

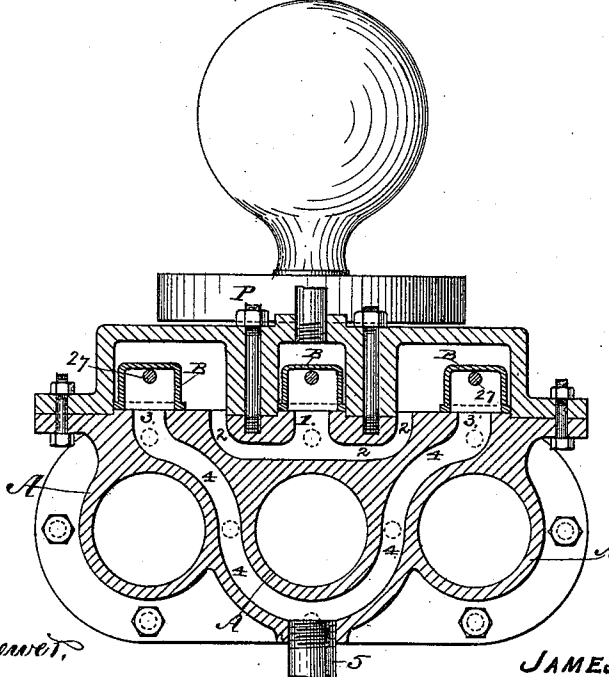
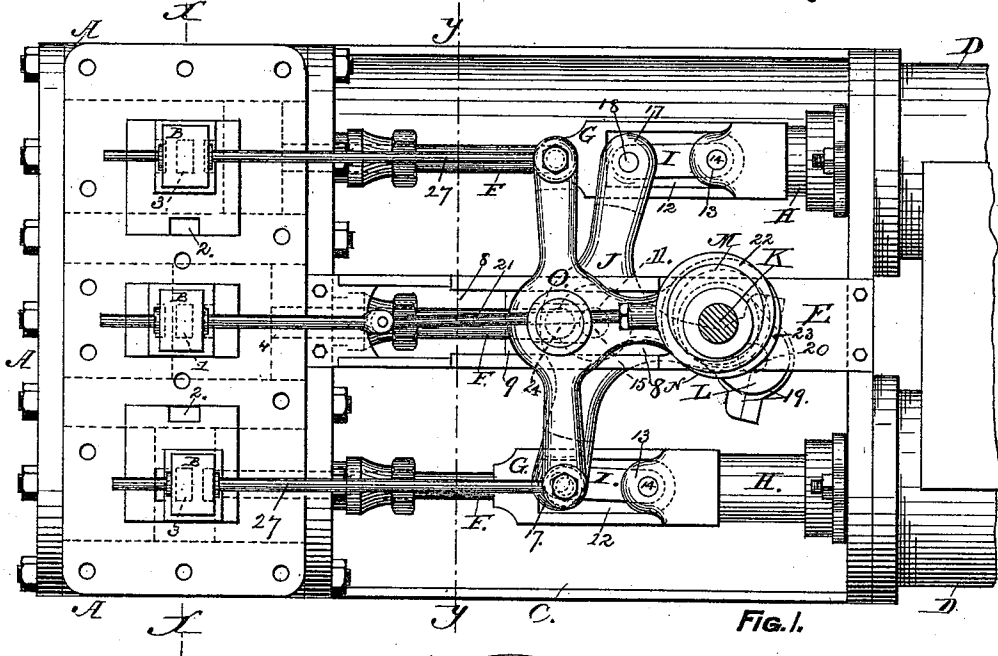
(No Model.)

3 Sheets—Sheet 1.

J. H. BLESSING.  
TRIPLE STEAM ENGINE.

No. 451,849.

Patented May 5, 1891.



Witnesses:

*S. D. Brewer,*  
*H. W. Scattergood.*

Inventor:

JAMES H. BLESSING.

FIG. 2.

*by William H. Low,*  
*attorney.*

(No Model.)

