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Explosives from Coal Tar.

That coal tar is susceptible of becoming a very deadly explosive in combination with certain acids was proved two years ago by Herr Hellhof, of Berlin, who at this time patented a process for making fulminating compounds from crude coal tar oils by direct nitration with strong nitric acid. Continued experiments in manufacture by the aid of steam have shown that the separate fractions of these oils, even those having the highest boiling point, are capable of nitration, and give a satisfactory yield of nitro-derivatives. So marked is this property, that the treatment of coal tar itself with strong nitric acid is a very dangerous operation, and could not be carried on largely without great difficulty and loss. In later experiments, therefore, a weaker acid is employed to cover the surface of the tar to be treated, the two being gradually stirred together. The pasty mass thus obtained is washed with excess of water, and the acid remaining in its pores is pressed out. The purified product is then mixed with certain oxygen yielding compounds, such as chlorate of potash, the alkaline nitrates, etc. All of these mixtures give new explosive compounds of different degrees of violence. The power of a concentrated nitric acid solution of one of these new nitro-derivatives is shown by the fact that a small quantity, when exploded by a percussion fuse, was able to shatter an iron shell. The great advantages of the new process for obtaining explosives from coal tar, by the direct use of weak nitric acid, are the cheapness of the raw material and of the light acid employed, and also the quiet and regular manner in which the operation of reduction is performed. Explosive nitro-compounds may also be made from the paraffins and similar mineral and wood oils and spirits. The *Deutsche Industrie Zeitung* observes that this branch of production is the more important since the value of tar may be expected to rise with every fresh use that is found for it.

IMPROVED FLOATING ELEVATOR.

We give engravings of a novel arrangement of floating elevator for grain, coal, etc., constructed by James Rigg, of Chester, Eng., who has for some years past devoted considerable attention to the design and construction of appliances for the mechanical handling of coal. The objects attained by this apparatus are the more rapid and economical transfer of certain classes of materials from barges to steamers or to a quay side than has been hitherto possible by cranes or manual labor.

For sectional details of construction, see page 354.

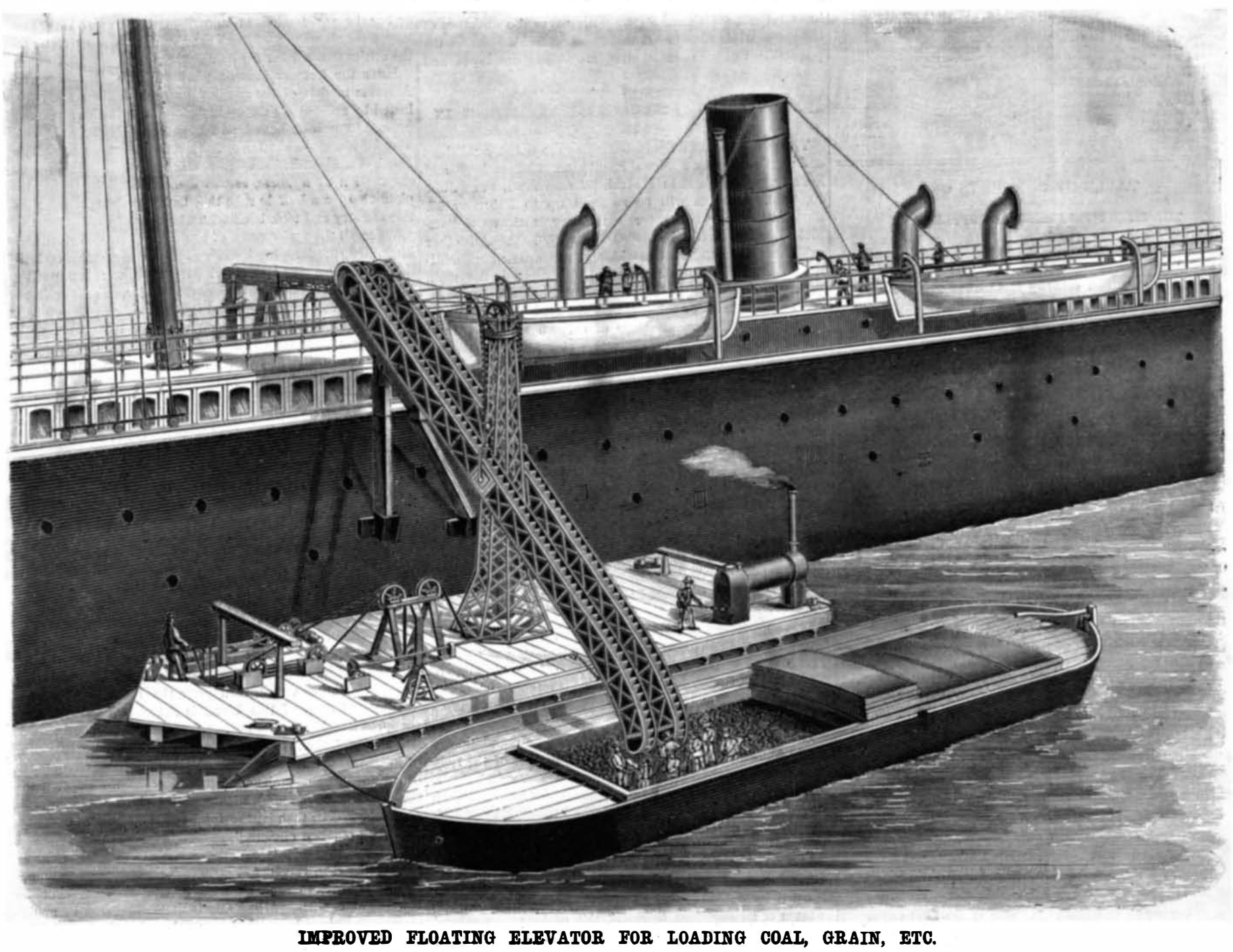
The perspective view represents the elevator as used in the coaling of steamers, but it is equally applicable to the loading under similar circumstances of salt, grain, and other matter. The necessity for some improvement on the present most general method of coaling steamers by hand has long been acknowledged, the system, if it may be so termed, being to place gangs of men in the barges, and others above them upon suspended platforms against the ship's side in sufficient numbers to enable them, by passing the baskets containing the coal from one gang to the next, ultimately to reach the ship's bunker. The expense and inconvenience attending such operations are considerable, and, moreover, are not under such ready control as steam or other power.

