SCIENTIFIC AMERICAN

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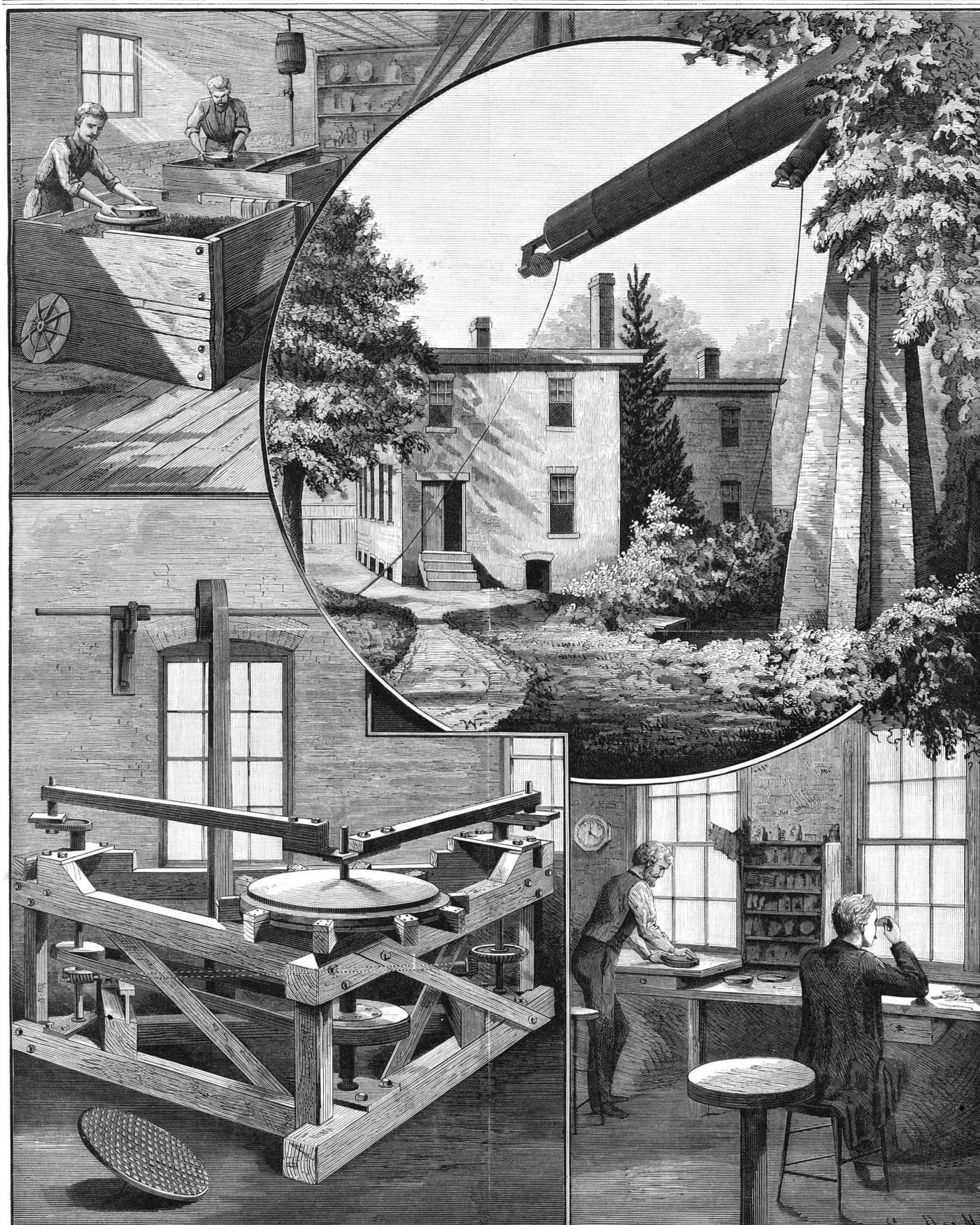

Grinding Objectives. Machine used in polishing the Lick Objective. Alvan Clark's Sons' Establishment. Polishing Objectives.

HOW TELESCOPES ARE MADE.

Scientific American.

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Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 612.

For the Week Ending September 24, 1887.

Price 10 cents. For sale by all newsdealers.

THE RETURN OF OLBERS' COMET OF 1815.

Prof. Brooks announced the discovery of a comet on Aug. 25. It took its place on the cometic annals of the year as "Comet *f* 1887 (Brooks)," and the discoverer was serenely unconscious that he had found a celestial pearl of great price. Other astronomers observed the new comer, and its elements and ephemeris were computed.

Olbers' comet of 1815 was expected about this time, on its first recorded return after an absence of over seventy years. A surprising resemblance was found to exist in the orbits of the two comets. Indeed, so close is the identity that there is scarcely a doubt that the comets are one and the same. Therefore, those who are fortunate enough to see the comet will behold the identical visitor that looked down upon our planet in 1815.

Olbers, a German astronomer, discovered the comet at Bremen, and Bessel, another German astronomer, calculated its elements. He assigned its next perihelion passage to February 9, 1887, and, wonderful to relate, the comet is but six months behind time.

Thus cometic astronomy has its triumphs. Pons' comet of 1812, also discovered by Prof. Brooks, looked down from the celestial depths after an absence of a little more than seventy years. Olbers' comet of 1815 now returns to shine in our sky after an absence of seventy-two years, and the dwellers on this planet in the year 1910 will doubtless behold Halley's superb comet spreading its gossamer train over their heads, on its third recorded return, after an absence of seventy-five years.

The latest comer among the comets is an ordinary specimen of the family, has a stellar nucleus and a faint tail, but will grow brighter until it reaches perihelion, on October 6. It will be seen, by consulting Prof. Brooks' chart, published last week in the SCIENTIFIC AMERICAN, that it is nearly north of Denebola on September 26. We wish it were larger and more favorably situated for observation; but we are none the less grateful that, in however humble form, Olbers' comet has made its first recorded return on August 25, 1887.

The Ninth International Medical Congress.

The Ninth International Medical Congress opened its sessions in Albough's Opera House, Washington, on Monday, Sept. 5. The attendance at the convention was extremely large, upward of 3,500 medical men being present. The surgeons and medical authorities of the Continent and of England were present in numbers. At 11 A. M. Dr. Henry M. Smith, of Philadelphia, chairman of the executive committee, called the meeting to order, and in accordance with his announcement it was opened formally by President Grover Cleveland amid great applause. Dr. Nathan Smith Davis, of Chicago, was nominated president of the congress. On the stage various notabilities were present, including Secretary Bayard, Surgeon-General Hamilton of U. S. Marine Hospital, and Deputy Surgeon-General Marston of the British service, among others. After the full list of officers, including a long array of vice-presidents, had been selected, Secretary Bayard addressed the meeting in a long address alluding to the vocation of science in the republic. It was very well received. Drs. Lloyd, of the British navy, Leon de Forges for France, Unna for Germany, Mariano Scenola for Italy, delivered short addresses on behalf of the contingents from their respective countries. Dr. Davis then delivered his presidential address.

The following day's proceedings comprised both business and pleasure. Many receptions and excursions were provided for. For the heading of papers the convention was divided into sections, so that comparatively small audiences heard many of the most important ones. Among the essayists may be named: Dr. Austin Flint, on "Fever, its Causes, Mechanism, and Rational Treatment;" Dr. Nicholas Senn, of Milwaukee, on "Intestinal Surgery;" Dr. John Homans, of Boston on "Laparatomy," based on 384 cases within the writer's own knowledge. This operation, involving opening the intestines for the removal of obstructions, has been several times performed successfully by Dr. William T. Bull, of this city. Before his work only one successful case was chronicled, performed by Kocher, of Berlin.

Dr. Cyrus Edson, of the Board of Health of this city, read a valuable paper on the "Milk Supply of Cities." The dissemination of scarlet fever, diphtheria, and typhoid fever by milk, already described by us, and the subject of the ptomaine "tyrotoxicon" in milk were treated of. Dr. Whitmarsh, of London, read a paper opposing the Pasteur treatment, in accordance with his well-known views.

The committee appointed to arrange for the next place of meeting reported in favor of Berlin, Germany. The date, as far as the year is concerned, is 1890. The day has not yet been fixed.

The proceedings terminated with a banquet on Thursday, September 8, though excursions and trips to Niagara and elsewhere prolonged the attendance of many of the foreign members.

Taken altogether, as regards the number present and the high rank of many of them in the profession, the quantity of papers read, and their importance, and in view of the many courtesies and attentions showered upon them by the society of Washington, the meeting may be pronounced one of the events of the year.

The Preparation of Arrowroot in Bermuda.

According to the last report of the United States Commissioner of Agriculture, it appears that of late years a considerable impetus has been given to the cultivation and preparation of arrowroot in Bermuda, and large quantities are annually exported from the island. In cultivation, the method adopted is very similar to that practiced in the culture of the common potato. The ground is first well manured and plowed deep; it is then harrowed and laid out in drills about six inches in depth and three feet apart. In these drills the roots are set about eight inches apart, covered with the plow, and the surface smoothed by harrowing. The plants require at least a year to mature, and economical planters set the drills somewhat wider apart, and introduce an intermediate row of the potato, the crop of which is ready for removal before it can injure the arrowroot crop. Indian corn is occasionally planted in these rows, which is cut for forage when green, as, if it is allowed to mature, the main crop would be impaired by it. The mode of preparing the fecula from the roots greatly influences its value, and the superiority of the Bermuda arrowroot is attributed to the extreme care and cleanliness exercised in the different processes of manufacture. The roots, after being collected, are washed, and their outer skin completely removed. This operation has to be performed with great nicety, as the cuticle contains a resinous matter which imparts color and a disagreeable flavor to the starch which no subsequent treatment can remove. After this process, the roots are again carefully washed, and then crushed between powerful rollers, which reduce the whole mass to a pulp. This is thrown into large perforated cylinders, where it is beaten by revolving wooden paddles, while a stream of pure water carries off the fecula from the fibers and parenchyma of the pulp, and discharges it, in the form of milk, through the perforated bottom of the cylinder, from whence it is conveyed in pipes and passed through fine muslin strainers into large reservoirs, where it is allowed to settle, and the water is drawn off. After being repeatedly washed, it is allowed to settle for some time, and then the surface is skimmed with palette knives of German silver, in order to remove any slightly discolored particles which may appear on the top, and retaining only the lower, purer, and denser portion for drying for market. The rollers and cylinders are made of brass and copper, in order to preserve the purity of the material. The drying process is conducted also with great care and cleanliness. The substance is spread in flat copper pans, and immediately covered with white gauze to exclude dust and insects. These pans are placed on rollers, and run under glass-covered sheds when there is any danger from rain or dews. When thoroughly dry, it is packed with German silver shovels into new barrels, these being first lined with paper, which is gummed with arrowroot paste.

The Volunteer Chosen as Defender of the America's Cup.

After several unsuccessful attempts, a decisive trial race came off between the Mayflower and Volunteer, at New York, on September 16. The latter won by 16 minutes $2\frac{3}{4}$ seconds over a $41\frac{1}{4}$ mile course. The breeze was a strong one, and the Volunteer gained over 12 minutes of her lead in going ten miles to windward. The race was watched by the Thistle, which went over the course with the yachts. The final international contests are set for September 27, 29, and, if necessary, October 1, 1887. The Volunteer is beyond cavil our best boat, and it is to be hoped that she will win. If defeated, it will be a difficult task to get the cup back to America.

Alumina Bleaching Compounds.

Hypochlorite of alumina has long since been employed in bleaching, under the name of "Wilson's bleaching liquid," and has been preferred on the grounds that "it accelerates the bleaching process and deteriorates the fibers of the tissue much less than the chloride of lime." Up to the present, the usual method of manufacture has been by double decomposition of alumina sulphate and chloride of lime. "Experiments have proved that similar but still more energetic bleaching compounds of alumina are produced by the direct action of chlorine on aluminates, and especially on aluminates of sodium or calcium and of magnesium, whereby the use of chloride of lime is entirely obviated. These bleaching alumina compounds may be prepared either in the form of a solution or in a solid form." Chlorine is passed through a solution of the aluminate or over the solid substance till no more is absorbed. The inventor claims that the alumina compounds prepared in the manner he describes act as very rapid bleachers "in consequence of the delivery of ozonized oxygen." "The use of acid baths is also dispensed with; also these alumina compounds deteriorate the fibers much less than chloride of lime."—*R. Weiss*, *Oranienburg*, *Russia*.

FOR STAR GAZERS.

As the earth has now reached that part of her orbit in which the constellation Perseus appears opposite the sun, and is therefore visible in the early evening and throughout the night, we have the opportunity of observing at a convenient hour the singular variations in the light of Beta Persei, or, as it is commonly called, Algol, the Demon Star.

As is generally known to those who possess even but a slight knowledge of the appearance of the heavens, Algol varies in the amount of light it emits to the eye to such a degree that, while its normal brilliancy is that of a second magnitude star, it is often seen to be only of the fourth magnitude, presenting at such a time a very insignificant appearance. This change occurs with the greatest regularity once in every period of two days twenty hours and nearly forty-nine minutes. For two days and about twelve hours the star shines with a luster equal to a second magnitude star, the rest of the period, amounting to about nine hours, being occupied in a gradual though very perceptible decline to the appearance of a fourth magnitude star and an equally perceptible increase to its normal brilliancy.

The dates upon which the rapid changes in the light of Algol may be conveniently observed during the evenings of the ensuing fall and winter are given in the following table, which notes the moment when the light of the star is at its minimum. As the eclipse, for such it undoubtedly is, occurs at the same instant for the whole earth, the time at which it may be observed is independent of the place of the observer, and in a region so large as that covered by the circulation of the SCIENTIFIC AMERICAN, there are many eclipses visible at each extremity which cannot be observed at the other. It is, therefore, necessary to cover at least the four standard time divisions of the United States.

The table includes every eclipse visible in any of the four divisions that occurs between the hours of 5 P. M. and 1 A. M.

STANDARD TIME.

EASTERN.	CENTRAL.	MOUNTAIN.	PACIFIC.
		SEPTEMBER.	
		28th, 0:10 A. M.	27th, 11:10 P. M.
30th, 10:58 P. M.	30th, 9:58 P. M.	30th, 8:58 P. M.	30th, 7:58 P. M.
		OCTOBER.	
3d, 7:47 P. M.	3d, 6:47 P. M.	3d, 5:47 P. M.	18th, 0:51 A. M.
21st, 0:40 A. M.	20th, 11:40 P. M.	20th, 10:40 P. M.	20th, 9:40 P. M.
23d, 9:29 P. M.	23d, 8:29 P. M.	23d, 7:29 P. M.	23d, 6:29 P. M.
26th, 6:18 P. M.	26th, 5:18 P. M.		
		NOVEMBER.	
		10th, 0:22 A. M.	9th, 11:22 P. M.
12th, 11:11 P. M.	12th, 10:11 P. M.	12th, 9:11 P. M.	12th, 8:11 P. M.
15th, 8:0 P. M.	15th, 7:0 P. M.	15th, 6:0 P. M.	15th, 5:0 P. M.
		DECEMBER.	
3d, 0:53 A. M.	2d, 11:53 P. M.	2d, 10:53 P. M.	2d, 9:53 P. M.
5th, 9:42 P. M.	5th, 8:42 P. M.	5th, 7:42 P. M.	5th, 6:42 P. M.
8th, 6:31 P. M.	8th, 5:31 P. M.	23d, 0:35 A. M.	22d, 11:35 P. M.
25th, 11:24 P. M.	25th, 10:24 P. M.	25th, 9:24 P.M.	25th, 8:24 P. M.
28th, 8:13 P. M.	28th, 7:13 P. M.	28th, 6:13 P. M.	28th, 5:13 P. M.
31st, 5:2 P. M.			
		JANUARY.	
	15th, 0:6 A. M.	14th, 11:6 P. M.	14th, 10:6 P. M.
17th, 9:56 P. M.	17th, 8:56 P. M.	17th, 7:56 P. M.	17th, 6:56 P. M.
20th, 5:44 P. M.			
		FEBRUARY.	
		4th, 0:49 A. M.	3d, 11:49 P. M.
6th, 11:38 P. M.	6th, 10:38 P. M.	6th, 9:38 P. M.	6th, 8:38 P. M.
9th, 8:26 P. M.	9th, 7:26 P. M.	9th, 6:26 P. M.	9th, 5:26 P. M.
12th, 5:14 P. M.			

An extension of this table to the 24 divisions of standard time would show that every eclipse of Algol is visible from some quarter or other of the earth, though those that occur in May, June, and July would be visible from very limited regions, and under unfavorable conditions.

On the 30th of September, at New York, at the hour given for Eastern time, Algol is about four and a half hours high in the northeast. On the 12th of February, the star when eclipsed is almost in the zenith.

Those to whom this interesting subject is new, and who wish to observe this mysterious waning and waxing of the light of a star that far exceeds our own brilliant sun in dimensions, will find full directions for locating it by means of a map of the region in which it is situated, with many interesting particulars of the Demon Star, in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 558, for September 11, 1886.

Aluminum Dental Plates.

