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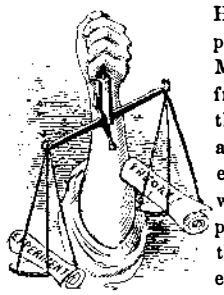
## WHAT MAY BE LEARNED FROM THE EXPERIMENTS AT THE METROPOLITAN MILLS.



THE letters in relation to the experiments at the Metropolitan Mills, which pour in upon us from every direction, show that these experiments have attracted a very general interest among the engineers of the country, and while this interest alone would prompt us to examine them, we think they are well worthy of examination from their own intrinsic value. It is almost impossible for any experiments which are conducted with the aid of actual weights and measures, to be wholly barren of results, either in the way of confirming conclusions already obtained or of modifying them. Wherefore, we have great respect for experiments, deeming their conclusions more reliable than those of any process of reasoning, with the single exception of mathematical demonstrations. It requires however the action of reason to determine what is the lesson which any experiment does really teach, and it seems to us that there is one truth which is demonstrated, not, indeed, for the first time, but with new force by the experiments at the Metropolitan Mills.

First, however, let it be remarked, that these experiments show beyond the reach of question, that engines constructed precisely like those that were there used, driving a flouring mill under exactly the same circumstances that there obtained, do not run more economically with cut-offs than they do without. From this single fact, thus absolutely proved, the general conclusion follows that whether the economy of running an engine will be promoted by cut-offs depends upon the construction of the engine and the service that it has to perform.

The great truth, however, of practicel value which is impressed with renewed force by these experiments, is the importance of perfection of arrangement, and accuracy of wormanship, in the construction of the steam engine. The engines used at the Metropolitan Mills were regarded by practical engineers as of a good quality, and yet from the strangling of the steam on its passage from the boiler to the cylinder, or from other defects in the arrangements, the value of expansion was completely overwhelmed. This was the case to a considerable extent in the Smithery engine used by Chief Engineer Isherwood, in his experiments at the Brooklyn Navy Yard, and he points out these defects in the plainest and fullest manner. And here let us state very distinctly that those who are denying the economy of working steam expansively, have no warrant for citing Mr. Isherwood's authority in support of their position. On the contrary, he recognizes this economy fully, and in his learned, able, impartial and truth seeking discussions of his own experiments, he calls attention to the several circumstances which prevented this economy from being more completely realized. We differ from Mr Isherwood in some of his theoretical positions, but we are compelled to admire the manner in which he handles the whole question; and we commend his work to engineers of the country as being full of valuable instruction.

The importance of wise arrangement and nice workmanship in the steam engine is shown not merely by these experiments, but by the whole of its history. The very best engines that have ever been constructed utilize only about one-tenth part of the power of the fuel, while those at the Metropolitan Mills, which are probably of average quality with engines of that size in general use, yield only about one-seventieth part of the power of the fuel. Notwithstanding the immense amount of study and contrivance that has been expended in efforts to bring the steam engine to perfection, it would seem to be still one of the most promising fields for invention that is to be found in any department of mechanism.

## THE FINAL DESTINY OF THE EARTH.

Encke's comet, which revolves about the sun in 3½ years, has been observed to complete its revolution in a constantly shortening period, showing that it is being drawn inward towards the sun. This fact has led to the general conclusion by astronomers that the planets are moving in a resisting medium, far more attenuated than our atmosphere, but still sufficient to affect their motions. If this is so, it follows by strict necessity that our earth and its sister orbs are all winding spirally towards the sun, and that they must eventually strike against it and become incorporated with its mass. The time required for this purpose belongs to those inconceivable periods with which geology and astronomy have to deal. The resisting medium is so exceedingly attenuated that it exerts but a slight influence on the comets, which are themselves masses of the very thinnest vapor, and its influence would of course be very much less on the dense matter of the planets. Astronomical observations, with all their wonderful delicacy, have yet failed to detect the slightest progressive shortening in the periods of revolution of any of the planets. It is curious, however, to note the multiplied obstacles which prevent the perception of this fact, if it does exist. All the *measures* of these revolutions are shortening with the revolutions themselves. If we begin, for instance, with the earth, the problem is to ascertain whether the time occupied by the earth in its journey around the sun is gradually becoming shorter. The first plan that suggests itself is to compare this with the rotation of the earth upon its axis, to see whether the year occupies the same number of days and hours and seconds that it did in former times. But if the earth is gradually cooling, it is contracting in size, and its rotations on its axis are becoming more rapid; in other words, the day is shortening with the year; and if the measure shrinks just in proportion to the thing measured, we cannot tell whether the latter is becoming shorter or not. If we take the time of the revolutions of the moon around the earth as a standard, the same resisting medium would draw the moon towards the earth and shorten the month also with the year. If we resort even to the less satisfactory measure of the sun's rotation on his axis, his bulk is also diminishing by the radiation of his heat, and the period of his rotation is consequently becoming shorter. In brief, from the two causes of radiation and the resisting medium, all the times and distances which could be used to measure the earth's distance from the sun (or the period of its annual revolution) are shortening together. So that the *differences* in the extent of these several contractions are the only means left for detecting by observation the approach of the earth to the sun, if such approach is really taking place. These differences would doubtless reveal themselves in the course of generations to refined astronomical observations.

