

No. 640,218.

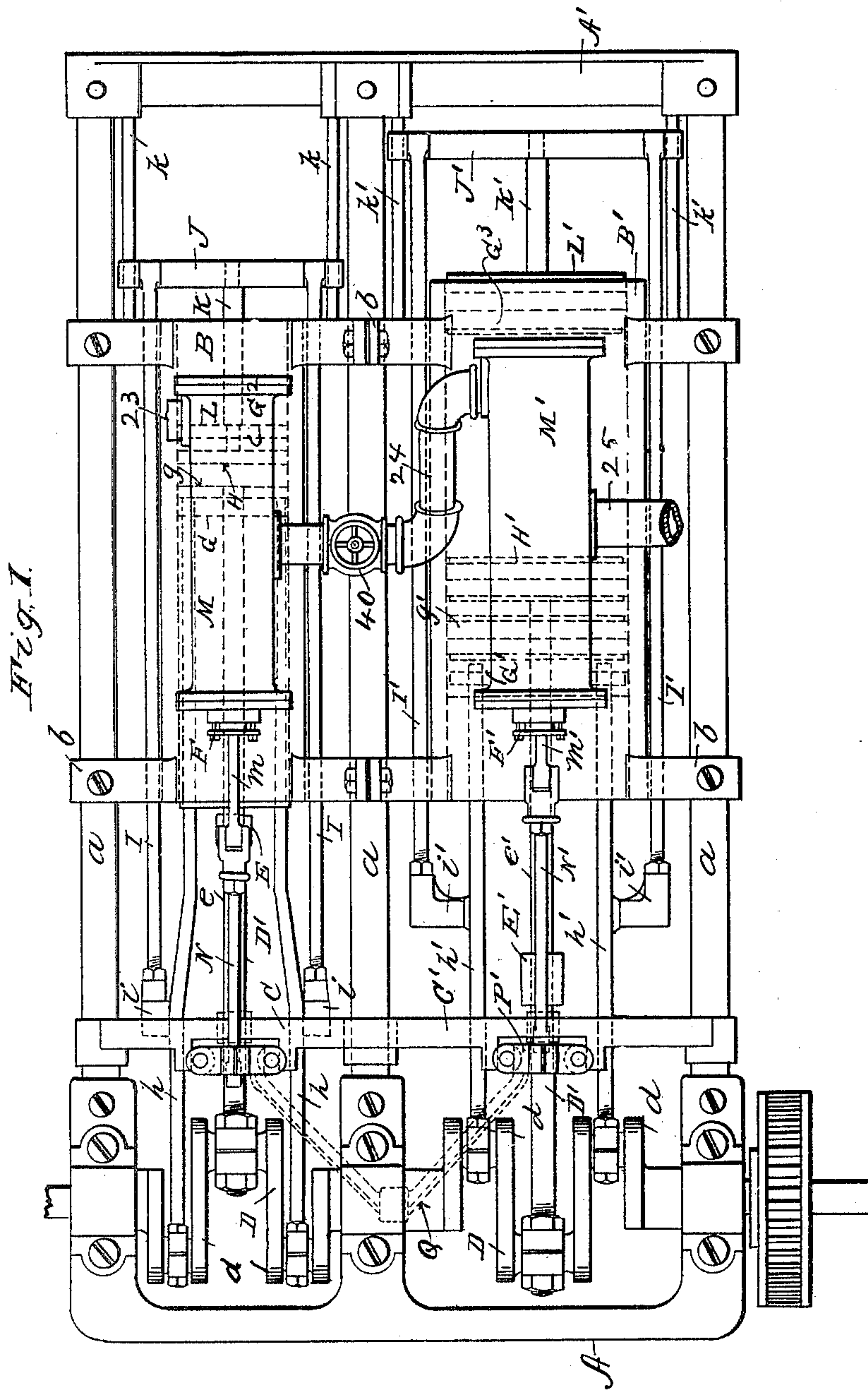
Patented Jan. 2, 1900.

