Referring to the foregoing engravings in illustration of our subject, Fig. 1 affords an excellent idea of the exterior appearance of the engine, and the smaller drawings, Figs. 2, 3, 4, and 5, relate to especial parts which will be adverted to as we proceed.

The concentric cylinder or casing, A, is bored out smoothly to form a perfect circle within, and is pierced at either side with induction ports, B, Figs. 2, 3, and 4, which extend across the rim, forming narrow slits of about half an inch in width. At C, Fig. 2, are shown the exhaust openings, of which there are four, two on each face, and which together aggregate in area four times that of the induction ports. A steam jacket, represented in section in the upper portion of Fig. 2, incloses the top of the case so that the steam, entering by the pipe from above, is supplied to both induction ports at once. The exhaust passes through the openings above noted, into annular chambers, and thence exits by the pipes, D.

A E, Figs. 1 and 2, are the steam chests communicating with the jacket and containing the valves, F, the form of the latter being more clearly shown in Fig. 4. It will be here observed that the two parts of the valve are separated by springs, and that the outer part is made in the segment of a circle (see section in Fig. 3) to fit the chamber, against which the springs hold it. The valve journals are arranged as shown, one resting in the cover and the other passing through and terminating in a short crank, G. The construction is of course the same in both valves.

Between the cranks, G, extends a horizontal bar, H, Fig. 1, the portion of which passing over the shaft is shown in Fig. 5. On this bar is a small projecting roller, J, and formed on its inner side are other projections. The lug on the left side of the bar, or that nearest the reader, is perforated and travels on a horizontal screw-threaded bar, secured to the head of the casing. Also inclosing this bar is a spiral spring, K, which presses against the lug. On the opposite side of the bar, H, another projection, not shown, also travels on a screw-threaded rod held in fixed standards, on which, however, are nuts which can be turned forward or back on the screw so as to limit the play of the projection and consequently the horizontal movement of the bar, H, to which the latter is secured. On the shaft of the engine is a disk, L, Figs. 1 and 5, shown in the former figure just in rear of the governor pulley, on which are formed two cams which, in the revolution of the disk, press upon and push aside the roller, J. The motion of the valves is therefore governed as follows: Rotating the disk throws the roller, J, to the left; the spring, K, is consequently compressed by the lug on the bar, H, being carried against it. As soon, however, as the cam pressure relaxes, the spring acts and, by its recoil, throws the bar over in the opposite direction, so that by this means the cranks, G, and the valves attached thereto, are moved. Referring now to Fig. 5, on the left side of the right hand cam will be noticed a number of additional pieces. These are movable blocks bolted on and easily adjustable, which serve to increase the length of the cam so as to control the points of time of opening the valves and admitting steam. When it is desirable to cut off earlier, with reference to the revolution of the drum within, more of these blocks are added; and when a more continuous supply of steam is needed, some are removed. The ready manner in which the cutting off can thus be regulated is, we think, an ingenious and novel improvement.

Through the action of the lug and nuts on the right of the bar, H, in governing the horizontal play of the latter, it is clear that the apertures of the induction ports are also thus regulated, for necessarily, if the cranks, G, are carried over a shorter distance, the valves are moved over diminished space. By this means the induction orifices can be arranged to admit steam to their full capacity, or to allow it to enter in the thinnest possible sheet, so to speak, in accordance with the power and work required of the engine. The same device can also be made to afford an extremely sensitive variable cut-off, by connecting the governor with a movable wedge which will thus, by entering more or less, shorten or lengthen the play of the bar, H, and thus automatically control the valves in their motion over the very narrow ports. These changes, the alteration of the cams and the nuts on the sliding bar, it should be noticed, are all easily accomplished in a moment, from the fact that the parts are outside the machine, and hence directly at the hand of the engineer.

