

**IMPROVED COMPOUND STEAM PUMP.**

The special advantages claimed for the improved steam pump illustrated herewith are as follows: 1st. It has only two moving parts, except the pump valves, thereby reducing friction to a minimum. 2d. The steam, having performed its work in the high pressure space, is afterward expanded, thereby extracting all the power possible from it, and effecting a large saving in fuel. 3d. The high pressure and expansion are both carried on simultaneously throughout the entire stroke, thereby maintaining a more uniform aggregate piston pressure to the end of the stroke. 4th. It is simple, compact, durable, and portable, and can be used without expensive foundations.

The indicator diagram shown in Fig. 1 was taken from one of these compound cylinders, and a study of it will demonstrate the economy of such a pumping engine in comparison with pumps that must use a cylinder full of steam at each stroke. Attention may also be directed to the very short passage ways for live steam between the valve and the high pressure piston, thus insuring less waste of steam from steam passages than is usually the case.

In Figs. 2, 3, and 4 three sectional views of the machine are given. The elongated piston has two ends provided with packing, and has a cylindrical portion of a less diameter extending between the said ends, the said portion being fitted to work steamtight in a central partition in the cylinder. Two annular chambers are thus formed, into which steam is admitted to act upon the smaller areas of the piston ends; and it is afterward expanded into the spaces between the piston ends and the cylinder covers, to act upon the larger areas of the said piston. A double cylindrical valve regulates the movements of the steam, each half of it being formed with a passage to connect two ports, through which steam passes from the annular space to the space between the piston and the cylinder head, and also with a passage which connects the larger steam space with the exhaust passage. Steam is admitted into a space between the two parts of this

Fig. 3.

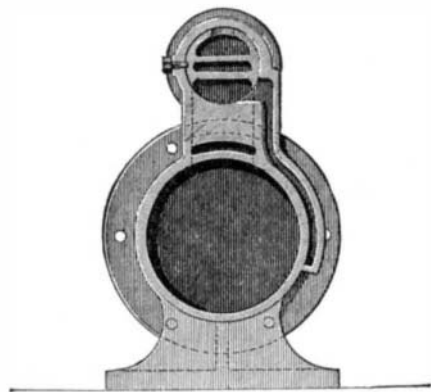
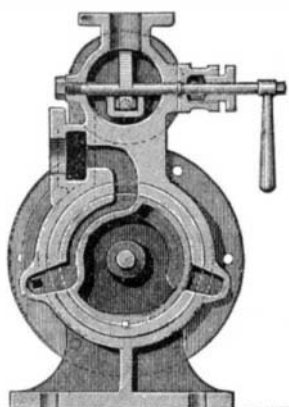


Fig. 4.



valve, and finds its way by suitable openings into the end spaces between the said valve ends and valve box covers; the said end spaces are connected by passages with ports formed in the aforementioned partition; and as the piston moves

to and fro, passages formed in the said piston establish a communication between the said ports and a port leading into the exhaust passage, thus relieving the valve from pressure on one end and causing it to be quickly pushed in that direction by the steam at the opposite end; the parts are all so arranged as to provide effectually for sufficient steam

Fig. 1.