E. McCONVILLE.
COMPOUND STEAM ENGINE.

(Application filed Apr. 20, 1899.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses.
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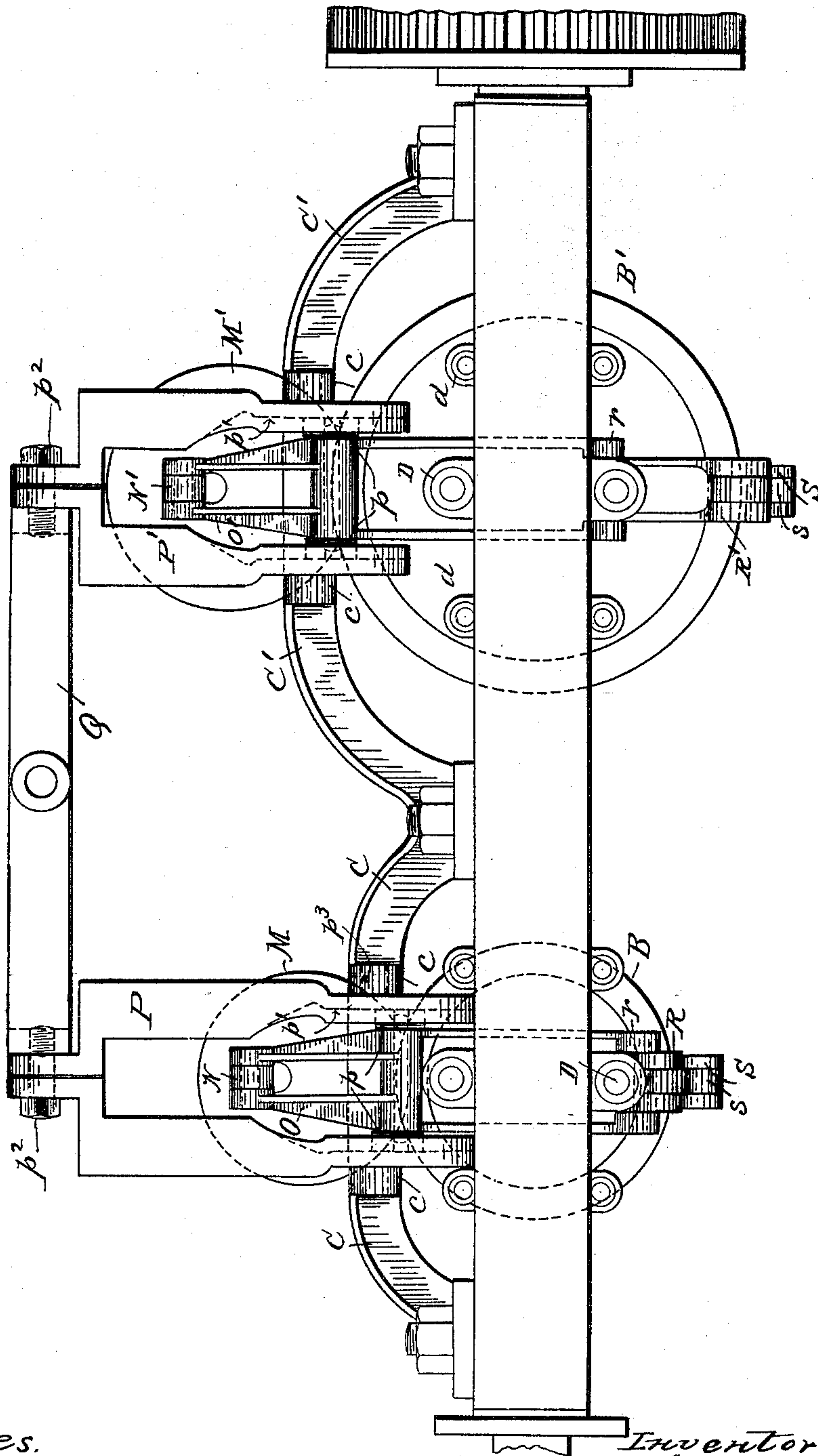
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Fig. 2.