The early use of aluminum was not satisfactory, as the metal was impure, owing to the presence of iron, and it soon succumbed to the fluids of the mouth. This was more generally true of cast plates, which were not only more difficult to make, but were not as good. The metal is not very easy to cast, as it does not flow freely like other metals, and the contraction is considerable, causing cracked blocks. When made from rolled plate and pure metal, aluminum for upper cases has proved very satisfactory in my hands, and not being very expensive is a recommendation, as it is a metal, and is thus better than rubber and less in cost than gold. It is very light and strong, perfectly tasteless and odorless, and as healthy to the gums as gold or platina. The teeth are best attached with rubber.—*Geo. H. Swift, West. Dent. Jour.*

The British Museum.

I made but two brief visits to the British Museum, and I can easily instruct my reader so that he will have no difficulty, if he follow my teaching, in learning how not to see it. When he has a spare hour at his disposal, let him drop in at the museum and wander among its books and its various collections. He will know as much about it as the fly that buzzes in at one window and out at another. If I were asked whether I brought away anything from my two visits, I should say, certainly I did. The fly sees some things, not very intelligently, but he cannot help seeing them. The great, round reading room, with its silent students, impressed me very much. I looked at once for the Elgin marbles, but casts and photographs and engravings had made me familiar with their chief features. I thought I knew something of the sculptures brought from Nineveh, but I was astonished, almost awe struck, at the sight of those mighty images which mingled with the visions of the Hebrew prophets. I did not marvel more at the skill and labor expended upon them by the Assyrian artists than I did at the enterprise and audacity which had brought them safely from the mounds under which they were buried to the light of day and the heart of a great modern city.

I never thought that I should live to see the Birs Nimroud laid open, and the tablets in which the history of Nebuchadnezzar was recorded spread before me. The Empire of the Spade in the world of history was founded at Nineveh by Layard, a great province added to it by Schliemann, and its boundary extended by numerous explorers, some of whom are diligently at work at the present day. I feel very grateful that many of its revelations have been made since I have been a tenant of the traveling residence which holds so many secrets in its recesses. There is one lesson to be got from a visit of an hour or two to the British Museum—namely, the fathomless abyss of our own ignorance. One is almost ashamed of his little paltry heartbeats in the presence of the rushing and roaring torrents of Niagara. So if he has published a little book or two, collected a few fossils, or coins, or vases, he is crushed by the vastness of the treasures in the library and the collections of this universe of knowledge.

I have shown how not to see the British Museum. I will tell how to see it. Take lodgings next door to it—in a garret, if you cannot afford anything better—and pass all your days at the museum during the whole period of your natural life. At threescore and ten you will have some faint conception of the contents, significance, and the value of this great British institution, which is as nearly as any one spot the *nœud vital* of human civilization, a stab at which by the dagger of anarchy would fitly begin the reign of chaos.—*Oliver Wendell Holmes, Atlantic Monthly.*

Minerals at the American Exhibition, London.

One of the most conspicuous features of the American Exhibition is the remarkable collection of minerals brought over and exhibited by Mr. A. E. Foote, of Philadelphia. Many of the specimens, which are extremely fine, have been obtained during collecting expeditions undertaken by Mr. Foote himself, and several new species and varieties have been made known to science through his indefatigable labors.

The central feature is a hexagonal pavilion covered with mica, and surmounted by a model of a snow crystal. Each side of the pavilion is devoted to a separate mineral region of the North American continent, except the first, which is filled with a collection of gems and ornamental stones. Here are rough and cut specimens of a precious ruby, topaz, opal, williamsite, with examples of malachite and azurite beautifully banded and taking a fine polish.

A lapidary who has had several years' experience in making rock sections for the British Museum is constantly employed close by.

Minerals from the region near the Pacific coast come next. Wulfenite, a rare species, some of the finest specimens ever seen, is here exhibited in large groups of orange-red crystals; also brilliantly red vanadinites and large bright crystals of chessylite or azurite associated with velvet tufts of malachite. All these are from the marvelous country that Humboldt called New Spain. The deep red garnets from Alaska in their somber settings of gray mica-schist are especially noteworthy. Among the minerals of the Rocky Mountain region are wonderful crystals of the green Amazon stone; ore from the famous Bridal Chamber at Lake Valley, New Mexico, so rich that the heat of a match will cause it to melt and fall in drops of nearly pure silver. A space the size of a moderate sized room produced about £100,000. The precious turquoise comes from Los Cerrilloz, New Mexico, where Montezuma got his chalchuhuitls that he valued above gold and silver. The Indians still make long pilgrimages for the sacred stone.

Most striking among the minerals of the Mississippi Valley and lake region are the blendes and galenas from Southwest Missouri, a district that now produces over one half of all the zinc mined in the world. It was formerly so abundant that farmers built their fences with it. Masses of the lead ore weighing ten tons were found within 12 feet of the surface. Here Indians formerly procured the lead for their bullets, placing the ore in hollow stumps and building a fire over it.

From Arkansas come fine rock crystals or hot spring diamonds, with powerful lodestones, arkansites, and hydrotitanites.

From the Lake Superior region come copper, chlorastrolites, and zonochlorite, a remarkable gem-like mineral.

In the case devoted to the North Atlantic coast region is rhodonite, so much used by the Russians in their ornamental work, in fine crystals. The mines at Franklin, N. J., produce also many minerals found nowhere else in the world, such as franklinite, named after the illustrious philosopher; anomolite, a new species recently described by Prof. G. A. Konig, of the University of Pennsylvania; troostite, jeffersonite, blood-red zincite, etc. Cacoclasite, a new species in fine crystals, associated with pink titanite, comes from the same region, as do the remarkable crystals of apatite. These are among the finest specimens ever seen, and associated with them are the brilliant twin zircons. From the apatite are manufactured hypophosphites to stimulate the appetite and superphosphates to grow wheat and corn.

The last case devoted to the South Atlantic coast region contains amethysts, sapphires, aquamarines, tantalite, gummite, and uranolite, huge sheets of mica, etc.

Next to the wall opposite is a very extensive collection, illustrating the mineralogy of Pennsylvania, which, besides the well-known coal, iron, and other ores that have made the State famous, includes very extraordinary specimens of the rare mineral brucite, from which the medicine Epsom salts may be made; diaspore in fine crystals, corundum for polishing purposes, chromite for producing brilliant yellows, etc.

Adjoining, in cases and drawers, are the college and educational collections, indispensable for the studies of mineralogy, geology, and chemistry.

The collection of American geological surveys and other scientific works is very extensive, over fifty volumes from Pennsylvania alone being shown. We have devoted so much space to the description of the extensive exhibit made by Mr. A. E. Foote, of Philadelphia, that we can only refer to the minerals shown by Kansas and other States, by the Denver and Rio Grande and C., B., and Q. railroads, and by various mining companies.—*Nature.*

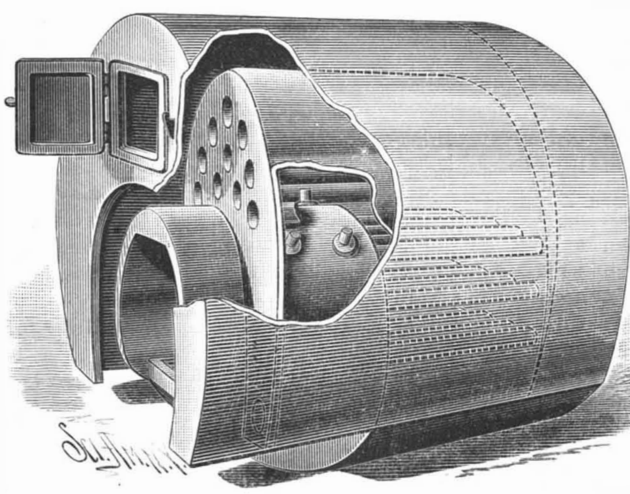
How to Act at a Fire.

In a lecture before the Society of Arts, London, Mr. A. W. C. Ghean gave the following concise and simple directions how to act on the occurrence of fires. Fire requires air; therefore, on its appearance every effort should be made to exclude air—shut all doors and windows. By this means fire may be confined to a single room for a sufficient period to enable all the inmates to be aroused and escape; but if the doors and windows are thrown open, the fanning of the wind and the draught will instantly cause the flames to increase with extraordinary rapidity. It must never be forgotten that the most precious moments are at the commencement of a fire, and not a single second of time should be lost in tackling it. In a room, a table cloth can be so used as to smother a large sheet of flame, and a cushion may serve to beat it out; a coat or anything similar may be used with an equally successful result. The great point is presence of mind—calmness in danger, action guided by reason and thought. In all large houses, buckets of water should be placed on every landing, a little salt being put into the water. Always endeavor to attack the bed of a fire; if you cannot extinguish a fire, shut the window, and be sure to shut the door when making good your retreat. A wet silk handkerchief tied over the eyes and nose will make breathing possible in the midst of much smoke, and a blanket wetted and wrapped around the body will enable a person to pass through a sheet of flame in comparative safety. Should a lady's dress catch fire, let the wearer at once lie down. Rolling may extinguish the fire, but if not, anything (woolen preferred) wrapped tightly round will effect the desired purpose. A burn becomes less painful the moment air is excluded from it. For simple burns, oil or the white of egg can be used. One part of carbolic acid to six parts of olive oil is found to be invaluable in most cases, slight or severe, and the first layer of lint should not be removed till the cure is complete, but saturated by the application of fresh outer layers from time to time. Linen rag soaked in a mixture of equal parts of lime water and linseed oil also forms a good dressing. Common whiting is very good, applied wet and continually dampened with a sponge.

ENAMELED or glazed bricks, for outside or interior decoration, are made by applying to the surface a flux, which, during the burning, causes the silex to melt and form a vitreous covering. Such flux is easily colored, and thus very beautiful fancy bricks produced.

A LOW PRESSURE BOILER FOR STEAM HEATING.

A boiler of simple construction, designed to be very economical of fuel, and more especially intended to serve for steam heating purposes, is shown in the accompanying illustration, and has been patented by Mr. James S. Priest, of Manayunk, Philadelphia, Pa. Within the main inclosing case is arranged a crescent-shaped boiler and crescent-shaped fire chamber, the latter extending back about midway of the lower half of the boiler proper and also projecting forward beyond the front end of the boiler. The boiler proper has two series of flues, one series extending direct from the fire chamber through the lower portion of the boiler to a rear chamber, as shown in dotted lines, and the other series extending from this rear chamber to the front, whence the products of combustion pass rearward over the boiler to an exit flue. The crown sheet of the fire chamber has a number of copper plugs, so that the heat will be more quickly transmitted to the water within the boiler. In the back wall of the boiler case is a doorway, normally closed, similar to one shown in front, to give access to the flues for cleaning them.

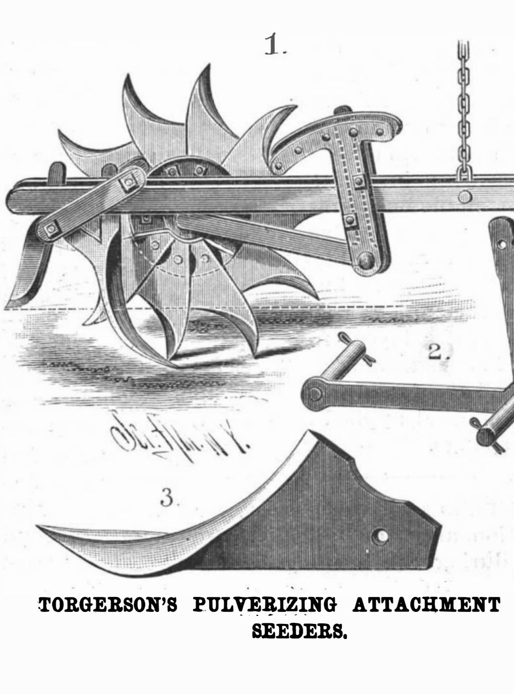


PRIEST'S BOILER FOR STEAM HEATING.

AN IMPROVED PULVERIZING ATTACHMENT FOR SEEDERS.

A device for thoroughly pulverizing and breaking all clods and lumps in the ground passed over by a seeder is shown in the accompanying illustration. Upon the seeder beam is clamped a segmental rack, its lower portion affording a bearing for a short shaft which carries a rigidly connected arm supporting a sectional hub, in which are fixed radially extending curved blades, while integral with this shaft and arm is a nearly vertical lever held at such angle as may be desired by moving a pin in the segmental rack. The upper ends of the blades are made substantially in the form of sectors, so that when a series of blades are inserted in the hub sections their approaching edges will abut the one against the other, as shown in Fig. 1, a single blade being represented in Fig. 3. The preferred way of making the short shaft, wheel shaft, arm, and lever, all cast in one piece, is shown in Fig. 2. Just to the rear of the journal of the sectional hub is mounted a cultivator shovel, the standard of which, with a rearwardly extending brace, is held to the beam by side clips, their forward retaining bolt being above and their rearward retaining bolt below the beam. The clip on the side of the beam next the pulverizer blades is made with an extension, by which it is carried toward the blades and then down and to the rear in a vertical plane substantially parallel with the edges of the blades, thus forming a clearer for them.

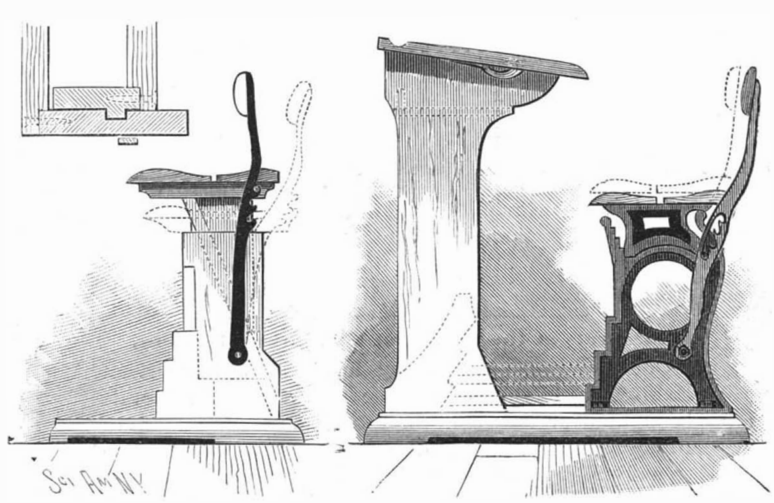
For further particulars relative to this invention address the patentee, Mr. Anthony Torgerson, Barnes, Barnes County, Dakota Ter.



TORGERSON'S PULVERIZING ATTACHMENT FOR SEEDERS.

AN IMPROVED ADJUSTABLE SCHOOL SEAT.

A school seat in which the seat and back, as well as the foot rest, are adjustable to suit the size or height of the scholars is shown in the accompanying illustration. The seat may be of a length to accommodate one or more scholars, and may be constructed of wooden slats secured upon metallic frames, or it may be made of wood in the form shown in the two smaller figures. The uprights are made with brackets projecting forwardly from their upper corners, and having a series of steps on their inner sides. The rear corners of the sides are likewise constructed with forwardly extending guide arms or brackets. The lower front corners of the seat frame are adapted to rest upon the steps of the uprights, while their lower rear corners have laterally extending studs or lugs adapted to rest in notches in the rear side of a slot formed in a lever pivoted to the outer side of each of the uprights, these studs bearing against the forwardly projecting guide arms, and preventing the seat from sliding backward off the steps. The back is secured to the upper ends of the side levers, which are thereby connected and braced. The front sides or edges of the uprights have steps adapted to support the inner ends or edges of the foot boards or rests, the front or outer edges of which are supported in a series of notches formed in brackets attached to the desk standards. With this construction, as the seat is raised or lowered, the back is simultaneously thrown in a rearward or forward direction. To raise the seat, it is only necessary to move the lugs into a higher notch in the side levers and then raise the front ends of the frames to a correspondingly higher step, when the seat will be firmly held until its rear edge is again raised for the purpose of placing it at a different height.



PEDERSEN'S ADJUSTABLE SCHOOL SEAT.

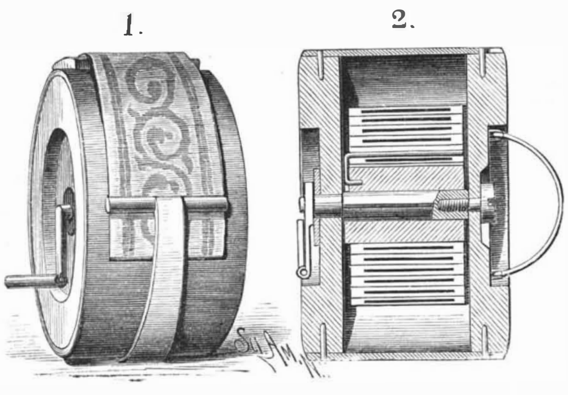
This invention has been patented by Mr. Johannes Pedersen, of Copenhagen, Denmark, and further information relative thereto may be obtained of Mr. Robert Richardi, P. O. box No. 773, New York City.

The Possible Consequences of Using Natural Gas.