In Fig. 2 the interior arrangements are clearly depicted; M, the revolving drum, is secured to the shaft, and its length is very nearly that of the case, so that its ends when rotating are in such close approximation to the latter that steam is prevented from passing between. The weight of this drum is such and it is so constructed as to act as a balance wheel with equal momentum throughout its entire revolution. The pistons, N, and abutments, O, against which the steam presses, are located in the space between the drum and cylinder. The pistons, N, are hinged by their cylindrical ends in projections, P, screwed to the drum, which form sockets. From these extremities the pistons are flattened for a certain distance, sufficient, when at a proper angle, to cause them to close the space. Their width is such as to permit their front or loose ends to extend across and completely fill the said space, while their extremities enter slots formed in the drum. These slots are provided with shoulders, at Q, which the flanged ends of the pistons take against, so that when the latter are lifted by the springs, R, under them (which are made only just strong enough for such purpose) or by steam entering beneath, they will be caught and prevented from being forced up so as to cause undue friction between their upper surface and the inner periphery of the cylinder. The wearing edge of each piston is faced with steel, as indicated by the dotted lines, the plate being screwed on and easily removable. In order to obtain access to this part of the engine for alteration or repairs, it is only necessary to remove the head of the cylinder and draw the pistons laterally from their positions by hand, an operation very quickly and easily performed.

The abutments, O, fixed on the case are arranged similarly to the pistons, their movable ends entering slots, S, and steam passing along their outer sides. It will be observed that the pistons come under these abutments, so that each moves through one half the space between the drum and cylinder, while they laterally entirely and closely occupy the chamber. All jar and consequent wear due to sudden contact is ingeniously obviated by a nice arrangement of working parts; thus, supposing the drum to turn from right to left, the abutment, O, is first met by the inclined projection, P, which slides under and is prolonged by the flat portion of the piston, N, which is followed by another inclined projection, T, secured to the drum. By this means the parts which travel under the abutment are inclined planes, which readily slide by without jar. Similar arrangements, it will be noticed, are provided in connection with the abutments to prevent sudden contact of the pistons with the cylinder.

The operation of the engine can now be easily comprehended. Steam entering at the top passes through the jacket, thence through the ports, and thence, entering the cylinder, actuates the drum. In Fig. 2 the pistons are shown near the end of the stroke. Before their faces have reached the exhaust ports, the valves will have closed, thus cutting off the steam while the pistons are passing the abutments. The exhaust ports being open, the moment the faces of the pistons pass their edges the steam exhausts.

It remains, in conclusion, to sum up the advantages of the machine, as claimed by the inventor. Of these the principal is a positive equalization of steam pressure, on all sides of the drum, at all times and at every point of its revolution, so that frictional wear is reduced to its lowest point for the main shaft and journals. The drum is balanced by the steam, and hence its oscillation is prevented. In proof of these assertions the inventor, in our presence, caused an engine of some thirty horse power to start and operate under a steam pressure of less than half a pound. From further trial of the machine at the Ridgewood Works of Mr. C. P. Ladd, of Bloomfield, N. J., where it was built, we may add we were favorably impressed with its construction and operation; but of course, in the absence of complete tests and calculations as to power, etc., we are unable to speak, with such certainty as we should desire, of its probably high efficiency.

Further points of advantage may be briefly stated as follows: Cheapness, as all the parts are simple lathe work, strictly circular, or else have flat and straight edges easily planed; compactness; economy of fuel, because the driving power is always at the same leverage from the center of the main shaft, and, through the cam, steam may be employed expansively to any extent compatible with length of stroke or size of engine, according to the horse power required for the work to be done; simplicity and ready accessibility of working parts; practically no appreciable clearance; capability, from its plane surfaces, of being packed as readily as a reciprocating engine; lastly, and especially claimed by the inventor, owing to the machine being concentric and the steam space being uniformly the same, the amount of steam used can be cubically calculated so as to institute a comparison between this and the reciprocating engine as to bulk of steam used and power developed. There are other matters, mostly of theoretical nature, also claimed to prove further advantage, but owing to lack of space we are obliged to omit their consideration.

