THE

Scientific American.

MUNN & COMPANY, Editors & Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN, S. H. WALES, A. E. BEACH.

☞ Messrs Sampson Low, Son & Co., Booksellers, 47 Ludgate Hill London, England, are the Agents to receive European subscriptions for advertisements for the SCIENTIFIC AMERICAN. Orders sent to them will be promptly attended to.

VOL. XIV., No. 4...[NEW SERIES.]..*Twenty-first Year.*

NEW YORK, SATURDAY, JANUARY 20, 1866.

Contents:

(Illustrations are indicated by an asterisk.)

Every man who has money to invest always desires to place it where it will make the best return. This being admitted, we undertake to say that $3, invested in the SCIENTIFIC AMERICAN, will return three-fold in the amount of valuable information which its columns supply. Mechanics, inventors, manufacturers, farmers—as well as every head of a family—will get, on an average, $10 worth of information from a year's number of this journal, and yet they can get it for the low sum of $2 50, in clubs of ten names.

Talk about high prices—here is something cheap enough to stop the mouths of all grumblers. Only think of it—a large volume of 832 pages, full of costly engravings, for $3, and less to clubs. It any of our readers think we can get rich at such prices, let them try the experiment. Send in your clubs and subscriptions.

CONCERNING BELTS.

In other parts of this paper our readers will find some thing of interest relating to belts. One is a communication from a Mr. W. Annan, of Illinois, on lacing, and the other an invention to facilitate the process. Certainly nothing can be of greater importance to manufacturers than belts, and all relating to them, for there is not a factory in the land, of any size, but has thousands of feet in daily use. Further, they are costly to replace, and careless or ignorant persons frequently destroy them by misuse.

Great remissness in lacing belts and laxity in the matter of inspecting them frequently, to see if they need repair, is noticeable. We have seen large machine shops stopped for hours while the main belt was being laced, and it is nothing uncommon for half or three-quarters of an hour to be wasted in stretching or putting in rivets, when the same ought to have been attended to over-night, or, at the least, during noon hour.

Manufacturers know very well that half an hour deducted from the labor of a machine amounts to a large sum, where there are many machines, and when these petty losses are easily avoided, there is certainly no excuse for their occurrence. Some man of experience should be paid extra to lace the belts whenever they need it. Let him make it his business to inspect them regularly, and be held accountable for their failure, if it appears that his neglect was the cause. This relates, of course, to the principal driving belts, for on the individual machines each workman ought to take care of his own.

The ends of a belt should always be cut off square, not guessed at by the eye, but laid off with a tool. The holes ought to be made with a small punch at a proper distance from the end—the size of the holes and the distances of them depending on the width of the belt. The use of an awl is reprehensible, for the holes are apt to be made irregular by it, and much larger than there is need of. The end of the lace should be tied with a square knot in the middle of the outside, for the corners of the belt where it is cut are most exposed and apt to whip out. Tieing a belt lace does not look so neatly as where the ends are put through an incision, but tieing saves the belt from having extra holes made in it. The laces ought to be of the same thickness from end to end, or as nearly so as possible. It often happens that laces have very thin spots in them; such should be kept for short belts, and never used for long ones. Moreover, the holes must be made at equal distances apart and not too many of them; every hole weakens the belt, and none that are not absolutely essential should be cut. All new laces, as well as new belts, should be stretched by hanging weights on them before they are used—petroleum, sawdust, resin, and similar substances should never be used. When a belt gets harsh or dry, neat's-foot oil is the best thing to apply to it.

A LARGE STEAM CYLINDER.

Not very long since, a steam cylinder six feet in diameter was regarded as something extraordinary, and many sagacious and experienced mechanics doubted whether any larger would ever be made. With years, however, came increased knowledge, and engineers were found bold enough to project engines with cylinders over 100 inches in diameter. Mr. Erastus W. Smith was the first engineer, in this country, to build large beam engines; the *Metropolis*, of the Fall River line, having an engine with a cylinder 105 inches in diameter, and twelve feet piston stroke. When this cylinder was cast at the Novelty Works, some six or eight years ago, it was considered an event. A horse and cart were driven through it lying on its side, and a collation was served in it to show its huge dimensions. After that many steam cylinders were cast of nearly the same size.