A writer in the Cincinnati *Commercial Gazette* says that two hundred years ago, in China, there was just such a craze about natural gas as we have in this country to-day. Gas wells were sunk with as much vim and vigor as the Celestials were capable of, but owing to a gas explosion that killed several millions of people and tore up and destroyed a large district of country, leaving a large inland sea, known on the maps as Lake Foo Chang, the boring of any more gas wells was then and there prohibited by law. It seems, according to the Chinese history, that many large and heavy pressure gas wells were struck, and in some districts wells were sunk quite near to each other. Gas was lighted as soon as struck, as is done in this country. It is stated that one well with its unusual pressure, by induction or back draught, pulled down into the earth the burning gas of a smaller well, resulting in a dreadful explosion of a large district, destroying the inhabitants thereof. Lake Foo Chang rests on this district. The same catastrophe the writer thinks is imminent in this country unless the laws restrict further developments in boring so many wells. Should a similar explosion occur, there will be such as upheaval as will dwarf the most terrible earthquakes ever known. The country along the gas belt from Toledo, through Ohio, Indiana, and Kentucky, will be ripped up to the depth of 1,200 to 1,500 feet and flopped over like a pancake, leaving a chasm through which the waters of Lake Erie will come howling down, filling the Ohio and Mississippi valleys and blotting them out forever.

A CONVENIENT HOLDER FOR RIBBONS, EDGINGS, ETC.

A simple and inexpensive device for holding ribbons or like narrow fabrics within a case, secure from injury by dust and light, and so as to allow ready inspection or sale of the goods, is shown in the accompanying illustration, and has been patented by Mr. George A. Loyd, of Loveland, Col. The case has one fixed head, the other head having pins which enter open slots in the edge; and the spool on which the ribbon is wound, either with or without a measuring tape or band between its coils, is provided with an axial shaft, on one end of which is a crank arm, that may be folded down flat when not in use, as shown in the sectional view, Fig. 2. The other head of the case is provided with a bail, wire, or handle, which may be folded down. The outer end of the ribbon is passed through a guide slot, where it is held in position to show the goods by a spring clamp, attached to a short elastic plate, soldered or otherwise fastened to the face of the tube.



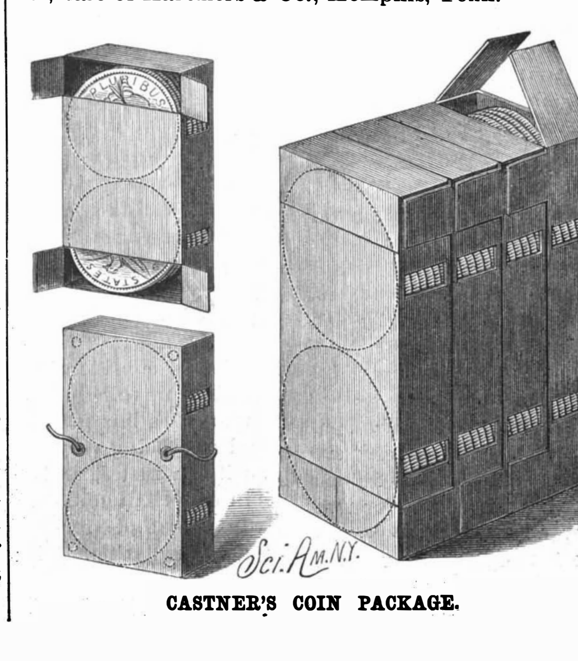
LOYD'S RIBBON HOLDER.

The Glasgow International Exhibition.

In the last issue of this paper, page 182, a résumé of the industries to be represented at the above exhibition was amply set forth. We have now to call attention to an advertisement on another page, giving further information of importance to those contemplating the exposition of their wares. From the prospectus before us, it is evident the Scotch people intend their exhibition shall not be behind any of their neighboring countries in point of size or interest. It is important that those intending to exhibit should apply for space without delay, as the limit of time for applications for space is set for November 1 next. It has been suggested that those industries which are to be represented in the Paris International Exhibition of 1889 might be readily transferred from Glasgow to Paris, after the closing of the Scotchmen's exhibition.

A READY-RECKONING COIN PACKAGE.

A coin package which may be depended upon to hold an equal and exact number of coins of the same denomination in a given space, so that the coins may be viewed and counted without opening the package, is represented in the accompanying illustration. It is made up of a series of packages, each having slits in its side, and with covering and uniting flaps, the latter made integrally with the body of the package, and each lapping the fellow or companion package of the series. The fact that coins are never so abraded by wear as to allow room for one more in such spaces as are assigned in this package renders it practically a self-counter, in which there can be no danger of "shorts" or "overs," and its convenient shape admits of thus uniting several packages of the same or of different denominations into one compact bundle, and of dividing them at pleasure, the different parts still remaining intact. For further information, address the patentee, Mr. George L. Castner, care of Hartmers & Co., Memphis, Tenn.



CASTNER'S COIN PACKAGE.

SPLENDID WORK DONE BY RUBBER BELTS.

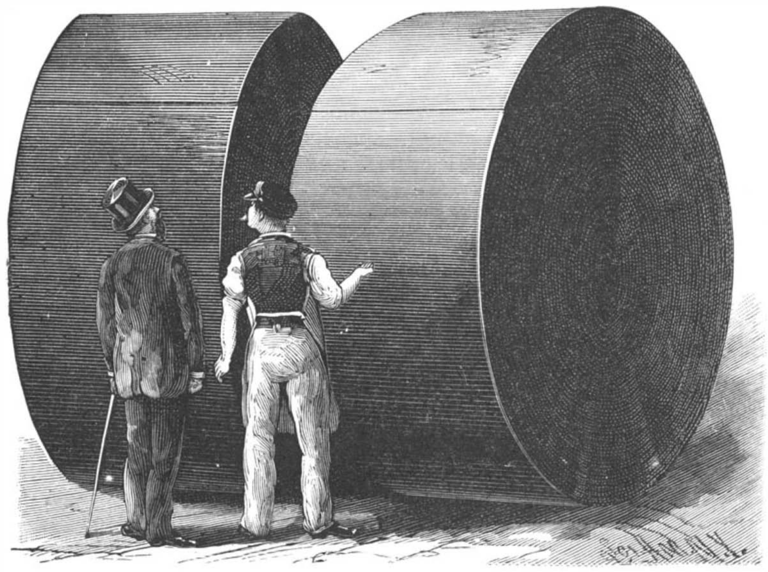
The high standard of efficiency which can be realized by the employment of strictly first-class rubber belts is now receiving merited recognition from users who have had them in severe service for many years, and whose experience cannot fail to be of value to all mill owners and furnishers of factory equipments. In the matter of simple tensile strength, the superiority of these belts has long been conceded. In ordinary work, however, this consideration is practically of far less importance than that of having a belt which will hug the pulley tightly, or with which there will be no "slip." In this particular, whether the pulleys used be of the ordinary iron pattern or whether they be covered with leather, rubber, paper, or other material, the rubber belt has incontestably the advantage, as it will never slip under any service to which a belt of nearly suitable size for the power required can be subjected, whether the pulleys be covered or not. The slipping of belts is one of the most troublesome incidents in many shops, and it is not infrequent to find mechanics rubbing them with beeswax, resin, and other substances, to prevent slipping. This should never be done with any kind of belt; but where a rubber belt is used, the slipping, which affords a temptation to resort to such expedients, does not occur.

In the accompanying illustration we show two large belts of this kind recently completed by the New York Belting and Packing Company, each of them nearly half a mile long. These belts were sent to West Superior, Wis., and each of them weighed 11,000 pounds. Had they been made of leather, they would have required at least 500 selected hides to manufacture each one of them. At the same time the company also furnished a driving belt 52 inches wide, eight-ply, 298 feet long, and weighing 4,000 pounds.

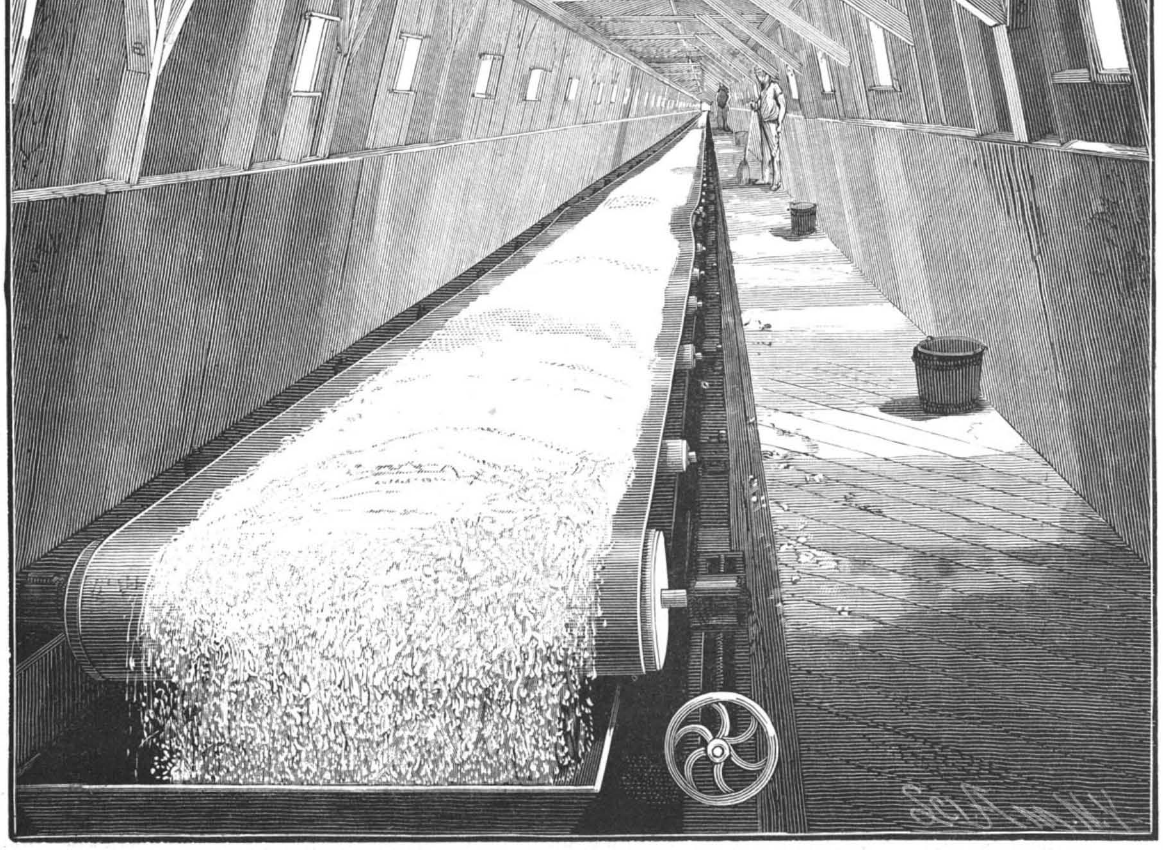
In the larger picture may be seen a belt 2,700 feet long, recently made for the Pennsylvania Railroad Company, and in use in one of their grain elevators in Jersey City. This belt is used to convey grain from one end of the immense building to another, the grain being delivered upon the belt from another belt, and being taken off by a simple form of guide arm at any portion of its length, as well as at the end, and conducted into chutes for delivery to vessels at the dock. The belt runs on small rollers, and there is a simple form of tightener at the ends, by which it can be readily kept straight and even. In making conveyer belts of this description the company has long held a leading place, the superiority of such belts in point of economy, as well as of efficiency, being equally pronounced.

Perhaps the most important consideration of all to be taken into account in fitting up machinery is to have the plant so provided with power that there shall be no "breakdowns." Such mishaps necessitate the waiting of workmen in time they are paid for, as well as delay of the work, and involve an increased expense in the cost of production, which is seldom estimated at its true importance. In fact, there is no room allowed at all for such an item of cost with the close figuring practiced in many of our large industries at the present day, although it occurs with more or less frequency in every business. As touching this point, the company last year received a highly significant testimonial of the durability of one of their belts under heavy service. It was a main driving belt, 48 in. wide and 320 ft. long, six-ply, used in Central elevator "B," Chicago, and had been in constant service from September, 1869, until April, 1886, a period of sixteen years and seven months. The uninterrupted use for so long a period of so large and heavy a driving belt affords the best possible practical gauge of the character of its manufacture. The great tensile strength of rubber belting is due to its web of heavy cotton duck, the rubber being driven through and through its meshes by powerful machinery. The fabric used for this purpose is made expressly for the company by Brinckerhoff, Turner & Co., of New York, and has more than double the strength of the heavy cotton duck used for sails of ships. The preparation of the rubber itself is, however, a long and very elaborate process, in which the present manner of working has only been reached after years of experiment. The sulphur to be used in the vulcanizing is carefully tested and weighed, as are also the different metallic oxides, making a semi-metallic compound, which gives the surface of the belts a high degree of firmness, while there is yet sufficient elasticity to allow of their hugging the pulley closely, and enables them to resist a high degree of heat, so that their surfaces may not be injured by friction. The several thicknesses of rubber-impregnated duck which go to make the several weights of belts are so arranged, by the folding over of the outside strip, as to present a perfectly even and half round edge, and then passed between powerful heated rollers. Subsequent to this the large belts are finished in an immense steam press, said to be the largest of the kind in the world, and calculated to completely take the "stretch" out of the largest sized belt. The press will take a belt six feet wide and fifteen feet of its length, steam being let into its bed and platen so that the temperature can be readily regulated, and the pressure and heat applied while the belt is under the full tension of the heaviest strain it may be desired to put upon it, thus setting its fibers as compactly as they are formed in a steel spring. The company owns the patent for this stretcher, in combination with the press, as well as many other patents of great value in the business.

The principal factory of the company, and the oldest one engaged in the rubber business, is at Newtown, Conn., although they have another one at Passaic. The offices, salesroom, and warehouse are at No. 15 Park Row, New York City. John H. Cheever is the treasurer of the company and general manager of the business.



LARGE RUBBER BELTS.



A BIG GRAIN ELEVATOR BELT MADE BY THE N. Y. BELTING AND PACKING CO.

Tyndall on Lightning Rods.

Professor Tyndall, in a letter on lightning conductors, points out that the abolition of resistance is absolutely necessary in connecting a lightning conductor with the earth, and this is done by closely embedding in the earth a plate of good conducting material and of large area. The largeness of area makes atonement for the imperfect conductivity of earth. The plate, in fact, constitutes a wide door through which the electricity passes freely into the earth, its disruptive and damaging effects being thereby avoided. A common way of dealing with lightning conductors adopted by ignorant practitioners is, Dr. Tyndall remarks, to carry the wire rope which forms part of the conductor down the wall and into the earth below, where it ends without any terminal plate. Such a "protection" is a mockery, a delusion, and a snare. Some years ago a rock lighthouse on the Irish coast was struck by lightning, when he found by the engineer's report that the lightning conductor had been carried down the lighthouse tower, its lower extremity being carefully embedded in a stone perforated to receive it. If the object had been to invite the lightning to strike the tower, a better arrangement could hardly, he believes, have been adopted. He vetoed the proposal to employ a chain as a prolongation of the conductor, as the contact of link with link is never perfect.

A Simple Test of Kerosene Oil.

Take an ordinary pint tin cup. Fill it within an inch of the top with water warmed to the temperature of 120° F. Pour on this water three or four tablespoonfuls of the oil to be tested. Stir the oil and water together, and wait a short time, say a minute or two, for the oil to collect on the top. Try the thermometer again, and if the temperature is more than one degree from 120° F., add a little cold or hot water, as the case may be, so as to bring the temperature to within one degree of 120° F. Then stir again and give time, as before, for the oil to come to the top. Now apply a burning match or lighted taper on a level with the top of the cup, say within half an inch of the oil. If within one second no flash occurs, the oil is reasonably safe; otherwise, it is unsafe. Purchase four or five gallons of oil at a time, and apply this test at each purchase.—*Bulletin N. C. State Board of Health.*

Graphitic Carbon.

Mr. H. Warren has succeeded in producing a very dense graphitic carbon for incandescent electric lighting by passing the electric discharges from an induction coil between two electrodes inclosed in a vessel containing illuminating gas. The graphite forms at the negative electrode and gradually elongates toward the positive pole. This carbon burns in oxygen without leaving any residue. —*Annales Industrielles.*

Stove Bronzes and Tiles.

An unusually large number of stove dealers from out of town, says the *Mail and Express* (New York), have been in the city the last few days purchasing their fall supplies. There is the liveliest sort of a craze for stoves ornamented with fancy tiles and bronze images.

"Why, the stove has now got to be as ornamental as any other part of the house," said Mr. Henry Gleason, an active member of the Republican Club, who has made the subject of stove decoration a special study for years, "and the consequence is that just now all the manufacturers are doing their best to get ahead of one another in this matter of stove decoration. The result will be to put on the market this fall stoves that in ornamentation will surpass anything ever before made. You remember when Oscar Wilde was here, about six years ago? Well, the change began then, and was caused by his criticising our stoves and calling them of a pump log style, decorated with funeral urns. The same year a company was started to make tiles and bronzes for stoves, and the result is seen to-day in a complete revolution in the stove trade. Now the manufacturers are seeing who can turn out the most giddy stove. They are putting lots of money in it too. Many recent models are from plaster casts, and I know of complete sets of castings that cost $10,000 and $15,000 each."

Among the bronze figures that are the rage for stoves are Roman warriors, gladiators, Knights of the Red Cross on horseback, Charles V., Joan of Arc, which is a great favorite, and many "Mikado" characters. One of the favorite pieces is the "The Flute Players," which was modeled after the original in the Stewart collection. The figure is placed on the top of the stove, and does away wholly with all suggestion of the "funeral urn." All these bronzes are so tastefully got up and look so much like the real article that, as a rule, they are taken from the stove and used as mantel ornaments during the summer.