3 Sheets—Sheet 2.

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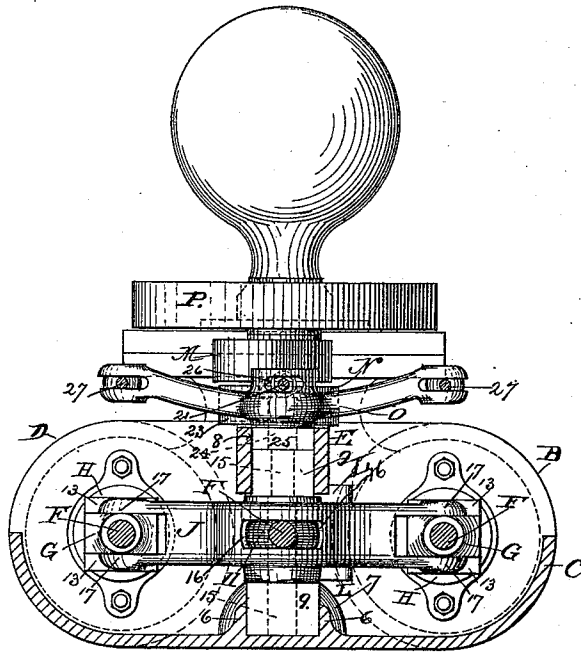


FIG. 3.

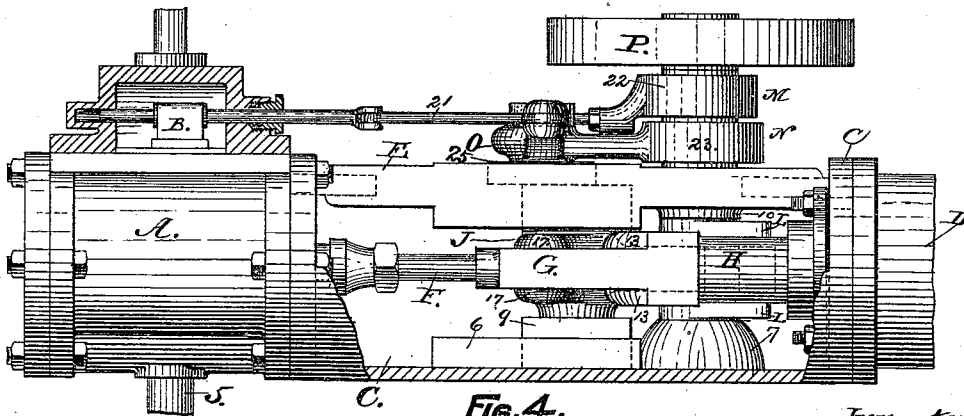


FIG. 4.

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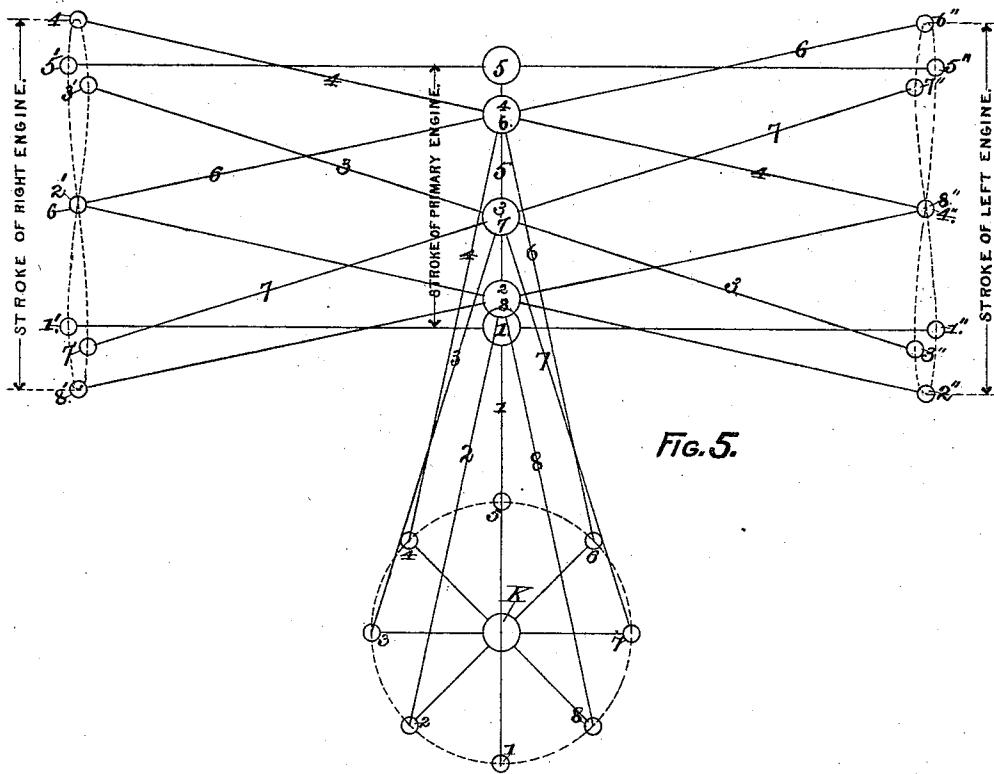