Recently Mr. Smith has designed some beam engines much larger than any now afloat. In point of piston area they are only surpassed by some screw engines in the British navy, which have cylinders 112 inches in diameter, and 48 inches piston stroke.

The engines alluded to are for a new steamboat company, formed to run vessels on the Sound between this city and Bristol, R. I., and the large cylinder belonging to one of the engines was successfully cast at the Etna Iron Works of Mr. John Roch, in this city. Its diameter internally is 110 inches by 12 feet piston stroke, and the weight is 18 tuns. The net length is 13 feet 8 inches, and the steam port is 60 inches by 12 inches. The walls of the cylinder are about 2½ inches thick. The casting is one of the handsomest we have ever seen; it was superintended by Mr. William Gaynor, the foreman of the foundery.

The condenser for these engines is of the surface variety, and is a bulky affair, exceeding the cylinder in weight and dimensions. It is a rectangular body, 12 feet wide, 9 feet high and 18 feet long, and weighs 23 tuns. The average thickness of the walls is 1¾ inches. This would make a room much larger than an ordinary parlor, and far more commodious than the little 'dens called rooms in watering-place hotels. We shall give fuller and further details of these engines at an early day.

DEATH OF PROFESSOR MAPES.

Professor James J. Mapes died in this city on the 10th of the present month, in the 60th year of his age. Professor Mapes was born in New York and passed most of his life here, though for the last 17 years he had been cultivating a large farm with signal success in New Jersey. This farm was considered the model farm of the country, and was made so by the management of its owner; though a barren sand plain in 1848, it is said to have yielded recently a revenue of $20,000 per year.

Professor Mapes, like many Americans, tried various pursuits. In the course of his life he was in turn a trader, a sugar refiner, an editor, a farmer and a lecturer; and he made a number of valuable inventions. He was appointed Professor of Chemistry by the American Institute, and lectured on the science before that association. From want of early and systematic education, his statements were not always to be received without examination, but from the natural clearness of his intellect he had a faculty of stating what he did know that might well have excited the envy of many more learned men. With the single exception of Dr. Lardner, we never heard a speaker who was so lucid as Professor Mapes. In the useful labor of making science popular his ability was unsurpassed. He was a genial man, full of wit and humor, and through a very wide circle of acquaintances and friends his death will be sincerely mourned.

OUR POSITION ON THE EXPANSION QUESTION

We have many thousand new subscribers, and from communications received from some of them, we perceive that our remarks, in relation to the *Algonquin* and *Winooski* trial, have given the impression that we are advocates of Mr. Isherwood's theories, and that we do not believe in the economy of working steam expansively. Both of these notions are incorrect, as all our old subscribers and readers know.

We have repeatedly stated that we have no doubt of the economy of working steam expansively—that the most economical measure of expansion depends on the pressure of the steam, the extent to which it is superheated, the perfection with which the cylinder is jacketed, the velocity of the piston, and several other circumstances, including even the temperature of the atmosphere in which the engine is operated. In order to ascertain the most economical measure of expansion by experiment, we should want all the conditions to be as nearly alike as possible, except the point of cut-off. In the *Algonquin* and *Winooski* trial, one engine was run with 20 lbs. pressure and the other with 70, the steam in one being cut off at $\frac{13}{100}$ths of the stroke and in the other, at $\frac{62}{100}$ths. No human intelligence could ascertain whether any difference in the results would be due to the difference in the pressure or the difference in the expansion. A costly experiment conducted in this way seemed to us ridiculous.

On page 244, Vol. XI., we published an elaborate article on the theory of expansion, in which we expressed our dissent from the notion of Mr. Isherwood, that steam in expanding without doing work would be partly condensed. We stated that as the total heat of high-pressure steam is greater than that of low-pressure steam, expansion, where no work is done, should be accompanied by superheating.

In reply to this article Prof. W. J. Macquorn Rankine, of Glasgow University, sent us a communication in which he indorsed our position in opposition to that of Mr. Isherwood. As Prof. Rankine is the highest authority in the world in this department of physics, and as his statement of the law of expanding steam contains more matter in relation to the subject than was ever before expressed in the same number of words, we publish his communication for the benefit of our new subscribers.

