THE NEW ORLEANS EXPOSITION.

(*Continued from first page*).

the other machine the difference was only about 25 degrees. One of the ingredients of the piston packing rings is graphite, the effect of which, in combination with the circulation of the water in contact with the cylinder walls, is a very perfect automatic lubrication.

The large bearing surfaces, the heavy and well distributed framing, and the efficient method of cooling allow these compressors to be driven at more than ordinary speed and at the same time secure economical results.

The "pony pattern" air compressor requires but a slight foundation, since it is self-contained in the manner of direct-acting steam pumps. The upper crosshead guide is cast solid with the frame, thus placing a liberal proportion of metal above the center line of the cylinders, and taking the working strains in direct pull and thrust. This obviates the necessity for the deep box which has been customary with this style of machine, and makes it practicable to support it at each end only, and also prevents any springing or bending due to bolting a long bed to an irregular surface. The piston rods and crosshead are of steel, the crank pins, pins and links of valve connections are of mild steel, casehardened, and all the brasses are of phosphor-bronze. The valves are of the poppet type, giving a minimum of waste room in the ends of the cylinder, which is provided with a water jacket. The inlet valves are similar to those described above. The bearing surfaces are all large, and the machine is well made throughout.

Although we have mentioned but two of the air compressors, we have given enough to acquaint the reader with the principal characteristics regarding the construction and operation of the machines manufactured by this firm.

The rock drills shown in the engraving belong to the class known as "striking drills," in which the drill steel is an extension of the piston rod. The cylinder slides in a guide or shell, mounted upon a tripod formed with a universal joint, and is fed toward the rock as fast as the steel penetrates it. A positive motion valve insures certain operation when steam or air is admitted, without depending upon close fits or clean parts; it allows of a variation between the up and down stroke, thereby saving steam and increasing the working capacity of the drill. The valve is moved in the same direction as the piston. The rotating bar is made full size where it enters the ratchet, and it is claimed that it never breaks. The piston rod and chuck are made small and solid outside of the cylinder, whereby greater lifting power is obtained. The throttle is placed on the steam chest, where it cannot be lost or injured in handling. The coupling has no gaskets that can drop out, and provides for instantaneous connection of the hose without the use of a wrench or spanner.

The length of stroke of a rock drill is uncertain, since, as the hole progresses in depth, the cylinder must be correspondingly fed forward, but to effect this feed with perfect regularity is impossible. In these drills provision has been made for this irregular feed and length of stroke, but nevertheless, when full strokes are made, the valve does not move nor is steam admitted below the piston until the actual delivery of the blow. The result is that while in cushioned drills the blow struck is that due to the difference between the action of the driving steam and of the cushioned steam, in this drill the blow is that due to the full, unobstructed action of the driving steam.

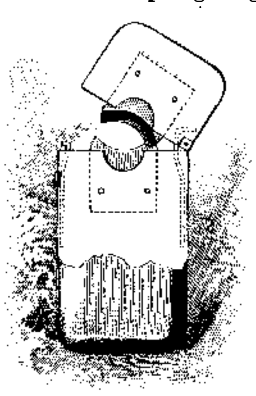
In the adjustable tripod both front legs are so arranged that they can be set at any angle or placed in any desired position. The movement of the legs is not limited to a small area, but they can be pointed toward the side, front, or rear, raised at right angle to the drill rod, or pointed straight upward in an opposite direction to that in which the rock is to be bored. This arrangement is particularly useful in drilling "lifting holes," and where it is desirable to drill a hole close to the side of a cut, or in bench work in mines. In the iron mines of Lake Superior, where many of these drills are at work, the miners are often called upon to commence drill work 40 feet or more from the floor of the chamber. A ladder is set up against the side of the mine, the miner climbs to the place to be drilled, lowers a rope, and with the help of his mate pulls the drill up after him. He chips out of the rock a spot large enough for the rear leg and one for one of the front legs of the tripod, the other front leg being tied to the ladder. The hose being connected, four or five holes are drilled in the solid ore, iron bars are placed in the holes, and across the projecting ends of these bars planks are laid and a stage constructed from which drilling and blasting in the regular way are soon carried on.