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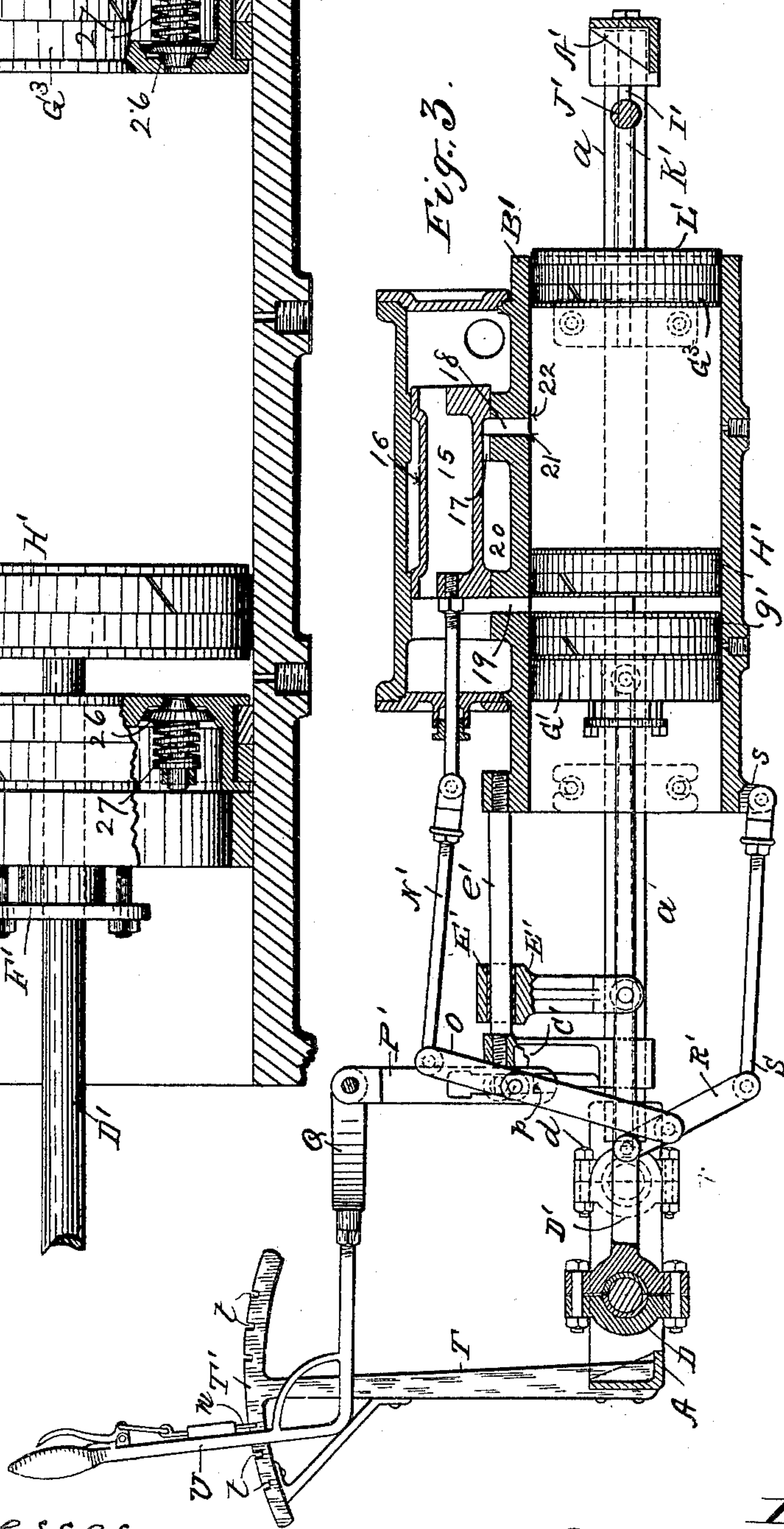
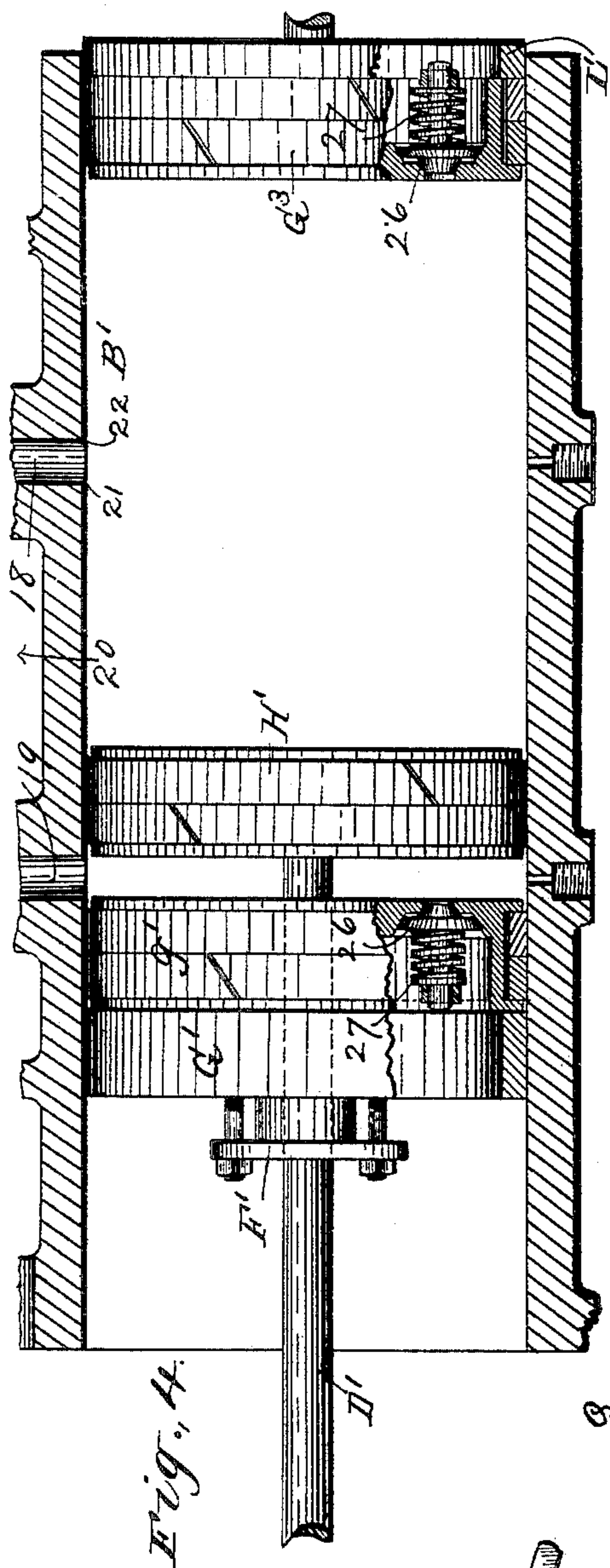
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4 Sheets—Sheet 3.