TO THE EDITORS OF THE SCIENTIFIC AMERICAN:—

Gentlemen,—

As I see that in the SCIENTIFIC AMERICAN of the 15th of October, you make some reference to a work of mine, I beg leave to make the following remarks on the subject of your article.

The circumstances under which steam undergoes expansion may be classed under five heads:—I. When the steam expands without performing work. II. When it expands and performs work, the temperature being maintained constant by a supply of heat from without. III. When it expands and performs work, being supplied from without with just enough of heat to prevent any liquefaction of the steam, so that it is kept exactly at the saturation point. IV. When it expands and performs work in a non-conducting cylinder. V. When it expands

and performs work in a conducting cylinder, not supplied with heat from without.

I. When steam expands without performing work (as in rushing out of a safety-valve or through a throttle-valve) it becomes superheated, as is well known; the temperature falling very slightly in comparison with the boiling-point corresponding to the diminished pressure. The precise rate at which the temperature falls is not yet known; but it will probably be soon ascertained through some experiments by Prof. Thomson and Mr. Joule.

II. When steam expands and performs work, the temperature being maintained constant by supplying heat through the cylinder, the law of expansion at first deviates from Marriotte's law by the pressure falling *less rapidly* than the density; but as the expansion goes on, the law approaches more nearly to that of Marriotte, as recent experiments by Messrs. Fairbairn and Tate have shown.

III. When the steam expands and performs work, *being maintained exactly at the temperature of saturation*, the law of expansion—as you observe, is perfectly definite. In the treatise to which you have referred I have shown what it is; and also that it is expressed nearly enough for practical purposes by taking the pressure as being proportional to the 17th power of the 16th root of the density; a function very easily calculated by means of a table of squares and square roots. In many actual steam engines the circumstances of this case are practically realized, as is shown by the agreement of their performance with the results of calculation.

IV. When steam expands and performs work in a non-conducting cylinder, it was shown by Prof. Clausius and myself, in 1850, that the lowering of the temperature, through the disappearance of heat in performing work, goes on more rapidly than the fall of the boiling point corresponding to the pressure, so that part of the steam is liquefied. This result was experimentally verified by Mr. G. A. Hirn, of Mulhouse, a few years afterward (see his Treatise on the Mechanical Theory of Heat). The mathematical law of the expansion in this case can be given with perfect precision; but its circumstances are not accurately realized in practice, because the cylinder is always made of a rapidly-conducting material.

V. "Lastly, when the steam expands and performs work in a conducting cylinder, which receives no supply of heat from without, but is left to undergo a great alternate rise and fall of temperature through its alternate connection with the boiler and the condenser, the law of expansion becomes very variable, and the problem of determining it extremely complex. It is certain, however, that a great waste of heat occurs in every case of this kind, as Mr. Isherwood's experiments have shown. In a paper read to the Institution of Engineers in Scotland, about two years ago, I discussed some of Mr. Isherwood's earlier experiments, and showed that they gave proof of a waste of heat increasing with the fall of temperature due to the expansion of the steam, with the extent of conducting surface of the cylinder, and with the duration of the contact between the hot boiler steam and that conducting surface."

As to the value of indicator-diagrams, I have always held that they gave a good approximation to the whole *work done* by the steam during each stroke, though not to the pressures at particular instants, which, in ordinary indicators, are affected by oscillations and other disturbing causes; but that defect I consider to be nearly, if not entirely overcome in the indicator of Mr. Richards; and I hope for very valuable results from the extension of its use.

W. J. MACQUORN RANKINE.

Glasgow University, Nov. 18th, 1864.

RIPPING SUTURES IN CLOTH.—Messrs. J. Pullar & Son, proprietor of the Mill-street Dye Works, Perth, Scotland, write to us for information concerning F. B. Converse's patent for the instrument above. They wish to correspond with the patentee.

AMERICAN PHOTOGRAPHIC ALMANAC.—This is an excellent little work, full of most useful information for photographers, by Prof. Towler. Every photographer should have a copy. 50 cents. J. H. Ladd, No. 88 White street, N. Y.

ISSUED FROM THE UNITED STATES PATENT-OFFICE

FOR THE WEEK ENDING JANUARY 9, 1865.

Reported Officially for the Scientific American.