Two or more of these drills (without the tripod) may be mounted upon arms projecting from shifting sleeves placed upon a swivel jointed bar which may be held between the walls of a shaft or the floor and ceiling of a gallery. The bar is firmly held. and is not loosened by the jar of the drills while running. The drills can be moved along the bar to any position, and can be worked at any angle. A quarry bar is used to carry drills for channeling, gadding, etc. It can be set at any angle, and with it holes can be drilled true and in line.

It has always been the aim of the Rand Drill Company, in all of the appliances made by them, to design the machines in accordance with both the theory and practice, to employ the best material and so distribute it as to obtain ample strength without unnecessary weight, and to insure economy and effectiveness in operation and great durability.

COMBINED CIGAR-CUTTER AND MATCH BOX.

The convenient little device herewith illustrated was recently patented by Mr. H. B. Eggert, of Bethlehem, Pa. The body of the box, made of sheet metal, is provided with a spring hinged lid, which is thrown open when released by pressing on a front button catch. Secured within the box on the one side of the body, and corresponding side of the lid, are two concave steel cutters, which project beyond the meeting edges of the body and lid, so that in closing the lid one cutter slides, as the blade of a shears, over the other. An opening is formed by notching the meeting edges of the lid and body of the box at the point where the cutters are located, the object of this being to prevent the end of the cigar from being crushed, as it would be if the meeting edges were straight. The arrangement of the cutters within the box prevents the cutting blades from catching on the lining of the pocket in which the box is carried.



Curing Herring.

In Mr. Perley's Report of the Fisheries in the Bay of Fundy, the manner of curing herring is thus described:

The fish are scaled by being washed in bushel baskets with a square bottom, open like a coarse sieve, the men standing in the water up to their knees. The best fish have very few scales, and only half a bushel of them are taken in the basket at once; they are then salted in large tubs, the salt being stirred through them by hand; the quantity used is half a bushel of salt to two and a half barrels of fish, which are a tub full. They lie in salt twenty-four hours, and are then washed in fresh water to prevent their becoming "salt burnt," after which they are strung on rods, with their heads all one way, and then hung up in the smoke house. In Clements the smoke houses are usually 30 feet square, with 14 foot posts and a high roof; no fish hang nearer the fire than 7 feet, but the most careful curers do not hang them nearer than 8 feet. Rock maple is used in smoking; when it cannot be procured ash is used, being considered next best. The process of smoking usually occupies eight weeks; and it requires the whole time of one person to watch the fire and to attend to the smoking, in which much judgment and great care are required. The smoke is usually made up at nightfall, unless the weather is warm and wet, during which time no fires are made. In fine weather the smoke houses are thrown open during the day to cool; and the greatest care is taken at all times to keep down heat, and to render the smoke house as cool as possible by numerous windows and openings. After being smoked, the fish are packed in boxes 18 inches long, 10 inches wide, and 8 inches deep, measured on the inside; and there should be 24 dozen fish in a box of prime herring. If the fish are large and of the best quality, it requires some pressure to get this number into a box. The Digby herring are in some instances cured in pickle, unsmoked, and packed in half barrels.

The Air and the Telescope.

The air we breathe is, in truth, the worst enemy of the astronomer's observations. It is his enemy in two ways. Part of the light which brings its wonderful, evanescent messages across inconceivable depths of space it stops; and when it does not stop, it shatters. And this even when it is most transparent and seemingly still; when mist veils are withdrawn, and no clouds curtain the sky.

Moreover, the evil grows with the power of the instrument. Atmospheric troubles are magnified neither more nor less than the objects viewed across them. Thus Lord Rosse's giant reflector possesses—nominally—a magnifying power of 6,000; that is to say, it can reduce the apparent distances of the heavenly bodies to one six-thousandth under their actual amount. The moon, for example, which is in reality separated from the earth's surface by an interval of about 234,000 miles, is shown as if removed only 39 miles. Unfortunately, however, in theory only. Professor Newcomb compares the sight obtained under such circumstances to a glimpse through several yards of running water, and doubts whether our satellite has ever been seen to such advantage as it would be if brought—substantially, not merely optically—within 500 miles of the unassisted eye.

Correspondence.

A Grand Chance for Inventors.