Another reason given why they are so greatly in favor is that a system has been discovered here for making them very cheaply. Sometimes the models are designed in this country, but in most cases an imported French bronze piece is bought and used as a model. This costs perhaps $10. The purchased model is divided into pieces with the aid of a blowpipe, and a separated plaster cast is made of each piece. This is done because it is impossible to cast cheaply the entire figure in one mould. From these plaster casts brass moulds are made, which, when finished, are given to the casters. Then begins the work of making the figures. One caster has, for example, the mould of the left arm, another that of the right arm, and so on until all parts are distributed. The different casters fill their ladles with molten spelter, each ladleful being enough to make a number of casts. Holding the mould in his left hand, which is protected by a covering of heavy cloth, the caster quickly pours the spelter through a funnel-shaped orifice at one end of the mould, until the latter is filled. As soon as the mould is filled the spelter is poured back into the ladle, leaving a thickish shell clinging to the inside of the mould. With a single blow the latter is opened, and out drops a complete cast of silvery-looking metal, the entire operation not having taken more than five seconds. The pieces are then taken to the trimmers, who, with machinery, cut away the uneven edges. Next the pieces are carefully joined and soldered by expert workmen. The next operations are "buffing" or smoothing the surface, which is done with a mixture of grease and fine sand, and "washing," which is to dip the figure in potash and then wash it. Then the figure is ready for the plater, who gives it a wash in brass, copper, or other solutions, after which the finishing touches are put on, and it is ready for the market. The figure can be sold for $1, with a reasonable profit left for the manufacturer.

It is estimated that of tiles to be used in decorating stoves, more than one million will be sold this year. They are made in all tints and sizes, and in colors the American make now exceeds both the French and the English. More than 300 designs have recently been made up here, including romantic and ideal heads and scenes, warriors, celebrated people, flowers, etc., and the like. They are placed on all possible parts of the stove, and are particularly effective on the doors and open work around the center. Small tiles are also put on the knobs of the doors, and it is even beginning to be the thing to ornament cooking stoves and ranges in this fashion.

The clay used in making these tiles must be white, hard, strong, and of uniform shrinkage. To get this a mixture is prepared and ground to dust, the clear whiteness of which is due to the presence of North Carolina china clay. This dust is dampened and the clay is then ready for the press. This is an upright affair, with a long lever or a wheel operating a screw press. The lower end of the screw carries a die plate, and the bed has a matrix. From a box at his hand the operator takes a scoopful of the dampened clay dust, fills the matrix and evens it off. A turn of the wheel is made, and the die imprints itself sharply and firmly into the clay. The tile is now perfect in shape. Air drying for several days comes next, to evaporate all moisture, after which the clay becomes sufficiently hard to be handled without breaking. Before being placed in the kiln, for the firing process, the air-dried tiles are packed in earthenware boxes called saggers, which are tightly closed to preserve their contents from discoloration. When packed the saggers are carried into the kiln and built up in rows, tier above tier, until the entire kiln is filled. Then the door is built up with fire brick, the interstices are filled with clay, and the fires are started. After the firing is completed the tile is ready for glazing. A glaze is, in fact, a coating of glass. After being ground to dust, the glaze is mixed with water and applied with a brush, or the tile is dipped in it. After this comes the final firing in a muffled kiln, heated by radiation. This process lasts four days, and then the tile is ready for use.

Flower Farming and Perfume Manufacture in Southern France.

For nearly a century the culture of flowers on a large scale and the manufacture of perfumes and essences have formed a special and lucrative industry in Southern France. The principal district in which the manufacture is carried on is at Grasse, in the department of the Alpes Maritimes; but it is also conducted on a more or less extensive scale at Sommieres, Nimes, Nyons, and Seillans. The descriptions of flowers principally grown, and their season of harvest, are the violet, jonquil, and mignonette, which are usually gathered in February, March, and April, although, in mild, moist winters, the violets commence as early as December; roses and orange blossoms, with thyme and rosemary, in May and June; jasmines and tuberoses in July and August; lavender and spikenard in September; and the acacia in October and November. The flower harvest covers, therefore, about three-fourths of the year, but the season of greatest activity is May and June, when the roses and orange blossoms are gathered. Thyme, rosemary, and lavender are among the minor products grown principally by small farmers of the grape and olive, who have at home the simple apparatus for distilling the flowers, and they produce a more or less inferior class of essences, which are used to dilute and adulterate the superior essences produced at the large establishments in towns and villages.

Consul Mason, of Marseilles, in a recent report upon flower farming in Southern France, says that the conditions of industrial success in flower growing can be best studied by a specific example, and he quotes the case of a plantation at Seillans in the department of the Var. This farm is about twenty-three acres in extent, and is situated on the southern slope of the hills, about 2,000 feet above the level of the Mediterranean, and at a distance of twenty miles from the coast. The calcareous soil was originally naturally poor and thin, and the olive trees, which had occupied the ground for a century or more prior to 1881, yielded but scanty and unsatisfactory returns. The slope of the surface was so steep that the waters of a spring which flows from the rocks above the track could be but imperfectly utilized for irrigation, and the land was regarded as practically worthless. In 1881 the proprietor caused the olive trees to be removed, and the land prepared for flower culture. The ground was first dug up to a depth of four feet, the larger stones removed and built into sustaining walls for the terraces into which the surface was divided and leveled. Along the upper margin of each terrace a shallow ditch was cut, connecting with transverse channels which supply the spring water for irrigation. The abruptness of the slope will be indicated by the fact that, on the tract of eighteen acres, the terrace walls required to produce a series of level or gently sloping surfaces are over 2,000 yards in length. Thus terraced, the tract yielded about seventeen acres of prepared ground for planting. In the autumn of 1881, 45,000 tufts of violets and 140,000 roots of the white jasmine were planted. The following spring the remainder of the ground was planted with roses, geraniums, tuberoses, and jonquils, and a laboratory erected for the manufacture of perfumes. The position proved to have been well chosen, as the flowers grew vigorously and well, and in 1885, the fourth year after planting, this farm, which had previously yielded a rental of £23 a year, produced perfumes valued at £8,630, giving a net profit of £1,553. This is sufficient to illustrate how lucrative flower farming may become in favorable districts and under good management.

From observation at Seillans and in the neighborhood of Grasse, where perfume flower growing is the leading industry, Consul Mason says that the essential conditions appear to be an altitude of from five hundred to two thousand feet. Flowers grown on such elevated positions are said to be richer in perfume than similar varieties which bloom in valleys and lowlands; a soil rich in calcareous elements, a situation sheltered from cold northern winds, and not subject to the white frosts which in spring and autumn affect the damp lowlands. In countries like Southern France, where the rainfall is always scanty, and often wanting entirely from May until September, irrigation is essential to the culture of flowers as well as every other crop. It is said the perfume growers and distillers on the Mediterranean coast attribute their success not less to the peculiar climate of Provence than to their knowledge of every detail of the industry, a knowledge acquired by more than a century of experience, and transmitted from generation to generation. One essential principle in perfume culture is that all fancy and "improved" varieties of flowers are discarded, and the natural, simple, old-fashioned kinds are exclusively grown.

The roses on the slopes of Seillans are the common pink ones, and the single wild violet is preferred to all the larger artificially developed varieties. Only the white jasmine is used, the yellow and less fragrant variety appearing to be either discarded or unknown. Jasmine plants are set in rows about ten inches apart, and are closely pruned. Roses are grown on the lower terraces, and are also cut low, and the ground between the plants heavily manured. After the roses have been gathered, the stem is cut to within a few inches of the ground to preserve for the next season the entire vigor of the plant.

During the harvest season traders or "middle men" go through the country every day with wagons collecting flowers from the farms, for which they pay prices varying according to the extent of the crop and the demands of the market. Their loads are hurried to the nearest manufacturer, and delivered while the flowers are still fresh and crisp. The flowers are usually gathered in the morning, as soon as possible after the dews of the preceding night have disappeared. The manufacture of perfumes includes the making of pomades and oils by the process of absorption, and of essences and essential oils by distillation. Every complete establishment is provided with apparatus for all these processes. Pomades are the commercial vehicles for absorbing and transporting the perfumes of the jonquil, tuberose, jasmine, and other species of flowers. A square frame or *chassis* of whitewood, about twenty inches by thirty in size, is set with a pane of strong plate glass. On either side of the glass is spread a thin even layer of grease—two parts lard to one of tallow—which has been purified and refined by previous boiling and straining. Thus prepared, the frames are piled up in ranks, six or seven feet high, to await the season of each special flower. When the blossoms arrive, the petals are picked from the stem, and laid so as to cover the grease in each frame. These being again piled so as to rest upon their wooden edges, which fit closely together, there is formed a species of tight chambers, the floors and ceilings of which are of grease, exposed to the perfume of the flower leaves within; the grease absorbs the perfume, the spent flowers are removed daily and fresh ones supplied, and this process goes on from two to four or five months, according to the desired strength of the pomade, which, when sufficiently charged with perfume, is taken from the glass with a wide, thin spatula, and packed in tin cans or *stagnons* for export. By these methods the delicate odors of flowers are extracted, and retained for transport to distant markets, where the grease, being treated with alcohol, yields the perfume to that stronger vehicle, and produces the floral waters and extracts of commerce. Coarse pomades are made by boiling the flowers in the grease, and subjecting the residue to pressure. The spent pomades are used for toilet purposes and in the manufacture of fine soaps.

The process of preparing perfumed oils involves the same principle, except that instead of solid grease, superfine olive oil is used. With this oil, pieces of coarse cotton fabric are saturated, which are then spread upon wire netting framed in wooden *chassis* about three feet by four in size. The flowers are spread upon the saturated cloths, and the frames piled one upon another, so that the perfume of the flowers is absorbed, as in the previous process. Essences and scents are produced by ordinary distillation, in which the flowers are boiled with water in large alembics. The vapor carries off the perfume, and is condensed in adjoining copper tanks. Some of the retorts used for this purpose are of sufficient size to receive at once half a ton of fresh flowers, with the requisite water for their distillation. When scents are to be produced, alcohol is used in the distilling tank to receive the perfumes. By skillful combinations of the perfumes of different flowers, sometimes with the addition of chemicals, a large variety of scents, such as "patchouli," "jockey club," etc., are produced at the original laboratory. The work of the manufactories is largely done by women, who earn from tenpence to one shilling for a day's labor of ten hours, and during the busy season of roses and orange flowers, they earn half as much more by working until midnight, or even later.—*Jour. Soc. Arts.*

Pneumonia.

It is generally supposed that pneumonia is due to the accidental penetration of specific microbes into the system, but the observations of M. Jaccoud, a French student of the subject, show that the disease really results from the development, under favorable conditions, of microbic germs permanently present in the system. A chief condition of such development is a sudden chill, which explains the frequent coincidence of lung affections with abrupt changes of temperature.

Correspondence.

Self-Mending Snakes.

To the Editor of the Scientific American:

In your issue of the third instant, I observe an article on the "Glass Snake," or on one variety of that somewhat diverse species. My acquantance is with a somewhat different one, which, so far as I know, is simply a snake, and not in any sense a lizard. I have seen many of them in earlier days here; but never saw one more than about 18 inches long. They are very beautiful, being a kind of steel gray and black, in small broken checks on the back, with two slightly defined stripes along either side, so far back as the vital organs extend. But I believe that you, like most scientific writers, are inclined to scout the idea of these snakes "putting themselves together" and crawling away after being broken in pieces. Now, facts are facts, no matter what philosophy may say. About ten years ago I caught one of these reptiles, broke him in pieces from one to two inches long, from the anus to the tip of his tail—two-thirds of the whole length of the way—then placed a cage over him so that he could by no means escape, and mistakes were impossible. Then, on returning to the place twenty-four hours after, the snake was there, sound and whole, in full length. On close examination, however, I could see where most of the breaks had been, and the first section, about an inch and a half long, was not perfectly in place, so that the fine longitudinal lines of the figure were perhaps one-sixteenth of an inch out of the way. The remaining fractions corresponded, not with that, but with the body. I did not know then that this putting together process was seriously controverted by scientific men, and supposed from previous careless experiments that it was only the illiterate who doubted. OLIVER WHITE,

Secretary of the Peoria Scientific Association.

Peoria, Ill., Sept. 6, 1887.

Annealing and Tempering Fine Tools.

To the Editor of the Scientific American:

Having had about twenty-five years' experience as a tool maker, I feel confident that I can give some of your readers a few good points on annealing and tempering fine tools.

I have occasion to visit the large railroad machine shops and other large shops that use large quantities of fine steel tools, such as taps, fluted reamers, thread cutting dies, milling cutters, etc., and I find that almost all of them lose from ten to fifteen per cent of these expensive tools when they are first tempered, or as soon as they are put into use, and at least twenty-five per cent the second time they are hardened, and about fifty per cent the third time. To avoid this large loss and annoyance, have your steel annealed by the steel manufacturers in short bars from five to six feet long, the sizes you may want, and cut off the required length you may wish for your tools. This will save the forging and consequently much expense, and your tools have not been overheated, and there is no uneven strain on the tool. If your tool is of such a shape that you have to have it forged, do not heat it too quickly, but thoroughly all the way through, and do not hammer nor *bend* the tool unless it is red hot. Do not hammer *cast steel* after the red has all *disappeared* in *any case*. You may hammer blister and shear steel to refine it at a black heat, but never do this *with cast steel*, for it will cause your tool to spring or crack. Forged tools should be annealed and roughed out by planing or turning off below the hammer marks, and then annealed again. This will avoid the springing when hardened. To anneal small sizes of steel, use iron pipes, plug up one end and fill up with the tools. Sift in fine charcoal dust, plug the other end, and heat it slowly until it is at a good red heat all the way through, then bury it in fine charcoal or wood ashes. If you have not got the wood ashes, use dry sawdust, and in a short time you will have the ashes and the most perfect annealing preparation in the world. Have this in a good tight iron box with a close cover. For annealing such tools as taps, reamers, and milling cutter dies, etc., use fine wood ashes, dish out the center and replace the ashes with dry sawdust. Heat your steel slowly to a good blood red, and bury it in the sawdust and cover it over with fine charcoal dust or fine dust from around the forge, put on your cover and let it remain until cold. I always make it a point to get my annealing in on Saturday if I possibly can, and let it remain until Monday or until cold. For hardening I use a good strong salt brine—about three pounds of salt to one pail of soft water, lard oil, and resin, about one-sixth resin to five-sixths of oil. When mixed together, the oil should be quite warm, also the resin. Pour the resin into the oil and stir it well. Heat your tools slowly and thoroughly all the way through, then immerse in the salt brine. If a tap or fluted reamer, put it down in the center of the tub as straight as you possibly can, and move it up and down slowly from one to two inches, so as to avoid a water line, until it is chilled about half way or one-third through, as near as you can judge. This you can determine quite accurately by the tremble of the tongs, caused by the condensing steam around the tool. The tremble will cease when the tool is chilled about half through. Then put the tool from the brine into the oil and resin as quickly as possible, move it up and down gently for a minute or two, then drop it into the oil and let it remain until cold, then take out, brighten, and test the hardness with a small sharp file, and you will find that you have about the right temper required. For cast iron and brass you will require the tool much harder than you will for wrought iron. Large tools after remaining in the oil will sometimes draw the temper a little more than required. If the oil commences to boil by the heat of the large tool, have a pail of boiling hot water close to your oil tub, take your large mill or whatever kind of tool it may be, and immerse in the hot water for eight or ten seconds as near as you can judge, and then return it as quickly as possible back to the oil, and let it remain until the oil stops boiling. We will suppose this to be a large mill cut on top and sides. If you are in a hurry for this tool, and cannot wait until it is quite cold in the oil, you may take it from the oil and put it over a clean slow fire and brighten a few of the teeth, and draw the temper at the same time to suit your work, then return again to the oil and let it remain until cold. It is the safest way to draw the temper on large tools a little on the outside at the same time the temper is drawing from the inside, but there is no occasion to draw the temper on most of your tools from the outside. With this process you will see that the temper is drawn from the inside of tools instead of the outside—the old-fashioned way. By tempering tools in this way, you have a *soft-centered steel*. The brine has hardened the tool so far as it is required to be hard, and the oil keeps it hard and allows the center or thick part to cool slowly. It will not throw your tool out of round, but will run on the centers as true as before it was hardened. Milling cutters, taps, and fluted reamers only require to be hard on the cutting parts, and with this process you have just what you want, and you can anneal and harden them a dozen times and never break them. The teeth will not crack off as they do in the old-fashioned way of hardening tools.

Chipping chisels, after forged, should be heated slowly at least three inches from the cutting edge, to take off the uneven strain caused by forging. Never hammer a cold chisel after the red has disappeared, especially on the edges. The corners will break off if you do. Immerse in clean soft water about two inches, and move the tool up and down slowly, keeping the point in the water at least one and one-half inches, until the water will not hiss on the tool. Then brighten and draw the tool to a sky blue, then drop it into cold lard oil, and let it remain until cold.

If a tap or any other fine tool should by chance get too hot or burnt, do not take the tool from the fire, but shut off the blast. Get some resin, put it on the tool freely, and let it remain in the fire ten or fifteen minutes, occasionally putting on the resin, and letting the tool cool down to a good cherry red, and then immerse as above described, and your tool is as good as if it had not been overheated. I do not recommend overheating steel. It should not be heated more than a cherry red for hardening, and should be heated in a furnace if possible. If you have much tempering to do, it will pay to have one built. A furnace suitable for heating will cost about one hundred and twenty-five dollars.