It is essential that any apparatus intended for this purpose should be so arranged as to be easily removable from place to place, and to meet this requirement the elevator now under notice is capable of being stowed away fore and aft of the pontoons upon which it is carried, as shown in Figs. 2, 3, and 4, page 354, thus avoiding any risk due to instability. The perspective view illustrates it in operation athwart and coaling a large ocean mail steamer through side bunkers, and the various movements effecting this change are so arranged as to be performed by steam power.

The six pontoons are 6 ft. in diameter by 20 ft. long, independently of their conical ends, and on the saddles riveted upon these are placed rolled wrought-iron beams, carrying the deck. A semi-portable boiler, F, provides steam for the pair of winding engines, which are used for three purposes, viz.: First, for driving the endless steel wire rope which actuates the two chains of elevator buckets or scoops; secondly, for raising and lowering the elevator arms; and, thirdly, for revolving them, that they may be stowed away fore and aft as shown in Figs. 2, 3, and 4. The hollow lattice tower, A, carries at its head a circular roller path, upon which a casting, B, is capable of revolving through the quadrant traversed between the two positions, and below this casting is attached a cast-iron column in three parts, within which pass the driving and return lengths of an endless steel rope; this rope being driven by the V-pulley on the first motion shaft, passes over and under the six grooved pulleys, Figs. 2 and 3, and a balance weight passes through the deck between guides, always maintaining the rope taut.

On the first motion shaft at the head of the elevator is a clip pulley driven by this rope, and a pinion upon this shaft is geared into a spur-wheel upon the drum shaft, thus giving motion to the double continuous chains of scoops (Fig. 9); and these scoops, which are of steel, are connected through malleable iron links to round steel spindles (Fig. 8), upon either end of which are small flanged pulleys traveling in double-angle steel guides forming part of the main suspended frames. The lower ends of these frames being concave, they will dip through the hatchways as deeply as the holds of the lighters or barges. Inasmuch as buckets cannot be so constructed as to pick up the coal, this is done by manual labor, and the buckets are formed as trays or scoops (Fig. 9), their capacity being about double that which can be

(*Continued on page 354.*)



IMPROVED FLOATING ELEVATOR FOR LOADING COAL, GRAIN, ETC.

IMPROVED FLOATING ELEVATOR.

(*Continued from first page.*)

filled by the number of men intended to be employed, thus insuring at all times receptacles for the coal to be loaded into. Payment for the work being made by the ton and not by the day or hour, the importance of this margin of capacity will be apparent.