If the earth and the sun are gradually becoming cold, this winding of the earth towards the sun would tend to keep up its warmth, and it may be a wise provision for prolonging, by some millions of years, the continuance of animal life upon our globe. But this period must come to a close, for if there is a resisting medium pervading the space between us and the sun, the final destiny of the earth is to curve gradually inward till, with a velocity hundreds of times greater than that of a cannon ball, it dashes itself with an awfully sublime crash into the mass of the sun.

## ROOM FOR IMPROVEMENT IN THE STEAM ENGINE.

The unit of heat is that which is sufficient to raise the temperature of one pound of water by one degree of Fahrenheit. The unit of work is the raising of one pound weight through a vertical hight of one foot—called a foot-pound. The experiments of Mr. Joule, of Manchester, indicated that if the whole of the heat could be rendered available, a unit of heat would raise 772 pounds one foot high; in other words a unit of heat is equal to 772 foot-pounds. This is called Joule's equivalent. A pound of charcoal will raise 78.15 pounds of water 180 degrees, which is equal to 14,067 units of heat. This multiplied by 772, gives 10,859,724 foot-pounds, which is equal to the production of 5½ horse power from the combustion of one pound of charcoal per hour. As the best engines consume nearly two pounds of coal per horse power per hour, it follows that only about one tenth part of the gross power of the fuel is utilized.

## OUR SPECIAL CORRESPONDENCE.

### OHIO MECHANICS' INSTITUTE FAIR.

CINCINNATI, Ohio, Sept. 15, 1860.

MESSRS. EDITORS:—For seventeen years in succession, the exhibition halls of the Ohio Mechanics' Institute have been thrown open to the public of the Queen City. In that time how many inventions now in general use, have been first timidly offered for public inspection under its auspices, and how many others which were sprung upon that public with specious promises of utility have died the natural death of humbugs, who can tell? These institutes for the aid of artisans are so many nursing mothers of genius, talent, industry, and mechanical skill; and it is safe to say, that no one which has been managed as this one has, could have lived through a seventeen years succession of annual displays without becoming a national blessing. We all remember the rich young girl in Sue's "Mysteries of Paris," who so honored the artisans who fashioned her costly silver vases, and furniture, and carriages and other things, that she allowed only their names, and not those of their employers to be inscribed upon them. So at these public displays of mechanical skill, the real worker may reap the honor due him for his work, before he loses his individuality in the shadow of the large manufacturer who may employ him.

The number and variety of articles on exhibition at the Institute this year, are said to much exceed those of the last; while there are some things of novel design and peculiar merit. Of course, it would be impossible to compress within the limits of a newspaper article, fair or even unfair notices of the mass of inventions on view; all that can be done is to note in meager outline those which attract attention as we thread our way through the maze of moving machinery and stationary things.