Witnesses.
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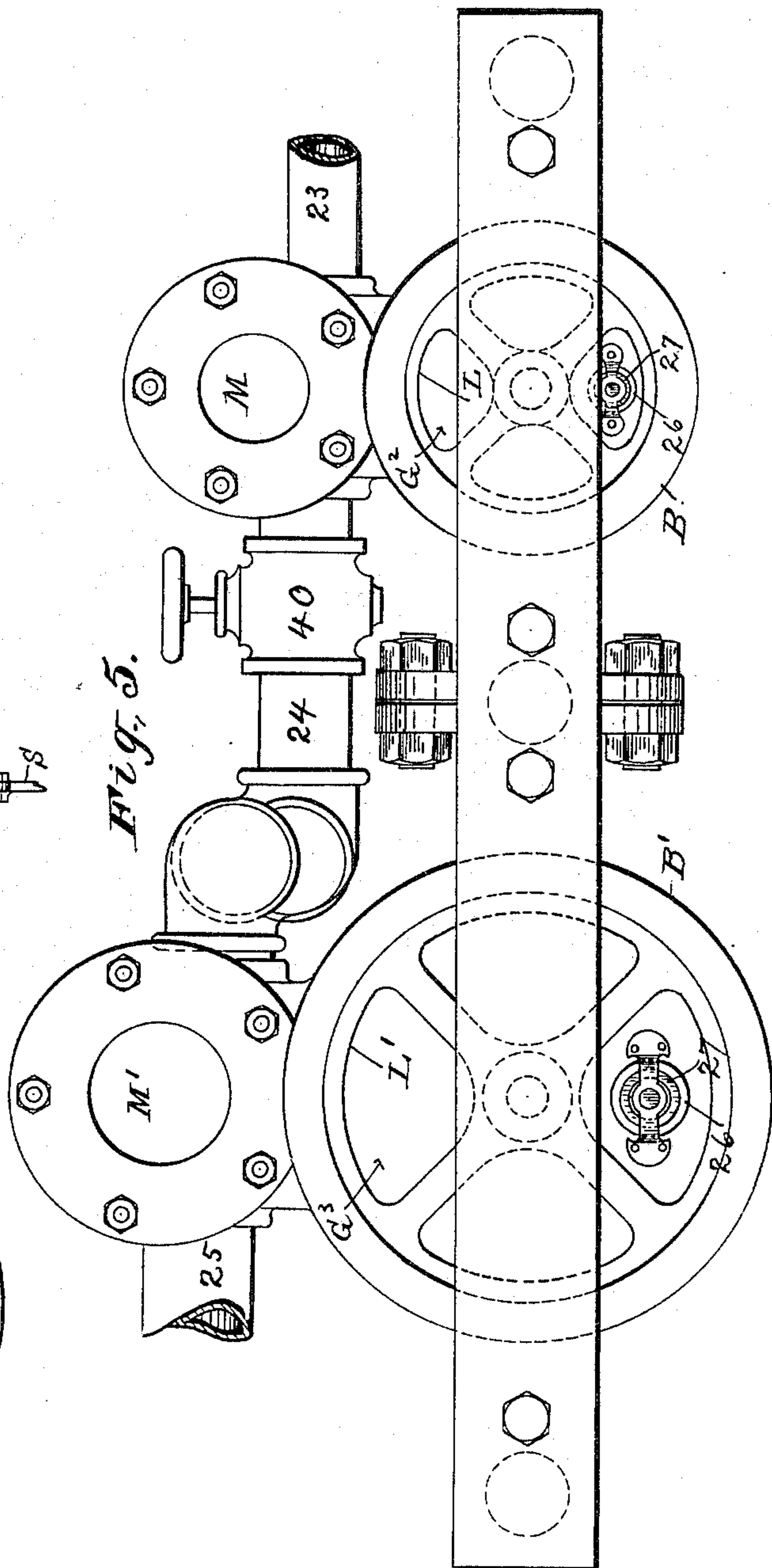
