THE TELESCOPE AT THE TROCADERO OBSERVATORY.

We represent herewith one of Mr. Leon Jaubert's telescopes arranged and constructed especially for the popular observatory of the Trocadero, and which has now been in daily use for nearly three years.

It is a short focus instrument, having only half the focal length of those formerly constructed by Mr. Leon Foucault. Its optical part consists of:

1. A silvered glass reflector, 16 centimeters in diameter, placed in the bottom of the tube. 2. A total reflection prism designed for sending the luminous fascicles, as in all Newtonian telescopes, to the lateral part of the instrument.

3. An ocular formed of several glasses arranged like the different lenses of a compound microscope, and giving an upright image.

It is through this ocular that the observer looks at the image given by the reflector.

The different pieces that go to make up the mechanical part produce, as a whole, a very beautiful effect. The instrument appears to be very light, while in reality it is very solid. The base rests upon a wooden frame mounted upon three rollers. The instrument is accurately leveled by means of three leveling screws. The base supports an openwork frame which carries a horizontal axle that may be called the axis of latitude. This serves for fixing, by means of a set screw, the horary axis on the latitude of the place where the observations are made. The horary axis is connected with the circle and horary wheels. The disk of the circle is likewise provided with a frame that carries the axis of declination, this latter being formed by the two trunnions belonging to the ring that surrounds the telescope tube. One of these trunnions carries a graduated circle accompanied by a vernier and called the circle of declination, and the other, a toothed wheel which is actuated by an endless screw.

The endless screw that actuates the horary wheel and the one that actuates the declination wheel are each mounted upon a hinged frame, which permits of engaging them instantly with the corresponding wheel, or of separating them in such a way that the instrument may revolve freely around the horary axis and that of declination.

In both its optical and mechanical parts this telescope presents some very interesting details.

Mr. Jaubert has placed in the opening of the instrument a cap which carries a circular glass whose surfaces are perfectly parallel and optically finished, and which is designed for protecting the silvering of the reflector from dust and atmospheric moisture. When it is desired to make an observation of the sun, this cap is replaced by a second one which carries a glass that is silvered upon one of its surfaces. The solar rays traverse the pellicle of silver, reach the parabolic reflector in small quantity, return in a condensed fascicle toward the prism, and, on reaching the eye of the observer, have but slight intensity. The rays thus weakened scarcely ever distort either the reflector, the prism, or the lenses of the eye piece. The mass of air inclosed within the telescope is also less superheated at the focus, and remains calm. Not only are the images better, but the reflector, prism, and eye piece are no longer liable to breakage, and the observer runs no risk of being blinded.

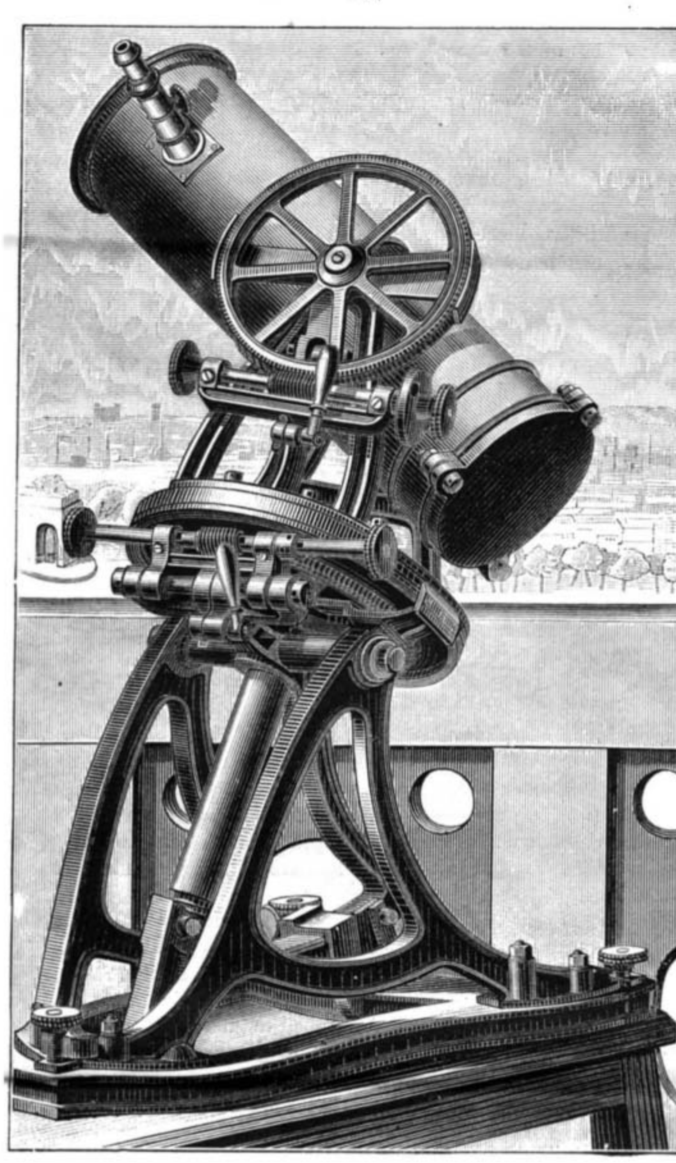
The reflector is mounted in a tube whose form merits notice. The external and lateral part of this tube, as well as the internal part of the telescope tube into which it is introduced, are both formed of two circular zones of the same diameter, one convex and the other concave. This simple arrangement has the advantage of permitting of the easy introduction of the reflector into the instrument, and of centering it instantly by tightening one or the other of the three bolts that connect the lugs of the tube with those of the breech piece. In order to remove it, it is only necessary to right the body of the instrument and take out the bolts, when the reflector tube will drop out of itself.

The telescope is provided with a revolving eye piece which carries four lenses, one of which is used as a finder, while the others give different magnifications. Mr. Jaubert has also devised for his telescopes, as well as for his microscopes, different styles of binocular eye pieces. He has also applied to the opening of his telescopes a special optical combination designed to bring within the field of the instrument stars that are very remote from one another, so as to compare the intensity or color of their light, or to compare the diameter of the sun and the moon, or the diameter of Venus, Jupiter, and Saturn when these different celestial bodies are no farther than 100, 120, or 130 degrees apart. The popular observatory makes use of telescopes of from 20 to 30 centimeters diameter, and these are employed by the amateurs who are attending the course of lectures on astronomy at the institution.—*La Nature.*

THE export of ostrich feathers from the Cape last year was unprecedentedly large. The prices obtained were enormous.