For the purpose of raising and lowering the elevator arms, a large double cast-iron drum is provided, from which two chains are passed over the deck and led round sheaves into and up the steel lattice tower, and over the cast-iron head to the blocks from which the two elevator arms are suspended The drum is provided with a brake-wheel, brake, pawl, and ratchet-wheel, and the engines have reversing motion. The third set of gearing consists of a powerful worm-wheel, keyed on to the lower end of the cast-iron column within the lattice tower, the worm driving this being connected by means of bevel gearing to the second-motion shaft of the engine, these three distinct sets of gearing being set in and out of motion by independent clutches, the handles of which are conveniently placed with regard to the engine. A warping drum is also placed on the end of the third-motion shaft. Two hand winches, E E¹ (Fig. 3), enable the angle of the elevator arms to be accurately adjusted and varied to suit the steamer's hatch and the load in the lighter. In addition to the four rings at the ends of pontoons, four towing-bits are attached to the deck for mooring. It should also be added that the six cylinders or pontoons, three on either side, are totally separate and distinct from each other, all the plates being riveted to welded angle-iron rings.

For coaling the bunkers on that side of the steamer which is next the elevator, a return chute (see cuts) is provided with an adjustable double metal trunk which can be set to suit steamers of various beams, and to the mouths of these pipes flexible trunks are attached, which lead the coal into portable hoppers placed in the bunker holes. A conveyer or belt is erected upon portable trestles, readily placed for the purpose upon the steamer's deck, the gearing at the head of the elevator driving this.

As regards the performance of the elevator above described, Mr. Rigg gives in *Engineering*, from which we take our engravings, the following as a fair estimate of the economy resulting from its use in the purpose for which it is mainly intended, viz., the coaling of steamers, and, to avoid any appearance of exaggeration, a liberal amount is allowed for working charges, and it is assumed to be in active operation for three days in the week only; a crew of four is sufficient to discharge the duties on board the pontoons and in making the connections to bunkers. The rate for filling the passing trays on the continuous chains is taken at the same amount as is paid for loading the baskets now passed from man to man connecting the barge and bunker, as previously described. The labor of trimming in the bunkers being the same in each case, these charges also are alike.

Cost of Bunkering Coal with Patent Elevator.

	£	s.	d.
Engineer per week	2	0	0
Stoker	1	7	0
Additional labor (two men)	2	10	0
	5	17	0

Depreciation:

Elevator, including engines, boilers, gearing, and pontoons	£ 2400		
Coal distributing troughs,	100		
	2500		
10 per cent per annum for one week on £2 500	4	16	2
Coals and stores per week (3 working days)	3	5	0
	13	18	2

Filling:

	£	s.	d.	per ton.
Eight men, each 7 tons per hour = 56 tons per hour or 560 tons in 10 hours (1 day) = 1,680 tons in 3 days at 1¼*d.* per ton	8	15	0	
Trimming 1,680 tons in bunkers at 2½*d.*	17	10	0	
Royalty on 1,680 tons, at ½*d.*	3	10	0	
	43	13	2	= 0 6¼
Present average charge 1,680 tons at 1*s.* 6*d.*	126	0	0	= 1 6
	82	6	10	0 11¾

Assuming a steamer taking 1,000 tons in her bunkers, the following would be the application of the above figures:

Loading by patent elevator 1,000 tons, at 6¼*d.*	26	0	10
Present charge by stevedores for manual labor, 1,000 tons at 1*s.* 6*d.*	75	0	0
Difference	48	19	2