Patented July 23, 1872, by Colonel E. P. Jones, one of the Commissioners to the Vienna exposition from Mississippi. For further particulars regarding proposals for construction, rights, etc., address the manufacturers, the Baltimore Concentric Engine Company, General Wade Hampton, President, care of Carolina Insurance Company, Baltimore, Md.

PUBLISHERS' NOTICE.

All new subscriptions, or renewals of old ones, will be commenced with the new volume, July 5, unless a request to commence at some other date accompanies the order.

The volume from January to July, consisting of twenty-six numbers, may be had in sheets, by mail, at the regular subscription price, namely, $1.50, or in substantial binding, at the office of publication, for $3, or by mail, including postage within the States, for $3.75. The first volume of the SCIENTIFIC AMERICAN for 1873, in sheets, and a copy of the SCIENCE RECORD, for either 1872 or 1873, will be mailed on receipt of $3, or a volume of the SCIENCE RECORD for each year and the last or coming six months of the SCIENTIFIC AMERICAN (optional to the subscriber) will be sent for $4.50.

Bound volumes of the SCIENTIFIC AMERICAN from January to July, 1873, and the SCIENCE RECORD, either for 1872 or 1873, will be forwarded by mail or express, free, for $5. Copies of the SCIENCE RECORD for 1872 and 1873, and the first volume of the SCIENTIFIC AMERICAN for 1873, bound, will be sent for $6.50, or delivered at the publication office for $6.

BINDING.—Subscribers wishing their volumes of the SCIENTIFIC AMERICAN bound can have them neatly done at this office—Price $1.50.

Remit by postal order, and address MUNN & CO., 37 Park Row, New York.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH

TERMS.

One copy, one year	$3 00
One copy, six months	1 50
CLUB RATES { Ten copies, one year, each $2 50	25 00
CLUB RATES { Over ten copies, same rate, each	2 50

VOL. XXIX., No. 4 . . [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, JULY 26, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

FRICTION OF WATER IN PIPES.

In a perfectly straight and smooth pipe, the quantity of water that will be discharged in a given time depends only upon the head. The velocity of the water will be that acquired by falling through the given head, and the quantity discharged will be the velocity multiplied by the cross section of the pipe. Algebraically, these results will be expressed as follows: $v^2 = \sqrt{2gh}$, and $Q = v \times S$, where v is the velocity in feet per second, h the head in feet, Q the number of cubic feet discharged per second, g the velocity acquired by a body in falling one second, and S the cross section of the pipe in feet.

In practice, it is found that the actual velocity with the smoothest pipes made is much less than the theoretical, part of the head being taken up in overcoming the resistance of friction. In the case of curved pipes, there is another loss of head, and consequently of velocity, at each bend. Numerous experiments have been made to determine the amount of this frictional resistance, and formulas have been constructed from the results. These formulas should always be checked by actual experiment, when great accuracy is required, as the results are greatly altered by seemingly unimportant details. Our object, in this article, is to give the best and simplest formulas for general use. Very good tables, showing the amount of water discharged under different heads from pipes of various diameters and lengths, will be found in Trautwine's "Engineer's Pocket Book."

For smooth iron pipes, Prony's formula is as follows: $h = 0{\cdot}00040085 \times L \div d[(v + 0{\cdot}15412)^2 - 0{\cdot}02375)]$, which may be thus translated: To find the necessary head of water to produce a given velocity of discharge, add 0·15412 to the velocity, square the sum, subtract 0·02375, and multiply the difference by 0·00040085 times the length of the pipe divided by the diameter, noting that all dimensions are to be taken in feet.

In 1858, some very interesting experiments were made by the Brooklyn Water Commissioners to determine the friction in pipes, the pipes experimented upon being very much corroded by long use; and, from the data so obtained, Prony's formula was modified to meet this case. The formula constructed from their experiment is: $h = 0{\cdot}00046749 \times L \div d(v + 0{\cdot}397)^2$, or: To find the head corresponding to any required velocity, add 0·397 to this velocity (expressed in feet per second), and multiply the sum by 0·00046749 times the length of the pipes divided by the diameter, in feet. For ordinary use, a much simpler formula, by Mr. Lane, will answer: $h = 0{\cdot}000625 \times L \div d \times v^2$, or: The required head equals the square of the velocity multiplied by 0·000625 times the length, divided by the diameter of the pipe, all measurements being taken in feet.