Zinc Blende at Niagara Falls.

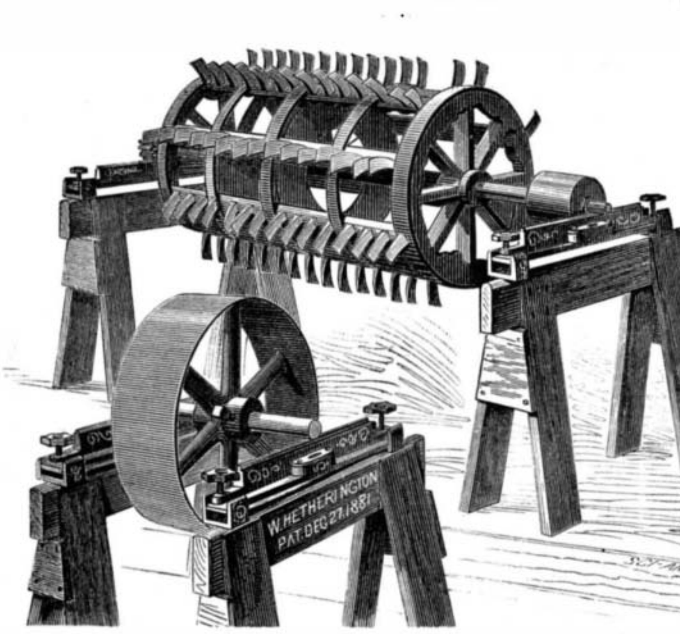
Prof. Osborn, of Miami University, Oxford, has discovered the beautiful amber colored mineral known to mineralogists as zinc blende or sulphide, in small quantities in the rocks at Niagara Falls. It may be found both above and below the inclined plane, but in the rocks which have recently been broken off, and sometimes in pieces several inches in length, especially in one immense block which has become detached from the American side, and lies near the water about 150 yards from the American Falls, in which one piece nearly five inches long was found. The specimens analyzed by Prof. Osborn all gave about 60 per cent zinc with traces of iron, but are only interesting as beautiful specimens of the mineral.



THE TELESCOPE AT THE TROCADERO OBSERVATORY.

PARALLELS FOR BALANCING PULLEYS, ETC.

We give an engraving of improved parallels for balancing pulleys, thrasher cylinders, and other rotating parts of machinery. Usually the parallels are blocked up by wedges of wood, pieces of pasteboard, or anything else at hand, the level is applied, and the parallels are leveled approximately after the expenditure of much valuable time. The improvement shown in the cut has been patented by Mr. W. Hetherington, and is designed to facilitate the operation of leveling the parallels. Each bar is provided with a level and with a leveling screw at each end, so that the adjustment may be very quickly and accurately made.



IMPROVED PARALLELS FOR BALANCING PULLEYS, ETC.

These parallels are very desirable for machine shops, planing mills, etc., for balancing pulleys, saw arbors, planer heads, spindles, and all kinds of high speed machinery. They will also find extensive use among thrashers for balancing separator cylinders in the field, thus saving a trip to the machine shop.

Further information may be obtained by addressing Messrs. Hetherington and Lukenheimer, St. Cloud, Minn.

English Torpedo Experiments.

An interesting series of torpedo experiments, carried out conjointly between the 28th Company of Royal Engineer Submarine Miners, under the command of Capt. Bucknill, R.E., and Capt. Markham and the officers of the Vernon Torpedo School, lately took place in Portchester Lake, Portsmouth.

The experiments illustrated the operations of torpedo attack and defense, and were also intended to determine certain debatable points with respect to formulæ, the resistance of various breadths of water cushions, the lateral effects of different charges of gun cotton, etc. For these purposes War Office tubular dynamometers and crusher gauges were extensively used, the reading of which will form the subject of subsequent consideration.

The first experiment was the most exciting and important of the series. It was for the purpose of practically ascertaining the effect of a ground mine, consisting of 250 lb. of gun cotton, upon a steam launch, moored broadside on at a distance of 50 feet horizontally from it, the submersion of the charge being 30 feet. The launch, which was moored fore and aft, was in complete steaming trim, the pressure in the boilers being regulated at 40 lb. to the square inch. The mine was fired from the Nettle at the slack of high water. The detonation was loud and startling, but the practical results were disappointing. The whole energy of the explosion seemed to be in a vertical direction, the upward rush throwing up a splendid dome of water, and the downward blow producing a considerable up heaval of mud.

The lateral extension of the force was comparatively insignificant, for not only were the machinery and boiler of the launch uninjured, but it was scarcely shaken. In future experiments the attack will be made at gradually reduced distances, until the target is disabled. The use of hand charges of gun cotton was next exhibited. While a boat steamed rapidly through the water, a grenade containing 9 oz. of gun cotton was thrown into a cask and fired by means of an instantaneous fuse and a pistol. The cask was shattered into a thousand fragments, the result showing the fatal efficacy of the weapon when directed against open boats. A run was next made with a Whitehead torpedo discharged from an impulse tube above water. The projectile went straight to the target, after passing which it got its nozzle into shallow water and stuck. Various charges of gun cotton lashed to floating spars were afterward simultaneously fired at a uniform depth of 3 feet, for the purpose of testing the accuracy of Abbot's formulæ.

The method of countermining mined channels was shown by means of blowing charges, the whole single line being simultaneously exploded. Two outrigger charges of gun cotton, each 35¼ lb., were also fired from a steam pinnace, which maneuvered in going ahead and turning, lowering its spars, reversing, and firing without a man being seen. The explosive force of the explosions was so violent that no ship could have withstood it. While this experiment was taking place, some practice with small guns was going on from the Excellent close at hand, and it was impossible to overlook the chances in favor of an outrigger attack.

The practice was made from a permanent, and consequently steady, platform, at targets at well known and unvarying ranges; and when it is considered that the targets were never once hit, the difficulty of staving off the attack of a rapidly moving torpedo craft will be easily recognized. The last experiment was made to test the effect of a boat mine upon a whale boat containing a dummy crew. The mine consisted of 12 lb. of gun cotton confined in a circuit closer jacket, sunk 2 feet under the water and at the same distance from the target. When fired, the whale boat rose piecemeal into the air, and descended in a rain of fragments.—*London Times.*

Canine Intelligence.