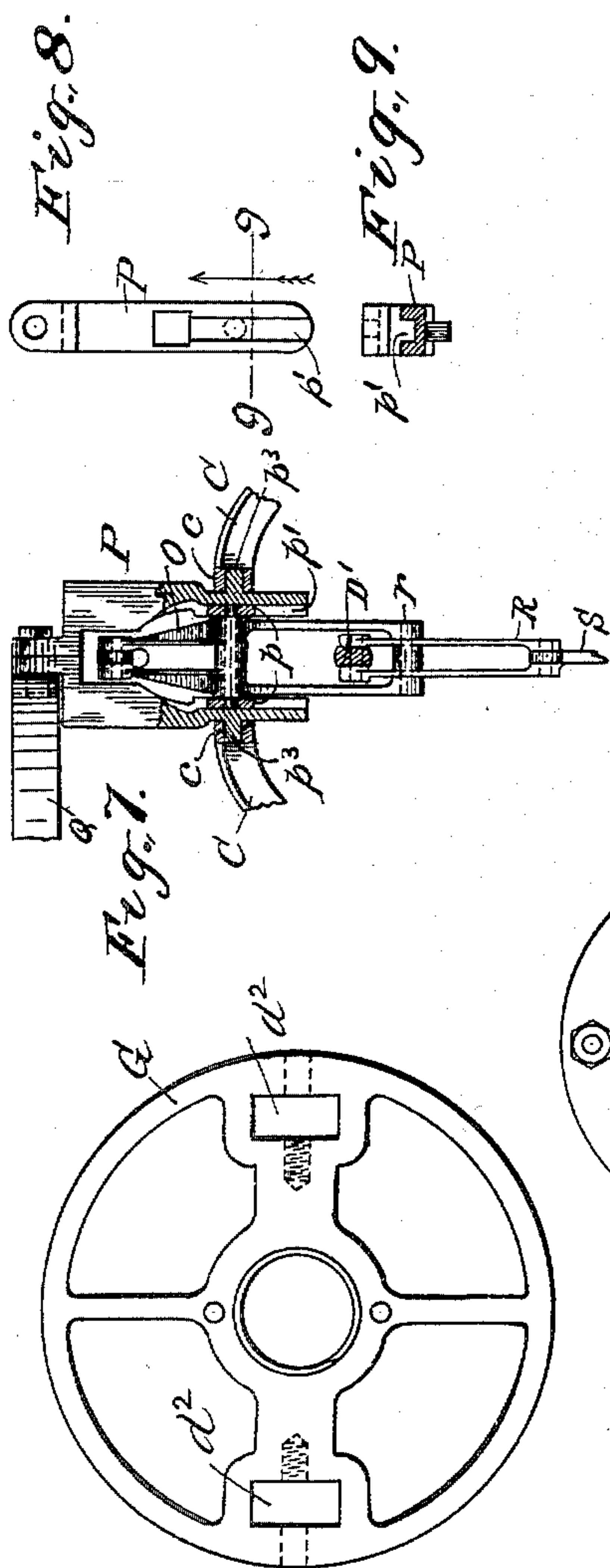
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(No Model.)

