheel, aerial, Cowan & Page ... 204,296
Paper and other fabrics, marbleizing, G. Grossheim 204,146
Paper pulp from wood, H. B. Meech (r) 8,256, 8,257, 8,258
Paper pulp pail, E. Hubbard ... 204,223
Pea nut warmer, F. A. Bowdoin ... 204,190
Pen, fountain, T. H. & J. E. Quinn ... 204,371
Pencil sharpener and eraser, W. Sellers ... 204,169
Pianoforte tuning attachment, H. F. Jacobs ... 204,152
Pianofortes, hand guide for, M. Sudderick ... 204,260
Pipe, stand, Lewis & Maloney ... 204,344
Planing and sawing wood, W. H. Webb ... 204,403
Planter and plow, corn, D. Hays ... 204,218
Planter, corn, H. Steckler, Jr ... 204,390
Plow, T. M. Moore ... 204,358
Plow, F. Nitschmann ... 204,361
Plow clevis, E. A. Sanders ... 204,253
Pocket for garments, Y. Chow ... 204,199
Pole, carriage, A. R. Bartram (r) ... 8,253
Post office apparatus, G. W. Wiles ... 204,270
Press, cotton, E. L. Morse ... 204,240
Press, cotton, Tate & Curtis ... 204,395
Press, power, J. L. Lewis ... 204,158
Pump, A. S. Baker ... 204,280
Pumps, machinery for operating, J. W. Hull (r) .. 8,262
Punching and beveling metal, J. Morgan (r) ... 8,251
Railway gate, C. P. Austin ... 204,279
Railway gate, McCaffrey & Larkin ... 204,160
Railway rail joint, O. Pagen ... 204,363
Refrigerator, R. T. Hambrook ... 204,216
Rein guide, check, A. L. Whitney ... 204,269
Rowlock, I. C. Mayo ... 204,159
Rubber cutting machine, Ford, Slade, & Baylies .. 204,145
Rule, lumber, A. J. Colburn ... 204,293
Sad iron stand, K. E. Keeler ... 204,338
Sash balance and lock, Rayner & Burr ... 204,374
Saw, R. E. Poindexter ... 204,369
Saw mill carriage, M. Taplin ... 204,394
Saw mill head block, Brett & Perry ... 204,192
Saw sharpener, W. M. Watson ... 204,402
Scale beam, J. Weeks ... 204,177
Scintillator for lighting cord, W. W. Batchelder .. 204,284
Scraper, earth, J. H. Edmondson ... 204,142
Screen, G. F. Halley ... 204,147
Screen, window, G. L. Reynolds ... 204,375
Scythe snath fastening, M. Hewitt ... 204,327
Seed and fertilizer distributer, W. Harper ... 204,323
Seed distributer, J. W. Dooley ... 204,301
Sewer trap, J. M. Thatcher ... 204,397
Sewer trap valve, P. J. Convery ... 204,135
Sewing machine needle bar, Cook & Hill ... 204,294
Sewing machine mechanism, E. Brosemann *et al* .. 204,291
Sewing machine table, S. Hill ... 204,219
Sewing machine table, T. Lanston ... 204,157
Sheet metal vessels, handle for, F. Grosjean ... 204,319
Shipping case, J. H. Byrne ... 204,194
Shoe lip, H. White (r) ... 8,263
Shoes, rack for holding, etc., J. Priest ... 204,249
Shot, tin plated, L. Crooke ... 204,298
Shovels, manufacture of, H. M. Myers ... 204,163
Sink, kitchen, M. W. Scannell ... 204,255
Slate, apparatus for grinding, etc., J. W. Hyatt .. 204,151
Snuff package, B. F. Weyman (r) ... 8,264
Soldering square cans, R. Gornall ... 204,315
Spectacle frame, J. F. Traub ... 204,265
Spinning mules, building rail for, Ogden & Garrett 204,362
Spinning mules, mechanism for, G. Gurney ... 204,214
Spring, door, O. Seely ... 204,382
Spring, vehicle, N. Nilson ... 204,360
Sprinkler, J. M. Josias ... 204,333
Sprinklers, inlet pipe for street, G. H. Stallman .. 204,172
Steam generator, Collinge & Savage ... 204,201
Steam generator, M. Cullen ... 204,203
Steam superheater, W. Standing ... 204,173
Stone sawing machine, Jennings & Robellaz ... 204,331
Stove damper, T. White ... 204,406
Stove for burning crude, etc., oils, P. Martin ... 204,349
Stoves, fire pot lining for, R. J. King ... 204,155
Sulphur, apparatus for refining, H. H. Eames ... 204,206
Suspender ends, E. Painter ... 204,166
Table, S. Robbins ... 204,377
Tablet, writing, W. O. Davis ... 204,138
Tanks, etc., movable hopper, F. C. Prindle ... 204,370
Target, spherical, S. A. Darrach ... 204,300
Tea and coffee pots, knob for, W. B. Choate ... 204,198
Telegraph repeater, F. Catlin ... 204,132
Thrashers, clover huller attachment for, J. Allonas 204,276
Ticket, railway coupon, C. J. Stromberg ... 204,174
Tile for fireproof buildings, bridge, M. F. Lyons 204,347
Tin, coating lead articles with, J. J. & L. Crooke 204,297
Tire setter, J. A. Miles ... 204,238
Tire upsetter M. W. Griffiths ... 204,317
Toy pistol, A. F. Able ... 204,123
Toy pistol, H. J. P. Whipple ... 204,405
Trace, etc., tug coupling, Hazlewood, Jr., & Reagin 204,324
Track clearer, A. Day ... 204,205
Truck shifting apparatus, car, R. H. Ramsey (r) .. 8,259
Truss, hernial, Banks & Merck ... 204,281
Tubing, manufacture of metal, B. C. Converse ... 204,136
Valve gear for engines, L. C. Mason ... 204,351
Vehicle running gear, P. Letalle ... 204,343
Vehicle, side bar, J. Kauffman ... 204,154
Vehicles, spring seat for, J. T. Yerkes ... 204,411
Velocipede, H. A. Reynolds (r) ... 8,252
Ventilator, S. S. Thompson ... 204,264
Ventilator valve, railway car, E. H. Winchell ... 204,271
Warming, etc., buildings, apparatus for, L. Bennett 204,126
Wash board, F. Kueny ... 204,156
Wash boiler, A. Friedley ... 204,311
Wash stands, water closets, cover for, F. Grosjean 204,318
Washing machine, E. S. M. Ford ... 204,310
Watch regulator, G. Bichsel ... 204,287
Watch winding device, B. Wormelle ... 204,274
Watches, winding click for, C. T. Higginbotham 204,150
Water meter, piston, T. Melling ... 204,357
Water wheel, W. S. Clay ... 204,292
Weather strip, D. Austin ... 204,122
Whip socket and rein holder, B. J. Downing ... 204,140
Wrench, Sievers & Winkler ... 204,386
Wringer, mop, W. Haas ... 204,215