Oil City, Pa. C. B. HUNT.

Speed of Centrifugal Extractors.

Several instances are on record of the bursting of extractors, and these accidents usually entail not only the destruction of the extractor itself, but also damage to other property and the infliction of serious, sometimes fatal, injuries to persons. A prominent manufacturer of extractors stated to us that investigation into such mishaps has developed the fact that the machines were usually run at an unnecessarily high rate of speed, ranging up to 1,800 and even 2,000 revolutions per minute. In order to ascertain what an advantage, if any, is gained by increasing the extractor's speed, experiments were carefully carried out under the supervision of the gentleman alluded to. Batches of clothes were wet and then placed in an extractor running at a comparatively slow speed, and, when a sufficient time had elapsed, were taken out and weighed. After having been rewet, the clothes were again put through the process at a higher speed and then again weighed. This was repeated at different rates of speed up to 2,000 revolutions per minute. These experiments showed conclusively that nothing was gained by running the extractor at more than 1,500 revolutions per minute. In other words, all the water that can be extracted by centrifugal force is removed by the machine when making 1,500 revolutions per minute.

Any increase of speed over that figure is superfluous. It confers no advantage, does not dry the clothes any more; but, on the contrary, may do an enormous amount of mischief. From the foregoing statement a valuable lesson is to be learned. In order not to endanger life or limb or property, let every laundry proprietor see that the extractor is never run at more than 1,500 revolutions a minute. A small increase of 50 or 100 revolutions may seem unimportant; but it is unnecessary, and there is every reason against making it and none in its favor. In machinery, the old adage of "the last straw breaking the camel's back" is often too true. Once the limit of endurance or resistance is reached, a small *additional* weight or speed is about as bad as a tornado or an earthquake.

Another point that deserves attention is to guard against dropping anything between the perforated basket and the outer shell. About three years ago a horrible accident occurred in the laundry of a hotel, if we remember aright, at Lake Minnetonka, Minn. By the bursting of the extractor several persons were badly hurt, one of them fatally injured. The cause of the disaster was a mystery, and, of course, it was attributed to defective workmanship or inferior materials, and the manufacturer was severely blamed. In a short time, however, the truth leaked out. A girl had allowed a monkey wrench to slip down in the hollow space under the basket, and, being unable to reach it with her arm, had said nothing about it, fearing to receive a scolding for the loss of time that would have been required to take the extractor apart. Two or three weeks passed without the wrench being shaken or washed into the right position to cause a smash, but the time came at last, with the distressing result already mentioned. Therefore it would be only prudent to take all possible care to prevent monkey wrenches, or anything else except water, getting into the chamber.—*National Laundry Journal.*

Croton Water, New York.

The Croton water contains in 1 U. S. gallon of 231 cubic inches the following normal impurities:

GRAINS IN ONE U. S. GALLON.

Soda	0·326
Potassa	0·097
Lime	0·988
Magnesia	0·524
Chlorine	0·243
Sulphuric acid (SO_3)	0 322
Silica	0·621
Carbonic acid	2·604
Organic and volatile matter	0·670
Total	6·395

One hundred million gallons of this water are used daily in New York, in which are contained the following quantities of the above mentioned substances in pounds and in tons of 2,000 pounds:

IMPURITIES IN 100,000,000 GALLONS OF CROTON WATER.

Impurities.	Pounds.	Tons.
Soda	4,657	2·319
Potassa	1,385	0·692
Lime	14,114	7·038
Magnesia	7,485	3·742
Chlorine	3,471	1·735
Sulphuric acid	4,600	2·300
Silica	8,858	4·429
Carbonic acid	37,200	18·600
Organic and volatile matter	9,571	4·785
	91,341	45·640

As the average flow of the Croton River is 400,000,000 gallons daily, there are 365,428 pounds, or nearly 183 tons, of impurities carried to the ocean daily by a stream which does not receive any refuse from factories.

Densities of Liquids.

Many determinations of the densities of the liquids which so short a time back were only known as permanent gases have been made, but until very lately it has been impossible to compare them, on account of the various conditions under which the experiments were made. But very recently Dr. Olszewski, to whose elaborate researches on this subject we are already greatly indebted, has succeeded in overcoming the difficulties of comparison. Taking advantage of the very low temperature produced by the evaporation of liquid ethylene, he succeeded in finding not only the boiling point of the liquefied gases at the normal atmospheric pressure, or very near to it, but also its specific gravity at this pressure. It is of course of particular importance to know the specific gravity at the boiling point, because this fixes the specific volume. Working in this way, Olszewski found for the three important liquids methane, oxygen, and nitrogen the following numbers: Methane: pressure, 736 mm.; boiling point, —164° C.; density, 0·415. Oxygen: pressure, 742·1 mm.; boiling point, —181·4°; density, 1·124. Nitrogen: pressure, 742·1 mm.; boiling point, —194·4°; density, 0·885. Scarcely inferior to the above research in interest is that of M. Amagat on the influence of pressure on the point of maximum density of water. It is well known that this liquid, remarkable in so many respects, occupies a less volume at 4° C. than at higher or lower temperatures. Hence the expansion of water is irregular, and is unlike that of any other liquid. But we now learn that this peculiarity only exists under ordinary pressures. When the pressure is increased, the point of maximum density falls, and at 200 atmospheres it is almost identical with zero; with greater pressure the irregularity of expansion lessens, and at 3,000 atmospheres it disappears and water behaves like any other liquid.—*Lancet.*

THE ALVAN CLARK ESTABLISHMENT.

The home and workshop of the sons of the world-famous Alvan Clark is situated in Cambridgeport, just in the environs of Boston, Mass. Leaving the city by the Cambridge road, crossing the waters of the Charles River and turning to the left before the University of Harvard appears, the place is soon reached. It is easily recognized by a telescope tube raised on a high pier that towers above the surrounding objects. A piece of ground of about an acre in extent contains the buildings. In front are three dwelling houses, the homes of George B. Clark, of his brother Alvan G., and of the widow of Alvan Clark, the father. The grounds are very prettily kept as a luxuriant lawn with flower beds and paths. In the rear of the residences is a lofty and now disused observatory, the great rusty telescope tube already alluded to, and a low brick building. The latter, as unpretentious as a structure well can be, is the factory. In it the great Pultowa, Washington, and Lick objectives were made. The least imaginative visitor cannot but feel a sense of inspiration as he treads the truly classic spot that has furnished astronomy with its most efficient weapons. The story of the foundation of the business has already been briefly told in the sketch of the life of Alvan Clark.* George B. Clark, when a student, made a reflecting telescope. It was so successful that it was the first inducement that caused him to take up the occupation of telescope making permanently. His brother Alvan G., when sixteen years old, entered a machine shop in order to learn the machinist's trade, intending, ultimately, to join his brother. When twenty-one years old he entered his brother's factory. Up to this period the father had only worked upon lenses in the evenings, painting portraits and miniatures by day. But a few years later he gave up his studio and devoted himself entirely to his favorite occupation. Thirty years ago the factory was removed to its present location. The father is dead. His two sons, including the founder of the establishment, now conduct the work personally. When they abandon it, it is hard to say where a successor can be found.

The demand for large lenses is so slight in this country that the glass disks for their manufacture are generally procured abroad. This is always the case with the large sizes. They may be made in different ways, but one typical method of preparation may be described. A lump of glass of any shape is selected in the glass house, and its specific gravity is determined. If this factor is high enough and the piece appears clear and good, it is melted down into a disk. The lump is placed on a slab of fire clay within a ring and exposed to heat, when it slowly flattens down into the desired shape. This furnishes the blank. If it proves clear and free from striæ, it is ground into shape and polished.

Sometimes the glass plate is delivered in the shape of rectangles. A sheet iron tube, fed with abrading material, is used as an annular saw to cut out suitable disks from such pieces for lenses. The plate is first polished and tested optically with the utmost care for striæ. Small bubbles do little harm, and are contained in some of the best objectives. Such portions of the piece as stand the test are used. Often a lens is cut from the center, while the corners have to be rejected.

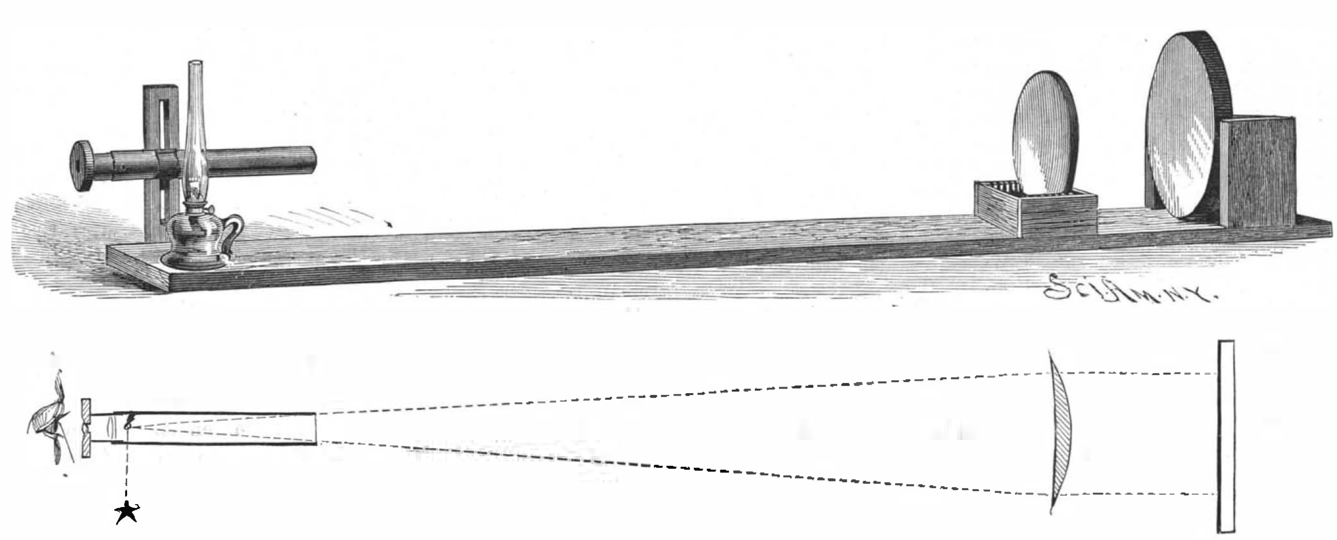
The manufacture of the objective properly begins with the circular disk. This possesses approximately parallel sides, which have been more or less completely polished for the purpose of testing. The processes it is subjected to may be divided into cutting and polishing. The former brings it very nearly into shape, with a rough surface. The latter polishes and imparts the last minute corrections.

The cutting is executed by cast iron laps. These rotate in a horizontal plane. They are cast of the general curvature of the lens, but reversed. They are fed with water and with a cast iron sand. The latter is made by flowing air into melted iron. This blast drives out a cloud of minute vesicles of metal, that are chilled instantly by the air. This material is very fine and is rust colored. On treatment with hydrochloric acid, hydrogen is evolved, thus proving the presence of the metal. It is used principally by granite polishers, and has been adopted by the Clarks for their work.

The lens is pressed upon the rapidly rotating lap, being held to one side of the center and slowly moved about to insure regular grinding. Were it held motionless, the part over the center of the lap would not be cut, and a prominence would soon be created there. The iron sand is the only cutting agent. It possesses a great advantage over emery, in not "breaking down." The grains, owing to their metallic nature, are very tough, and possess great cutting power. In this way the faces of the lens are brought to the proper curvature, and the lens is finally shaped in the rough. It has next to be polished.

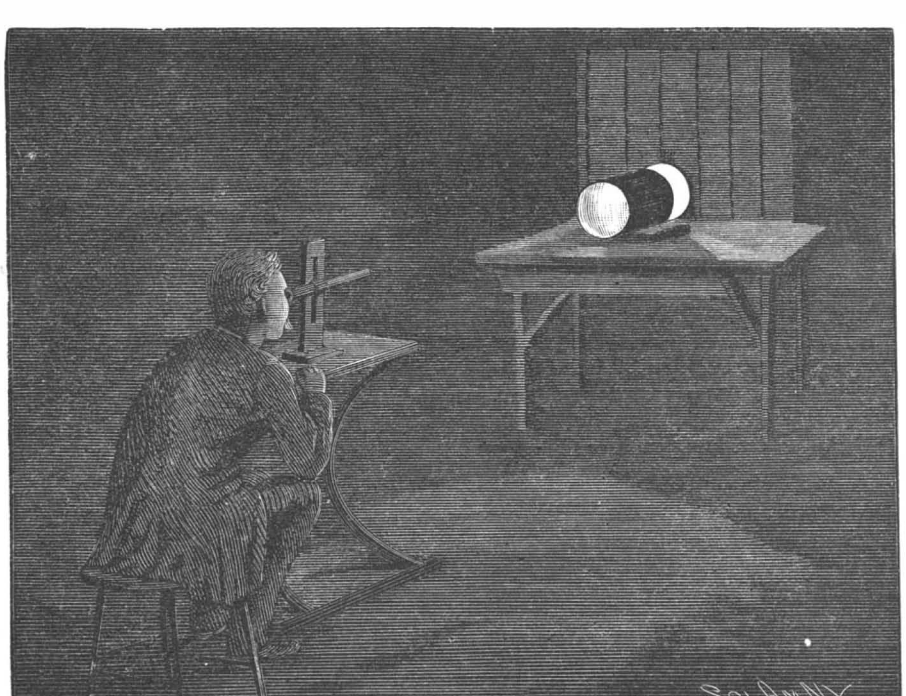
For this purpose a pitch lap used as below or above the glass is employed. For the smaller class of lenses the pitch lap is rotated precisely as is the metal lap, and is fed with water and rouge. Upon it the lens is pressed and moved about by hand. The pitch contains holes or grooves to prevent suction and sticking. The pitch is slightly or rather slowly yielding. It soon assumes the shape and contour of the lens, and polishes it without altering materially its shape. This operation is reversed for the larger lenses. These are rotated in a horizontal plane while the lap, composed of a metal backing and front of pitch, is moved about over the face. The bed upon which the lens rests consists of its original metal lap. Upon this a piece of Brussels carpet is cemented, and the lens is placed thereon. The illustration shows the machine in operation upon which the Lick lenses, the largest in the world, were polished. The lens resting upon its bed occupies the central position. Upon it rests the pitch-faced lap or polishing tool. A spindle rises from the center of the latter, and on it are journaled two pitmen, working at right angles to each other, and driven by cranks. These impart a double reciprocating motion to the tool. The amplitude, actual and relative, of the two motions can be varied by adjusting the length of the crank arms. One crank is driven at very slow speed by worm gearing. The other crank rotates much faster, as it is driven by tooth gearing. The effect of this is that the tool follows an endless variety of paths, never repeating its course over the face of the lens. The driving gear is seen under the bench, and the face of the pitch-faced lap divided by grooves into squares is also shown. Rouge and water is the polishing agent.

The lens thus shaped and polished has next to be tested. Two methods are used for this work. In one a prism is mounted in a tube attached to a lamp chimney of metal. A flame is maintained within the chimney. This prism is so screened as to furnish a minute source of light reflected outward. The lens to be tested is held in a generally vertical plane. Directly back of it a plane mirror, silvered on its anterior face, is placed. The lamp and prism are so placed that the beam of rays from the prism falls upon the face of the lens, passing through it, and returning again after reflection from the mirror, the prism occupying about the focal position. The eye of the observer is held as near the back of the prism as possible. The lens then appears brightly illuminated, because the eye so nearly coincides in position with the focus. The work is done in a dark room. If the lens is perfect, the field is of uniform brightness, presenting, however, the prismatic colors of the spectrum in broad areas. If the smallest irregularity exists, it appears as a spot or ring or other area upon the glass. To illustrate the sensitiveness of the test, Mr. Alvan G. Clark held his finger for a few seconds upon the face of a nearly perfect lens that was subjected to the writer's inspection by this test. On removing the finger, a strongly defined spot was seen, due to the heat thus imparted to the glass, and several minutes elapsed before it passed away. This was a proof of the extraordinary sensitiveness and perfection of the test. As a further illustration of the effects of atmospheric perturbation, a half dollar which had been held in the hand was laid in front of the lens. With the eye in position a perfect stream of heated air striæ appeared crossing the disk, and resembling in the spectral illumination a cloud of flame. The hand held in front of the glass seemed a source of conflagration, as the same effect on a larger scale was produced. All these changes appeared pictured upon or in front of the face of the lens.



TESTING VISUAL OBJECTIVES.

In the other method, which is shown in the illustration, the source of light is a minute bead or convex surface of glass, carried in the center of a sight-ing tube, about six inches long. The light from a lamp is received on this and dispersed. All is arranged otherwise as before. The pencil of light from this source, representing almost a mathematical point, is received and transmitted by the lens as before, is reflected from the mirror and again transmitted. The eye, held a few inches from the back of the reflecting bead, and hence out of focus if the bead is in focus, sees only a small disk of light, about a quarter of an inch in diameter. This image appears, of course, a little to one side of the reflecting bead. If the bead is in the focus of the lens, the spot should appear uniformly illuminated. If the lens is imperfect, the spot will appear unevenly lighted. In general, a dark or light spot appears in the center. By slowly moving the eye, a disk of light can be carried slowly across the field of view, and in this way a still more sensitive effect is obtained.