FIG. 5.

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# UNITED STATES PATENT OFFICE.

JAMES H. BLESSING, OF ALBANY, NEW YORK.

## TRIPLE STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 451,849, dated May 5, 1891.

Application filed November 19, 1889. Serial No. 330,862. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES H. BLESSING, of the city and county of Albany, in the State of New York, have invented new and useful  
5 Improvements in Triple Steam-Engines, of which the following is a full and exact description, reference being had to the accompanying drawings, which form part of this specification, and in which—

10 Figure 1 is a plan view of my invention as applied to a pumping-engine. Fig. 2 is a transverse vertical section of the same at the line X X. Fig. 3 is a like section at the line Y Y. Fig. 4 is a side elevation of the en-  
15 gines and a portion of the pumps, the side of the engine-frame being broken away to expose the parts that would be hidden thereby; and Fig. 5 is an enlarged skeleton diagram showing the relative positions of the pistons  
20 of the three engines at eight different but equally-spaced points in the circle described by the center of the crank-pin.

This invention relates to improvements on an invention in duplex steam-engines which  
25 was made Charles H. Overton and myself, and for which an application for Letters Patent of the United States, Serial No. 325,118, was filed on the 26th day September, 1889; and the object of this improvement is to adapt  
30 the said duplex engine to the purpose of utilizing the expansive force of the steam that is primarily used in one of the cylinders, preferably the middle cylinder, of the engine here-  
35 in described for operating the pistons of the other engines, the power of all the engines being applied to a single crank through the medium of a triple beam or yoke, as herein shown and described.

40 As represented in the drawings, A designates the steam-cylinders of my triple steam-engine, the three cylinders being preferably made in one piece with the center lines of all of them made parallel with each other and on the same plane.

45 For the purpose of simplifying the description the three engines which constitute my triple engine will hereinafter be referred to, respectively, as the "left," "middle," and "right" engines when considered separately, and their  
50 several locations will be determined as when seen while looking at them toward the outer end of the cylinders. The cylinder of the

middle engine is provided with an exhaust-  
port 1, which connects, by means of branch  
passages 2, with the chambers of the valve- 55  
chests of the right and left engines, so as to convey the exhaust-steam from the middle  
engine into the right and left engines, the  
valve-chests of the latter operating as receivers for the exhaust-steam of the middle en- 60  
gine. All of said steam-cylinders are provided with the usual steam and exhaust ports and with slide-valves B, by which the admission  
and emission of steam into and out of the re-  
spective cylinders are governed in the usual 65  
manner. The right and left engines are each provided with an exhaust-port 3, from which  
a branch passage 4 leads to exhaust-pipe 5, by  
which the exhaust-steam from the right and  
left engines may be discharged into the atmos- 70  
phere or into a condensing apparatus when preferred.