A remarkable instance of the fidelity and sagacity of the dog lately happened at Milford Haven. Two men named Davies and Taylor were out in a boat, which was swamped. The former of these was the owner of a dog, and while the men were struggling in the water the animal caught hold of Taylor with the object of supporting him; finding, however, that it was not his master to whom he was rendering this assistance, he relinquished his grasp and went to the aid of Davies, his master, supporting him until he was rescued by a passing steamer, the other man being drowned.

There are fifty-six shops for the sale of horse-flesh as food in Paris.

Brass and Its Uses.

It is an interesting fact that all the principal metals, with their amalgamations and alloys, have certain distinct and exclusive uses to which they are adapted, and for which no other metal can be substituted with as good results. The fact that for many uses one metal may be substituted for another to advantage does not change the other fact that there are certain adaptations and a certain fitness of things which give exclusive value to certain metals for certain uses. Thus, no matter how golden the age in which we live, the use of gold for fireplace fenders would be out of place, and not alone on account of its costliness. So the use of brass for personal ornament is equally unfitting.

Brass is mentioned in the earliest writings, although in many instances the word bronze would more correctly represent the character of the metal spoken of. Among the ancients, those who could not ornament with pure, solid gold seized that which looked the most like it, and answered, practically, the same purposes. Brass as an alloy will bear a variety of metals. Corinthian brass of the ancients combined, in its make, a proportion of gold and silver, as well as copper, tin, and other metals. Metallurgy is now so well understood that copper, zinc, tin, magnesia, sal ammonia, crude tartar, and other chemicals, in the hands of practical artisans, may be so combined that a metal can be made which will not only look like gold, but take a finer finish and remain longer bright, whether in use or in a state of rest, than the purest gold of California! For this higher grade of brass there is an increasing demand for many purposes. First-class banking houses become resplendent when finished up with choice rolled, perforated, polished, and otherwise ornamented brass, according to the position it is to occupy in forming divisions of the departments. Such brass shields may be so finely finished that for months, with a very little daily care, they will remain as bright and beautiful as a newly coined double eagle. For these good reasons perforated plate brass is in demand for not only bank work, but in first-class offices of all kinds.

Then, however comfortable our best automatic furnaces, or soft and diffusive the warmth of our extra plated and ornamented base heaters, gentlemen who are finishing up fine dwellings for their own use, in which they expect to spend the greatest proportion of their remaining days, like to retain the good old style of both their European and American ancestors, who sat before an open log fire or an open grate of coals! These, in every double parlor, under ample mantels, require not only grates of the most improved kind, but a variety of furniture, the ornamentation of which draws largely on the brass founder and his most skillful and ingenious workers. These very beautiful brass-decorated open grates have proved to be extremely attractive to young children, and genius of a high order has been in demand to concentrate its best powers to furnish such a "fender" as shall prove a guard, not only for the uncertain steps of childhood, but for the influence which a strong current of air has over the apron and pinafore; for these articles also need a barrier to the attractive draught of a glowing fire of coals. These brass fenders admit of very great elaboration. While very beautiful as shields, they must neither hide the glowing coals nor obstruct their light or warmth. For these adjuncts of the open grate no metal has yet been discovered so good as brass, for while it reflects much warmth, it is not injuriously affected, either in texture or polish, by an ordinary grate fire of coals. It is, therefore, an admirable metal for all stove and grate furniture or ornaments. Fenders, fire-irons, etc., in polished brass, with coal vases, fire-brasses, and dogs *en suite*, are in demand on both sides of the sea. A staple trade is done in polished all-brass fenders and curbs, composed of reeded rails and spindles, alternating with *repousse* or cast panels. A brass embossed Japanese fender in panels with bright steel bottom gives a pleasing effect. Pretty designs in Berlin black, relieved by buffing, supply cheaper goods. An effective fire-dog is a T-shaped tubular rest, with reeded base and knobs, and connecting scrolls in the Renaissance style. Another popular design is of tubular brass with cast supports in the Renaissance style, relieved by portions in gilding metal.

Among late and most beautiful tea and coffee urns may be seen those of brass. Mounted on a base or stand of the same metal, they are suspended on trunnions—similar to the latest style of ice pitchers—or hinged to their base they tip easily, and pour their contents with scarcely a perceptible effort on the part of the waiter. These goods are both exceedingly attractive and useful.

There is, also, a richness and beauty about a fine harness all of whose hardware is brass, that cannot be gained by any other combination. The pure polished black and yellow give the finest "jet and gold" that can readily be obtained.

The tendency in carriage, railway coach, and, indeed, in house furniture generally, is in the same direction. Butts, hinges, door knobs for passenger cars, have for some time been of bronze, as have been the hand-bag racks in the finest passenger car coaches, but fine brass wire or perforated rolls are now preferred on account of superior brightness and beauty. And for draw knobs brass "half shell" handles are—by all who use draws—greatly preferred, both for beauty and convenience.

These are but a few of the tendencies of the times which indicate a wiser and more extensive use of fine brass than heretofore. Time and space would fail to give merely a synopsis of its uses in the arts; its necessity to the machinist, especially machinery of the finest kinds, clocks, watches, chronometers, and philosophical instruments of all kinds; its adaptableness for lamps, chandeliers, gas-fittings, meters, and all kinds of scales. In proportion, therefore, as a people advance toward the highest kind of knowledge—that of best adapting means to ends—will there be an increasing demand for brass in machinery, in scientific instruments, and in all efforts to give permanent ornamentation which shall be excelled only by pure gold.—*Amer. Artisan.*

Origin and Development of Steam Navigation.

Rear Admiral George Henry Preble, of the retired list of the United States Navy, and one of its oldest officers, has written an interesting volume entitled "A Chronological History of the Origin and Development of Steam Navigation."

The work begins with the first practical use of steam as a motive power for vessels by Blasco de Garray, at Barcelona, Spain, June 17, 1543, and shows the advancement of steam navigation to the present time. The proposition of De Garray in 1543 appeared ridiculous, but he was so convinced of its ultimate success that he influenced the Emperor Charles V. to appoint a commission to witness his experiments. They were, in a degree, successful, and De Garray was promoted to the rank of an officer and rewarded with a considerable sum from the treasury.