The exhibition was held last year in a building, constructed under the direction of the committee, entirely of gas-pipe; and this novel structure which rose to the astonished view of the Cincinnatians, like some palace of Alladin, was sold after the fair, for a goodly sum. This year the directors secured three floors of the Catholic Institute, and the hall of the Mechanics Institute which adjoins it. There are several rooms devoted to machinery and manufactured articles; a long and spacious picture gallery, well filled with some pictures of all the fashionable styles, and oil pastel and crayon pictures by resident artists; and, at the top of the building, a grand concert room of magnificent proportions, all filled with articles of use. In the center of this vast saloon water jets in ceaseless flow from a fountain of graceful shape, and the echoes of the plashing drops ring along the arched ceiling and through the room with pleasing effect.

As we enter the main door of the first machine room on the lower floor, our attention is first attracted to three single cylinder printing presses from Wells' type-foundry, and to some beautiful fire proof safes from the shops of Dodd & Co., and Hall, Caryl & Co., which are finished with bronzing and flower painting to a degree that I never saw equaled. The exhibitor representing one of these firms, expressed an ardent wish to come in competition with our leading New York safe men, and remarked that it somehow strangely happened that none of them cared to venture on here with the goods to show against them. It may be that Lillie and Herring will say, as Morrisey does to Heenan, that if they wish to stir up a combat, it will only be necessary for them to give the provocation.

Almost every visitor as he moves along, stops to see the practical operation of Hill's and Porter's governors, which all through the evening are kept whirling around like dancing dervishes. Porter's is a centrifugal governor on a new principle, as all readers of the SCIENTIFIC AMERICAN will recollect, for it has been illustrated and

described in our columns quite recently. Perhaps, for the benefit of subscribers in foreign countries, who may not have received their numbers regularly, it may be well to say that it is a ball governor, the balls being very small, and revolving with much greater velocity than is usual, their centrifugal force being partly counteracted and balanced by a weight hung around the shaft. It is exceedingly sensitive and prompt in its action.

Sanborn's book-binders backing machine is a capital thing for the purpose. The machine on exhibition is as finely finished a piece of work as one would care to see, and it has the advantage over the one made last year, of being much stronger throughout. Mr. Sanborn also shows a book-piercing machine for power. A cam on a shaft raises a crossbeam, in a slot in which are fixed piercers at any required distance apart, and the work is done with neatness and dispatch. For binders who do not require a machine run by power, there is one of a smaller size to be worked by a treadle.

J. B. Mooney, of Cincinnati, has a machine for cutting bolts. The bolts are passed through a hollow spindle and into a pair of clamps, and the dies are so constructed as to cut with one motion. It obviates the fitting-up of dies, as a straight steel will do by putting a thread on. The barrel machinery of Smith & Gouchers must be capable of doing capital service in the oil region of Pennsylvania, if the specimens, consisting of cisterns and tanks on exhibition here, are of its production. Certainly no one could desire neater nor better fitted work than they exhibit. Steptoe & McFarlane show a tennoning and a molding machine of elegant workmanship; and John Lemon, of Cincinnati, a hoisting apparatus which merits a notice. The platform travels up and down between the guides by means of a rack and pinion, while an endless belt running from the top to the bottom of the building is driven by the engine. All danger of the falling of the platform in case the belt should break is obviated, since it is sustained by the rack and pinion; and supposing that the belt shifter should fail to work when it might be desired to stop at a given point, the man on the platform can still control its progress by slacking the belt by means of an ingeniously contrived lever placed close at hand.

Attracted by a kuot of persons gathered about some object of interest, I pushed my way through and found one of your foster children at its work. The machine for making stove pipe, invented by M. C. Root, of Toledo, and patented through your office, seems to be capable of doing at one operation what our tin-smiths are now doing at five. The usual routine followed in making a length of stove pipe, is, first, to turn the edge with one machine; second, to form the pipe with another; third, to make the seam by hand; fourth, to draw the end in by hand; and fifth, to put on the swedge or bead. These various details are merged into one operation by the ingenious Mr. Root. He has arranged four rollers—three in a line, and one back of them. The sheet is passed between the middle and lower rollers where it gets its edge and groove, then it goes over the middle and back rollers, and under the top one by which time the pipe has been formed, its seam flattened, been bearded or swedged, and the end contracted, which completes the operation, and turns it out as neat a joint of stove pipe as you ever saw in your life. The machine is worked by a crank and treadle, does the work of three men, and costs only $40.