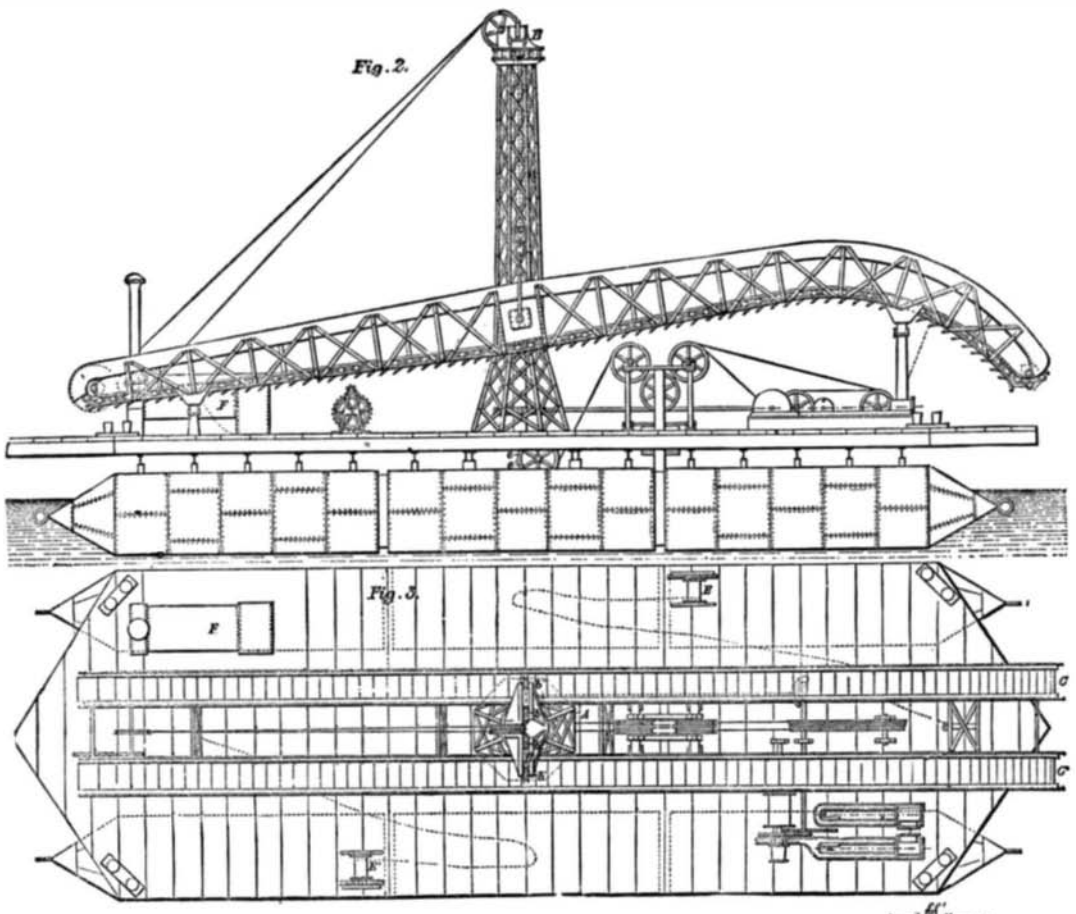
It will be seen that the above figures show a great difference in favor of the patent elevator over manual labor, and that an ample margin remains for profit for the coal stevedore.

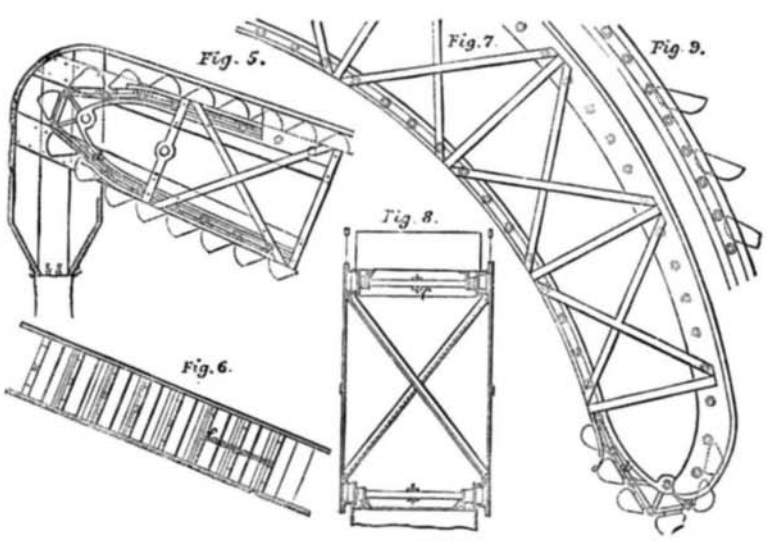
These figures are interesting, and clearly point to the great economy which may be obtained in the coaling of steamships, and the importance of this subject to their owners and the stevedores who now have the work performed by manual labor. The machinery being constructed of a capacity equal to double that of the eight men represented as loading, this number may under pressure be increased.

