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Contents:

(Illustrated articles are marked with an asterisk.)

COMPOUND ENGINES.

The idea of exhausting from one cylinder of a steam engine into another, and there utilizing the expansive force remaining in the steam after it has done its work in the first cylinder, is not by any means new. The history of the earlier attempts in this direction is so familiar to engineers that a review of it would be trite. Of late, however, this idea has been revived, and we are now in the midst of a compound engine mania.

A certain class of engineers seem to think that there is some peculiar law which works in a compound engine, by which a large gain in economy can be made. That great gain has been made by the substitution of compound engines for single cylinders, in certain cases, cannot be denied. That this gain is inherent in the compound system *per se* is denied by able engineers. The use of steam expansively, if the expansion be carried to its economical limit, will always show great gain over steam used non-expansively, or imperperfectly expanded. Whether the substitution of compound engines for single cylinder engines has accomplished more than would have been done by single cylinders so constructed as to admit of expansion to the same extent, is a question open to debate. A given volume of steam, at a given temperature and pressure, has in it the capacity for the performance of a given amount of work, which theoretical amount of work can never be exceeded by the use of any appliance whatever.

If compound engines can be proved to work steam nearer up to its theoretical limit than single ones can do, their value will be established. It is not established, however, by the comparison of compound engines with single ones confessedly inferior to other single ones. A gain in economy must be clearly traceable to the system as a system, and not only traceable to it, but capable of being explained on rational principles, before it can be accepted as a scientific fact. If there be any such gain, it neither depends upon any occult cause, nor results from anything other than the operation of well-known laws of heat and steam.

With the same initial pressure and the same expansion, waiving the effects of friction, radiation, and clearance, the same results would be obtained by engines of either class; but the disadvantages of clearance, radiation, and friction are increased in compound engines, and hence there must be some good reasons for their use, which compensate for these disadvantages.

These reasons may be briefly stated. Improvements in surface condensers enable marine boilers to carry much purer water than they could do formerly; and hence they can carry higher steam. With higher steam, the principle of expansion has become more economically available. Marine engines are for the most part, direct acting, using slide valves with which steam can not be cut off so as to expand in single cylinders to the extent desired. To effect this expansion without the use of an independent cut-off, the compound engine is employed, and it may therefore be considered as a substitute for independent cut-off single engines, designed to produce the same result.

It is evident that in the compound engine, the expansion might be carried to its extreme economical limit, by the proper proportioning of the size of the large cylinder to that of the small one, were it not that some losses occur, alluded to above; a commonly great source of loss arising from the waste space or clearance between the two cylinders.

It is not, then, because any principle is employed in the compound engine, not involved in the action of other engines, that it is found good practice to use them for propelling ships, but simply because their use renders it possible to accomplish a result not otherwise attainable except by the use of complicated valve gear, and by relinquishing other features desirable to retain in marine engines.

For land engines, there is less to be said in their favor. We doubt that any result, not attainable by a good variable and independent cut-off, has ever been shown by them; while at the same time they are more cumbrous and expensive. There have been, however, some statements made in regard to a 150 horse-power compound engine—running at Yonkers, a short distance from New York on the Hudson river—which, if substantiated, will go far to modify our opinion. We have not seen this engine, but are told that it is compact in the extreme, and that it gives an economical result of less than two pounds of coal per horse power per hour.

There is no mistaking the fact that we have entered upon an era of compound engines. Not only are old vessels being refitted with such engines, but some of the best new steamers are supplied with them. The steamship *Oceanic*, recently described in our columns, has a fine specimen of this class of engine, finished in a style worthy of that magnificent craft. A well-known engineer of this city is superintending the construction of several for the United States Navy, while abroad they seem to meet universal favor.

INSPECTION OF STEAM BOILERS.

We are in receipt of the second annual report of Mr. T. J. Lovegrove, Inspector of Steam Engines and Boilers, Philadelphia, Pa., which states that, during the year 1870, only two persons in the department have been injured by steam; one slightly scratched by the explosion of one of the sections of a Harrison boiler; and another scalded by the explosion of another boiler, but only so as to be confined to his residence for two weeks.

It is claimed that the immunity from disastrous explosions in Philadelphia, when contrasted with the large number that occurred during the same year in various parts of the United States, is evidence of the efficiency and utility of boiler inspection in that city.

If proper systems of inspection can be secured, there can be no doubt that steam boiler explosions would become so rare that the dangers attending the use of steam would be reduced to scarcely more than attend the use of water power. The difficulty lies in the selection of inflexible and thoroughly qualified officers, who know enough to perform their duties, and who will not, for any consideration, neglect them. Laws are easily framed, but it is not always easy to obtain their faithful execution.

The inspector regards as safe the class of boilers known as "sectional," which comprises numerous devices of tubes, globes connected by tubes, etc., in which the water is contained, and heated by the external application of the gases of combustion. He thinks such boilers might be properly exempted from inspection.

The increasing use of steam is shown by the fact that 31 new boilers have been put into use in Philadelphia during the year, while 27 old ones have been repaired and re-created, making a total of 58 more than were inspected the previous year, and which will furnish power to establishments employing in all 3,500 operatives.

During the previous year, so large a number of boilers were condemned that in the present year it has only been necessary to condemn one.