In 1630 Charles I. of England granted a patent to David Ramseye, "to make boats, shipes, and barges to go against strong wind and tide." While Denis Papin, a French engineer, is claimed to have been the inventor of the steam engine in 1690, Jonathan Hulls, who in 1736 obtained a patent for propelling a boat by steam, which, however, was never put to practical experiment, was no doubt the first Englishman who proposed to apply that power to naval purposes. James Watt, who did more to make navigation by steam a practical success than any inventor who preceded him, obtained his first patent for a steam engine in 1769. The general idea of propelling vessels by a submerged helix or screw is ancient, and its modern application to vessels propelled by steam power, Admiral Preble shows, is not due to any one man.

A vessel built by Capt. Ericsson was probably the first practical screw propeller the world ever saw. The successful application of steam to the purposes of ocean navigation has brought with it an era of rapid improvement in naval architecture and all other matters relating to nautical affairs.

In the year 1810 arrangements were made with Robert Fulton to construct a steam ferry boat, and on July 2, 1812, one named the Jersey began running between Paulus Hook, Jersey City, and New York. The event was celebrated with a grand banquet given by Jerseymen to the New York Common Council. The boat was supposed to make half hourly trips, but frequently an hour was consumed in making the passage. Near the close of 1814 Fulton exhibited to the President of the United States the drawing of a proposed war steamer or floating battery. The project was favorably received, and on June 20, 1814, the keel of Demologos or Fulton the First was laid at Brown's shipyard in New York. She was launched on October 29, 1814. After the war she was used as a receiving ship at the Brooklyn Navy Yard until June 4, 1829, when she was accidentally or purposely blown up.

Coming down to the construction of the American steamship Savannah, the first ocean vessel propelled by steam, and which made the passage from New York to Liverpool in twenty-six days in 1819, the author declares that Mr. Woodcroft was grossly in error when he pronounced her, in his work on "Steam Navigation," a myth. She was built at Corlaers Hook, New York, and was of 318 tons burden. The first steamboats to ascend the Missouri, Admiral Preble says, were three little Government boats, in 1819, one of which carried the figurehead of a serpent at her prow, and through the reptile's mouth the steam was discharged. When the savages saw this they fled in alarm, fancying the spirit of evil was coming bodily to devour them. In the same year the first steam vessel, the Robert Fulton, was put on the route between New York, Charleston, Havana, and New Orleans. She was afterward sold to the Brazilian Government, and was running as late as 1838. On July 12, 1822, the Rhode Island and New York Steamboat Company was formed, and this was the beginning of the Long Island Sound traffic.

The first iron clad battery was conceived by Robert L. Stevens, of Hoboken, in 1832. It was to be an iron armed ship, 250 feet in length. The keel was laid at the foot of Fourth Street, Hoboken, in 1843. At odd periods new improvements were designed, and upon his death Mr. E. A. Stevens left $1,000,000 to complete the vessel, directing that it should then be given to the State of New Jersey. The million was expended, suits were brought by the heirs, and at last, in 1880, the unfinished war vessel was sold as old material to W. E. Laimbeer for $55,000. Admiral Preble accords to John Ericsson the credit of inventing the first practical screw steamer in 1836, and the famous Monitor. Capt. Ericsson also had the honor of designing the Princetown, the first screw war vessel ever constructed, although Fulton the Second was the pioneer steam war vessel of our present naval organization, and the second war vessel built by the United States.

Experience having shown that a sea steamer of 1,800 tons, making the quickest passages to and from England and Australia, with a full cargo and complement of passengers, lost by the voyage from £1,000 to £10,000, did not deter the Eastern Steam Navigation Company, with a capital of £1,200,000, from building the Great Eastern, a vessel quite overshadowing Noah's Ark. The Great Eastern was 680 feet in length, 83 feet beam, 58 feet depth of hold, and 28,093 tons measurement. Noah's Ark was 547 feet in length, 91 feet beam, 54 feet depth of hold, and 21,762 tons measurement. The Great Eastern was eleven days making the trip to New York.—*Elevated Railway Journal.*

The Salmon Disease.

An interesting lecture was recently delivered by Professor Huxley at the Fisheries Exhibition Congress, upon the disease which makes such ravages among fresh water fish, particularly the salmon, and sometimes in the form of an epidemic. This disease, which is marked by the appearance of whitish patches on the skin of the fish, is attended with great mortality. In the last five years from 2,000 to 4,000 diseased fish have been taken out of the Tweed, and a like number from the Eden every year. Last year as many as 600 diseased salmon were taken out of a small river like the Leme. On the east coast a few cases have appeared in the Coquet, but none in the Wear. On the Tyne the disease is almost unknown among clean salmon, but it is common with kelts and dace. It may be said that there has been practically no epidemic outbreak in the eastern rivers south of the Tweed. The eccentric course of the epidemic, however, is shown in the fact that on the west coast the state of affairs is totally different, it having made its appearance more and more to the south, until last season it broke out in the Usk and Wye.

The disease is due to the fungus *Saprolegnia ferax*, which abounds in Irish waters, living on decaying organic matter, but having also the property of attacking living organic matter, so that the wonder is that salmon are not always diseased. Professor Huxley pointed out that it was desirable to ascertain the nature of the influences whereby the widespread sporadic disease suddenly assumes an epidemic character. On this point we have very little light at present, for although there is considerable reason for thinking that deficient oxygenation, whether produced by overcrowding or otherwise, may favor the production of the disease, and though it is probable that some kinds of pollutions may favor it, yet the disease sometimes becomes epidemic under conditions in which these two predisposing causes are excluded. The productiveness of a salmon river is not necessarily interfered with by even a severe epidemic, and therefore Professor Huxley's opinion was that on the whole it were better not to attempt to extirpate the diseased fish.

A Balloon Crosses the Channel.

A correspondent of the London *Times* says that two aeronauts, one a Belgian, named Morum, and the other a Frenchman, named Da Costa, without intending it, had succeeded in accomplishing what several balloonists have recently attempted in vain, viz., crossing the Channel. It appears that the aeronauts ascended at Courtrai, in Belgium, on Tuesday evening, with the intention of proceeding in an easterly direction and descending somewhere near Liege or Cologne. When over Louvain, however, they encountered an easterly current which took them over Ostend, and, to their alarm, they were carried out to sea. It appeared as if they would cross the Channel successfully, but suddenly from some unaccountable reason they began to descend. The aeronauts endeavored for some time in vain to check the descent of the balloon, so their position became an exceedingly perilous one. But by throwing overboard large quantities of ballast they again managed to ascend, and before long passed over Dover, when the balloon began to descend again, and next morning alighted in a field near Bromley. The aeronauts were treated with great hospitality, and, having allowed the gas to escape from their balloon, sent it on to London.