C designates the frame or bed-piece of my  
triple engine, which in the form shown in the  
drawings also forms the heads for the three 75  
steam-cylinders A and the two pump-cylinders D; but I do not limit myself to this particular form of frame, as the same may be  
changed to suit the different styles of engines. Said frame is provided with guide-strips 6, 80  
which are fixed near the center line of the frame, and so as to be parallel with the center line of the middle engine. The frame C  
is also provided with a boss 7 or other suitable  
appliance to form a step or bearing for 85  
the lower end of the crank-shaft of the engine. A guide-bar E extends to the opposite  
ends of the frame C and is provided with a  
slotted opening 8, having parallel sides to  
form an open slide, which is arranged to co- 90  
incide with the guide-strips 6 of the frame, so that the latter and the opening 8 will form  
suitable guides in which guide-blocks 9 are  
fitted to slide reciprocally. Said guide-bar  
is also provided with a boss 10 or other suit- 95  
able appliance for a journal-bearing for the upper part of the crank-shaft of the engine.

F designates the piston-rods for the several  
engines. The inner end of each of said piston-  
rods is provided with a piston of the form 100  
commonly used in reciprocating engines. The outer end of the piston-rod of the middle  
engine is provided with an eye 11, which  
engages with the wrist-pin of the triple beam

in such manner that the power applied to the piston of said middle engine will be exerted to produce only a reciprocating movement of said triple beam in a direct line that will correspond in length to the throw of the crank of the engine-shaft. The outer end of the piston-rods of the right and left engines is secured in a cross-head G, of which there is a separate one to each of said engines. Each of said cross-heads (in the form of engines herein described and shown) has a pump-plunger H, secured to the end opposite to the one in which the piston-rod F is secured, and said plunger forms a guide for the piston-rod, so as to relieve the latter from a lateral strain to which it would otherwise be subjected; but in engines intended for a different purpose, or, when preferred, for a like purpose, said cross-head may be provided with a different form of guide. Said cross head is preferably made with an opening 12, mortised vertically therethrough. Said opening has at one end lugs 13, which extend partially over the upper and lower sides thereof, and in said lugs a wrist-pin 14 is fixed to form a journal for one end of a link I, which is located in the opening 12, so as to bring the center line of said link to range with the center line of the corresponding piston-rod, and thereby the latter is relieved from the strain that would be produced by placing the wrist-pin on either the upper or lower side of the cross-head.

J designates the triple beam by which the piston-rods of the three engines are yoked together and to the crank of the engine-shaft. Said triple beam consists of three arms which are preferably formed on the same horizontal plane, two of said arms ranging on a direct line and the third fixed at right angles thereto and extending from the middle thereof. The three arms radiate from a center pin 15, that is commonly placed equidistantly from the end centers of said triple beam. Said center pin is extended both upwardly and downwardly to enter the guide-blocks 9, so that the movement of the center of the triple beam will be confined to a direct line. The triple beam J is provided with a central mortise 16, into which the eye 11 of the piston-rod of the middle engine enters for the purpose of engaging with the center pin 15. The ends of the two arms which form a direct line are bifurcated to form lugs 17, which extend over and under the cross-head G, and in each pair of said lugs a wrist-pin 18 is secured to form a journal-bearing for the corresponding link I when the engines are connected to the triple beam. The single arm of the triple beam J is provided with a box 19 or other suitable appliance for connecting said triple beam with the crank of the engine-shaft.

K designates the engine-shaft, which is provided with a single crank L, having a crank-pin 20, which is indicated by dotted lines in Fig. 1, and to which the single arm of the triple beam is connected, as hereinbefore described. Said shaft is provided

with eccentrics M and N, the latter being indicated by dotted lines in Fig. 1. The eccentric M is connected by a rod 21, provided with an eccentric-strap 22 to the stem of the slide-valve B of the middle engine, so as to impart motion to said valve at the proper times to effect the admission and emission of steam into and out of the cylinder of said engine. The eccentric N is fitted to engage in the end of the single arm of a triple beam O, to which the valve-rods of the right and left engines are connected. An eccentric-strap 23 is formed on the single arm of the triple beam O to receive the eccentric N.