To the Editor of the Scientific American:

Will you kindly permit me to give inventors a hint through your valuable paper? In 1877 I traveled through the Red River Valley on the Northern Pacific Railroad in Dakota. I noticed those large level fields of thousands of acres, which were being plowed or sod broken up by the slow process of a fourteen inch plow drawn by four horses. I thought then that the plow was far behind all other farming implements. I then thought of the ordinary hand plane and the revolving planing machine, and could not see why plowing could not be done on the same principle that a planing machine planes a board. If some inventor will get up a plow to run by steam or horse power, that will cut up the sod into chips like a planing machine cuts the top off a board, and plow about three inches deep, he will confer a great blessing on our Western farmers, as he can then put his field in condition to put in any kind of a crop the first year, and not be hampered for two or three years with long, dry strings of tough sod, which is always in his way in harvesting his crop.

MICHAEL LANG.

Mandan, D. T., March 29, 1885.

Lightships on the Ocean Cable Tracks.

To the Editor of the Scientific American:

As to the suggestion regarding ocean stations along the line of a cable for the purpose of communicating with the land, I would say:

At the meeting of the Ancient and Honorable Artillery Company, September 13, 1880, certain persons, supposed to be experts in all sublunary things, were invited to prepare papers *on the past and present*. These papers were to be sealed up in a box, and preserved until 1980. I was requested to write on commerce and navigation, but I wrote only upon the supposed condition of *the future*. I predicted that small craft would be located on the track of ocean steamers at convenient distances; they were to be fitted with electric lights and means to send messages to the shore; in short, my plan was identical with that above alluded to.

In discussing the practicability of anchoring small craft with steel wire cables, it must be kept in mind that they could not be depended on in waters of more than 500 fathoms, owing to the danger of breaking the wires. Having no chart at hand showing the depth of water on the line of a cable, I cannot say where the stations should be placed.

Consulting Col. Edward Wyman, who was an active member of the Ancients, he says: "Your statement recalls to my mind discussing the very point alluded to; your proposition, in brief, was that vessels could be anchored in mid-ocean at various points on the usual track of ships, and could communicate with passing ships, and transmit by cable to the land any desirable information."

Now, Messrs. Editors, as your sons or grandsons may be here in 1980, I beg you will let them know that I was thinking and writing on the said mode of communicating as far back as September, 1880. I regret that I have not preserved the publication of another writer on the same subject.

I am very truly yours,

R. B. FORBES.

March 31, 1885.

[The probable feasibility of establishing some such means of communication between ships at sea and ports on either side of the Atlantic has long been entertained. In 1876 mention was made in our columns of an invention which had "*revived* the discussion" of the practicability of "establishing telegraph stations in mid-ocean, by which messages could be sent along the line of the cable to terminal points on shore, and *vice versa.*" This particular device was for a hollow sectional column, to be anchored, and with a branch cable to be coupled to the main cable. The great difficulty would be, of course, in making and maintaining a permanent connection with the cable on the floor of the ocean, which through a great part of the length of the Atlantic cable is as much as 2,000 fathoms below the surface.—ED.]

Why Contagious Diseases Attack but Once.

Professor Tyndall thus endeavors to explain the immunity obtained against a second attack of a contagious disease: "One of the most extraordinary and unaccountable experiences in medicine was the immunity secured by a single attack of a communicable disease against future attacks of the same malady. Smallpox, typhoid, or scarlatina, for example, was found as a general rule to occur only once in a lifetime of the individual, the successful passage through the disorder apparently rendering the body invulnerable. Reasoning from analogy, I have ventured to express the opinion that the rarity of second attacks of communicable disease was due to the removal from the system, by the first parasitic crop, of some ingredient necessary to the growth and propagation of the parasite."—*Medical World.*

New Refrigerating Machine.

In refrigerating machines, up to the present time, there has been utilized as the sole source of cold the passage of liquid to the gaseous state without the intervention of any chemical phenomenon. The various systems of such machines differ merely in the absolute tension of the vapors on both sides of the compressing piston, and in details of arrangement. Instead of a single liquid, M. Pictet proposes to use a volatile liquid which may be split up into two or more volatile liquids by the mere fact of a fall of temperature. He has oxidized carbonic acid by associating it with sulphur oxide, and has obtained a series of compounds from $C_{40}O_{82}S$, boiling at —71°, to $CO_{16}H_7$, boiling at —7·5°. The more the temperature sinks, the more the original liquid is resolved into elementary volatile liquids, each giving off vapors.