Photographic Positives Produced Directly on Paper.

Cros. Vergerand has utilized the properties of bichromates to produce positives directly on paper. He first saturates a suitable kind of paper with a solution of 2 parts of bichromate of ammonia and 15 of glucose in 100 parts of water, dries it, and exposes it under any positive (either a glass transparency, a drawing, tracing, or other flat object). As soon as the exposed parts turn gray it is immersed in a bath consisting of one part of nitrate of silver and 10 of acetic acid in 100 parts of water. The picture makes its appearance at once and is of a blood red color (bichromate of silver).

Wherever the light acts upon it the glucose reduces the bichromate, but in those places which have been protected by the drawing, etc., the bichromate will be unchanged and hence capable of forming chromate of silver, which is insoluble in water. If dried by the fire the picture will remain red, but if exposed to the sunlight it becomes dark brown. Sulphureted hydrogen or a bath of potash and copper turns it black.—*Comptes Rendus.*

Decrease of Immigration.

The report of the Chief of the Bureau of Immigration to July 1, 1883, shows that while for the fiscal year ending June 30, 1882, the number of immigrants into the country, by seacoast and Canada, was 770,422, for the year ending June 30, 1883, the number was only 592,324. And for June, 1882, 84,786 immigrants landed; while for June, 1883, only 75,034 came into the country.

Centrifugal Strain in Revolving Cylinders.

BY S. WHIPPLE.

By the law governing central forces, all parts of a cylinder revolving about its axis exert a centrifugal energy as (proportional to) the weight and square of velocity *directly* and *inversely* as the radius of orbit.

Let R represent the radius, and L the length in feet of a revolving cylinder, and r the radius and v the velocity of revolution, and w the weight of a part at any distance from the axis within the periphery.

And let the cylinder be regarded as constituted of an indefinite number of very thin concentric circular bands or laminæ of uniform density and thickness. Then, the centrifugal tendency (*cf*) of each band will be as

$$\frac{v^2 w}{r},$$

or simply as r^3, since v and w are obviously each as the radius r. Whence it appears that the *cf* of the respective bands increases outwardly from the axis as the squares of respective radii; that is, in the same proportion as the sections of a pyramid parallel with the base increase from apex to base. And as the bulk of a pyramid equals the base into $\frac{1}{3}$ the altitude, so the aggregate *cf* of all the bands constituting the cylinder equals the *cf* of the outside band into $\frac{1}{3}$ the number of bands, or, obviously, equals what would result from a mass of the material represented by the area of the outer band multiplied by $\frac{1}{3}R$; or, a mass equal to $\frac{2}{3}$ the bulk of the cylinder, concentrated in the outer band.

Now, every mathematician or dynamical expert may be presumed to know that the force by which each half of a revolving cylinder tends to pull itself directly from the opposite half has the same ratio to the radial *cf* of material in the half cylinder that the diameter has to the semi-circumference; and as such radial force has been shown to be equal to that of a mass represented by the area of the half outer band into $\frac{1}{3}R$, the force tending to separate the halves, is equal to the radial *cf* of a mass represented by the diametrical section into $\frac{1}{3}R$; that is, equal to $2RL \times \frac{1}{3}R = \frac{2}{3}LR^2$, revolving in an orbit whose radius equals R.

Now the weight of this mass ($\frac{2}{3}LR^2$) equals $\frac{2}{3}LR^2G \times 62{\cdot}5$ lb. (G denoting specific gravity of material, and 62·5 lb. the weight of a cubic foot of the unit material for specific gravity), and substituting this expression for W in the familiar symbol for centrifugal force,

$$\frac{V^2 W}{gR}$$

(in which V = vel. in feet per second, W = weight of revolving body, R = rad. of orbit, and g = vel. due to the action of gravity during one second). We obtain the amount of strain upon an area of section equal to that made by a plane bisecting the cylinder and coinciding with the axis; that is, $= 2RL$.

Hence the equation:

$$\frac{V^2 \times \frac{2}{3}LR^2G \times 62{\cdot}5}{gR} =$$

strain upon an area equal to the bisecting section $2RL$.

Then, dividing by this section, we obtain

$$\frac{V^2 \times \frac{2}{3}LR^2G \times 62{\cdot}5}{2gR^2L} =$$

strain per square foot.

Whence, canceling $2R^2L$, transferring below the line the denominator 3 (of the $\frac{2}{3}$), substituting value of g ($32\frac{1}{6}$ feet), and dividing by 62·5, we have:

$$\frac{V^2G}{3 \times 32\frac{1}{6} \times 62{\cdot}5} = \frac{V^2G}{1{\cdot}544} =$$

strain per square foot; which divided by 144 gives:

$$\frac{V^2G}{222{\cdot}336} =$$

strain per square inch, $= S$. Whence

$$V = \sqrt{\frac{222{\cdot}336S}{G}} =$$

peripheral velocity required to produce a given strain equal S per square inch.

In the case of a grindstone or emery wheel with a hole in the center, the strain given by the formula is increased in the ratio of the reduction of section available for cohesion.

Cost of Live Beef and Dressed Beef.

The increase in the traffic in dressed beef between Chicago and the East has alarmed those dealers who are interested in the transportation of beef on the hoof, as, if the dressed beef business grows unchecked, the expensive rolling stock and yard equipment of the Chicago live beef shippers will become valueless. The Chicago *Railway Review* says:

"Every effort has been made therefore to crush out the dressed meat trade, and this it is hoped can be accomplished through an increase of rates on such business. It already pays a much larger rate than does live stock, the charge for the latter being 40 cents per hundred pounds, and for dressed meats 64 cents per hundred pounds."

An investigation has been made into the relative cost of the two conditions of beef while in transit. From the report of this investigation it appears that the cost of live beef shipment per 100 pounds in addition to transportation is 17¾ cents. The cost of dressed beef shipment per 100 pounds is 24 cents, exclusive of transportation charges. The summary of the report is contained in the following:

"The present rate for transporting live stock to New York is 40 cents per 100 pounds. The estimated cost in addition to transportation charges is 17¾ cents; the total cost per 100 pounds, including railroad charges, is 57¾ cents. It requires 175 pounds of live steer to make in Chicago 100 pounds of dressed beef; hence the cost of the dressed beef per 100 pounds, when obtained from live stock in the East, is $1.01. The extra cost of shipping dressed beef has been estimated at 24 cents. The railroad transportation charge should therefore be 77 cents in order to make the total cost of transporting 100 pounds of dressed beef from Chicago to New York the same as the cost of transportation of 100 pounds of dressed beef when the steer is slaughtered in New York and the rate of railroad transportation is 40 cents per 100 pounds."