TRADE MARKS.

Baking powder, Carter Brothers & Co ... 6,136
Cigars, Foxen, Newman & Co ... 6,132
Cigars, J. Hirsch ... 6,142
Cigars, Oliver & Robinson ... 6,150
Cigars, B. F. Weyman ... 6,154
Cigars, J. & A. Frey ... 6,156
Cigars, J. Martinez ... 6,161
Cigars, cigarettes, etc., Straiton & Storm ... 6,144
Cigars, cigarettes, etc., E. A. Smith ... 6,145
Cigars, cigarettes, etc., C. Swartz & Co ... 6,152
Cigars, cigarettes, etc., I. Underdorfer ... 6,158
Cigarettes, Seidenberg & Co ... 6,135
Cheese, G. S. Hart ... 6,133
Copying paper and books, W. Mann ... 6,159
Cotton fabrics, Hamilton Manufacturing Company 6,141
Cotton goods, Nashua Manufacturing Company ... 6,162
Dry goods, The Eddystone Manuf. Company ... 6,157
Illuminating oils, Wadsworth, Martinez & Longman 6,163
Knitted undershirts, etc., Dunham Hosiery Co ... 6,155
Ladies' corsets, C. A. Griswold ... 6,139
Lemonade compound, Abrams & Carroll ... 6,147
Liquid paints, G. W. Pitkin & Co ... 6,151
Overalls, jumpers, etc., B. Greenebaum ... 6,138
Perforated plasters, Holman Liver Pad Company.. 6,140
Pile ointment, G. W. Frazier ... 6,149
Plug tobacco, B. F. Weyman ... 6,148
Prepared skins for beer, C. Maegerlein & Son ... 6,134
Saleratus, soda, etc., H. A. De Land & Co ... 6,137
Smoking, etc., tobacco, Marburg Brothers ... 6,143
Snuff, B. F. Weyman ... 6,146, 6,153
Soap, Ecker & Co ... 6,160
Weighing scales, E. & T. Fairbanks & Co ... 6,131

DESIGNS.