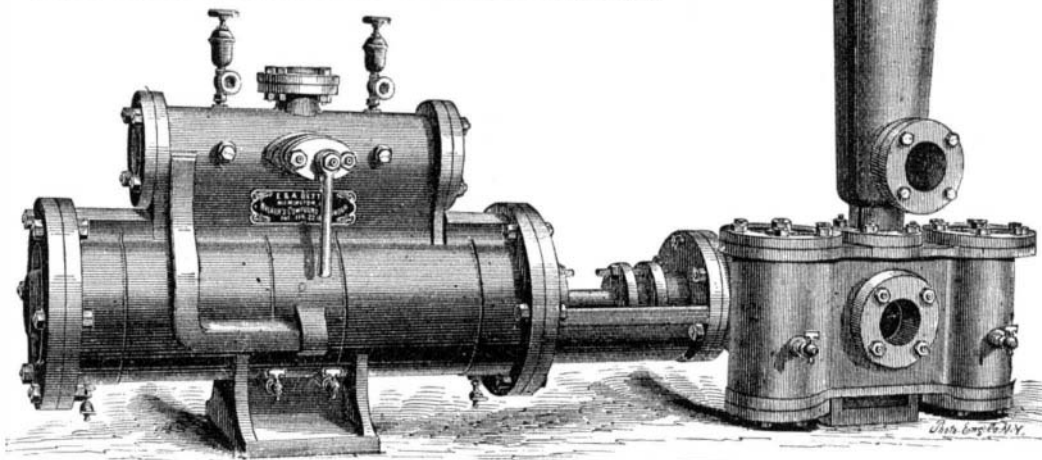
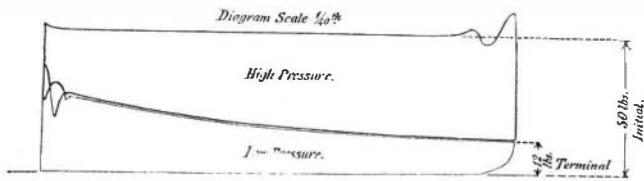
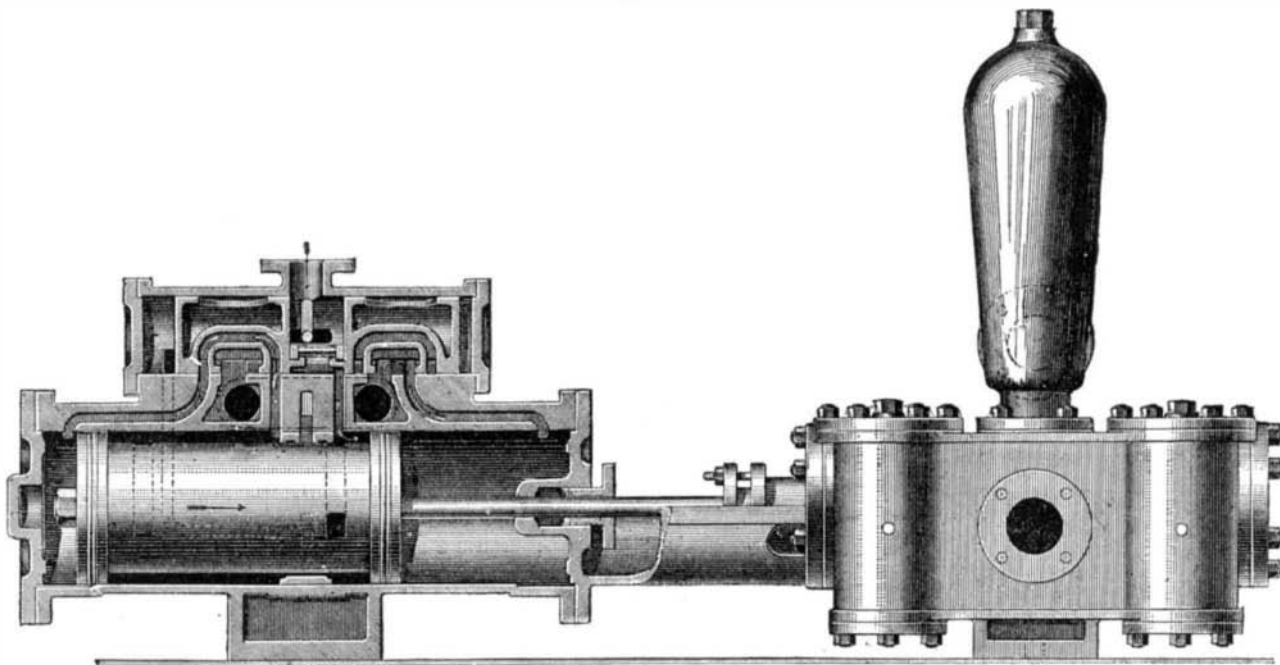


Fig. 2.



**WALKER'S COMPOUND STEAM PUMP.**

to cushion both the piston and valve so as to prevent striking under any circumstances.

For further particulars address the manufacturers, Messrs. E. & A. Betts, Wilmington, Del.

**American Nickel Mines.**

The nickel deposit near the Gap, Lancaster county, Pa., is considered the largest yet discovered in the world, and the only deposit of the ore worked in America. The mine is on the high dividing line between Chester and Pequea Valleys. Besides nickel, copper, iron, and limestone are found in the same locality. Nickel was discovered here about the year 1856, though copper, which is taken from the same mine, was known in the same locality seventy years ago. The ore has a gray color, is very heavy, and so hard that it is mined entirely by blasting. After the ore has been broken into small fragments, it is put into kilns holding eighty or ninety tons each, and subjected to heat produced at first by the burning of a small quantity of wood, and continued by the conversion of the expelled gas. It is then put into a smelting furnace, and undergoes a treatment similar to that of iron ore.