The animus of the movement for "crushing out" the dressed beef business is sufficiently shown by the quotation from the *Railway Review* given above, and the immediate object is "to make the cost of transportation on 100 pounds of dressed beef the same, whether the steer is slaughtered in Chicago or in the East."

It thus appears that consumers of beef in New York city and the East generally (largely the poor working people) are taxed on its original price to add to the profits of the railway companies and the dealers in live weight beef in Chicago.

But there are other considerations besides that of penny-wise economy in the two methods of transportation. A writer in the *Railway Review* alludes to a not uncommon sight in the following words:

"The present fashion of transporting live stock is barbarous in the extreme, and if the cruelties perpetrated upon dumb beasts which are to be used as food were known, public sentiment would suppress the whole business in short order. The writer recently saw a live stock train upon one of the trunk lines which made him heart-sick. The cattle were crowded into a car as closely together as they could stand; it was a hot day; all the animals were gasping for breath; some, exhausted, had fallen and were lying upon the filthy floor under their fellows. Whenever the train started it jerked them back, and when it stopped it threw them forward. In this way they were to be carried a thousand miles, and when they arrived, bruised, sick, and fevered, at their journey's end, the survivors were to be butchered to furnish meat for human beings."

On the contrary, the dressed beef sent from Chicago is from animals slaughtered after a rest in commodious stock yards; the meat is cooled in refrigerating rooms, and it is then hung in quarters in a refrigerator car, the ice of which is renewed when necessary *in transitu*. Taste, as well as humanity, would surely prefer the dressed beef method.

Standards for Freight Car Building.

The apparent benefit of some standards in the building of freight cars is so obvious that it is no wonder that railroad men have directed their attention largely to it within a few years.

The *National Car Builder* says that it is clear that nothing in the construction of freight cars can be fixed and unvarying so long as there is no absolute limit to the maximum weight of loads they are to carry. As the freight traffic of the roads is now managed, the maximum car load is the basis which necessarily regulates the construction. It is no exaggeration to say that within the past ten years freight car loads have been increased 15 tons, and this increase is likely to be doubled in the next ten years. If a limit could be fixed for the load, whether 30, or 40, or even 50 tons, there would be a basis upon which to work, although it might necessitate radical changes in the present structure of cars from wheels to roof. But unfortunately there is no restriction upon overloading, and things must take their course. The most important members of the structure are the wheels. Instead of uniformity in their manufacture, the diversities and irregularities are almost endless. There is trouble with the form of flange, width of tread and width of wheel, they are not round nor balanced, there is no standard gauge, the hub bore is not concentric with the circumference, there is no uniform point on the treads for measuring, and the utility of coning the treads is involved in great uncertainty. If the wheels are imperfect, the rest of the structure will share the imperfection. Those who are inclined to be sanguine that the millennium of standards and interchangeableness is about to dawn, should bear in mind that so long as every road is free to adopt and use what it pleases, it will be impossible to enforce the use of standards that put a veto on all subsequent improvements, and stop the process of development by saying, "Thus far and no farther."

It would seem, however, from some facts apparent at the recent railway exposition at Chicago, that the limit of load had been reached, or at least the limit of the relation of the load to the weight of the car; and to an outsider it would seem that some agreement of at least these important particulars might be reached by railroad men. The Chicago *Grocer* says that "ten years ago the maximum capacity of a freight car on most roads was 20,000 pounds, with a weight equal to or exceeding this amount. For every ton of paying freight hauled there was another ton of dead weight. Latterly the railroad companies have been increasing the carrying capacity of the car without materially adding to its weight. Thus the 40,000 pound car weighs on an average about 23,000 pounds, giving nearly two tons of paying freight to every ton of dead weight. These cars are now in general use on all the roads, the smaller cars being replaced by them as they wear out. But among the freight cars on exhibition, we noticed some of still greater carrying capacity. Thus a 50,000 pound car weighed only 24,900 pounds; a 60,000 pound coal car weighed but 22,750 pounds, and a 70,000 pound freight car weighed 32,300 pounds. This latter was a three truck car, there being a truck under the center as well as at each end. Some of these cars are doing regular service on the Missouri Pacific road, enabling the company, as we were informed by the person in charge, to do 30 per cent more business than with the cars of ordinary capacity."

Tests of Coals.

In making a series of experiments to determine the relative value of different coals as fuel for the army, Quartermaster-General Meigs tested thirty-one specimens, with the result of ascertaining that two submitted specimens of semi-bituminous coal showed a higher evaporative power than the submitted specimens of anthracite or bituminous coals. The following table gives the best results obtained by Gen. Meigs from coals of the different classes, showing the pounds of water evaporated, at 212°, per pound of coal.

Semi-bituminous coal, from Somerset County, Pa	9·85
" " " " "	9·75
Anthracite from Schuylkill County, Pa	9·37
" " Luzerne " "	9·28
" " Dauphin " "	9·07
" " New Mexico	9·04
Bituminous from Pittsburg, Pa	8·78
" " New Mexico	8·60
" " Glasgow, Scotland	7·61
" " Newcastle-on-Tyne, Eng	7·52
" " Weber coal, Utah	4·73
" " Lignite, Dakota	4·03

These tests must not be considered as generally determinate in regard to the highest value of different kinds of coal; for other well known authorities have accorded to anthracite the evaporative power of 9·50 pounds of water to one pound of coal, and for bituminous coal 8·75 pounds of water to one of coal. The tests made by General Meigs are only valuable as showing the comparative usefulness of the particular specimens subjected to his experiments.

Common Sense in Summer.

The employment of the natural common sense possessed by intelligent adult humanity would do much to mitigate the discomforts of our torrid summers. Natural appetite, if not corrupted or perverted, is an excellent guide to eating and drinking. The following of Procrustean rules as to the quality and quantity of food is pernicious. An unvarying amount of food, as three hearty meals each day, which might be healthful for winter or the cool weather of autumn, is not appropriate for the intense heats of summer. No set of rules can be laid down for anybody's guidance, still less is it competent to make rules for everybody's guidance; but a few simple suggestions made by a physician recently may not be amiss.