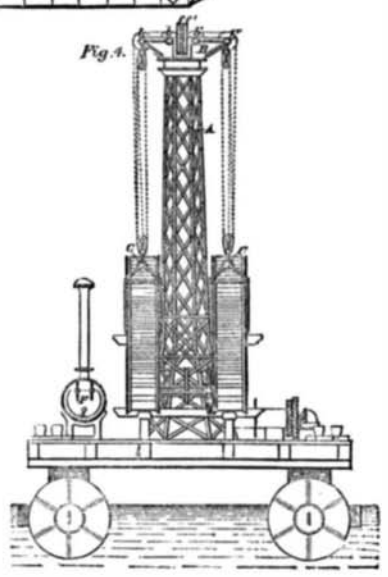
One of the secondary advantages is, that whereas coal barges must now be placed at each side of the steamer, the introduction of this elevator enables them to be used on one side only, leaving the other at liberty for loading cargo. The same apparatus is also available for loading salt and any other material, which is now similarly dealt with by hand. Suitably constructed buckets render the elevator also available as a dredger, the hand winches E E¹, Fig. 3, affording the ready adjustment of the elevator frames which is so essential.

The general dimensions of this elevator are as follows: Six pontoons, each 20 ft. long by 6 ft. diameter; length of pontoons over all, 71 ft. 4 in. length of deck over all, 74 ft.; beam, 24 ft.; height of central; lattice tower from deck, 28 ft.; length of suspended elevator girders or frames, 68 ft. 3 inches; pair of winding engines, 7 in. cylinders and 14 in. stroke; total weight, 66 tons.

This one has recently been constructed by Mr. Rigg for a foreign grain port, the buckets being of the form shown in Figs. 5 and 7, suited to grain, and it will be readily seen that a flow, which is practically continuous from two endless chains of buckets, will transfer more grain in a given time than steam or hydraulic cranes, which from their nature must be intermittent in their operation. For working grain a pair of timber bonnets are placed over the head of the elevator, and to these are attached flexible tubes for leading the grain into the hold. As a protection from the weather the troughs also, along which the buckets travel, are covered by removable waterproof sheets.







IMPROVED FLOATING ELEVATOR.—[See first page.]

What is the Comet made of?

MM. Thollon and Gouy have communicated to the French Academy of Sciences the results of their spectroscopic observations on the large comet now visible. It appears from these, says *Engineering*, that at the observatory of Nice, on the 18th of September, they detected very brilliant rays of sodium, which were slightly displaced toward the red. On the 9th of October the sodium lines had disappeared, leaving only four ordinary bands of carbon, of which the violet band was very distinct, but feeble, while the others were bright, especially in the head. This gave at the same time a continuous spectrum, in which could be seen a great number of black and bright rays. On the 16th of October the spectrum was much the same, except that the violet band had almost disappeared, and the continuous spectrum had become feebler. The spectrum, in fact, showed a striking resemblance to that of the flame of alcohol. Of course this does not imply that alcohol is present in the comet, since it is known that all compounds of carbon give the same bands, and of these alcohol was only chosen because it was most convenient for comparison. The "integral spectrum" taken by a direct vision spectroscope, showed that the major portion of the comet's light was white, and probably reflected sunlight. The vanishment of the sodium lines and other brilliant rays would seem to prove that the spectroscope cannot give a complete analysis of cometary matter. It is probable that this matter is similar to that of aerolites; and if the temperature of the comet is sufficient to produce an emission spectrum from the compounds of carbon, it ought also to give a spectrum of sodium: but this, as found by MM. Thollon and Gouy, is not always the case. They are, therefore, led back to the electric theory of comets. It is known that if a carbureted gas is traversed by the electric discharge from a Holtz machine deprived of condensers, the gas kindles and gives the carbon bands; and if it hold metal dust in suspension, it will give the bands without showing the lines of the metals. Something of the same kind possibly takes place in comets.

Petroleum Manufactures.

A census bulletin of statistics of the manufacture of petroleum during the year ending May 31, 1889, shows there were 86 firms and corporations in the trade, with an aggregate capital of $2,739,746, and giving employment to an average of 9,869 hands, 25 of them women and 346 children. The annual wages paid amounted to $4,381,572. The value of the raw materials used was $35,000,000, and the value of the manufactured products was close upon $44,000,000. There were in use 374 boilers of 12,744 horse power; 385 engines, 200 pumps; buildings to the value of $1,899,288, and machinery valued at $3,737,998. The losses for the year from fires and other accidents were $104,631.

Free Canals and Canal Improvements.

One of the notable features of the recent election in this State was the enormous vote in favor of entirely abolishing tolls on the State canals. For a long time the great food staples and some other commodities have been on the free list, and latterly all the West bound freight has been exempt from tolls. Under the new law the Erie Canal and its tributaries will constitute a free waterway the whole length of the State, from the Hudson River to the Great Lakes, for eight months of the year. The canals give employment to about 6,000 boats.