One corner of the grand saloon, up stairs, is occupied by an extensive display of carved rose-wood and walnut furniture, from the shops of Mitchell & Rammelsberg. In the very foreground of this collection of household luxuries, is a walnut arm-chair, in which the Cincinnati people hope Baron Renfrew may sit when he comes here in the course of his travels. The back is surmounted by the royal arms of Great Britain, carved in the wood, and supported by graceful columns aronnd which are entwined various appropriate emblems. The covering is of silken damask, and in the piece which covers the stuffed back, are woven the same insignia of royalty.

William Wood & Co., of this city, make a fine show of paints, which are said to be fair samples of the articles they sell. One of the jury of award who has had this department under investigation, informs me that in quality and tone these paints are, if anything, superior to those we make in New York, and that there is actually no necessity for western men to be any longer dependent npon the metropolis for their supplies. The cases of philosophical instruments from the manufactory of James Foster, Jr., would do credit to Pike, or even old Sol Gills, that wonderful gentlemen, who, we are told by Cap'n Ed'ard Cuttle Mariner, of England, could make a watch. Mr. Foster's skill is further shown in the "chronograph" invented by Professor Mitchell, for measuring time during his astronomical observations at the Cincinnati Observatory.

T. Bass, whose sign-card hung on the heap of baskets here, shows that "they are home-made," certainly deserves credit for his selection of the willows from which the large and small baskets and bird-cages are made, as well as for the admirable workmanship which they indicate him to possess. It may well be a question for our farmers to discuss, whether it is worth our while to pay Germany and France something like a million dollars annually, for willow and willow-ware, when the articles can be produced as cheaply and good as they are abroad.

Miles Greenwood for some cause or other, doubtless from press of more important business, makes a small show of his goods this year. There is a case and some loose samples of beautiful brass castings, and a new valve in the lot is both novel and excellent, but in comparison with what he might have done, his contribution to the Institute this year, is but a drop in a bucket. Mr. Greenwood took hold of Fawkes's steam plow last year, and improved it very materially, I hear. The plow-frame is now made of angle iron instead of wood, as formerly, and works much better both for raising and lowering as well as draft. The machine has been down to Mr. Sullivant's mammoth farm in Illinois, where Fawkes has contracted to break a thousand acres this season. He has finished threshing about ten thousand bushels of wheat for Mr. Sullivant, and has more work of the same sort laid out.

## RECENT AMERICAN INVENTIONS.

### COMPASS PROTRACTOR

The object of this invention is to produce an instrument which enables an inexperienced hand, and also a person not acquainted with the manner of making a calculation, to take the necessary observations for the purpose of determining the ships course to a given point, or the bearings of surrounding objects, or the position of the ship from bearings; and the invention consists in the combination with ordinary parallel rules of a movable circle, graduated as a compass and provided with a semicircular opening with the exact center of the circle, marked therein in such a manner, that by the combined operation of said circle and the parallel rules, all the operations for the purposes above stated, can be made in a simple and easy manner, and without the necessity of any calculation. F. H. West, of San Francisco, Cal., is the inventor of this instrument, and he has assigned his full right to F. S. Seabury, of Stoney Brook, N. Y.

### SADDLE TREE.

The object of this invention is to obtain a gig saddle tree, by which a saddle tree may be constructed to fit any horse, and thereby avoid injuring or galling the back of the animal, a contingency of frequent occurrence as saddles have been previously constructed. The invention has for its object the simplifying of the manufacture of gig saddles, especially those of a superior kind, and to render the same more elastic and neat in appearance, stronger and more durable than usual, the invention being applicable to all kinds of gig saddles, such as silvered and japaned seats, jocky-covered seats, &c., This invention was patented to S. E. Tompkins, of Newark, N. J.

### ATTACHING HANDLES TO SAWS.

The object of this invention is to attach handles to a cross-cut saw in such a manner that they may be firmly secured to the saw, and at the same time admit of being readily removed when necessary, in order that the saw may be drawn longitudinally from the kerf when the log presses or binds against its upper surface, and prevents a vertical withdrawal of the same, a contingency which always occurs where the log is not supported so that its outer ends will fall when the cut is made, and this cannot always be effected, especially with large logs, which are mostly sawed on the ground. This improvement was designed by Isaac Pelham, of Ithica, N. Y.