The sum of all these elementary tensions is much more considerable than that which would correspond to a single permanent liquid. At higher temperatures all these liquids recombine into one, and the maximum tension of the vapors is considerably reduced under the influences of the affinities developed. If we introduce into a refrigerating machine the new volatile liquid SCO_4, the vapor tension in the refrigerant will be very much superior to that of pure sulphurous acid, while the tension on compression in the condenser, where the vapors resume the liquid state, will be decidedly less than that of sulphurous acid. The compressing piston will thus receive a stronger pressure in aspiration, but a smaller one in compression, thus effecting a great economy in the force required for working the pump.

COMPOUND OPTOMETER FOR CORRECTING ERRORS OF REFRACTION.

In making examinations of the eye for the purpose of determining its refraction and the adaptation of spectacles to correct defects which may exist, the first part of the process is to determine visual acuteness. Letters are placed before the individual whose eye is being examined, of varying sizes; some to be seen by the normal eye under a visual angle of 5′ at 200 feet, and from that down to the distance at which the letters are from the observer. In order that the refraction of the eye be correctly measured, it must be in a state of rest—adjusted for parallel rays; and this ophthalmologists claim can only be secured by placing objects to be observed at a distance, and 20 feet has been accepted as the distance which practically accomplishes this object. But it is claimed that the optometer herewith illustrated renders rays emanating from objects placed at 13 inches from the eye parallel, and consequently measures the refraction perfectly. Lack of visual acuteness may be due to a defect in the perceptive part of the eye, the retina, or to a refractive anomaly. To determine this a concave and a convex lens, about one-thirtieth, are alternately placed before the eye, and if either improves the vision there is either myopia or hypermetropia. The number of the glass that produces the greatest visual acuteness measures the refractive error. If neither the concave nor convex lens increases the visual acuteness, the test for astigmatism is made, and when none of these tests improves vision the defect is in the retina.

This is the procedure followed by oculists, and while being correct theoretically and in its practical results, it is stated to be awkward and tedious when compared with the optometer.

The optometer shown in the accompanying engravings has an upright of about 12 inches, upon which are mounted two circular disks, one for spherical and the other for cylindrical lenses. Each disk can be so revolved that the lenses can be brought in front of a common opening or eye tube, through which the observer sees letters. The disk containing the cylindrical lenses is attached to an arm, by which it has a movement besides the one upon its central axis, and whereby the axes of its cylindrical lenses can be placed in any degree of a circle before the eye tube. The disks are so situated that the lenses of one can be interposed with that of the other, thus combining their effect if necessary. Upon the extremity of a horizontal bar attached to the upright, about 12 inches in length, rests a card rack in which the test letters are placed 13 inches from the observer's eye.

The spherical lenses are 38 in number, 19 concave and 19 convex, embracing a series from $\frac{1}{74}$ to $\frac{1}{4.5}$. Intervening between either extremity of the positive and negative lenses is a plain glass. The disk containing the cylindrical lenses has the same arrangement as the one containing the spherical, as mentioned above. There is an eye piece for the eye being examined, while the other will be deeply shaded, thus practically disposing of the inclination to convergence. The reason for this is that convergence and accommodation are co-ordinate acts, and in this case by controlling the convergence the tendency to accommodate is also greatly controlled.

At the extremity of the eye tube, and with the center of its system, about 2 inches from the cornea, as it rests in the eye piece, is placed an objective which is a compound achromatic lens, the principal focus of which falls on the test letters on the card. This practically produces a myopia of $\frac{1}{11}$. The rays proceeding from the objective to the eye are of necessity parallel, since the test letters are at the principal focus of the objective. It is claimed that this disposes of the objection to the instrument by those who state that it will not relax accommodation. Placing the objective outside of the anterior focal distance of the dioptric media of the eye magnifies the letters to be observed, but this in no way changes the results of the test for refraction, but the letters used should be proportionately small if a test for visual acuteness be made, else the visual angle of 5′ will be changed; if the letters are magnified one-half, they should be one-half smaller.