4 Sheets—Sheet 4.



Witnesses:
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Fig. 6.

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UNITED STATES PATENT OFFICE.

EMMETT McCONVILLE, OF PITTSBURG, PENNSYLVANIA.

COMPOUND STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 640,218, dated January 2, 1900.

Application filed April 20, 1899. Serial No. 713,701. (No model.)

To all whom it may concern:

Be it known that I, EMMETT McCONVILLE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Compound Multiple-Piston Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has reference to improvements in multiple-piston compound steam-engines and other novel features of construction pertaining to the same, which will be hereinafter fully elucidated in the specification in conjunction with the drawings and clearly pointed out in the claims.

The object of the present invention is to provide a three-piston compound steam-engine having their cylinders parallel on a single bed or frame and the steam communication from the high-pressure to the low-pressure cylinder connected through the medium of a steam-pipe to both steam-chests.

A further object of the present invention is to provide extremely simple and novel lever mechanism for operating the piston-valves through the medium of the connecting-rods and movable bifurcated levers mounted upon a double yoke spanning the engine-bed in conjunction with a shifting lever which operates both the piston-valves simultaneously and which is positive in its varied shifted positions.

A further object of the invention is to provide differential relief-valves in the pistons, located at the opposite end of each cylinder, for allowing water under extreme pressure to escape quickly.

A further object of the invention is to provide movable piston-heads which are secured to or integral with the pistons in a headless steam-cylinder and also to have said piston-heads skeleton in their construction.

A further object of the invention is to provide a hollow piston-valve which is open at its ends for allowing steam to have free access to all parts of a steam-chest.

A further object of my invention is to provide a skeleton bed or frame connected by

light tubes for supporting the cylinders crank mechanism, and double yoke.

In the drawings, Figure 1 is a plan of my improved compound multiple-piston engine. Fig. 2 is a front elevation, enlarged, of the device. Fig. 3 is a longitudinal vertical section of the device through the low-pressure cylinder, with the pistons in elevation. Fig. 4 is an enlarged view of the cylinder proper, with the movable piston-heads and their accompanying pistons partly broken away, so as to exhibit the differential valves therein. Fig. 5 is an elevation of the rear end of the engine. Fig. 6 is a detail of one of the movable skeleton piston-heads. Fig. 7 is a detail of the lever mechanism for operating the piston-valves. Fig. 8 is an inside view of one-half of a bifurcated lever. Fig. 9 is a section on line 9 9 of Fig. 8.

The invention consists of a bed or frame having the opposite ends A and A' of light castings, which are tied together by light steel tubes *a*. Said tubes support the steam-cylinders B and B' through the medium of brackets *b*. Also secured to said tubes *a* is a double yoke with its parts C and C' for supporting the valve-operating mechanism.

The front casting A of the bed or frame supports the crank mechanism, which consists of large cranks D and smaller cranks *d*, respectively. Cranks D support connecting-rods D', which are pivoted to sliding heads E and E', which are mounted upon rods or ways *ee'*. The piston-rods pivoted to sliding heads E and E' pass through stuffing-boxes F and F' of the skeleton piston-heads G G', thence through the front pistons *g* and *g'*, and are secured to the middle pistons H and H'. The small cranks *d* carry connecting-bars *h* and *h'*, which are secured to the forward movable piston-heads G and G' in mortises *d*². (See Fig. 6.) Secured to said bars *h* and *h'* are lugs *i* and *i'*, which carry side bars I and I' and which are attached to cross-heads J and J', operating on guides *k* and *k'*. Each cross-head carries a piston-rod K and K', respectively, which is secured to the rear movable piston-heads L and L' with their accompanying pistons G² and G³.

Mounted on each cylinder is a steam-chest M and M', carrying valve-rods *m* and *m'*,

which are pivoted to connecting-rods N and N'. Said rods are pivoted to rocking levers O and O', (see Figs. 2 and 3,) which are fulcrumed in sliding blocks *p*, mounted in recesses *p'*, (see Figs. 2 and 7,) formed in the bifurcated levers P and P'. Said bifurcated levers are in two parts. They are joined together at their upper part by bolts *p*², which also act as a pivotal point for the shifting yoke Q, being also secured by said bolts *p*² from lateral movement. Bifurcated levers P and P' are fulcrumed on trunnions *p*³, which play in bearings *c*, forming part of yokes C and C', previously referred to. (See Fig. 7.)