He said: "Keep cool in temper; enter into no argument or contention on politics, ethics, or religion; restrain anger; attempt no athletic feats of rowing, walking, or ball playing; look on the pleasant side of your circumstances; be kindly affectioned, as St. Paul recommended; do not sit out doors long after sundown—the less of this the better; never work before breakfast; eschew meats as much as possible and chew food thoroughly; drink but little ice water or hot tea and coffee—warm tea is not injurious. Lemonade in moderate quantities is not hurtful. Alcoholic stimulants should be tabooed entirely unless a physician's prescription compel their use. Do not allow your dress to be a burden in material or amount, nor have it so light and thin that the body, from perspiration, becomes chilled."

How to Remove a Tight Ring.

A novel method of effecting the removal of a ring which has become constricted around a swollen finger, or in any other similar situation, consists simply in enveloping the afflicted member, after the manner of a circular bandage, in a length of flat India rubber braid, such as ladies make use of to keep their hats on the top of their heads. This should be accurately applied—beginning, *not* close to the ring, but at the tip of the finger, and leaving no intervals between the successive turns, so as to exert its elastic force gradually and gently upon the tissues underneath. When the binding is completed, the band should be held aloft in a vertical position, and in a few minutes the swelling will be perceptibly diminished. The braid is then taken off and immediately reapplied in the same manner, when, after another five minutes, the finger, if again rapidly uncovered, will be small enough for the ring to be removed with ease.—*L ngon, Gaz. des Hop.*

Cleanliness of Sinks.

One of the most prolific causes of defilement and offensive odors in kitchen sinks and their outlets is the presence of decaying grease. This comes from the emptyings of kettles in which meat has been cooked, in the dish water, and in the soap. The grease lodges in every crevice and catches at every obstruction. A remedy may be found in the use of the common alkalies instead of soap, aqua ammonia in washing clothes, and borax in washing lawns and laces, and washing soda in cleaning dishes. These alkalies prevent a solid soap from forming in the sink and its pipes and neutralize all effects of decomposing fat.

Waterproof and Fireproof Fabrics.

The *Textile Record*, which ought to be good authority on such subjects, says that the tungstate of soda is about the most serviceable substance for making fabrics fireproof. For use it is dissolved in five times its weight of lukewarm water. The solution is then mixed with a very small portion of phosphate of soda, and it is then ready to be used for saturating tissues. After being well steeped the goods are wrung out and dried at a gentle heat, and may then be ironed, etc., as usual. They will be found capable of resisting the action of the heat for a long time, and if ignited they merely smoulder without bursting into flame. For making fabrics waterproof, the following process, the editor of the same journal says, is highly recommended, but he has never observed its practical results: A composition is prepared with nitrate of potassium (saltpeter), 200 pounds; resin, 270 pounds; gum, 30 pounds; slaked lime, about 100 pounds.

"A milk of lime is first prepared, then the saltpeter is dissolved in water, and heated in a boiler, then so much lime is added that it does not become pasty, when the two other substances which have been fused on a slow fire are added. This composition can be left to cool, and being unalterable can be kept for use. To render tissue waterproof 100 pounds of this mixture are dissolved with one gallon of boiling water, while on the other hand 10 pounds of alum are dissolved in 10 gallons of water. The fabric is first passed into the first solution, and then into the second, and finally dried between cylinders."

Honors to an American Engineer.

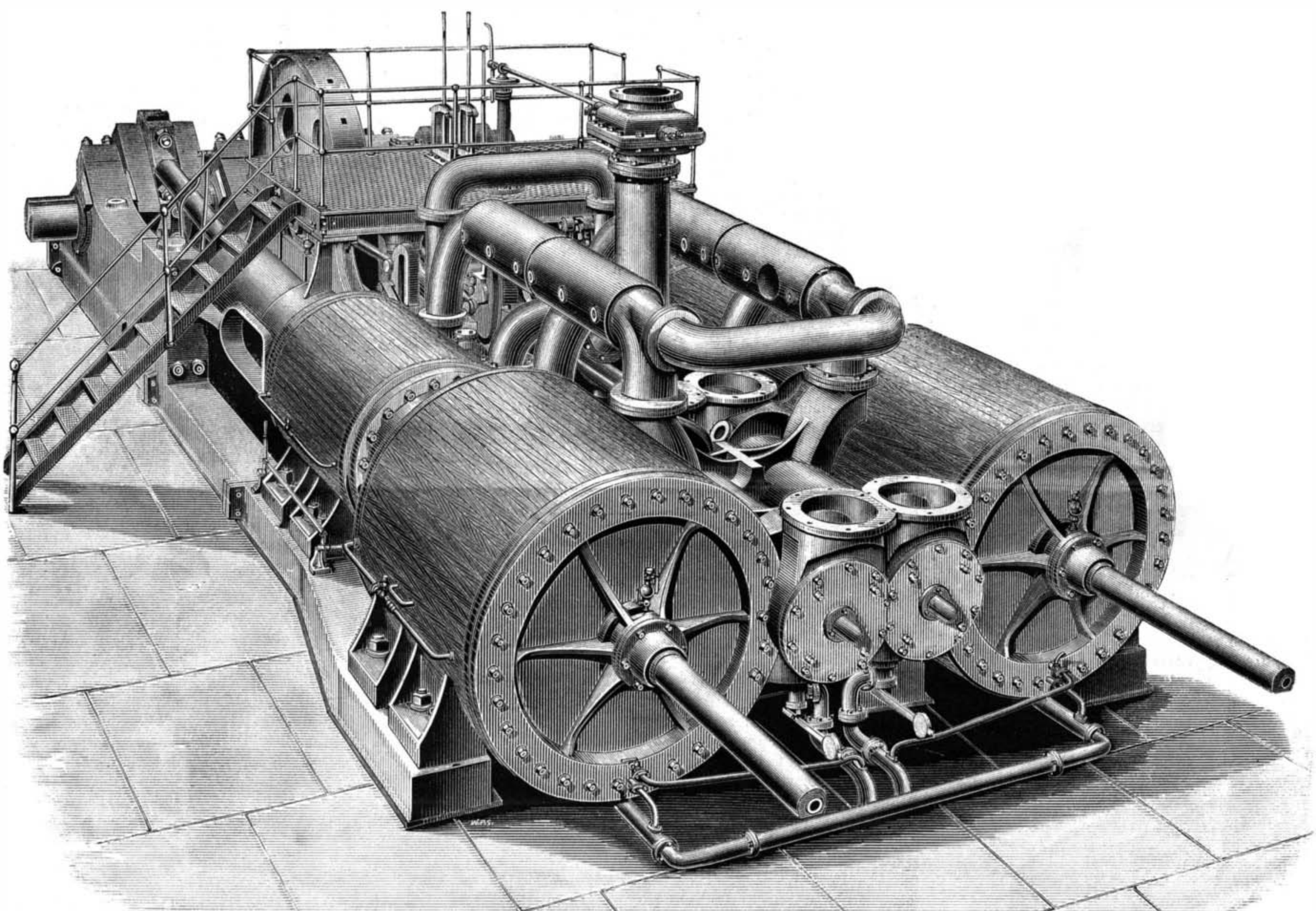
The Academie des Sciences, Belles-Lettres et Arts de Lyons, France, at its annual meeting on July 10, awarded the gold medal (founded by Prince Lebrun for the encouragement of useful inventions) to Mr. Ed. W. Serrell, Jr., of New York, for an automatic reel for silk. In a letter from Mr. Peixotto, published in the SCIENTIFIC AMERICAN, issue of June 10, 1882, on the silk industry of France, allusion is made to Mr. Serrell's invention. The writer at that time said he had great hopes that Mr. Serrell's automatic reel would prove successful, and that the invention was creating a great deal of interest among the silk growers and silk manufacturers in the south of France.