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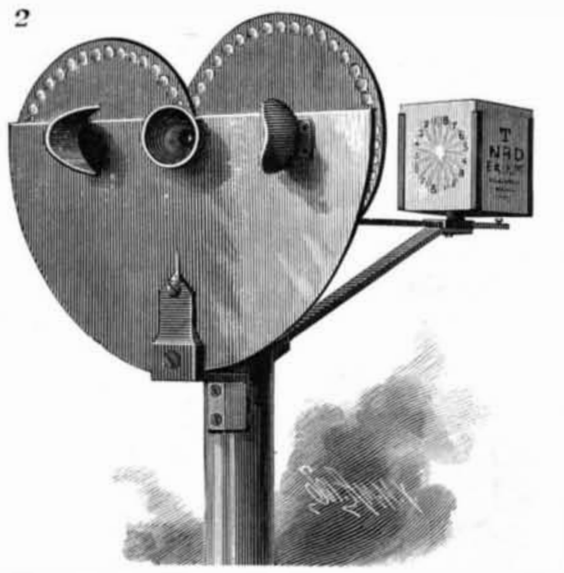
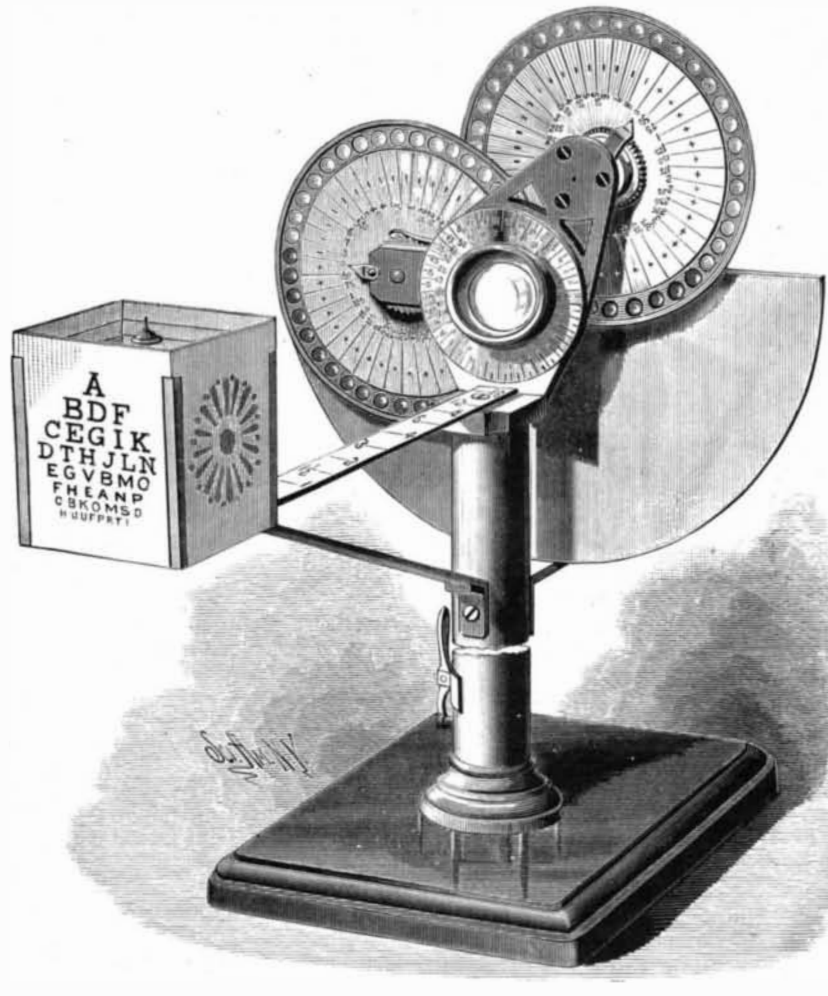


BETELING'S COMPOUND OPTOMETER FOR CORRECTING ERRORS OF REFRACTION.



BERTELING'S COMPOUND OPTOMETER FOR CORRECTING ERRORS OF REFRACTION.