TESTING PHOTOGRAPHIC OBJECTIVES.

In these methods the rays of light pass twice through the lens, so that a doubling of the effect due to a misshape is obtained. In the usual methods a star is used as the source of light, so that a single transmission only is had. The Clark process, therefore, is of twice the delicacy of the older methods.

A defect in the mirror might be interpreted as a defect in the lens, but this is very easily provided against by rotating the mirror. If the supposed defect moves with the rotation, it is due to the mirror; otherwise, to the lens.

These are visual tests. For photographic telescope lenses they are not applicable. In these the focusing

* See SCIENTIFIC AMERICAN, vol. 57, No. 10.

must have reference to the actinic portions of the spectrum, and such objectives can only be tested photographically. Two methods of doing this are in use by the Clark brothers.

In one the spectrum of a bright spot is photographed. A bulb of glass is set up in the sunlight, four or five hundred feet from the station. The lens and tube projects through an aperture in the shutter of a dark room. The ray of sunlight reflected from the bulb passes through the lens and is decomposed by a prism into a spectrum about three-quarters inch long as regards its actinic portion. It is received upon a photographic dry plate. If all the actinic portions are in focus, the spectrum will be photographed as a thin streak of uniform width; but if the lens is not correct, the spectrum will taper off at one end or the other, indicating an erroneous shape.

In the other method a star is photographed. The lens is directed toward Polaris, and a number of exposures at slightly varying adjustments are made upon a dry plate. The exposures are made upon both sides of the focus. If the lens is perfect, the spots produced when the plate is out of focus are of even illumination. If the lens is imperfect, a dark spot can be discerned in the center of some of them. The image of the star when in focus is, of course, a mere point; the unfocused image may be nearly an eighth of an inch in diameter.

Great skill is required in applying the results of these tests, whether visual or photographic. Upon them are based the corrections which impart to the lens its final character of perfection.

The tendency of the inequalities in an objective is to form circles. The location of these is determined by the visual or photographic tests, according to the class of lens under treatment. The lens is removed and placed upon a horizontal stand, whose surface under the lens is ruled in circles. The proper one is selected as the guide, and the operator rubs the protuberant area with his fingers, using, as before, rouge and water. A few minutes or upward may be devoted to this. The lens is next, for a very short time, placed upon or under the pitch lap, and polished, and is then cleaned and retested. The testing requires more time than the rubbing. This process, repeated over and over again, extending, it may be, through many months, gradually brings the lens into shape.

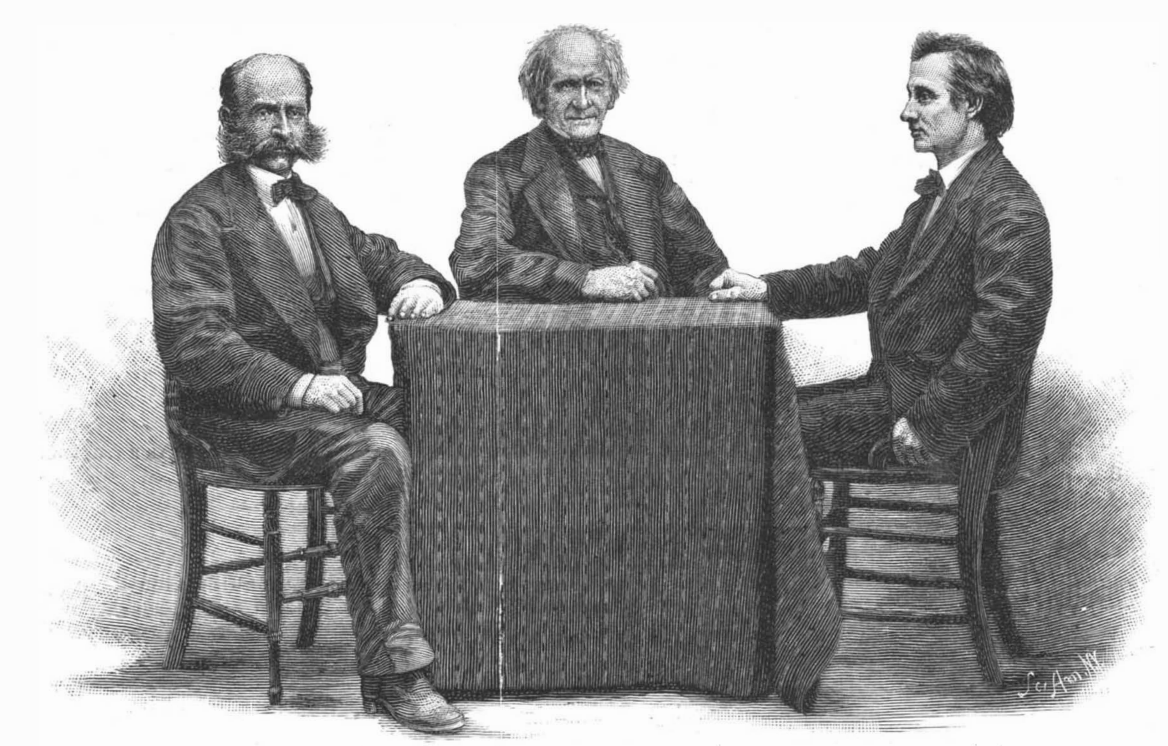
The plane mirror used in the tests needs to be very perfect. They are much harder to grind than lenses, and are made by the Clark brothers for their own use. Such mirrors are also required in some astronomical work. As an illustration of the extraordinary degree of perfection to which their manufacture has been brought, the case of some manufactured for the government by the Clark establishment may be instanced. These were to be used in the observations of the transit of Venus. They were made with the guarantee that they were to be of eight miles radius of curvature as a minimum, and of the lot all exceeded this standard.

Although their objectives are what the reputation of the firm has been built upon, they also make the other portions of telescopes, furnishing them complete with all adjuncts, clock motion, and circles of graduation.

Although the thirty-six inch objective of the Lick telescope would seem a sufficient triumph, the brothers hope to be engaged to construct a still larger objective. They believe that they can make a forty inch objective of as good quality and as perfect as those of the Washington or Lick telescope. The work exercises a sort of fascination or excitement upon the operators, and to hear the story of their work from themselves upon the ground of their achievements is inspiring to the listener.

We also present an interesting group of the three coworkers. In the center, Alvan Clark, the father, appears. On the right of the picture, on his father's left, is George B. Clark, now the senior member of the firm. On the other side Alvan G. Clark is sitting. Two years ago death removed Alvan, the son of Alvan G. Clark, at the early age of fourteen years. With him the male line of the family was extinguished. His portrait, painted by the grandfather, shows strongly the Clark features.

Many of the paintings of Alvan Clark are still preserved in his old home. They include miniatures on ivory and portraits on canvas. They show that the lens maker was a skillful painter, his miniatures being especially beautiful. In the upper story of the factory he had a sort of a studio, where, within a few years of his death, he still handled the palette.



ALVAN G. CLARK. THE LATE ALVAN CLARK. GEORGE B. CLARK.

The Analysis of the Air.

The editor of the *Engineering and Mining Journal* thinks there are few, if any, branches of scientific inquiry that have done so much for the "greatest good of the greatest number" as those which have unfolded and developed the principles of hygiene and sanitation, and taught us that the preservation of good health and the prolongation of life both chiefly depend upon a supply of pure air and pure water. It has over and over again been proved that in such crowded cities as our own the most malignant forms of infection are chiefly propagated by spores or germs floating in the air, or carried into our drinking water by the infiltration of sewage matter; and although a great deal of attention has undoubtedly been devoted to the analysis of both these elements, there is still a great deal of room for the simplification of processes and the popularization of easy and reliable methods of investigation. Our first knowledge of the air and its composition was in a very large measure due to the labors of Dumas and Boussingault, but it has been greatly amplified of recent years, and we now know that the dust or minute particles of solid matter which are constantly suspended in space by the action of the currents contain various germs which disseminate disease, and an immense variety of minute seeds, which, when deposited in certain liquid or moist substances, immediately germinate and induce mould. mildew, and fermentation. From the standpoint of hygiene it is extremely difficult to determine whether it is more desirable to have a thorough knowledge of the air we take into our lungs or of the water we drink, each being so important; and the only reason why the latter has hitherto received a greater share of attention is probably to be found in the fact that its analysis is much less tiresome, comparatively devoid of complications, and therefore more easily comprehensible to the ordinary mind than that of the former. The recently published and highly interesting results that have lately been obtained in England by a group of experimenters promise to create a revolution in this state of affairs by drawing more attention to air analysis, and it will be interesting to briefly glance at the newly suggested method by which to arrive at an accurate determination of the various atmospheric constituents.

The test for carbonic acid consists in placing several two gallon glass bottles side by side and filling them with air, withdrawn from different parts of the room by means of India rubber tubing. Into each bottle is then poured a small quantity of weak baryta water, which, acting upon the carbonic acid, gives rise to a dense white precipitate of barium carbonate, easily separated by filtration, and weighed.

The germ test is made by means of a glass tube, some two feet long by three inches in diameter, lined inside with a coating of transparent gelatine. A certain quantity of air is made to pass through the tube, and the germs deposit themselves upon the gelatine, where they can live and multiply, and where they may be distinguished and identified under the microscope.

For the detection of organic matter, six large glass bottles are filled with distilled water, and are connected with each other by glass tubes. The air, made to pass through the whole series in a continuous stream by means of an aspirator, communicates to the liquid all the organic impurities with which it was charged, and, without visibly affecting its color, causes it to acquire a disagreeable smell. The *ensemble* of this simple process recommends and entitles it to the serious consideration of all those who are intrusted with the care of the public health, and we should be glad to see all public buildings and apartments in which large bodies of persons daily congregate for business or for pleasure provided with the necessary and inexpensive apparatus. It might be presided over by some intelligent person (not necessarily a scientist), its frequent use would insure the immediate detection of noxious elements, and we might thus constantly maintain or restore pure air by applying such preventive or remedial agents as are well known and always at hand.

Newspaper Advertisements.

An advertisement of the present day, as a rule, is a model of clearness, precision, and compactness.

In fact, quite a degree of pleasure can be derived from the perusal of it, aside from the important information which it oftentimes conveys.

In ingenuity the modern advertisement is remarkable; in fact, it is frequently a work of art, both in a literary and typographical sense. The aim of some advertisers in many cases seems to be to draw the attention of the reader away from the fact that it is an advertisement. While not taking rank among what may be termed literary productions, it possesses many of their brightest features. In the hands of a master workman, be he advertiser, writer, or compositor, the matter becomes attractive to the most casual reader. The latter's attention is drawn toward it, and his interest in it aroused before he is fully aware of the fact. The old style of merely puffing one's merchandise has passed out of date. The reading and purchasing public of to-day demand something stronger and better. That this want is recognized and appreciated by the keen advertiser and equally alert public is apparent to almost every one. The fact is, advertising has become such an integral part of modern business methods that it is almost impossible to carry on any kind of trade or traffic without its aid. It is well known that many concerns pay large salaries to skilled writers whose only employment is the invention and the framing of attractive and telling advertisements.

Thousands of dollars are annually expended simply in putting the matter in shape, and many millions more for its publication in the press. The firm who can express in clear, strong, and concise language, set in attractive form of display, just what it has to offer, at once attracts the merchant as well as the consumer.

No merchant can now wholly depend for business upon the fact of his being well known to the trade. No matter how many years he may have been established, or how familiar his name is to the purchasing public, or how celebrated his wares are; if he does not advertise and keep doing so in some way, buyers and consumers will in time ignore him and visit and trade with his competitor who sounds his trumpet upon all occasions to the extent of thousands of dollars a year, and pays the same without murmur because it pays him to do so.—*Dry Goods Review.*

Magnesium Light for Photographic Purposes.

It is proposed that the magnesium be mixed in the state of fine powder with an oxidizing agent, such as a chlorate or nitrate, and a substance such as amorphous phosphorus, which would accelerate combustion. The mixtures suggested as most suitable are—12 parts of chlorate of potash, 6 parts of magnesium powder, and 1 part of prussiate of potash or 24 parts of chlorate of potash, 12 parts of magnesium powder, and 1 part of amorphous phosphorus. The light may be colored by the addition of salts of suitable metals to the above mixtures. The powder burns with a flash, lasting only from $\frac{1}{30}$ to $\frac{1}{50}$ of a second, and yields a more intense light than when wire or ribbon is used; and the shortness of its duration removes the difficulty hitherto experienced of getting the proper "exposure" with the magnesium light.—*By J. Gaedicke, Berlin, and A. Miethe, Potsdam, Germany.*

FURTHER information desired as to the elevated railway gate described in our last issue will be furnished by Mr. G. Civolari, Temple Court, room 107, No. 7 Beekman Street, New York City.

Poisonous Bakery Adulterations.

Concerning the use of poisonous adulterants in bakeries, the Philadelphia *Record* says:

Notwithstanding all that has been published relative to the poisonous character of chrome yellow as a coloring matter for buns, cakes, and pastry, President Amerling, of the Society for the Prevention of the Adulteration of Food, states that a large number of bakers are still using the stuff. Recently he visited five bakeries, each of which does a large business, and in every case chrome yellow was found in use. The proprietor of one of these, a prominent up-town baker, was exceedingly indignant at the appearance of President Amerling, and stoutly denied using the poison. "Well, what do you use?" asked the president. "Why, canary yellow, and that's not poison. I'm not afraid to eat it myself."

The matter, when shown, proved to be nothing else than chrome yellow. The baker was cautioned not to use it again under pain of prosecution. He had been reported to the society by a gentleman who stated in a letter that his own family and a number of neighbors had been made sick by eating buns purchased at his bakery. Letters are beginning to pour into the office of the society at No. 142 South Sixth Street, giving information as to bakeries that are using the poison, and President Amerling is accumulating a mass of evidence against offending parties. The aim of the society, however, is to improve and educate, not to prosecute, and the evidence will only be used against those who, after being warned, continue to use the poison. It is estimated by the coroner that fully 50 per cent of the bakeries in Philadelphia have been constantly using chrome yellow.

The following circular has been sent out by the Society for the Prevention of Adulteration of Food to the bakers and confectioners:

You are hereby notified that the enumerated colors herein are poisonous, and if you persist in the use of any of them after receipt of this notice, you will be prosecuted to the full extent of the present law:

COMMON AND POISONOUS COLORS.

Common Name.	Chemical Name.
YELLOW.	
King's yellow	Sulphide of arsenic.
Cadmium yellow	Sulphide of cadmium.
Turner's yellow	Oxychloride of lead.
Turpeth mineral	Basic sulphate of mercury.
Chrome yellow	Chromate of lead.
Chrome zinc	Chromate of zinc.
Citron yellow	Chromate of barium. Chromate of strontia.
Naples yellow	Oxides of lead and of antimony.
Yellow ocher	Clay and hydrated ferric oxide.
Mosaic gold	Sulphide of tin.
RED.	
Minium	Oxide of lead.
Vermilion	Sulphide of mercury.
Purple red	Basic chromate of mercury.
Iodine scarlet	Mercuric oxide.
Realgar	Sulphide of arsenic.
Red ocher, Colcothar	Ferric oxide.
GREEN.	
Chrome green	Chrome oxide.
Cobalt green (Rimmam)	Oxides of cobalt and of zinc.
Mountain green	Malachite green.
Scheele's green	Arsenite of copper.
Verdigris	Basic acetate of copper.
Emerald green	Acetate of arsenite of copper.
BLUE.	
Ultramarine	Silicate of alumina and soda with sulphide of sodium.
Mountain blue	Malachite blue.
Smalts	Silicate of cobalt and potassium.
Antwerp blue, Insoluble Prussian blue	Ferric ferrocyanide.
Soluble Prussian blue	Ferro potassic ferrocyanide.
Indigo	
BROWN.	
Manganese brown	Binoxide of manganese.
Vandyke brown	Ferric oxide.
Burned sienna, Burned umber	Clay colored with oxide of iron and manganese.
ORANGE.	
Chrome orange	Basic chromate of lead.

Odor of Arc Lights.

Complaint was recently made by the correspondent of a Rochester, N. Y., paper as to the bad odor of the electric lights on the streets. Mr. Redman, the manager of the Brush Company, endeavored to correct certain curious misconceptions on the subject, and said:

"The bad odor at this time of the year does not come from the electric fluid nor from the burning of the carbons. The explanation is very simple, and would be manifest to this correspondent if he had ever been present at the cleaning of a lamp after a warm night. The light attracts innumerable insects that kill themselves in contact with the lamp and collect there by the pintful. The mass of decaying animal matter gives out the offensive odor that the correspondent complained of. I do not wonder at his complaint, for the stench is particularly offensive. In certain situations we are obliged to protect the lamps with wire gauze to prevent the winged creatures from flying against them and interfering with the light. Ever since the introduction of electric lights here, the workmen at the various works have been wondering at the strange and varied visitants that come into the rooms at night. Our works at the lower falls are particularly well situated to attract all sorts of creatures that fly by night, and we have a very miscellaneous collection pinned on the walls, after the fashion of regular entomologists. The boys have had some monster moths come in at night, and all the specimens were duly pinned to the wall. It might interest a collector to call and examine our cabinet. Most of those we have seem to fly altogether by night, for they are of a kind that I never see by day. In former years we frequently caught a large green butterfly, but I have not seen one of them this year. Perhaps their season for skirmishing by night does not arrive until later in the year.