Knowing the actual head required for any velocity of discharge, we can readily ascertain the head required to overcome friction, and consequently the increased pressure necessary, in pounds per square inch. Thus, the theoretical head (disregarding prejudicial resistances) necessary to produce a given velocity is found by dividing the square of the velocity by 64·4; or, expressed algebraically, the formula is $h = v^2 \div 2g$, and the difference between the actual and theoretical head is the amount required to overcome friction. The pressure per square inch required to overcome this friction is equal to the weight of a column of water of one inch cross section, and with a hight equal to the ascertained head.

In order to render the preceding remarks more intelligible, we will assume data and work out an example by each formula. Length of pipe = 100 feet, diameter of pipe = 3 inches. Required velocity = 2 feet per second. By Prony's formula:

Required head $= 0{\cdot}00040085 \times 100 \div {\cdot}25 \times [(2 + 0{\cdot}15412)^2 - 0{\cdot}02375)] = 0{\cdot}74$ feet.

By Brooklyn Water Commissioners' formula:

$\text{Head} = 0{\cdot}00046749 \times 100 \div 25 \times (2 + 0{\cdot}397)^2 = 1{\cdot}07$ feet. In this case, the pipes being very much corroded, the resistance is greater, and more head is necessary.

By Lane's formula: $\text{Head} = 0{\cdot}000625 \times 100 \div 0{\cdot}25 \times v^2 = 1$ foot. (Pipes in average condition).

A correspondent has asked us what is the difference of friction in a pipe, under 15 pounds pressure and under 150. We will use Lane's formula in making the necessary computations for the answer, though the same method would answer with either of the others.

A column of water, to have a pressure of 15 pounds per square inch, must be about 34·6 feet high. We will assume the diameter of the pipe to be 6 inches, and the length to be 500 feet. Then the formula gives: $34{\cdot}6 = 0{\cdot}000625 \times 500 \div 0{\cdot}5 \times v^2$. From which we find that $v = 7{\cdot}44$ feet per second. The theoretical velocity corresponding to a head of 34·6 feet is equal to the square root of 64·4 multiplied by 34·6, or 47·2 feet per second, and the theoretical head necessary to produce a velocity of 7·44 feet per second is the square of 7·44 divided by 64·4, or about 0·86 feet; so that the head necessary to overcome friction is 34·6—0·86=33·74 feet, and this produces a pressure of about 14·6 pounds per square inch.

In the second case, when the pressure on the pipe is 150 pounds per square inch, the head of water will be about 346 pounds per square inch; and substituting this value in the formula, we have: $346 = 0{\cdot}000625 \times 500 \div 0{\cdot}5 \times v^2$. From which we obtain: $v = 23{\cdot}53$ feet per second. The theoretical head required for this velocity is the square of 23·53 divided by 64·4, or about 8·6 feet; so that the head necessary to overcome friction is 346—8·6=337·4 feet, which corresponds to a pressure of about 146·2 pounds per square inch. By comparing the velocities under the two given pressures, it will be seen that the velocity is about 3·16 greater in the second than in the first case, while the pressure necessary to overcome friction is 10 times as great in the second case. Now the square of 3·16 is about 10, and we say that friction in pipes increases as the square of the velocity of discharge. We hope we have succeeded in making this matter plain to our readers. We have given them formulas which apply to the flow of water in iron pipes under various conditions, these formulas embodying the results of the most reliable researches on the subject.

THE ZODIACAL LIGHT.

The name zodiacal light is given to a faint nebulous appearing radiance, which, at certain seasons of the year, and especially within the tropics, is seen in the west after twilight has ended or in the east before it has begun. The light is conical in shape, the breadth of the base varying from 8° to 30° in angular magnitude, and the apex being sometimes more than 90° to the rear or in advance of the sun.