The triple beam O is made substantially in the form of the triple beam J with such changes as are required to adapt it to the different service it performs. Said triple beam is pivoted on a center pin 24, which is secured to a guide-block 25, fitted to slide in the upper part of the opening 8 in the guide-bar E. The hub of the triple beam O is provided with a slotted opening 26, through which the eccentric-rod 21 passes; but this feature of the construction may be varied at the pleasure of the constructor, the only necessary point to be observed being that there shall be no interference between the triple beam O and the connection between the eccentric M and the slide-valve of the middle engine. The opposite ends of the two continuous arms of the triple beam O are connected to valve-rods 27 of the slide-valves B of the right and left engines.

P designates a balance-wheel, which is secured to the shaft K and performs the usual functions of such wheels.

It should be understood that the stroke of the piston of the middle engine will be less than the stroke of the pistons of the right and left engines, for the reason that the stroke of the middle engine is only equal to the throw of the crank L, while the pistons of the right and left engines will have a stroke that is increased beyond the throw of the crank L by reason of their being connected to the triple beam J, as fully explained in the specification forming part of the application Serial No. 325,118, hereinbefore referred to. The steam-cylinder A being preferably made of a uniform length, the difference in the length of the stroke of the piston of the middle engine and the stroke of the pistons of the right and left engines is compensated for. This is preferably done by making the piston of the middle engine of greater length than the pistons of the right and left engines, the difference in the length of said pistons being made equal to the difference in the length of the strokes of the pistons—that is to say, the piston having the least stroke will have the greater length. Preferably, the diameter of the bore of the three steam-cylinders is made uniform; but this is not an arbitrary rule and can be varied when required, the exhaust-steam from the cylinder of the middle engine being conveyed into the valve-chests of the right and left engines, so as

to enter the cylinders of the latter in an expanded condition, all the advantages obtainable by compounding engines are obtained in a very simple manner in this construction. By this construction all the advantages of a three-cylinder engine provided with a three-throw crank are obtained, for the reason that it is impossible to get more than one of the three pistons of my engine at the extremity of its stroke at any one time, as will be seen by reference to the diagram shown in Fig. 5. When it is required to convert this form of engine into a low-pressure or condensing engine, the same can be effected in a very simple manner by placing an air-pump in alignment with one of the steam-cylinders, preferably with the cylinder of the middle engine, and extending the piston-rod of the corresponding engine through the bottom cylinder-head, so as to attach the piston of said air-pump thereto, the balance of the condensing apparatus being of any suitable form well known for such purposes.

The following description, considered in connection with the diagram shown in Fig. 5, will enable others to understand the operation of my engine, it being understood that the valve-operating mechanisms are adjusted so that the engine will run to rotate the engine-shaft K in the direction indicated by the arrow on Fig. 5, and it being also understood that the crank-pin 20 is at the point 1 on the circular path of said crank-pin, as shown in Fig. 5, at which point the piston of the middle engine will be at the extreme point of its movement toward the engine-shaft, and the slide-valve of the middle engine will be in position to just begin the opening of the steam-port at the corresponding end of the cylinder of said engine and to allow the steam from the opposite end of said cylinder to escape therefrom and, after passing through the branch passages 2, to enter the valve-chests Q of the right and left engines, ready to enter any of the steam-ports of said engines which are at the time open to admit steam into the cylinders, or either of them, of said engines. When the crank-pin is at the point 1, as above described, the piston of the right engine will be in a position that will correspond to the point 1' in the path of the end center of the triple beam to which said piston is connected, and said piston will then be moving toward its mid-stroke position, which corresponds to the point 2' in the above-named path. At the same time the piston of the left engine will be in a position corresponding to the point 1'' in the path of the end center of the triple beam to which the piston of the left engine is connected, with said piston moving toward the extremity of its stroke toward the engine-shaft, which position corresponds to the point 2'' in the path last referred to, and it will be seen by reference to the diagram that when the piston of either the right or the left engine has reached the extremity of the stroke in either direction