☞ Pamphlets containing the Patent Laws and full particulars of the mode of applying for Letters Patent, specifying size of model required and much other information useful to inventors, may be had gratis by addressing MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, New York.

51,908.—Steam Water Elevators.—John B. Atwater, Chicago, Ill.:

First, I claim the construction and arrangement of the within-described apparatus for elevating water from wells, by the direct application of steam upon a body of air which is compressed within a chamber above a column of water, said apparatus being so constructed that it will automatically refill itself with water when the pressure of steam is removed, substantially as described.

Second, In an apparatus constructed and arranged as herein described, I claim forming a communication, C, between the chambers, a b and B, which is of less diameter than the said chambers, for the purpose of presenting as small a cooling surface as possible to the steam, substantially as described.

Third, In an apparatus constructed and operating substantially as herein described, I claim arranging the discharge end of the pipe, C', in such relation to the valve. c2, that steam will impinge thereupon as it enters the chamber, c, substantially as described.

51,909.—Composition for Razor Strops.—Frank R. Atwood, Lowell, Mass., and Abm. Elston, Port Jervis, N. Y.:

We claim a paste made of the ingredients herein specified, with or without neats-foot oil, substantially as set forth.

51,910.—Pipe Coupling.—E. Barbaroux, Louisville, Ky.:

I claim a soil or driving pipe for oil and other deep wells, whose sections are united to each other substantially in the manner and for the purpose above described.

51,911.—Hollow Auger.—Fordyce Beal and Major Smith, New Haven, Conn.:

We claim the combination of the slide, I, with the cutter, D, constructed and arranged to operate substantially as and for the purposes specified.

Second, The arrangement and construction of the cutter, D, adjusting screw, h, and set screw, d, combined so as to operate for the purpose of increasing or diminishing the depth of cut of the auger.

51,912.—Salinometer.—Benjamin F. Bee, Hardwick, Mass.:

First, I claim the combination of the closed vessel for containing the water to be tested, and the instrument for testing it, the same being subject to the boiler pressure.

Second, The arrangement for adjusting and retaining the water line in sight, by the compression of the air contained in the cylinder, B, and tube, C.

Third, The arrangement of the valve, e, and its appendages, when used for the purpose as set forth.

51,913.—Tank for Preparing Peat.—Albert Betteley, Boston, Mass.:

I claim the construction of the tank with the provision for separation of water from the peat, substantially as set forth.

Also combining with a tank so made the screw, c, for discharging the prepared peat, substantially as set forth.

51,914.—Medical Compound.—George B. Bieler, Cincinnati, Ohio:

I claim the compound of ingredients for purposes as specified.

51,915.—Rope Machine.—John Blackie, New York City:

First, I claim the stationary reel or bobbin holder, G, provided with the slotted plate, m, and adjustable arm, i, mounted upon the hollow journals, within the revolving frame, I, as shown and described.

Second, In combination with the stationary reel, G, the main frame, A, and the inner frames, I, arranged to revolve in opposite directions, substantially as set forth

Third, the combination and arrangement of the operating wheels, B C D and E, main frame, A, inner frames, I, and reels, G, operating in connection, as described.

Fourth, In combination with the main frame, A, of the right and left handed screw, R, arranged to operate in connection with the wheels, T, as shown and described

51,916.—Horse Shoe.—John H. Brown, Watertown, Minn.:

I claim the tapering grooves in the heel portions of the shoe, formed in the manner and of the shape described, in combination with the short tapering section of india-rubber, as and for the purpose set forth.

51,917.—Plow.—Oscar F. Burton, New York, and Lora B. Hoit, Cedar Falls, Iowa:

First, I claim making the mold board of a plow entirely of glass, substantially as and for the purpose described.

Second, The combination of clamps, c d, and V-shaped grooves, a b, for the purpose of attaching the mold board, D, without bolts or screws, substantially as and for the purpose set forth.

51,918.—Window Sash Fastener.—E. Calderwood, Portland, Me. Antedated Jan. 3, 1866:

I claim the metallic strip, r, inserted within the side of the sash frames, o, in combination with a thumb screw, v, all being arranged together and operating substantially as herein described and for the purpose specified.