**New Steam Canal Boat.**

A new invention for the propulsion of canal boats was tested at Rochester, N. Y., recently. The peculiarity of this boat is in the position of the propelling wheel or screw. It is placed in the middle of the boat, and works against the water at an angle of thirty-eight degrees, in this way throwing the water against the bottom of the canal instead of horizontally. It works in a casement from which the air is exhausted and which is consequently full of water. On the trial, without a load, three miles an hour was run by a boat to which the screw had been affixed.

**Extension of the Greenwich Railway, London.**

The London and Greenwich Railway was constructed and opened upwards of forty years ago, not long after the opening of the Liverpool and Manchester railway—the first steam passenger railway in England. The Southeastern Company, who are now the owners, have extended it to the North Kent line, *viz* Maize Hill, Charlton, and Woolwich, which

places Greenwich in direct railway communication with Gravesend, Chatham, Maidstone, and other districts in North and Mid-Kent.

The old London and Greenwich line is carried entirely on masonry arches, and on a high level, that is to say, it is a city elevated railway. The extension line about to be opened is, however, an underground line, diverges from the elevated line near Deptford Creek, and is thence carried, in a northeasterly direction, along a descending gradient, until it arrives at London street, which it passes under, immediately on the south side of the parish church. In constructing this portion of the line, about 150 houses had to be purchased; and as the whole of one side of a thoroughfare was also absorbed and diverted, the company have had to construct a new street, with a roadway under the new line leading into Greenwich road. At this point a heavy outlay has likewise been incurred by the company in the diversion of about 1,700 feet in length of the main sewer belonging to the Metropolitan Board of Works, near London street. The new sewer, which is carried at a considerable depth under the railway level, is 11 1/2 feet in width. It is circular in form, and lined at the bottom with blue Staffordshire brick, and all round with white gault brick. There are staircases at intervals for the purpose of descending into the sewer from the street. The cost of this sewer was \$260 per yard. From London street, Greenwich, the line is carried forward in a tunnel, 26 feet in width and half a mile in length, which passes under the Royal Naval Schools. At the end of the tunnel the line is carried on to the Maize Hill Station, through a cutting which is walled in throughout its entire length. The portion of the line from Maize Hill to Charlton and Woolwich, where a junction is formed with the North Kent line, was opened nearly two years ago; the entire length of the line from Greenwich to Woolwich is between two and three miles.

The whole of the works have been designed by Mr. Brady, the company's engineer, and executed by Messrs. Lucas & Aird, the contractors.

**MAY'S IMPROVED BILLIARD TABLE LEVELER.**

The invention herewith illustrated is a combination of leg

Fig. 1

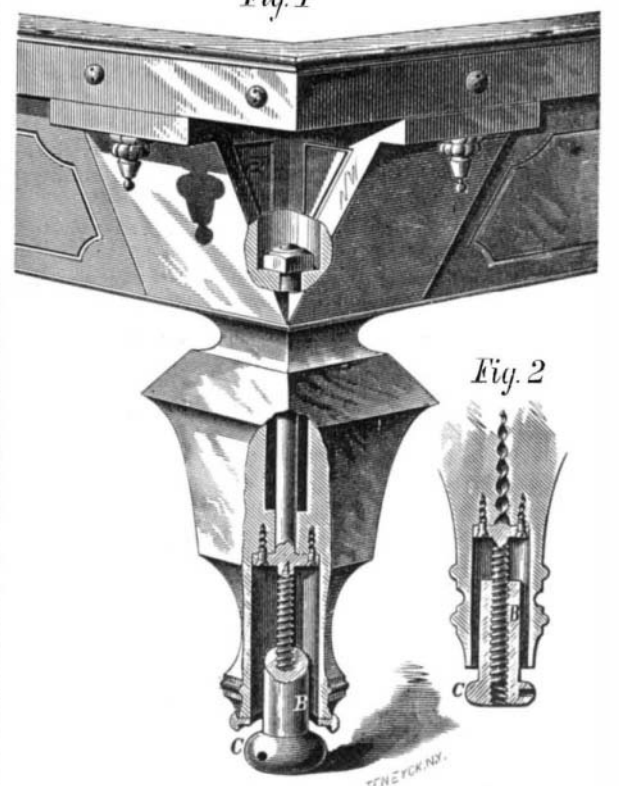


Fig. 2



bolt and leveler, so that a single bolt holds the leveling attachment firmly to the leg, and at the same time secures the latter to the table. In some billiard tables the legs are merely doweled on, but this is liable to give trouble in case