## REPORT OF THE TRIAL OF STEAM FIRE ENGINES AT RENSSELAER COUNTY FAIR, TROY. N. Y.

[Reported expressly for the Scientific American.]

On Thursday of last week, the principal steam fire-engine builders assembled at Troy, N. Y., for the purpose of testing the merits of their several machines, and to arrive, if possible, at some definite conclusions respecting the merits of the various plunger and rotary pumps employed by them. The day set apart for the trial was the 27th ult., and at the hour specified the several engines made their appearance on the grounds, drawn either by hand or horse-power. We have not room for the meteorological report of the Smithsonian Institute, which was taken for us, but the wind was light through the day, except at intervals, when it blew quite fresh from the West; indeed, had the day been specially selected from the year, it could hardly have been finer for the purpose. The sky was covered with sullen clouds until nine o'clock, when, having relieved themselves of a slight shower, they partially cleared away. The prizes to be awarded by the Fair Committee, of which William E. Hagan, Esq., was chairman, amounted to $100, $75 and $50. In addition to these, it was announced from the judges' stand that the citizens had contributed $200, to be awarded as the Fair Committee thought proper. Two tests of each engine were to be had—one to play from the pipe through 50 feet of hose, using such nozzles as the exhibitors pleased, for 30 minutes from signal. The other test was in the case of first-class engines, to pump, through 800 feet hose, 18 inches against time, out of a tank 15 by 22 feet in measurement, and not quite three feet in depth. In respect to the second class pumping on quantity, they were to work on the tank for 15 minutes from signal; the amount of water discharged in that time to be estimated by the judges. The exhibitors were allowed 15 minutes from the tap of the bell to get ready. At the second tap they were to start fire and play for 30 minutes, as previously set forth.

The engines entered for competition were as follows, in the order of playing:—Messrs. Lee & Larned, Novelty Works, New York City—Self-propelling steamer *Niagara*; weight, 11,500 lbs.; size of steam cylinders, 7½ inches diameter by 14 inches stroke; capacity of pump (Carey's rotary), 1,200 gallons per minute. Hand engine No. 5, of this city, same makers—horizontal steam cylinder, 7 inches diameter by 8½ stroke; capacity of pump, 220 gallons per minute; weight, 4,448 lbs.; with one gage of water in boiler and no water tank. *Mechanics' Own*, same makers; same size cylinder and pump; weight, 4,278½ lbs.; water in boiler; no tank. Steamer *Southwark*, Philadelphia (this engine played last), same makers—horizontal steam cylinder, 9 in. diameter by 8½ in. stroke; capacity of pump, 600 gallons per minute. Amoskeag Manufacturing Company, Manchester, N.H.—Hand engine No. 2, weight, 4,858½ lbs.; size of steam cylinder (vertical), 8 in. diameter by 12 in. stroke; size of pump (plunger pattern), 4½ in. diameter by 12 in. stroke; capacity of pump, 251 gallons per minute; no air chamber on pump. Steamer *Huron*, same makers, first-class engine—size of steam cylinders, two direct acting vertical engines, respectively 8 in. diameter by 12 in. stroke; two plunger pumps, 4¾ in. diameter of plunger by 12 in. stroke; weight, without fuel or water, 6,030 lbs.; wood and water, 7,100 lbs.; capacity of pumps collectively, 600 gallons per minute. Silsby, Mynderse & Co., Seneca Falls, N. Y.—One first-class engine, rotary pump and engine (Holly's patent); weight, 6,049 lbs.; air chamber on pump; size of steam cylinders not given; capacity of pump, 600 gallons per minute.

These are all that were entered by prominent manufacturers; others were expected, but failed to arrive. We must not omit, however, to notice one machine entered for competition, which will certainly, if it grows a little, create a great revolution; this is the handiwork of Charles Fichtel, of Philadelphia. Size of steamer built by Charles Fichtel, horizontal steam cylinder, 4-8ths of inch diameter by 6-8ths of an inch stroke; capacity of pump, one nut-shell. This was really the neatest specimen of workmanship we have seen for some time. The whole affair weighed but 2½ pounds, and was an exact *fac-simile* of the Lee-Larned engine, even to the Worthington pump which supplied (?) the boilers with water, whose cylinder was only ⅛th of an inch in