Buckle, F. Crane ... 10,704
Fancy cassimere, F. S. Bosworth ... 10,692 to 10,702
Handkerchief, J. Grimshaw ... 10,703

English Patents Issued to Americans.

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GENERAL TABLE OF CONTENTS.

Brewster's Carriage Manufactory, New York. One engraving.
The Parlor or Cabinet Organs of Mason & Hamlin.
The New Wheeler & Wilson Sewing Machine.
Howe's Improved Scales.
The Chickering Pianos
The Ingersoll Rock Drill.
Photo-engraving.
The Paper Product of the United States.
Electrical Indicator for Exhibiting the Rotation of the Earth. Two engravings.
The Elevated Railroad Nuisance
Steam Boilers.
Progress of our Western Industries.
The Decline of the Whaling Industry.
Transmitting Power by Electricity.
Native Magnesium Salts.
Scientific American Export Edition for June.
The Eothen Arctic Expedition.
Patent Matters in Congress.
The Turkish Bath.
Remarkable Locomotive Performances.
The United States Building at the Paris Exposition.
Recent Ship Designs.
Figures which Seem Untruthful.
The Hotchkiss Ship's Log.
Starting New Industries.
The Telephone at Sea.
Horizontal Condensing Engine at the Exposition. One engraving.
Deep Boring.
Whitening Positives.
Mr. Thomas A. Edison. One engraving.
Patteson's Improved Car Coupling. One engraving.
Project for Increasing the Water Power of Pennsylvania.
A Japanese Built Ironclad.
A Great Public Nuisance.—The Steam Street Railways New York City.
hat the South Owes New England.
New Mechanical Inventions.
Iridescent Glass.
Fast Paper Making.
Effect of Gas on Cotton Goods.
Electrotypes of the Brain.
Astronomical Notes for July. With Three figures, giving the Positions, Rising and Setting of the Planets.
Sun Spots.
Removing Spots from Cloths.
"American" New Process Milling.
New Agricultural Inventions.
A Defense of Sludge Acid.
Shad Hatching at Havre de Grace, Md.
Improved Wrench. Two engravings.
A Drygoods Palace Car.
Radial Drilling Machine. One engraving.
Improved Self-oiling Car Wheel. Three engravings.
The Whitehead Torpedo. One engraving.
A Californian Wheat Farm.
Edison's Telephonic Researches. Eleven figures.
New Inventions.
New Electric Light.
Quick Freight Time.
The Adams Gas Process. Three engravings.
The Invention of the Microphone.
Preparation of Iron Fuels.
Millstones.
An Hour with Edison. Four engravings.
Suspension Bridge Accident.
Mill Explosion Science.
Learn Something.
Unsuitable Steam Vessels. One engraving.
Our Naval Tubs.
Leaves and their Functions.
Lever and Cam Valve. Two engravings.
An Ingenious Toy. One engraving.
Milk as a Substitute for Blood Transfusion.
Dr. Brown-Sequard.
Odd Uses of Paraffin.
American Institute Exhibition.
Solidification of Petroleum.
A Simple Fire-escape.
Mr. Edison on the Microphone.
Driving Piles in Sand.
Is our Globe Hollow ?
The Best Penwiper.
The Etiology of Asiatic Cholera.—A New Theory.
Diagnosis.
Proposed Process for the Fixation of Atmospheric Nitrogen. Two figures.
Hallucinations.
Perils of Base-ball Playing.
Music Boxes.
Electric Light Photography.
Improved Beehive. Three engravings.
A Good Act.
Improved Gas Condenser. Two engravings.
American Crop Prospects.
The Launch of the Nipsic.
The Swiss House at the French Exposition. One engraving.
The Ingenuity of Bees.
The St. Benoit Twins. One engraving.
Improved Method of Milling.
A Remarkable Meteoric Phenomenon.
Drinking Water.
Where to Observe the Solar Eclipse of July 29th.
Explorations and Surveys
Tests for Good Burning Oil.