The inspector refers, in his report, to an editorial published in this journal (in our issue of April 23, 1870), upon Steam Boiler Inspection; in which we opposed a proposition said to have been made in Chicago, to vest the power of inspection wholly in a steam boiler insurance company. He thinks the other suggestions made in the article referred to would, if adopted in Philadelphia, prove advantageous to its interests. We felt certain, when writing the article in question, that we were reflecting the views of intelligent steam engineers and steam users throughout the country; and we trust that the remarks made on that occasion, in connection with others made before and since, will continue to aid in the efforts now making in different parts of the country to establish thorough systems of boiler inspection.

We also gather from this report, that the system of inspecting and licencing such men as are to have the charge and care of boilers, is working well, although we are surprised that there are so many reported as examined and licenced, considering the fact that there is no penalty attached to the employment, for this purpose, of men who have not passed such an examination, and who possess no licence. To be efficient, such examination should be made compulsory, under penalty for neglect. Without this, it will be little more than a farce.

The average qualifications of men who claim to be able to perform the duties of engine and boiler tenders, is shown by the fact that, out of 56 examined, only 4 were first class: 26 were second class, 22, third class, and 4, fourth class. Out of 39 renewals, only 9 were first class.

We are convinced that the inspection of boilers needs to be supplemented by the thorough examination of boiler tenders, before we can expect the full value of any system of inspection to be fully demonstrated. With good sound boilers, and men thoroughly qualified in all respects to use them, we should rarely hear of disastrous boiler explosions.

ONE HUNDRED THOUSAND DOLLARS REWARD FOR A NEW INVENTION FOR PROPELLING CANAL BOATS.

The Legislature of the State of New York, at its recent session, passed a bill offering a reward of one hundred thousand dollars for the best improvements for the propulsion of canal boats. This bill had not, at the time of our going to press, been signed by the Governor, but his prompt signature is expected, and thereupon it becomes a law. In another column, we publish the full text of the bill.

The reward offered is a handsome one, is not hampered by any obnoxious or narrow conditions, the terms of competition are broad and liberal, and the whole matter is highly creditable to the authorities. In nearly all other examples of public rewards for improvements, it has been made an imperative condition that the inventor should surrender his rights to the patent. In the present case, nothing of this kind is required, but the inventor will be entitled to the offered reward, and to all additional benefits that he may be able to derive from his patents.

These liberal and judicious terms will have a tendency to stimulate the inventive geniuses of our country; and, that some of them will succeed in studying out good and practicable plans, meeting every requirement of the case, we cannot for a moment doubt.

The Commissioners, who are to decide upon the merits of the various plans, embrace some of our most honored and able citizens. Gen. George B. McClellan, of New York city Chief Engineer of the Department of Docks, 348 Broadway is to be chairman of the commission. Rules and regulations for the filing and examination of plans will doubtless be issued by the Commission, which we shall duly place before our readers.

The Commissioners, after examining the plans, will decide as to the best, and may issue in the aggregate three certificates. Should they issue but one certificate, the holder will receive fifty thousand dollars. If two certificates are issued, the holder of number one draws thirty-five thousand dollars, and number two, fifteen thousand. If three certificates are issued, number one draws thirty thousand dollars, number two, fifteen thousand, and number three, five thousand.

After this selection from the plans and payment of rewards, practical trials thereof upon the Erie Canal are to take place, and upon such trials, the Commissioners are to award the further sum of fifty thousand dollars, issuing three additional certificates, as before described, making the total sum of one hundred thousand dollars.

The improved navigation of the Erie Canal is a matter of momentous importance to the State of New York. Upon the economy and expedition with which produce can be transported through the canal depends the question, whether this State is to maintain its pre-eminence as the main highway for Western export and supply, and this city, its proud position as the emporium of shipping and commerce.

THE REMOVAL OF THE HELL GATE OBSTRUCTIONS.

Few who have not visited the scene of operations now in progress for the removal of the Hell Gate obstructions in the East river, have an adequate idea of the extent and difficulties of the undertaking. We have in progress an engraving illustrating the work, which will shortly be published, and we shall accompany it with more detailed description than we have yet given.

The rock which has to be removed in making the headings is a very hard trap rock, extremely difficult to drill. The drills used are the diamond drills of Severance & Holt, illustrated descriptions of several kinds of which have, at different times, appeared in this journal. The style of drill used in this work may be described as follows:

The boiler, a small upright, used extensively in mining work, is stationed in the shaft, and steam is driven through a two inch rubber pipe to the machine proper. This consists of a simple framework of iron, about seven feet high by three feet square, formed by four upright posts, with cross arms at top and bottom. A small double acting oscillating engine, with cylinder three by six inches, drives the rotary drill, which is a hollow tube, upon the end of which is secured a piece of steel somewhat less than two inches in diameter, called the "head." In the face of this head are set four rows of the carbons or black diamonds, three in each row, with four more in the outer circumference, one between each row, making sixteen diamonds in all. The setting of these stones is similar to the setting of a jewel in a finger ring. Although they are diamonds, the value is but a trifle compared with the more common yet less useful carbon bearing that name. The market price is from three to six dollars each.

A small force pump connected with the machine, and worked by it, forces water through the tube or drill, so that the surface upon which the diamonds act is always wet. This prevents the heating of the drill, and at the same time softens in a measure the surface of the stone. The drill is driven at a speed of about 400 revolutions in a minute, and is capable of drilling a two inch hole about six feet per hour,