51,919.—Mode of Sinking Wells.—J. C. Campbell and M. V. Campbell, Syracuse, N. Y.:

We claim the combination of the conical pointed plug, B, strainer, C, and pipe, A, as and for the purpose set forth.

51,920.—Heddle Eyes for Loom Harness.—John L. Cheney, Lowell, Mass.:

I claim the improved heddle eye made substantially as described, viz., of one piece of wire bent into the form exhibited in Fig. 1, and with its extremities arranged at the junction of two of the loops, and having solder or brazing applied to the said junctions and to the said extremities, as specified.

51,921.—Hot-air Furnace.—John Chilcott, Brooklyn, N. Y. Antedated Dec. 28, 1865:

First, I claim the arrangement, substantially as herein described, of two or more tiers of flues, A a, forming one continuous series, through which the gaseous products of combustion from any suitable fireplace circulate one after the other, and a series of intervening, separate, and independent air passages, heated by the said flues.

Second, The construction of said continuous series and intervening air passages, in slabs or plates, C D, D E, in which each of the said flues and air passages are half in one and half in the next slab, a plate above or below it, substantially as herein described.

51,922.—Flues and Setting of Open Boilers.—John Chilcott, Brooklyn, N. Y. Antedated Dec. 25, 1865:

I claim the combination, for heating a melting pan, kettle, or open boiler, of a series of flues running back and forth under the bottom of the said pan, kettle, or boiler, and a series of flues surrounding the same, the whole forming a continuous system, through which there is a circulation from the furnace or fireplace to the chimney or uptake, substantially as and for the purpose herein specified.

51,923.—Furnace for Steam Boilers.—John Chilcott, Brooklyn, N. Y. Antedated Dec. 28, 1865:

First, I claim the slab, F, arranged across the ashpit, C, below the grate, B, substantially as and for the purpose herein specified.

Second, The arrangement of the opening, e, passages, f g h, and opening, i, in combination with each other and with the furnace and slab, F, substantially as and for the purpose herein described.

Third, The arrangement of the opening, k, passages, l l m n, and orifices, p p, in combination with each other and with the furnace and ashpit, substantially as and for the purpose herein specified.

51,924.—Shutter Fastening.—Ell Cole, Tarrytown, N. Y.:

I claim the combination of the box, a, catch, e, and catch, f, all arranged with reference to the sash, D, and blind or shutter, C, substantially as set forth, for the purpose specified.

51,925.—Well Drill.—Adam G. Coles, Mamaroneck, N. Y. Antedated Jan. 3, 1865:

First, I claim the construction of a drill for drilling or boring oil or other artesian wells, or other drilling operations in the earth's crust, with a central cutter and a surrounding series of reversible movable radial cutters, substantially as herein specified.

Second, The combination of the dovetail-headed cutters, a d a d, the longitudinal grooves in the stock, the surrounding collar, B, and the key, f, substantially as and for the purposes herein set forth.

51,926.—Clasp for Leather Straps.—Alonzo B. Conde, Albany, N. Y.:

I claim the clasp formed and operating as described and for the purposes set forth.

51,927.—Railroad-station Indicator.—Alexander S. Cox, Washington, D. C.:

First, I claim the combination of a rectilinear reciprocating draw rod, D, which is provided with a rack, r, the spur wheel, f, pawl, g', and ratchet wheel, g, with the band roller, B, and cylinder, C, the whole operating substantially as described.

Second, Providing the station indicator with a rectilinear draw rod, D, which is acted upon by a spring, s, and adapted for actuating the mechanism that moves the band, a, substantially as described.

Third, The combination of the band roller, B, and winding-up cylinder, C, with brake straps, c c', and a tension adjuster, substantially as described.

Fourth, The studded ratchet wheel, g, in combination with the stop pawl, J, and the belt roller, B, substantially as described.

51,928.—Fancy Loom.—George Crompton, Worcester, Mass.:

First, I claim the construction of the vertical heddle levers, having slots or mortises with pins passing through them, for the support of the double hooks, as described.

Second, The construction of the loop, with its spur-like branch, attached to the extremities of the vertical levers, as described.

Third, The construction and combination of the two pairs of oscillating levers, 21, 21 and 24 24, and their respective bars, 27 and 26, forming the lifter, depresser and eveners, with the hooks, and pattern cylinder or chain, as described.