Curious Hedge Figures. One engraving.
Food Supply of Paris.
The Leona Goat Sucker. One engraving.
Oatmeal.
Salt in Beer.
Dr. Morfit's Method of Preserving Animal and Vegetable Food.
The Ring of Fire, and the Volcanic Peaks of the West Coast of the United States.
To Imitate Ground Glass.
Railroad Birds.
Improved Variable Automatic Cut-off. Four engravings.
The Uses of Mechanism.
Working Gold Ores.
The Sun. With nine engravings. An excellent paper.
Professor Edison's New Carbon Rheostat. Two engravings.
The Chase Elemental Governor. Two engravings.
Chinese Wine Powder.
Amber Varnish.
The Alkaloids of Opium.
Microscopy.
Is the Moon Inhabited ?
Description of the Recent Most Important Mechanical Inventions.
Counterfeiting American Goods.
The Steam Street Railways of New York City.
Improved Piston Rod Stuffing Box. One engraving.
Improved Automatic Fan. One engraving.
Wandering Needles.
Improved Step Box. One engraving.
Heat Conductivity.
New Volcano in Peru.
Wood Carver of Simla. One engraving.
Natural History Notes.
Belgium, Holland, and England.
Jointed Artillery.
The Armstrong 100-ton Gun.
The Phonograph.
Scientific American Boat Drawings.
Wire Tram way Worked by Water Wheels.
Shell Polishing.
Floating Batteries at Kertch.
Apparatus for Administering Medicine to Horses. One engraving.
Apprentice Shops for the Boys.
A Boat Older than the Ark Three figures.
Employment of Ships against Forts.
The Otto Bicycle. One engraving.
A Simple Gas Generator. One engraving.
Labor in Scotland.
The Cattle Drives of 1878.
Effects of Emancipation.
A New Trouble with French Wines.
The New Twin Steamer "Calais-Douvres." One engraving.
Industrial Drawing and Art Studies.
Vulcanizing Rubber.
Strawberries and Constipation.
Professor Langley's Papers on the Sun.
Destruction vs. Construction of Ironclads.
How Raisins are Prepared.
The Sun.—A Total Eclipse. With six engravings.
The Bishop of Manchester on British Trade Depression.
A New Insect Pest.
Death of a Giant.
Edison's Phonomotor. Two engravings.
Excavating Scoop. One engraving.
Treatment of Acute Rheumatism.
How a Horse Trots.
Danger of Carbolic Acid Dressings.
Welded Union and Rebel Bullets. One engraving.
Indicator of a Steamboat Engine.
A Remedy for the Effects of the Poison Ivy.
Thymol.
Copper Oysters.
The Use of Antimony in Batteries.
Photographs on Silk.
How to Use a File. A valuable practical paper.
Our Iron Industry.
Two Ways of Looking at the Same Facts.
New Screw-cutting Lathe. One engraving.
New Cloth Measuring Apparatus. One engraving.
Moth Remedies.
Gampert's Wood-sole Shoe. Three engravings.
Science and Sentiment.
American Coal in Europe.
An Active Volcano in the Moon.
Tic-douloureux.
Landing of Cleopatra's Needle. One large engraving.
Heat Conductivity.
The Total Eclipse of the Sun, July 29. Two figures.
New Iron Fence Two engravings.
The Adjutant. One engraving.
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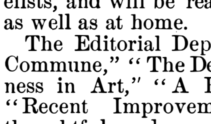

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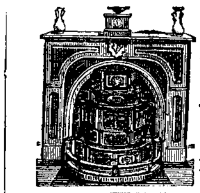

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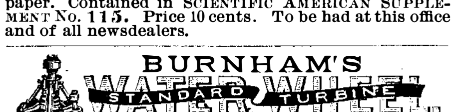

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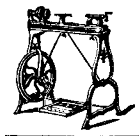

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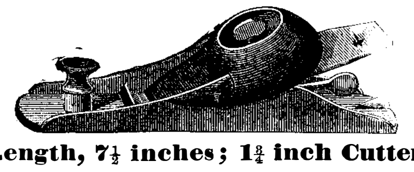

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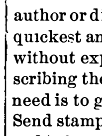

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