The object of the abolition of tolls is to increase the traffic of the canals, so as to make them a more potent factor in solving transportation problems, and in helping to maintain the commercial supremacy of New York. How far the end aimed at will be furthered by the change remains to be seen. The inability of the canals to be the dominant factor in controlling the charge for transportation across the State, and in determining the course of trade in competition with railways, however, would appear to be due less to the amount of tolls hitherto demanded, than to the inability of the canals to meet promptly and parallel the improvements in transportation introduced by the railways. In carrying capacity and economy in transportation the railways are progressive, while the canals are, or have been, practically stationary.

As Mr. Robert Taylor, of this city, has pointed out, the Erie canal boat, towed by two horses, and the 20-car wheat train hauled by a 30-ton locomotive, were for many years equivalent units in wheat transporting capacity, with the advantage of greater economy in favor of the canal.

"So long as this continued, the canal was the regulator of grain freight rates, but as the volume of grain transportation increased, railway improvement was stimulated, and the advent of heavy steel rails suggested better ballasting of the road bed and heavier and closer laid ties. Then came the 70-ton Mogul locomotives, which could fairly fly with forty cars, each containing 500 bushels of wheat—a train load of 20,000 bushels—when the railroad became the regulator of grain freight rates, being able to carry at much lower prices than the canal could possibly carry at, even at 2½ cents, if necessary, and make money."

To raise the canals to their old commercial rank two things are proposed. One is to make the Erie Canal throughout a ship canal, a costly undertaking, and one that might prove the reverse of beneficial either to New York or to the cities along the line of the canal, as the actual benefit of the change would fall rather to the producers and shippers of the far West than to the people of New York.

Another and more reasonable proposition is to increase the carrying capacity of the canal by improving the existing lock gates. The old fashioned, slow moving swinging gates are still used. By a change to lift gates, which could be done without great expense, the available length of the locks would be increased by 35 feet, and the canal boats might be made 130 feet long instead of 97 feet as now, with a proportional increase in their carrying capacity, or from eight thousand to ten or eleven thousand bushels of wheat. The cost of operating the larger boats would be little, if any, greater than for the boats now in use. With improved lock gates, it is further claimed, the carrying capacity of the canal might be five times what it ever has been.

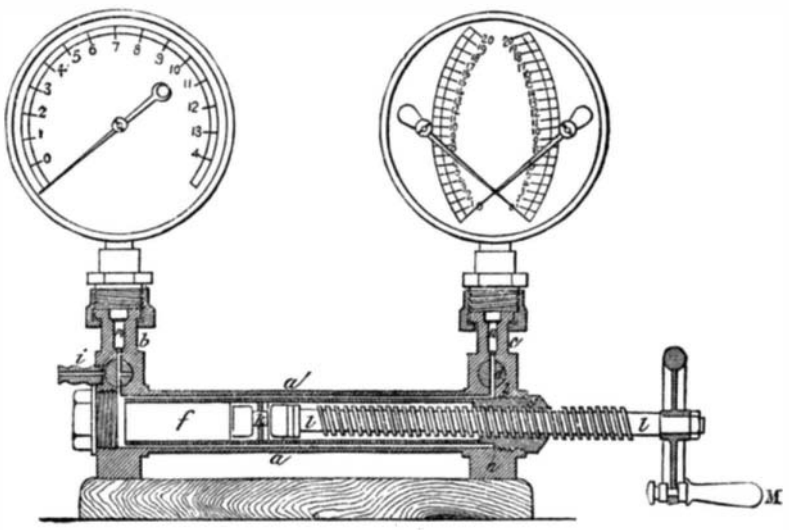
Touching the proposition to abandon the canals entirely as having outlived their period of economical usefulness, it is urged that water carriage remains, and is likely always to remain an important commercial factor, even where railroads are most abundantly developed. Proof of this is seen in the large use of the great canals of England and Scotland, and in the efforts which the more advanced European states are making to extend their facilities for water carriage. Thus in France 74 per cent of the domestic commerce of the country goes over the canals, and efforts are making to largely increase the capacity of such artificial waterways. Germany, likewise, has entered upon the work of enlarging and improving the 2,000 miles of canals within the limits of the empire, and Holland and other states are spending large sums for a like purpose.