Very many theories have been adduced to account for the phenomenon. Kepler supposed it to be the atmosphere of the sun. Cassini considered it as a lenticular solar emanation, and Mairan believed it a reflection from the sun's atmosphere, stretched out into a flattened spheroid. La Place, however, founded the theory which astronomers have generally adopted, and in his *Système du Monde* he pronounced it a nebulous rotating ring, situated somewhere between the orbits of Venus and Mercury. It is unnecessary to enter into any discussion of these earlier views, as probably the best records extant which tend to explain the nature of the phenomenon are the observations of the Rev. George Jones, chaplain of the United States Japan Expedition, made on the Pacific Ocean, over an uninterrupted period of two years from April, 1853. Of these we give below the general conclusions in order that the reader may compare them with the theory of a correspondent, Mr. T. R. Lovett, which will be found, with an explanatory diagram, on another page of this issue. We may here remark that the idea therein stated, ascribing the zodiacal light to the reflection of the rays of the sun from the atmosphere, seems to us plausible, particularly as it accounts quite clearly for portions of the phenomena especially noted by Mr. Jones. The pulsations or intermittent variations in luster of the radiance, observed by Humboldt and others, our correspondent ascribes to refraction in the body of the atmosphere, or irregular motion of its surface. Mr. Jones, in referring to the same appearance, speaks of two distinct degrees of luster, a triangle within a triangle, the boundaries of which could be detected. It will be observed, on examining the explanation of the new theory, that these two triangles may be accounted for by the observer seeing both base and elevation of the spherical triangle, reflected from earth to atmosphere and thence to the eye. Again Mr. Jones states that when his position was north of the ecliptic the main body of the light was on the north side of the line, and conversely when he was south of the sun's apparent path; but when he was on or near the ecliptic, the light was equally or nearly divided by that line. Our correspondent's views agree with this, for he considers that when the spectator is in the plane of the ecliptic, that is, when the latter is perpendicular to his horizon, it is the only period when he can see the double light pyramids at east and west at the same time. Mr. Jones says that at midnight he saw the light simultaneously on both eastern and western horizons, which also agrees with the second proposition of Mr. Lovett. The remainder of Mr. Jones' conclusions ascribe the phenomenon to a nebulous ring similar to that which surrounds the planet Saturn. He considers the change of shape of the light due to change of horizon attributable to new portions of nebulous matter coming into position to give visible reflection, while portions lately visible were no longer capable of giving such reflection. The change of shape he believes based on a principle similar to that of the rainbow, the arch of which is new with every alteration of position. Hence the parallax of the light cannot be found. This may be compared with our correspondent's first conclusion.

Mr. Jones alludes to the reflection from the atmosphere theory, but does not believe that the light takes its shape from such cause, because "the lenticular elongation of the earth's atmosphere, consequent upon diurnal rotation, must be directly over the earth's equator; while the course of the zodiacal light shows not the slightest affinity for this line." The other conclusions point out that, as a nebular ray, it cannot lie between the orbits of Mercury and Venus as shown by La Place, that it must be something continuous and unbroken, that Mairan's theory above given cannot be true, that the substance of the light cannot be very remote from the earth, owing to its alteration of outline due to change of observer's position, and that it seems full of internal commotions.

THE GREATEST GAS WELL IN THE WORLD.

The Newton gas well, six miles from Titusville, Pa., discovered last year, still continues to pour forth its gaseous treasures at the rate of three millions of cubic feet of gas every day of twenty-four hours. The gas issues under a pressure of from twenty to thirty pounds per square inch, and for the most part goes to waste. Pipes have been laid to Titusville, and some two hundred and fifty dwelling houses, shops, etc., are now supplied with the gas for illumination and fuel. For heating purposes it is admirable, but for illumination it requires to be passed through naphtha, as it is deficient in carbon.