Fourth, So constructing the bearings of the rod, 39, that it may be raised and return to its original position, substantially as and for the purpose set forth.

51,929.—Roll for Pressing, Sizing, and Calendering Paper.—Francis Curtis, Malden, Mass.:

First, I claim as a new manufacture the employment of hard rubber rolls in pressing, calendering and sizing paper.

Second, As a new article of manufacture, I claim pressing, calendering and sizing rollers to be used in the manufacture of paper when made of hard rubber or of iron, or any other material covered with hard rubber.

51,930.—Self-acting Mule.—Lorenzo C. Dam, Lowell, Mass., and John Wigley, Milford, N. H.:

We claim the expansion drum, formed by the cone and hinged arms, or their equivalents, substantially as herein described and for the purpose specified.

We also claim the combination of the expansive drum with the scroll cam, T, and the pulley, K, or their equivalents, by which the velocity of the cylinder that drives the spindles is increased or diminished as required.

We also claim the combination of the faller wire and the attached nippers with the band pulleys, screw, Y, and lever, 19, or their equivalent, for moving the cone, 8, to the right or the left at the right time, and to such a distance as may be necessary to impart the requisite velocity to the cylinder, 46.

51,931.—Inkstand.—Samuel Darling, Bangor, Maine:

I claim the combination and arrangement of the open cavity, c, the projection, b, and the circular groove, d, with the pen passage or tube, a, the ink reservoir, A, and the base, B, when such base and reservoir are made and applied together with inclined surfaces at their junction, arranged in manner and so as to operate substantially as described.

I also claim the arrangement of the vent hole, e, in the upper part of the supply tube or dipping cup, in manner and for the purpose specified.

51,932.—Shuttle-box Motion in Looms for Weaving Figured Fabrics.—Christopher Duckworth, Mount Carmel, Conn.:

First, I claim the pawl lever, J, suspended in front of the cam, h, in combination with the hooked arms, c c1 c2 and c3 c4 c5, substantially as described.

Second, Attaching the hooked arms, c c', or their equivalents, at different distances from the axis of motion of their oscillating lever, F, substantially as described.

Third, Arranging hooked arms, which are indirectly connected to the pin cylinder, or its equivalent, so as to be operated by it in such manner that a vibrating pawl lever, J, will operate upon all of them at proper times, substantially as described.

Fourth, The combination of the hooked arms, c c', oscillating arm, F, and a pattern governing device, substantially as described.

Fifth, Pivoting the cam rods, G G', to arms, F' F, the movements of which are controlled by a pin cylinder, or its equivalent, substantially as described.

51,933.—Animal Trap.—John H. Elward, Polo, Ill.:

I claim the combination of the revolving lever with a revolving stop, when arranged and operating substantially in the manner and for the purpose described.

51,934.—Telegraph Insulator.—A. B. Ely, Boston, Mass.:

First, I claim the hard-rubber or gutta-percha cap, having its lower edge in the form of a bead and terminating in a flange or disk bent inward toward the hook, substantially as and for the purpose described.

Second, The combination of two caps with the hook, substantially in the manner and for the purpose described.

51,935.—Insulating Telegraph Wires.—A. B. Ely, Boston, Mass.:

First, I claim insulating telegraphic wires, or their supports, with the material applied, in the manner substantially as and for the purposes set forth.

Second, The new article of manufacture herein described, constituting an insulated wire, made substantially as described for the purposes set forth.

51,936.—Rotary Pump.—Wm. Foster and Robert Foster, Brooklyn, N. Y.:

First, We claim the adjustable head, E, in combination with the cylinder, A, piston wheel, B, and sliders, D, substantially as and for the purpose set forth.

Second, The combinations of the set screws, a, and tubes, b, with the adjustable head, E, and with the cylinder head and piston, substantially as and for the purpose specified.

Third, the V-shaped adjustable strips, c, in combination with the sliders, D, of the piston wheel, substantially as and for the purpose described.

51,937.—Manufacture of Fire-proof Safes.—Samuel T. Fowler, Brooklyn, N. Y.:

First, I claim the new article of manufacture, consisting of a safe filled with hydraulic cement, as described, for the purpose specified,