A FLAGEOLET player charmed all his hearers by his musical performances at Neuilly, near Paris. He had formerly suffered from diphtheria. Tracheotomy was performed, and the silver tube which was introduced at the time of the operation, and kept stationary by means of a circular pad, now serves the musician of Neuilly as a natural aperture through which he breathes, and so successfully that his flageolet playing was enthusiastically applauded by all present.—*British Medical Journal.*

APPARATUS FOR TESTING PRESSURE GAUGES.

The accompanying cut represents a small portable apparatus designed to test pressure gauges, and which is the invention of Mr. C. D. Gäbler, of Hamburg.

It consists of a brass cylinder, *a*, with tubes, *b* and *c*, provided with cocks, *d* and *e*. In the interior of this cylinder there is fixed, by means of a screw, *g*, a small pump chamber, *f*, in which moves a piston, *k*, actuated by a screw, *l*, with winch, M. When it is desired to use the apparatus, the gauge to be tested and a standard apparatus are connected with the cocks, *d* and *e*, as shown in the cut. But the apparatus must first be prepared by adapting to the tube, *i*, a piece of rubber tubing whose other extremity dips into a glass of water. The conduits, *n* and *m*, are then closed by means of the cocks, *d* and *e*, the latter, which is a three-way one, being turned so as to admit water through the tube, *i*.



APPARATUS FOR TESTING PRESSURE GAUGES.

The piston, *k*, is afterward led, by means of the screw, *l*, to the extremity of its travel, and the inner cylinder is filled with water. Then the cocks, *d* and *e*, are opened so as to allow the air to be disengaged, and the piston is gradually pushed in, so that the water shall rise above the tubes, *b* and *c*. The cocks are then closed, and the piston is withdrawn, so that the apparatus is entirely full of water. The two gauges can now be fixed to the apparatus. It is evident that on driving the piston forward the two gauges will be submitted to pressure, and that they may be easily compared in measure as the pressure rises.

For testing barometers, the operations are the same, save that the piston must be driven into the cylinder when the barometers are affixed to the apparatus. When the piston is withdrawn, a vacuum is created. It has been found that on maneuvering the piston twice in succession, care being taken to place the cock, *c* and *d*, properly, an almost perfect vacuum may be produced.

This apparatus has been devised for shops, and, as it is very portable, and takes up but little room, it is capable of rendering service to inspectors of boilers.

CATAPULT FOR THROWING LIFE LINES.

This apparatus is designed for affording a sure, speedy, and safe means of escape from the interior of burning buildings, from sinking vessels, and other places of danger. As shown in the engraving, the apparatus is supported by four wheels like an ordinary wagon. It is provided with a very strong frame, upon which is mounted sector wheels, which are moved by a pinion on the crank shaft, to adjust the elevation of the powerful compound springs mounted on a frame of which the sector wheels form a part. These springs are fixed at their larger ends to the frame near the pivot of the sector wheels, and their free ends are connected by a cross bar carrying a cup which receives the ball attached to the line to be thrown.

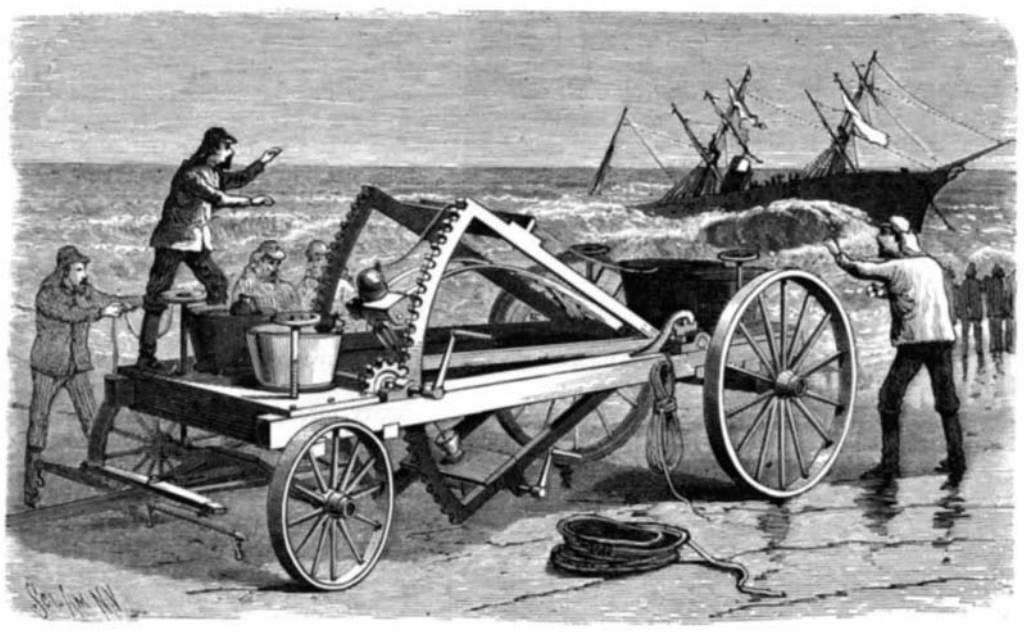
On the lower part of the bar to which the cup is attached is fixed a hook which is caught by nippers attached to a rope wound on a windlass journaled on the lower arms of the sector wheels. The rope is wound through a funnel which serves to trip the nippers and release the springs when it is desired to project the ball.