This well may be justly regarded as one of the wonders of the world. If the bowels of the earth in its vicinity were transparent, and the owners could satisfy themselves of the continuity of the gas flow, we presume that pipes would be laid from the well to several of the large cities, such as Pittsburgh, Cleveland and Buffalo, distant from 130 to 150 miles.

We have heretofore published accounts of the gas wells at Painesville, Ohio, and other places. But we believe that the quantity of gas delivered by the Newton well exceeds the combined supply derived from all other wells in the country

TO EUROPE BY BALLOON.

We publish on another page a variety of particulars concerning the construction of the great *Graphic* balloon, wherewith Professors Wise and Donaldson intend to attempt the passage of the Atlantic, starting from New York about the 20th of August next.

The only chance for a successful issue of this hazardous voyage, almost the only chance, indeed, for life which the daring aeronauts will possess, depends upon the flotant endurance of the aerial ship. To fortify the apparatus in this respect will be the paramount consideration of the navigators. Doubtless they would be glad to elongate the balloon, provide propellers and steam power, and so continue the experiments in aerial navigation ably begun by De Lôme and others. But the necessities of the present occasion forbid.

The ordinary rotund form of balloon, although unsuited for mechanical propulsion is best adapted for strength as a gas holder, and this is the form that has been wisely chosen.

Professor Henry, writing to the *Graphic*, also to Professor Wise, fully endorses the views of the latter in respect to the existence of constant easterly currents above the earth, and expresses the belief that, if the balloon can be kept afloat long enough, she may be wafted over the ocean to Europe. But he does not recommend the attempt, and, if it must be undertaken, wishes that some other person, in whom he had less personal regard than Professor Wise, were about to make the trial. He thinks that, as preliminary to this ocean voyage, Professor Wise ought to make an overland flight from the Pacific to the Atlantic, a distance nearly equal to the width of the Atlantic ocean.

To this Professor Wise replies that the easterly currents will be found steadier and safer over the ocean than above the land; and he prefers to take the risks of dropping into the sea rather than the chances of bumping against the cliffs of the Rocky Mountains.

In view of the Professor's experiences on his great voyage from Missouri to New York, in 1859, described in our last number, we think his conclusion is correct. He expects to be able to keep afloat in the air for at least ten days, while only three days will be actually required for the great "waft." To us, the probabilities of his success appear to be little better than those of an individual who, in an open boat, without sail or oars, should attempt to float across the Atlantic upon the surface of the Gulf Stream.

A NEW SUBSTITUTE FOR RUBBER.

Daniel M. Lamb, of Strathroy, Canada, is the author of a method of producing gum from the milkweed plant, or other plants of the asclepia family, and flax and other seeds, which consists by macerating and fermenting the substances and then by evaporation reducing the resulting liquid to a thick gummy mass. The gum thus obtained may be cheaply produced, and is alleged to have many of the valuable qualities of rubber. It is insoluble in water, may be vulcanized with sulphur, etc. The price of pure rubber is now very high, and the discovery of an economical substitute is a matter of the greatest importance in the arts.

J. H. F. reports the discovery of a fossil corn shuck in Missouri. It was found 30 feet below the surface, imbedded in clay.

SCIENTIFIC AND PRACTICAL INFORMATION.

OXYMALEIC ACID.

M. Bourgoin gives the above name to a new organic acid which he states differs from maleic acid by 2 equivalents of oxygen, and from malic acid by 2 equivalents of hydrogen. Thus: Maleic acid $= C^8H^4O^8$, oxymaleic acid $= C^8H^4O^{10}$, malic acid $= C^8H^6O^{10}$. The new substance is solid, white, and of an odor similar to that of malic acid. It is very soluble in water, which it abandons on evaporation, under the form of very delicate, long, penniform crystals. It is equally soluble in alcohol and in ether, separating itself from the latter vehicle in the shape of elongated crystals grouped in stars.

NEW QUARRIES OF LITHOGRAPHIC STONE.