In the construction of the system for measuring visual acuteness with this optometer, a letter is used for a basis the measurement of whose diameters forms the base of an angle of 5′, the distance from the center of the system of the objective to the letters forming the sides of the angle. If the eye were placed at 11 inches from the letters, they would be the same size as the objective renders them at 13 inches, so that the visual angle is measured from the center of the system rather than from the position of the cornea. The letter, then, at 11 inches should have a diameter of $\frac{11}{60}$ of a line, or for practical purposes $\frac{1}{5}$ of a line. For the purpose of keeping a record of visual acuteness, as by the method of Snellen, when the smallest letters can be read, which are $\frac{1}{5}$ of a line in diameter, it may be stated that $V=\frac{20}{20}$. When the next letters which are one-half larger are the smallest that can be read, V may be marked $\frac{20}{40}$, and so on up to 200 feet.

This optometer, which is the result of several years of careful study and experiment, has been patented, and is now manufactured, by Mr. L. A. Berteling, of 427 Kearny Street, San Francisco, Cal.

Ornamental Trees.

As soon as the frost has left the ground, loosen the earth around each tree several feet; rake out all the grass and weeds, to prevent turf forming; pulverize the soil thoroughly, to receive and retain moisture; crowd it gently toward the trunk, leaving a small trench around the circumference. This will tend to carry the moisture and nourishment toward the rootlets. Then, if your trees stand in the yard or lawn, you can plant these bare circular spots of ground with any kind of low annuals, such as candy tufts, fumitories, portulaccas, sweet alyssa, pansies, trailing verbenas, etc. Thus you will enlarge your flower space, and the constant cultivation of these flowers will keep the ground about your trees beautiful and in the best growing order. When the season advances, you can mulch with grass or leaves.

Iron Pyrites.

Pyrite, or iron pyrites, is one of the commonest of minerals, occurring in rocks of all geological ages from the oldest granites to the newest slates. It generally occurs in small cubic crystals scattered irregularly through the rocks, but is not uncommon in masses and beds of considerable size. Among the large number of mineral specimens which come to the office of this paper, with the inquiry if they do not contain gold, copper, or some other valuable substance, pyrites comprises the greatest. "Silex," in the *Journal of Commerce* (Boston), gives some interesting facts about pyrites, which is likely to interest considerable of a number of our readers. Pyrites, or sulphide of iron, is composed of about 53 parts sulphur to 47 iron. It is a pale, sometimes bright, yellow mineral, nearly as hard as quartz and about twice as heavy as quartz or granite. It can be but slightly scratched by the knife, is always opaque, somewhat brittle, and strikes fire readily with steel. The latter circumstance gave rise to its name, which is derived from a Greek word for fire.

Pyrite very commonly occurs in quartz veins with various metallic ores, and is almost invariably found in gold bearing quartz intermingled with the precious metal. Gold not uncommonly occurs disseminated through the pyrite, which is then called auriferous or gold-bearing pyrite. A considerable proportion of the yield of gold is obtained from this variety.

Pyrite is one of the most changeable of minerals, and when exposed to the action of the weather for a length of time, as at the outcrop of a vein, it decomposes, loses its yellow color, and becomes of a rusty iron hue, changing into iron oxide. The rusted honeycombed appearance of much gold-bearing quartz is due to the composition of the pyrite. This liability to decomposition renders all rocks containing much of this mineral unfit for building purposes where beauty and durability are desired. The yellow color of pyrite has often led people to mistake it for gold, and a great deal of money has at one time and another been wasted in mining fool's gold, as it is often called, in the belief that it was the precious metal. Gold is very easily distinguished from pyrite, the only resemblance being in the color. Gold is a soft mineral, easily cut by a knife, is of a deep yellow color, and is nearly five times heavier than pyrite. However, as a small proportion of gold is often present in pyrite, it is always well to ascertain by analysis if enough gold is there to pay for working.

Though pyrite contains nearly 50 p. c. of iron, it is never worked for this metal, as it can be obtained much more cheaply and easily from other ores. Sulphur is sometimes obtained from the mineral, but its principal uses are in the manufacture of copperas and sulphuric acid. It has not been mined to any great extent in this country, as yet, for these purposes, though largely used in England. Though pyrite occurs almost everywhere, there are some localities that afford unusually fine specimens, as Waterville, Me., Rowe, Mass., and Roxbury, Conn., in New England. Fine specimens of crystallized pyrite are found in many places in the Middle and Western States, and especially in Colorado.