That part of the frame not occupied by the gearing, sector wheels and springs is floored over, and at convenient places thereon are placed coils of lines or ropes with balls attached in light movable cans with flaring sides, the line to be first thrown being placed on the rear of the frame in the center. In diagonally opposite corners of the frame are embedded four levels, two in each corner, and its frame can be made level by means of the leveling screws passing through nuts in each corner of the frame, whatever he the inequalities of the surface on which the wheels rest.

In practice the apparatus is kept in readiness for removal at an instant's notice, with the sector wheels elevated as far as possible and made stationary, the nippers caught on the hook at the end of the springs, and the rope held taut by the windlass. Having been rapidly hauled to the scene of operations, the apparatus is turned with the rear toward the place where the danger is. The apparatus can be then turned or aimed in any direction by simply backing the horses. The direction having been obtained, the frame is rapidly leveled by means of the leveling screws, the desired elevation obtained by the gearing operating in the sector wheels, the ball to which the line is attached placed in the cup, and the springs brought down by the rope and windlass till they are loosed by the nippers being drawn into the funnel, when the ball carrying the line will be thrown to the desired place.

Should it be desired to reach more than one point, any number of lines which may be prepared could be thrown by removing the can containing the line first thrown and replacing it by another.

Seats may be arranged on the frame for the entire crew needed to manage the apparatus, three men being all that is required—one driver and two to manage the apparatus. Such a crew, with practice, would become so skillful that within a few minutes of its arrival at the scene of danger it could throw a line into any specified window or aperture of any building, or over any building or vessel, and thus provide a means of escape. Further information may be obtained by addressing the inventor, Philip W. Claypool, Summitville, Col.



CLAYPOOL'S CATAPULT FOR THROWING LIFE LINES

Absorption of Moisture by Building Materials.

Every one connected with buildings of brick and stone knows the absorbent nature of those materials under the most favorable circumstances. It would astonish most people, adds the *Building News* (London), to be told what a large quantity of water is stored in the brick walls of an ordinary house after a heavy rainfall; the drying or evaporation of which must take place inside in cold weather, unless proper precautions are taken to render the walls impenetrable. The plea for hollow walls has been raised again and again in this journal, and though the system is coming to be adopted more generally in some districts, the idea of solidity of wall structure seems to have taken too deep a hold on the ordinary building mind to be given up. Some time ago a suggestion was made that colliery owners, and others who have large quantities of slag, might with profit utilize this material for building cottages and other purposes. We are not sure whether the hint was taken, but in some parts of the country the material furnishes an admirable aggregate for concrete. Where good aggregates exist like slag, broken brick, sandstone, or furnace ashes, concrete building ought to be much cheaper than brick, as no skilled labor is required.

There is another consideration besides cost which tells in favor of concrete, and that is the non-porosity of walls so constructed. Not only does brick absorb moisture in wet weather, but it is now known to absorb animal gases as well; and here we have a condition which builders of our hospitals and infirmaries ought to be reminded of. We are not sure if concrete has been applied to any buildings in England of this kind on a large scale, but as absorbent walls are known to be injurious in harboring the germs of infection, the value of walls constructed of concrete, made of burnt aggregates, cannot be overrated. Slag-made concrete has the great advantage of being fire resisting, the material in its rough state having been subjected to intense heat. There is nothing in it to "kill" the cement, and the rough surface of walls built with it becomes an excellent "key" for the plastering. In the construction of walls of this material, three sizes of the slag may be used; the larger lumps being packed in layers in the middle of the wall, and the other two sizes, the larger of the size of walnuts, run in with cement on each face in the proportion of eight to one.