The Chinese Fan Palm (Livistona sinensis), and its Uses.

In the report of the superintendent of the Botanical and Afforestation Department of Hong Kong for 1886, the following interesting facts are given on the cultivation of the Chinese Fan palm (*Livistona sinensis*, Mart.) for the manufacture of fans.

The Rev. B. C. Henry, who has traveled much in the Kivangtung province, says in his book "Ling Nam" that the palm district extends about twenty miles from east to west and ten miles from north to south. It appears that fan palm cultivation is confined to the San Ui district. In reference to this, Mr. Henry says: "That the limitation of this industry is a matter of necessity and not of choice is proved by attempts made at various times to cultivate the palm in other places, attempts that have always resulted in failure."

Judging from the appearance of the country in traveling through the delta, the reputed failure of the palm when its cultivation has been attempted in other places than the San Ui district could scarcely be attributed to soil, as everywhere this had much the same appearance of richness and constituency. Knowing the immense influence which winds have on the growth and success of not only delicate plants, but also on the hardiest of trees, it is possible that the uninterrupted sweep of certain winds over the flat land of the delta, combined with some other minor uncongenial circumstances, may be the cause of the failure of the palm for commercial purposes. The San Ui district is protected by lofty hills to the north and westward, which possibly afford the conditions of shelter that the palm requires for the development of perfect leaves suitable for the manufacture of fans.

The palm plantations are situated on flat alluvial lands, about six to ten feet above the water of the rivers and creeks which run through the delta, and they are intersected with numerous open canals or ditches four feet wide or more, for carrying off the surplus water in the rainy season, and for retaining it, by means of wooden sluices fixed on the banks which surround the plantations or fields for purposes of irrigation.

The land is not wholly given up to palm cultivation, but other crops, as bananas, plantains, papays, oranges, peaches, ginger, betel-pepper plant, and various vegetables occupy shares of the ground.

The cultivation of the palm, and the manufacture of fans from its leaves, is a most important industry. According to Mr. Henry, the manufacture of the fans after the leaves have been cut gives employment to about one hundred firms and from ten to twenty thousand people. When the plantations are made, the young seedlings are placed at various distances apart, in order that different kinds of leaves, which are produced from plants growing at close and wider distances asunder, may be obtained for the manufacture of fans, for which thick or thin or large or small leaves are required.

"The most perfect plantation which I saw was about half a mile in length and about a quarter of a mile in width. It was drained by means of open canals as above described. The main body of plants were in perfectly straight rows, and they were exactly four feet four inches apart; the stems were from two feet to four feet high, and they bore about six fully developed and perfect leaves, the pellicles (stems) of which were five feet long, and the blade or leaf itself three feet long. Next to and surrounding the main body of palms, about one hundred feet wide of smaller palms, which were growing at only two feet from each other. The stems were but one foot high, they bore the same number of leaves (six) as the other plants, but, unlike them, half the number of leaves were bad. The leaves and their stems were each one foot shorter than those on the larger plants, and the pellicles were much more slender. Outside of this belt, and on the extreme margin of the plantation, there was a second belt, which, however, was very narrow. It consisted of only three rows of palms, the plants being very close together, only one foot four inches apart. None of the leaves on this belt appeared good enough for fan manufacture.

The inner belt of plants was intended, by reason of thicker planting, to serve as a screen to protect the main plantation from the damaging effects of winds, while at the same time it affords finer leaves for smaller fans. The marginal and closely planted belt was placed on the river bank to serve as a fence to keep intruders out of the plantation. For this purpose the palm, while in a young state, and when planted together, is well adapted; the spines on the pellicles presenting a barrier sufficiently offensive to the bare, stockingless, and shoeless legs and feet of the Chinese coolie. The long, straight vistas, the regularity of the planting, and the canopy of the verdant leaves overhead, produce on the visitor a delightful impression which is worth traveling some distance to experience.

Other plantations contained palms of all ages. Some had trees upward of a hundred years old, according to the assertions of natives, but these plantations always contained trees of mixed ages, young plants having been constantly added to take the place of older ones as they died out or were blown down by winds. The old trees were always of a very stunted appearance—a condition which would naturally ensue from the continued lopping of their leaves. A parasitical fungus or lichen covered these old trunks, and gave them the appearance of having been whitewashed. The tallest trees seen were only about twelve feet high, but they were said to be upward of a hundred years old. The leaves on these old trees are larger and stouter than those on young plants, and the stems of the leaves are only about a foot long. The palm begins to yield leaves suitable for fans when it is about six years old. The first cutting of leaves takes place early in the year, and the leaves which are somewhat damaged by the winterly winds, and consequently of inferior quality, are used for thatch in the construction of the "matsheds" which are so extensively used for temporary purposes in China.

Leaves for fan making are obtained in April, one, two, or three leaves being taken from each plant, and the process is continued each month until November, when, I was informed, cutting is discontinued for a few months. The leaves are taken from the plantations to a clear space covered with short grass turf. Here each leaf has a thin piece of bamboo placed across the blade where it is joined on the stem. Each end of the bamboo is secured in its place by the loose end of a segment of the leaf being dexterously bound round it. The bamboo prevents the leaf curling up while it is drying. The leaves are then laid out singly on the turf to dry in the sun, and collected and stacked at night. The process is continued daily until the leaves are quite dry, when they are either sent off direct to the town to be made into fans or they are stacked for a time until the manufacturers are ready to receive them."

The manufacture of the fans is carried on chiefly in the town of San Ui, but there are also some establishments in the country where this is done. The dried leaves are subjected to a process of blanching by means of sulphur. They are then straightened and rendered shapely by being held and manipulated over a charcoal fire. The operator, as he finishes the fans, places them one by one on each other, making a heap on the floor; the heap is firmly pressed down by the weight of the operator, who stands on a board placed on top of the heap while he is working at succeeding fans. When a heap of twenty or thirty fans have been thus treated, they are removed, and another series is begun. The next process is sewing on the bindings at the edge of the fans. This is done by women and children, chiefly at their own homes, and the fans returned, when finished, to the manufacturer. The more expensive fitting of horn and bamboo handles is done at Canton. The portion of the stalk which is not required as a handle for the fan is not wasted; it is composed of fibrous material that is utilized in making short lengths of rope used as slings to suspend baskets from carrying poles. Around the stem, as bases of the leaf stalks, there is a quantity of fibrous substance, somewhat resembling coir fiber. This is carefully collected, and also used for making ropes.

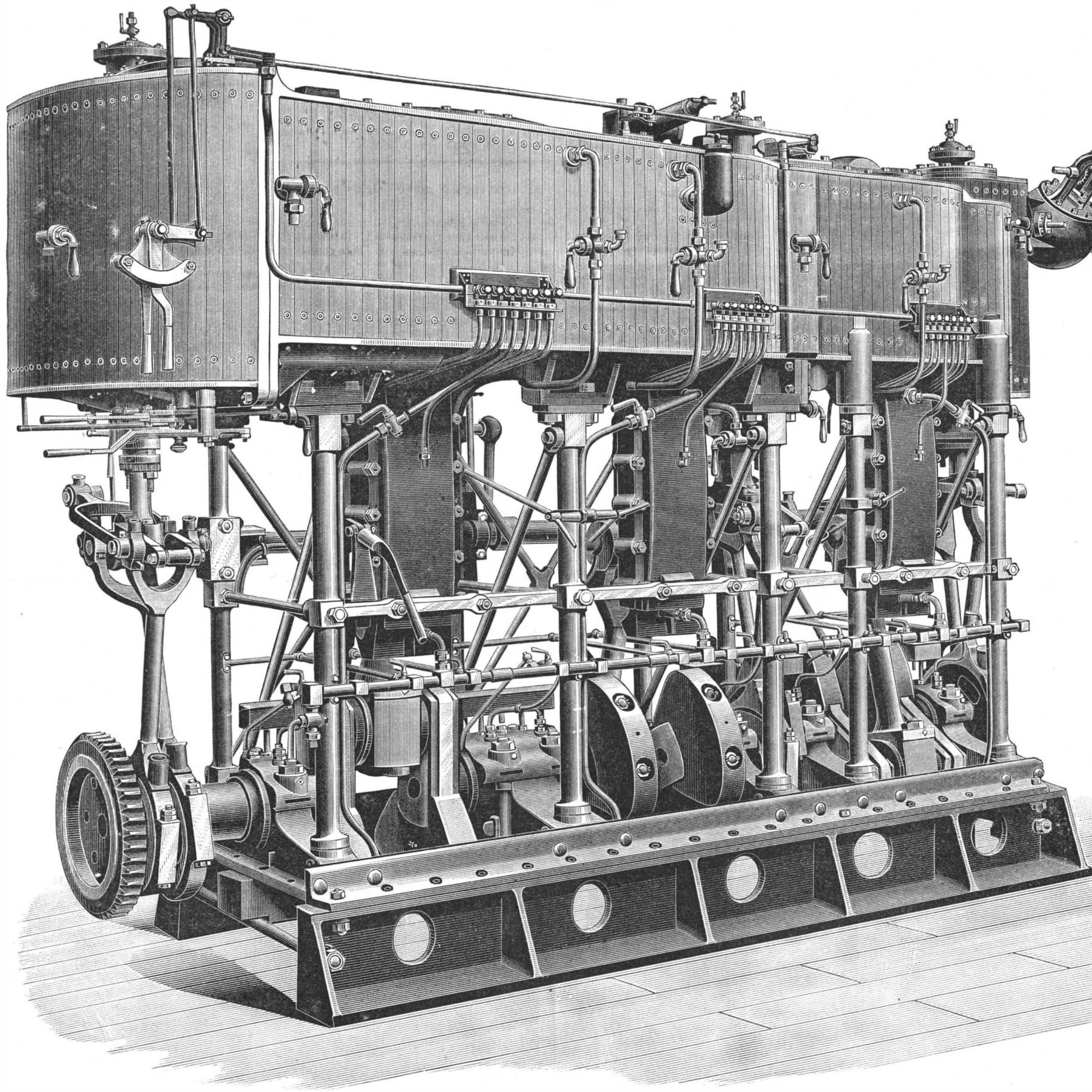
Counterfeit Jewels.

Artificial precious stones have become an important article of trade. The products of some of the shops would almost deceive an expert, but the test of hardness is still infallible. The beautiful "French paste," from which imitation diamonds are made, is a kind of glass with a mixture of oxide of lead. The more of the latter the brighter the stone, but also the softer, and this is a serious defect. The imitation stones are now so perfectly made, and are so satisfactory to those who are not very particular, that their influence begins to be felt in the market for real stones. By careful selection of the ingredients, and skill and manipulation, the luster, color, fire, and water of the choicest stones are to the eyes of the layman fully reproduced. There are a few delicacies of color that cannot be perfectly given, for they depend on some undiscoverable peculiarities of molecular arrangement, and not on chemical composition; but the persons who buy the stones know nothing of that. Yet Sidot, a French chemist, has nearly reproduced these peculiarities, including the dichroism of the sapphire, with a composition of which the base is phosphate of lime. Two other French chemists, Fremy and Fell, have produced rubies and sapphires having the same composition with the genuine stones and nearly equal hardness.—*Popular Science Monthly.*

TRIPLE EXPANSION ENGINES.

We illustrate below a set of triple expansion marine engines, constructed by Messrs. R. & W. Hawthorn, Leslie & Co., Limited, Newcastle-on-Tyne, and which are now being shown by that firm at the Newcastle Exhibition. These engines, says *Industries*, are of the inverted cylinder direct-acting surface-condensing type usually designed by this well known firm for use in torpedo cruisers, and they certainly appear to combine the maximum of power with a minimum of weight. The cylinders are in size respectively 20 in., 27 in., and 42 in. diameter, the stroke being 18 in. The i. h. p. averages as much as 1,800 with a boiler pressure of 160 lb. per square inch. In proportion, general design, and workmanship, these engines appear to be all that could be desired. Lightness of weight, combined with strength of material, and easy access to every part—such are the leading characteristics of this excellent specimen of marine engineering; and visitors who take an interest in following out the latest developments of this branch of industry will find it well worth their while to spend some time in examining the details of this exhibit.

In its immediate neighborhood is also shown, by the same firm, a model of the triple expansion engines designed by them, and now being constructed by the Societa Hawthorn-Guppy, of Naples, for the royal Italian twin-screw ironclad Sardegna. These engines will be capable of developing the enormous aggregate power of 25,000 horses, and will be by far the largest hitherto erected in any vessel. Each propeller on the Sardegna will be driven by two sets of engines coupled in line, as shown in the model, and for ordinary cruising purposes, when a low power only is required, the forward engines may be disconnected and the aft engines alone used to propel the vessel.



IMPROVED TRIPLE EXPANSION MARINE ENGINES.

Coloring Copper and Nickel.

The following process is given in the *Journal des Appl. Electriques*, by which it is claimed eleven different tints can be produced upon copper and eight upon nickel. The articles are thoroughly cleaned and polished, and placed in the following solution:

Acetate of lead	31 grains.
Hyposulphite of soda	93 "
Water	1 quart.

The bath must be heated nearly to the boiling point before the copper or nickel articles are placed in it, when a grayish tint is first produced, which changes successively to violet, chestnut brown, red, and blue, including the intermediate shades. When any desired color is obtained, the articles are withdrawn from the bath, washed, dried, and varnished. This process is especially adapted to the coloring of buttons or similar small metallic articles.

Boracic Acid for Hides.

An improved process of treating hides or skins is employed by Mr. Joseph Townsend, of Glasgow. A compound or mixture is made of aluminate of soda or aluminate of potash, containing by preference 50 per cent of soda or an equivalent quantity of potash and 40 per cent of alumina and one gallon of water to each pound of aluminate. The skins are steeped in this mixture or are impregnated with it in any suitable manner; and after a few days of this treatment the hair can be removed. The skins, having by preference been washed with water, are next placed in a solution containing from 2 to 4 per cent of boracic acid, and are again by preference washed with water. The skins may afterward be tanned in the ordinary way or may be otherwise treated.

The treatment with boracic acid may also be used with skins that have been treated with lime. The boracic acid will remove the excess of lime and render the skins more suitable for the tanning process, while the boracic acid absorbed by the skins at this stage will tend to prevent the decomposition of the tanning material when it is afterward applied. The soluble borate of lime contained in the washings may be mixed with the tanning material, as it will also tend to preserve that material from decomposition. Instead of treating the skins with boracic acid alone after they have been treated with aluminate of soda or aluminate of potash or with lime, they may be treated with a solution containing boracic acid and sulphate of alumina or other soluble salt of alumina. And instead of first treating the skins with aluminate of soda or aluminate of potash, or after so treating them, silicate of soda or silicate of potash may be used, of a strength of about 18 degrees Twaddell. When using an aluminate and a silicate, however, it is preferable to steep the skins for some time in the silicate alone, and after draining, to steep them in the aluminate, then to wash in water, and after removing the hair to steep in the solution containing boracic acid and a salt of alumina.

A New Boiling Well.

A roaring well has been discovered near Harlem, Columbia County, Ga., about thirty miles from Augusta. A noise can be distinctly heard down in the well resembling the sound of a swarm of bees, and a glance down plainly shows that it is boiling furiously. A lighted torch was let down in the well to see if it contained gas, but without result. This well was dug about one year ago, and has been acting like other wells until about three weeks ago, when it began to boil, and has continued to boil incessantly ever since.

ENGINEERING INVENTIONS.

A locomotive engine has been patent- ed by Mr. William J. Tripp, of New York City. It is constructed with large drivers, for high speed, and with the preponderance of weight below the main axle and near the track, in connection with various novel combinations of detail and arrangement of parts.

A railroad crossing gate has been pa- tented by Messrs. Nicholas Thelen, of Schenectady, and Henry Cluever, of Albany, N. Y. This invention provides a novel construction and combination of parts for gates upon each side of a track, which may be readily raised and lowered simultaneously by one person.

A grip for cables has been patented by Mr. Patrick Kelly, of Poughkeepsie, N. Y. It consists of a fixed and a movable jaw, the latter with an eccentric clamping arm, and the latter rigidly connected to a guide arm, with a hook adapted to fit over the cable and to hold the jaws in lines parallel with the general line of the cable, the device being especially applicable for tightening derrick cables or guys.

A rotary engine has been patented by Messrs. Louis A. Perrot and Harry W. Warrington, of Richmond, Va. A wheel with buckets and central shaft is fitted in a cylinder, an extension being formed on the cylinder with channels leading in opposite directions to the buckets, while a valve is held in the extension provided with a steam inlet opening and an exhaust opening connecting with the channels.

A car coupling has been patented by Mr. Charles W. Chisholm, of Winnipeg, Manitoba, Canada. It is an automatic coupling of that class wherein a pivoted pin, hook, or dog is employed to engage the coupling link and hold it in position within the drawhead, and it may be set to allow for the uncoupling of the cars, and, when the link is withdrawn from the drawhead, the coupling hook or dog will be returned to a position for automatic coupling.

AGRICULTURAL INVENTION.

A combined cultivator and pulverizer has been patented by Mr. Joseph Ashenfelter, of Liberty, Neb. It has two connected runners, each carrying an outwardly extending platform crusher, and sets of disks held at an angle to the runners at their rear, adapted for cutting the weeds and hilling rows of listed corn with earth.