New quarries of lithographic stone have quite recently been found in Italy near the French frontier, and on the coast of the Gulf of Genoa; from these it is stated that an excellent quality of lithographic stone has been obtained. This discovery is of great importance, as of late years the supply of this stone, which has been almost exclusively, for European use, obtained from Germany, has been gradually diminishing, in proportion as the beds in that country were depleted.

MEDICATED CRACKERS.

M. Limousin, a Prussian apothecary, encloses powders, such as quinine, aloes, rhubarb, and other drugs disagreeable to swallow, in crackers. The cracker is split and a matrix made within, in which the powder, carefully measured, is placed. The two parts of the envelope, which is quite small, are then closed together and secured. When taken, it is soaked in water for a moment until softened, then gulped down whole.

STILL ANOTHER NEW ANILINE RED.

By allowing a few drops of chloride of sulphur to act upon 30 grammes of aniline, the mixture being continually stirred, Hamel has produced a new red dyestuff, which, in 10 minutes, became solid. This body dissolves in acetic acid with a red color, and on evaporating this solution to dryness, a black, glistening mass is obtained. Like most aniline dyes, it dissolves in alcohol, ether, and acetic acid. The study of this interesting compound has not yet been pursued far enough to ascertain its composition, nor can we yet prophesy its future.

STEEL BOILERS.

The steamboat Mary Powell, running daily on the North river, between this city and Rondout, has recently been fitted with steel boilers. We append the dimensions and weights, which may be interesting to our readers. There are two boilers, of the form known as flue and return tubular. Each boiler has 10 flues of different diameters, 9, 15, and 16 inches, and 80 tubes of 4½ inches outside diameter. Each boiler is 11 feet front, 25 feet long, and the diameter of shell is 10 feet. The sheets of the boiler are of steel, made by Parks Brothers, of Pittsburgh, and having a tensile strength of 70,000 pounds per square inch. The sheets are $\frac{5}{16}$ of an inch thick. Each boiler has two furnaces, each 8 feet in length and 4½ feet wide. Blowers were used with the former boilers, to promote the draft; but a novel form of steam jet is at present employed, which seems to work very satisfactorily. The grate bars are cylindrical in form on top, and are provided with mechanism so that the fire can be shaken down when it is dull, somewhat after the manner of a grate in an ordinary stove. The boilers weigh 28 tuns each, the weight of the two being 7 tuns less than that of the old boilers. The consumption of coal per round trip is about 24 tuns. The diameter of the steam cylinder is 62 inches, and the stroke is 12 feet. The engine makes 23 revolutions per minute, the steam pressure being between 35 and 36 pounds.

The Auroral Phenomenon of June 26.

The brilliant aurora borealis of the evening of Thursday, June 26, was accompanied by the appearance of a series of bars of light moving in rapid succession towards the north and disappearing, other bars coming on at the southern end of the series. Mr. G. Meyer, of Richmond, Mich., Rev. A. S. Talcott, of Garretsville, Ohio, Mr. H. P. Cobb, of Northville, Mich., and Mr. J. D. Beck, of Liberty, Pa., have reported the singular phenomenon to us, it being visible at the respective localities under slightly various forms.

A New Steam Organ.

Thomas Winans, of Baltimore, the well known railway contractor, machinist, etc., is building, for his private music hall in the above city, a gigantic organ. It is to be worked by steam power. It will have twenty-five bass pipes each two feet square and thirty two feet long. It is to be finished within a year, and it is expected that it will be a roarer. Compared with it, the great organ of Boston will dwindle into insignificance.

M. KRUPP has just insured his steel factory at Essen, in twelve German companies, to the amount of $5,697,912. This sum includes the value set upon only the portions of the establishment liable to destruction by fire, and not that of the steam foundery, railroads, telegraph lines, canal system, special shops, and metal stock.

PHINEAS ALLEN, JR., for many years editor of the Pittsfield (Mass.) *Sun*, died in that town on July 4. The *Sun* was founded by and preserved in the Allen family for a period of 72 years, having been established in 1800.

THE extensive collections and preparation of mosses, made by the late William S. Sullivant, were bequeathed to Harvard University.