closure of the Grand Bayou and the construction of a dyke at the head of the pass. The object of these works is to deflect more water into the South Pass and thus increase the velocity, and consequently the scouring action, of the current.

During the progress of this important undertaking, the observations made from time to time gave evidence of the correctness of the theory on the faith of which it was undertaken. The channel was found to continuously and steadily increase in depth as the lines of the jetties were extended, and within a brief period after their final completion, several years ago, a channel of 30 feet in depth for a width of 200 feet was satisfactorily secured, and has since been maintained without dredging, or other artificial aid than that afforded by the jetties themselves. The fear that the action of the jetties would simply have the effect of shifting the bar a little farther out, where it would again form and prove as great an obstacle to navigation as ever, has not been verified, the sediment being most probably carried out sufficiently far by the rapid flow of the river to cause it to be carried off and dissipated by the currents of the Gulf.

The completion of this important engineering work has established the unrestricted navigation of the greatest water-way of the continent. The largest ocean steamers can now enter and pass out of the river without difficulty. The commercial results flowing from the improvement of the Mississippi's mouth are of vast national importance. Already the work has given an immense impetus to the foreign commerce of New-Orleans and other cities upon its banks. It has caused the diversion of a large and growing share of the vast grain traffic of the West from the great trunk lines of railway, and New Orleans, St. Louis and other cities upon its banks will speedily become dangerous rivals to the great Eastern cities for the exportation of the agricultural and mineral products of the West and South, of which the latter were formerly practically the sole possessors. The work of improving the navigation of the Mississippi, which Capt. Eads has accomplished in so signally successful a manner, although it has already greatly benefitted the trade of Southern and Western States that border upon it, promises for the future to yield still greater results.

IMPROVED DOUBLE-ACTING STEAM PUMP.

The accompanying illustration represent a double acting steam pump which for simple but substantial construction and effective and reliable working has gained considerable favor in England. It is the speciality of Hulme and Lund, Manchester, and is particularly suitable for the drainage of deep mines, some pumps of this class being at work at the present time forcing water 1,200 feet vertically in one lift. Four substantial columns support the steam cylinders and serve at the same time as air vessels for the pumps. The steam valves are of the ordinary kind, worked directly from eccentrics on the shaft below. The water valves are furnished with separate bonnets or doors, and are therefore at all times capable of easy inspection. The flywheels are heavy, and are turned true, so that they run with accuracy and will carry a belt for driving purposes. In all parts the most suitable materials are employed. The connecting rods and shafts are made of the best scrap iron, the piston and valve rods of steel, and the glands, bushes, steps, eccentric straps, and water valves are all of the best gun metal. The pistons are furnished with metallic packing, and the joints throughout are planed and faced. All the working parts and the packings are easy of access and of ready adjustment. Pumps of this class are specially made, capable of pumping against any pressure up to 1,000 lbs. per inch.

TUBULAR BOILERS.

The Hartford Steam Boiler Inspection and Insurance Company, in its *Locomotive* says :—

In the early history of the horizontal tubular boiler, it was regarded necessary to crowd as many tubes as possible into the lower half, especial care being taken to put them in after the plan known as "staggered," because more tubes could be inserted, and all the room economically (?) occupied. Little regard was paid to the spaces between the tubes and shell, or to the distance of the tubes to each other. The question of the circulation seems to have been little thought of, and almost no regard was paid to facilities for inspecting and cleaning. The tubes were usually 2" and 1 1-2" in diameter. They were packed so closely together that after a year or two the spaces became filled with deposits of lime and mud, and their efficiency was greatly impaired. In time, 3" tubes were introduced, but the manner of setting them was not changed. When the Hartford Steam Boiler Insurance Company first began business this was the condition of things mainly, and we at once set ourselves at work to influence, if possible, a change in this practice. Our aim was to have the tubes not less than 3" in diameter, and to have them arranged in vertical and horizontal rows, and not in any case nearer than 3" to the shell of the boiler. This, of course, reduced the number of tubes, and consequently the calculated heating surface of the boiler, and was bitterly opposed by many boiler makers. The rapid increase in manufacturing and consequent increase in the use of steam demanded important changes in the methods of constructing boilers, but the old prejudice lingered, and gave way only under severe pressure. A manufacturer wanted a new boiler of a certain horse power. He would apply to two or more boiler makers for estimates of cost. They would make up their specifications, accompanied with the estimated cost. On examination it would be found that their specifications agreed only in length and diameter. One would be crowded with tubes while the other would have them well arranged and judiciously distributed. The former would claim greater efficiency because his boiler had more tubes, and consequently more heating surface, while the latter would contend that his boiler was superior because it provided for free circulation of the water. There was great difference of opinion among boiler makers on this point, and there seemed to be no well established authority of the subject. Again and again were we applied to as umpire in such cases, and without reference to workmanship, which would be equally good in both cases, we believe we invariably advised the tubes to be set in vertical and horizontal rows, well distributed, and in no case nearer than 3" to the shell. At the bottom we advised at least a distance of 6" in the smaller boilers, and 8" in the larger onces, for abundant room to adjust the hand holes —one in each end of the boiler,—and to give a larger body of water over the fire, which is the hottest part. This was a great improvement on the old practice and came to be very generally adopted, and is largely the practice to-day, particularly in the East.

But experience raised the same question some time ago as to whether this plan could not be improved upon? Were the tubes equally efficacious? It was found that the levity of the heated gases naturally carried them to the upper rows of tubes and the lower ones consequently did comparatively little work. The question then arose how many tubes can be removed and the maximum efficiency of the boiler maintained? Another was, as to whether the size of the tubes should be increased? We have experimented more or less in this field, and to say the least, favor a reasonable departure in this direction. We have furnished many specifications for boilers, constructed on this plan, and they have given good results. Boilers makers in many parts of the country are constructing boilers on this plan.

Over the centre of the bottom there should be a distance of 18" from tubes to shell. This gives space for a good solid body of water over the fire, besides allowing room for a man hole in the front head underneath the tubes. The latter arrangement greatly facilitates the work of inspection. The entire bottom of the boiler can be inspected internally and externally, and sediment can be easily removed.

FIRE-PROOF SAFES.

The desirability of having the best made fire-proof safes in use for the storage of documents, cash, and other valuables, and the best means of setting the same in masonry or brickwork are points which continually force themselves on attention, and are just now prominently called up afresh by reason of the gigantic fires which have occurred in various places of the city. Upon this subject a writer in the *Times* offers the following observations: One lesson which the recent disastrous fires in London have taught is the desirability of using properly made safes for preserving valuable books and documents. Although the manufacture of fire-proof safes is an important speciality of the British iron trade, it is remarkable that in England itself large numbers of persons keep valuable articles in their offices and houses without the protection, which is so easily attainable, of a safe scientifically constructed to resist the attacks of fire and thieves. Most of the notorious robberies of jewellery and plate from private houses in the last few years might have been prevented by the use of safes. Fire-proof safes are sent from Great Britain to all parts of the world; while factories also exist in the United States, Vienna and Hamburg. The Sultan of Morocco recently ordered a set of safes to be made at Liverpool for conveyance across the desert on the backs of camels to a strong city in the interior. English fire-resisting and thief-re-