MISCELLANEOUS INVENTIONS.

A band for paper, currency, etc., has been patented by Mr. Oscar S. Matthews, of Dallas, Texas. The band is of paper or like material, with a stiffened back and flexible flaps, on which are secured clips of sheet metal with clamping ends and a tongue, for use in connection with an elastic band.

A book holder has been patented by Mr. William Simmonds, of Yonkers, N. Y. It consists principally of a spring clamp adapted to span the back of the book and grasp the leaves upon either side of the back and hold them firmly upon the covers in convenient position for reading or copying.

A pocket rule has been patented by Mr. Edward R. Billings, of New York City. It is provided with a pivoted plate connecting two sections of the rule, whereby it may be used as a protractor of angles, the invention consisting of the special construction of the rule and the connections of the sliding end of the pivoted plate with the rule.

A rein guide has been patented by Mr. Noah D. Noble, of Carroll, Iowa. It has two arms pivoted to a staple for connecting the rein to the harness, in combination with a roller held at the free ends of the arms, and a fastening device, the object being to reduce the friction of the rein in the guide to the minimum.

A metallic printing block has been pa- tented by Mr. John M. Hawkes, of New York City. It is of novel form and construction, and provided with fixed and movable clamps, whereby electrotype and stereotype plates can be firmly locked in position or released at will, the invention being an improvement on a former patented invention of the same inventor.

A berry box has been patented by Mr. William Henry Moser, of East Portland, Oregon. It is a box made of veneer, made without the use of tacks, having a flap or tongue lock for adjacent ends shaped in a novel form, and in such way that the shaping, cutting, and scoring of the blank may all be done by machine at one operation.

A dry goods exhibitor has been pa- tented by Mr. Andrew J. Nichols, of Ozark, Ark. It consists of a case in which are arranged guide rollers and carrier rollers, so that goods on adjacent rollers will not interfere with each other, and the goods on the several carrier rollers may be fully displayed, and can be readily drawn out for cutting, measuring, etc.

A medicine case or satchel has been patented by Mr. David L. De Myers, of Pierce Station, Tenn. The invention consists principally of a bag or satchel having a central support to which holding devices or clasps are attached for holding bottles, etc., in connection with a special construction of satchel, especially fitted for the use of physicians, surgeons, etc.

A shade exhibitor has been patented by Mr. Robert K. Slaughter, of Brooklyn, N. Y. It is a double-faced revolvable cabinet with swinging frames, either one or both of which may be swung outward, to be placed in a convenient position on the floor of an apartment, and so arranged that either line of shades may be readily exhibited and returned within the case.

A straw rope machine has been pa- tented by Messrs. Cyrus Stephens and Charles A. Carter, of Lewis Creek, Ind. It is for making straw ropes for grain-binding harvesters, the feed being designed so that one or two straws will be fed to the rollers of the machine so as to add them to the rope every two or three inches, to form ropes rapidly of nearly uniform size.

A step ladder has been patented by Mr. William R. Allan, of Pittston, Pa. The supporting legs can be swung toward and from each other, in addition to having a hinged connection with the ladder, thus making a wider support in proportion to the width of the ladder than is possible with rigid supporting legs, and the ladder can be folded to occupy but little space.

A washing machine has been patented by Mr. Henry Bauerfeind, of Shawano, Wis. It has a drum with parallel straight ribs journaled in a tub, vertically grooved plates on opposite sides of the tub, and a rocking frame with parallel rollers journaled in its sides, the washing being done by an alternate backward and forward passing of the clothes between the drum and the rollers by operating a crank.

An apparatus for producing malleable iron or steel direct from the ores has been patented by Mr. Christian Husgafvel, of Picksamaki, Finland. The invention covers a novel construction and combination of parts for a system of charging the ore with less coal and reducing the working temperature of the furnace, to thus furnish a completed product without the ordinary intermediate processes.

A method of constructing wagon seats has been patented by Mr. John Q. Flint, of Wilton, N. H. It consists in securing the back piece to a suitable form, bending the parts of the rail over the form and along the edge of the back piece, clamping or otherwise securing the rail to the edge of the back piece, and finally removing the back piece and rail together from the form.

An automatic grain-weighing machine has been patented by Messrs. Valentin Weber and James R. Harrison, of Princeville, Ill. The invention covers a novel construction and arrangement of various parts and details of an improved machine for automatically weighing grain as it is received from the thrashing machine, in connection with a device for registering the quantities weighed.

Special.

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.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) A. S. S. asks what will remove the stain of iodine from the hair of a horse without injury to the horse or hair? A. Try rectified alcohol.

(2) J. A. asks in what manner chemicals are applied to paper, so as to form crystalline coating. A. Mix a very concentrated cold solution of salt with dextrine, and lay the thinnest possible coating of the fluid on the surface to be covered by means of a broad, soft brush. The following salts also produce beautiful crystalline coatings: sulphate of magnesium, acetate of soda, and sulphate of tin. The paper must first be sized, otherwise it will absorb the fluid and prevent the formation of the crystals on its surface.

(3) A. H. wants formula for making line negatives. A. Volkmer's process as detailed in *Photographic Times Almanac* is good, as follows:

Plain Collodion.

Ether	500 grammes.
Alcohol	400 "
Pyroxyline	16 "

Sensitizer.

Chloride of calcium	1·6 grammes.
Iodide ammonium	4·7 grammes.
Iodide cadmium	7·8 grammes.

Dissolve in 100 grains of absolute alcohol and mix with the collodion.

Silver Bath.

Nitrate of silver	1 ounce.
Distilled water	10 "

Iodize, and acidulate with nitric acid.

Intensifier.

A.	Bromide of potassium	¼ ounce.
	Water	4 "
B.	Sulphate of copper	½ "
	Water	4 "

Mix equal parts A and B and pour on the film. When perfectly whitened, blacken with nitrate of silver, 30 grains to ounce of water. In place of the above method try a very slow grade of gelatino-bromide plate and develop with an excess of pyro, previously soaking plate for 3 minutes in solution of gallic acid, 3 grains to each ounce of water.

(4) P. H. asks how photographs are enameled. A. The ordinary way is to first prepare a sheet of glass by flowing over it a solution of wax or paraffine in ether, then rubbing it over with a dry cloth, which leaves a thin film of wax on the glass, then, when dry, in coating the glass with a thin, transparent plain collodion. This is allowed to partially set, and is then immersed in water until the greasy lines disappear. The dampened albumen print is then squeegeed face downward on the collodion film. When dry, by cutting around the picture with a knife, the print is pulled up at one corner, bringing with it the collodion film, which gives the fine glossy appearance so much admired. For further details see SCIENTIFIC AMERICAN SUPPLEMENT, No. 78, page 1062.

(5) J. C. asks how magic photographs are made, which appear when the paper or glass supporting the film is blown upon by the breath. A. The picture is printed and fixed in the usual way, but not toned; then it is bleached out with a solution of bichloride of mercury. It may now be made visible again by blowing on it with the breath, especially if the smoke from a cigar is mingled with the breath. The picture may also be reproduced by placing the print upon a pad of blotting paper saturated with hyposulphite of soda.

(6) J. H. and G. W. H.—The mottling of small pieces of iron by the case-hardening process has no peculiarities further than protecting the work from the oxidizing effect of air while in the process of heating and the rapidity of transfer to the water when ready for hardening. The process consists in packing the pieces carefully in animal charcoal (charred leather, scrap hoofs or horn), pulverized so as to allow it to pack closely in contact with the surface of all the articles, in an iron box (cast iron preferred), with a cover to fit closely inside, so that if the box is not full the cover will set in contact with the material. Have no articles touch each other; press the cover down and put a little white sand on top to prevent air passing in between the cover and box. Heat the box in a forge fire or furnace to a bright red heat; keep it at this heat for 15 minutes for small articles like gun lock work. Then take off the cover and seize the box with a pair of tongs; hold it over a tub of water, tip the box, and spill gently the contents (iron and charcoal) into a tub of water. The time of dropping the pieces into the water governs the depth of color. This must be had by practice. Turning the box over slowly and shaking clears the pieces

from the charcoal and gives each piece a short exposure to air while hot; the oxidation by contact with the air while hot gives the color or cloudiness. The distance the box is held above the water may be 6 inches to 2 feet, according to the effect you wish to produce. The work should be taken from the water immediately, dipped in boiling hot lime water, dried, and oiled.

(7) G. H. S. asks: 1. Is it true that the force of an explosion of dynamite, giant powder, or indeed any of the nitroglycerine compounds, acts vertically? If true, does it exert greatest pressure downward? If above be true, please explain the *rationale* of the phenomenon. Why does dynamite when exploded differ from gunpowder, since, like gunpowder, the pressure is produced by the rapid disengagement of a large volume of gas under the action of heat, due to chemical combination? A. The explosion of dynamite and similar compounds differs from that of gunpowder in being more sudden. It acts equally in all directions except as modified by the position of the point of ignition. It is often supposed to act most violently downward, because the air shows no effects of an explosion. The general reason why dynamite is more powerful than gunpowder is because it is a chemical compound, and not a mechanical mixture. 2. Why does dynamite explode better by the use of a detonator than by a match, for by either heat is applied? A. The detonator seems to start the molecules into decomposition more suddenly and with more energy than a match.

(8) W. H. complains of having trouble in working Prof. Husnick's asphaltum process. A. First obtain a pure solution of asphaltum in turpentine from some reliable drug house; we recommend Eimer & Amend, New York. Add a little oil of lemon. Then coat the plate, expose, and when dry and cold proceed to develop. This requires great care, and is apt to proceed too rapidly. For further particulars see SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, page 2507, No. 138, page 2195, No. 243, page 3866. The benzole dissolves out the portions of the film not affected by light.

(9) J. V. F. writes: I have a linoleum cloth on my floor which looks rough and the first finish is worn off. What shall I use to renew it and make it last longer? A. Wash occasionally with skim milk and water. Rub once in three months with boiled linseed oil. Put on a very little, rub it well in with a rag, and polish with a piece of old silk.

(10) A. G. A. N. writes: I have a large quantity of argentic nitrate partially oxidized; also some scraps of gold of different carats. How am I to proceed to extract the pure metal from each one? A. See Practical Hints on Saving Gold and Silver Wastes, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 307. Metallic silver can be obtained by fusing the chloride with dry sodic carbonate in a Hessian crucible, and the gold is thrown down by iron sulphate from a solution of its salts.

(11) B. H. L. asks: How can I fasten a lead top on a carbon plate? A. Make a mould of wood or plaster of Paris large enough to inclose the end of the carbon,and also to produce a cavity for the lead,then cast the lead around the carbon. The mould, if made of plaster, should be thoroughly vented and baked before use.

(12) J. C. F. P. asks for instruction for making large (or small) trays out of wood, for photographic purposes—the best manner of making the joints, and the best process of rendering them water and chemical proof. A. Make them of white pine. Halve the corners. Put them together with brass screws. Soak the tray when done in hot paraffine, or make the joints with glue to which has been added a little bichromate of potash. Expose to daylight for 10 or 12 hours, and finally varnish heavily with alcoholic shellac varnish.

(13) E. P. B. asks: Is there any drug or acid or any other cheap preparation that will destroy the smell attaching to salad oil and China nut oil, and render them odorless and not make them muddy or discolored? A. Thoroughly wash the oils with hot water, frequently renewed, or blow steam through them until the desired effect is produced. Air freely employed for some time succeeds admirably with certain oils, and its use has the advantage of not introducing moisture into the article. Another method is to boil the oil for 15 to 30 minutes with calcined magnesia. To remove the odor, however, charcoal is the simplest means, but of course it takes the color with it.

(14) J. A. asks: 1. Is there any way of removing stains made by water in tracing cloth? A. Tracing cloth is made by varnishing linen with Canada balsam dissolved in turpentine, to which a few drops of castor oil have been added. An application of this mixture will cover the spots from which it has been partially removed by water. 2. I desire a rapid method for copying printed engravings, cuts, etc., clearly, from one book into another, without injuring the leaves in either book; or how could I accurately reproduce them in any manner? A. We know of nothing simpler than photography.

(15) J. G. C. asks: 1. Can I obtain a supply of oxygen by any simple process of separation from the atmosphere? A. For separation of oxygen from the atmosphere, we refer you to our SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 92, 119, 313, which we can send you for 10 cents each. 2. Why does egg albumen assume the condition it does from the effect of beating? A. Egg albumen has a high coefficient of viscosity and does not evaporate. Hence the bubbles it forms last for a long time.

(16) W. H. R. asks: 1. Is there any cement that will fasten glass to brass? A. Boil 3 parts of resin with 1 part of caustic soda and 5 parts of water, thus making a kind of soap, which is mixed with ½ its weight of plaster of Paris. 2. Please give the analysis of refined petroleum. A. It should have a density of 46° Baume, a flashing point of 115° Fah., and a burning point of 138° Fah. 3. Is there much chance for improvement in oil lamps? A. There is always an opportunity of producing something better, although a great deal has been done in this line. 4. What is the extreme range of the English 110 ton gun? A. They penetrate 35 inches of iron at 1,000 yards. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 586, for article on this subject. Such guns are very seldom tested as to the extreme distance to which they would send a projectile. To do this they would have to be fired at an angle of 45 degrees, and the whole force would be expended in carrying the projectile the greatest distance. They are instead fired with a much flatter trajectory, to give penetrating power of more or less efficiency at a certain distance.

(17) E. K.—The black willow flowers in May, and fruits in June. As the catkins usually fall off in one piece soon after fruiting, you will probably not be able to obtain any so late in the season. The black willow is widely distributed, and ought to be found in abundance in your neighborhood. If you need the catkins for study, you might perhaps get dried specimens from Mr. M. S. Bebb, of Rockford, Ill., who has made the study of willows a specialty.

(18) W. H. H. desires a receipt for making a white liquid for stamping with perforated paper patterns on dark goods. A. Use white lead mixed with dry gum arabic powder, which goes through the perforations and is attached to the material by pressing with a hot iron. We know of no fluid for the purpose.

(19) D. L. asks if there is any economical way to condense the exhaust steam of an engine so it can be used in the boiler again, where the water supply is very short. A. An air condenser may be made of iron pipe so that air can circulate upon the outside, cooling the pipe, which in turn will condense the steam upon the inside. If you have a small portion of water to spare, the coil may have a sprinkler over it, so as to wet the surface with cold water, which will enable you to use a much smaller coil than when cooled by air alone.

(20) O. C.—You can carry steam 200 or 300 feet if pipes are carefully felted and boxed, with very little loss. You cannot pump as much water through a two inch pipe as a pump having a 3 inch discharge opening is capable of pumping.

(21) J. J.—The pole star is about 1° 17′ from the true pole. When Polaris is on the meridian at upper culminations, the star Alioth, the second star from the pointer in the dipper handle, will be on the lower meridian. The east and west elongation is opposite to Alioth when Alioth is at the same altitude as Polaris.

(22) A. S. E. asks (1) how to take iron rust from granite. A. Scrub with dilute muriatic acid. 2. A cement to make joints for granite monuments. A. Use clean sand 20 parts; litharge 2 parts; quicklime 1 part; and linseed oil, sufficient to form a thin paste. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 313.

(23) C. W. desires a recipe for preserving the juice of lemons. A. Mix it with one-tenth of alcohol and then bottle. By this means it will be prevented from decomposing.

(24) Portmanteau asks: What would be the best way of renovating a black canvas covered portmanteau on which the color has been rubbed off a good deal? A. Coat it with a black leather varnish, such as the following: Digest shellac 12 parts, white turpentine 5, gum sandarac 2, lampblack 1, with spirits of turpentine 4, and alcohol 96.

(25) R. & K. ask the manner of preparing and the ingredients used in the manufacture of carpenter's prepared chalk. A. The ordinary white crayons are made by taking the finest powder of calcined oyster shells, sifted through muslin. Mix up with water in which a little rice and a little white sugar candy has been boiled; according to the quantity of the rice, so will be the hardness of the crayon. For process of manufacture, see Spons' "Workshop Receipts," first series, which we can send you for $2.

(26) H. S. asks: 1. What is understood by second growth of potatoes? A. In order to obtain a maximum crop of potatoes, they must have constant growth, which, if checked in any way, the tuber ceases to enlarge evenly and starts a second growth from its eyes, forming prongy or knoby potatoes. 2. What kind of grass is best on a hill that washes? A. Bermuda. 3. Where can I get a good book on poultry? A. We can send you Lewis' "Practical Poultry Book" for $1.50, postpaid.

(27) E. R. S. desires a preparation that is good for marking and stenciling cases with a brush. I have been using lamp black, but it rubs off so. I am now using bluing, but it is so thin that I cannot stencil with it, and it also runs terribly in marking. A. Dissolve ordinary asphaltum in turpentine, and you will have an excellent stenciling ink. See also answer to query 2, in SCIENTIFIC AMERICAN for September 3, 1887.

(28) R. G. writes: I have in my possession a rosewood bassoon, which is cracked through in one of the joints. Would you give me a receipt for a cement or glue which will resist the warm moisture, and make the instrument air tight? A. Powder and dissolve one part of glue in one of thick linseed oil, varnish boiling hot, and mix thoroughly. In using it, heat the two pieces, apply the glue warm, and press the pieces together.

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

A. T.—They are worthless.

TO INVENTORS.

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