the piston of the opposite engine will be at its mid-stroke position. When the piston of the middle engine has reached the termination of its stroke at the opposite end of the cylinder, the crank-pin 20 will be at the point 5 on the path of said crank-pin, and the piston of the right engine will be in a position corresponding to the point 5' in the path of the corresponding end center of the triple beam, and the piston of the left engine will be in a position corresponding to the point 5'' in the path of the end center of the triple beam nearest said left engine, the piston of the right engine being then moving toward its mid-stroke position, and the piston of the left will be moving toward the extremity of its stroke most remote from the engine-shaft. When the piston of the left engine has terminated its stroke in one direction at the point 2'', the piston of the middle engine will have moved back from the point 1 to the point 2, and the piston of the right engine will then be at its mid-stroke point 2', and when the piston of the left engine has terminated its stroke in the opposite direction at the point 6'' the piston of the middle engine will have moved forward from the point 5 to the point 6, and the piston of the right engine will then be at its mid-stroke point 6'. When the piston of the right engine has terminated its stroke in one direction at the point 8', the piston of the middle engine will have moved back to the point 8, and the piston of the left engine will then be at its mid-stroke point 8'', and when the piston of the right engine has terminated its stroke in the opposite direction at the point 4' the piston of the middle engine will then have moved forward from the point 5 to the point 4, and the piston of the left engine will then be at its mid-stroke point 4''.

From the foregoing it will readily be seen that it is impossible for any two of the pistons to reach the termination of their strokes simultaneously, and that neither of the pistons of the two side engines can simultaneously attain corresponding points in their respective cylinders unless said pistons are moving in opposite directions.

In the drawings the triple beam J is made so that the three arms will be of the same length from the center of the pin 15 to the center of the point of attachment of each of said arms to the part to which it is appropriated. By this construction the stroke of the piston of the middle engine will correspond to the throw of the crank L, and the stroke of the pistons of the right and left engines will exceed the stroke of the piston of the middle engine in the ratio of about four hundred and twenty-five to three hundred; but this ratio can be increased by making the single arm of the triple beam shorter than the other two arms. Said ratio can also be diminished by making the single arm the longest of the three.

This engine can be readily applied to other

purposes besides that of operating pumps in the manner illustrated in the drawings. Power can be taken directly from the engine-shaft in the manner commonly followed in taking power from steam-engines. It can also be used advantageously for driving screw-propellers for marine purposes by arranging it vertically in an inverted position.

It is obvious that this engine may be constructed with three cylinders provided with pistons which are connected to a triple beam and by the latter to a single crank, all of said cylinders being fitted to receive live steam directly from the boiler instead of using the exhaust-steam from one cylinder to supply the others, and while I prefer the construction first described in this specification my invention includes this modification.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a triple steam-engine, the combination of three double-acting steam-cylinders, each of the latter being provided with the usual piston, piston-rod, and valve for controlling the admission of steam thereinto, a shaft provided with a single crank and two eccentrics, a triple beam or yoke which forms a connection between one of said eccentrics and the valves of the two side engines, and a

connection from the other eccentric to the valve of the middle engine, as and for the purpose herein specified.

2. In a triple steam-engine, the combination of three double-acting steam-cylinders, each of the latter being provided with the usual piston, piston-rod, and valve which controls the admission of steam thereinto, a shaft provided with a single crank and two eccentrics, a triple beam or yoke which connects all of said piston-rods with said crank, said triple beam comprising three arms which are on the same plane and radiate from a common center which coincides with the pivot on which said beam oscillates, two of said arms ranging in line with each other from the opposite sides of said center and the other arm forming a right angle to said two arms, and a triple beam or yoke which forms a connection between one of said eccentrics and the valves of the side engines, the other eccentric being connected with the valve of the middle engine, as and for the purpose herein specified.

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