This discovery, according to experts, says the *Continental Gazette*, Paris, is destined to work the same revolution in the silk world as was wrought ninety years ago by the invention of the cotton gin. Cotton before then went to waste on the fields, and by the proletarian labor of Europe, and particularly of the Orient, the reeling of silk from the cocoon is until now an impossibility in the United States, and is rapidly becoming so in Europe, owing to the increased and increasing cost of labor. In according the prize to Mr. Serrell, the President of the Society, M. Rougier, one of the most eminent of French barristers, paid a high compliment to the genius and perseverance of the countryman of Benjamin Franklin. He said that France, in her appreciation of genius, knew no country or nationality. She resembled in this respect the great Republic of Washington, and she was ever happy to render to genius her merit, for science and art were universal.

IMPROVED REVERSING RAIL MILL ENGINES.

The engravings on this and another page illustrate by two perspective views a large pair of horizontal compound reversing rail mill engines, made by Messrs. Tannett, Walker & Co., of Leeds, for the works of MM. De Wendel et Cie, Hayange, Lorraine, and Joeuf, France.

The engines in question have two high pressure cylinders, each 34 inches in diameter, and two low pressure cylinders, each 60 inches in diameter, all having 5 feet stroke. The cylinders are steam jacketed, and provided with piston valves and link motions, the latter being worked by a hydraulic cylinder for reversing. The crank shaft, which is of the marine type, is made in two pieces bolted together, and weighs about 13 tons. The pins are 18 inches in diameter and 15 inches long, and there are four bearings, each 18 inches in diameter and 22 inches long. The connecting rods are 13 feet 6 inches centers. The engines are constructed to work at a pressure of 90 pounds to 100 pounds per square inch, and deliver their exhaust steam to a surface condenser, fitted with brass tubes three-fourths of an inch in internal diameter. This condenser also serves to condense the steam of the accessory engines, always to be found in a rail making plant, and is provided with an independent pair of horizontal engines, with cylinders 16 inches in diameter by 30 inches stroke, which work two double acting circulating pumps. We are indebted to *Engineering* for the illustrations and particulars.



IMPROVED REVERSING RAIL MILL ENGINES.

Engineer and Fireman Both Asleep.

The occurrence on the Holyhead line of the driver and stoker of a train falling asleep while on duty and the extraordinary escape of the Irish mail last week was even more serious than reported. It would appear from inquiries made on Monday at Llandudno Junction by our correspondent that the signalman there, by extraordinary presence of mind, saved the Irish mail passengers on Tuesday night from what might have proved a terrible fate. The signalman at the junction received a message from the signalman at Conway, the next station toward Holyhead, that a light engine was coming. The junction signalman, knowing that the Irish mail was due, decided to run the engine into a siding in order to permit the express to pass. He accordingly put up all the signals against the light engine, but to his extreme astonishment the engine came straight into the junction at full speed, swept round the corner, dashing past all the danger signals, and disappeared from view down the line toward Chester. A moment's reflection convinced the signalman that both driver and stoker must be asleep. He accordingly wired to the Colwyn Bay Station signalman, "Engine coming; driver asleep; put fog signals on line." The man at Colwyn Bay was equally prompt, for, running out of his box, he had hardly time to lay a number when the engine came thundering along and an explosion followed, which effectually awoke the men. The engine was stopped and run back into a siding, when it was discovered that the fire had gone out, the water had disappeared from the boiler, and that the men had been asleep some time. Inquiry has resulted in their immediate discharge. They had been fifteen hours on duty.—*London Times.*

Waterproof and Other Special Paints and Varnishes.

The *Neueste Erfindungen* says that the waterproof preparation of G. Gehring, in Landshut, is prepared by melting together 60 parts of paraffine, 15 parts of wax, and 30 parts of palmitate of alumina made by precipitating a solution of palm oil soap with alum. The stone, metal, or wood that is to be waterproofed is warmed to 140° or 200° Fah., and then coated with the melted mixture. For fabrics he employs a mixture of 60 parts of paraffine, 20 parts of palmitate of aluminum, and 10 to 15 parts of yellow wax dissolved in linseed varnish, to which is added from 6 to 15 parts of oil of turpentine.

A. Riegelmann, in Hanau, has patented a rust protector which consists of ordinary oil paint mixed with 10 per cent of burned magnesia, baryta, or strontia, as well as mineral oil. This neutralizes the free acid of the paint, and the alkaline reaction protects the iron from rust.

To prevent iron from rusting in the ground it is painted over with a mixture of 100 parts of resin, 25 parts of gutta-percha, 50 parts of paraffine, and 20 parts of magnesia, besides mineral oil. A temporary paint for the movable parts of machinery contains 20 or 30 per cent of magnesia or burnt dolomite, with some vaseline added to prevent drying.

THE Suez Canal Company intend adopting the Pintsch system for lighting the entrance to the canal; and with this view have ordered eight 9-foot spherical gas buoys, each to burn for two months, three fixed lights to burn two months, and three large holders for storing gas and filling the buoys, together with a small gas works to be erected at Port Said. It is proposed to extend the system to other parts of the canal.