Secured to the lower end of each rocking lever O and O' at *r* are links R and R'. The upper ends of said links are secured to the connecting-rods D.' (See Figs. 3 and 7, where only one is shown. The lower ends of said links are secured to pivotal stay-rods S, which are secured by an ear *s*, connected to each cylinder.

Located centrally on the forward part of the bed or frame is a standard T, which carries an arc plate T', having notches *t* therein for securing a latch *u*, which is attached to a bent lever U, making connection with the shifting yoke Q, said shifting yoke being connected to both bifurcated levers P and P', whereby the piston-valves in each steam-chest can be operated simultaneously for starting or reversing the engine. As only the steam-chest in the low-pressure cylinder is shown in section, with its accompanying valve, and as both valves are exactly alike, I will proceed to describe this valve.

As will be observed, the piston-valve 15 is hollow, whereby the steam can have free access to all parts of the steam-chest. There is a neck 16 formed on said piston-valve, so as to allow the exhaust-steam to have free circulation through opening 20, which is very desirable in fast-moving engines. This neck 16 allows a space 17 to be formed adjacent to each steam-port 18 and 19 as the valve moves alternately over each steam-port.

The high-pressure engine receives live steam through pipe 23 and exhausts when cut off into pipe 24, passing through the adjustable check-valve 40, connecting with the valve-chest M' of the low-pressure cylinder.

25 is the exhaust for the low-pressure cylinder.

Located in the movable pistons are differential release-valves 26 for allowing any extraneous pressure caused by water or other fluids to escape freely, so as to prevent the pistons being ruptured. The springs 27 on the back of these valves can be of any desired tension to accommodate the steam-pressure, the area of the large valve-seat being about six times the area of the small seat facing the inside of the cylinder.

This engine is designed to carry about eighty pounds of steam, and if the valve should be set to open by hydraulic pressure at one hundred and fifty pounds the pressure on

the large valve would be only about twenty-five pounds, thus allowing all the fluid to escape at a pressure less than the steam-pressure.

Operation of my improved engine, referring in the singular only to the low-pressure cylinder: As steam enters port 19 it enters the steam-cylinder between the front piston *g'* and the middle piston H'. Consequently each piston is forced in opposite directions, and as the middle piston H' moves backward it draws the large crank D toward said piston, and as the front piston *g'* moves forward it pushes the small cranks *d* forward, and by the time the middle piston reaches the point 21 in the cylinder the back piston G³, which was drawn forward to the point 22 by means of the side bars I', secured to connecting-bars *h* of the forward piston *g'* the valve is shifted and the steam enters the port 18, when the middle piston H' and back piston G³ are forced in opposite directions. The pistons then assume the position shown in Fig. 3, the back piston G³ acting through the side bars I' to bring the front piston to the position as also indicated in Fig. 3, this operation being repeated for every stroke of the engine. As the connecting-rods play back and forth they operate the lever mechanism, the rocking lever moving by means of its blocks *p* in the grooves *p'*, formed in the bifurcated levers P and P'.

Having described my invention, that which I desire to claim is—

1. In a compound steam-engine having one high and one low pressure cylinder, three movable piston-heads in each cylinder, the two extreme heads in each cylinder being skeleton or open heads, but integral with a solid piston, said pistons having differential valves coöperating with an opening in a solid piston, a distribution-valve for each cylinder, a steam-pipe connecting the steam-chests of said cylinders for transmitting steam from the high to the low pressure cylinder, an exhaust-pipe leading from the low-pressure cylinder, and suitable operative mechanism connected to said cylinders and valves for communicating motion therefrom for the purpose as shown and described.

2. In a compound steam-engine having one high and one low pressure cylinder, three movable piston-heads with pistons integral therewith in each cylinder, each of the extreme pistons having differential valves, a distribution-valve for each cylinder, a steam-pipe connecting the steam-chests of said cylinders for transmitting steam from the high to the low pressure cylinder, an exhaust-pipe leading from the low-pressure cylinder, and the means for operating said engine through the medium of its cylinders and valves in combination with a skeleton bed or frame as shown and described for supporting said engine.

3. In a compound steam-engine having one high and one low pressure cylinder, three

movable piston-heads in each cylinder, the two extreme heads in each cylinder being skeleton or open heads, but integral with a solid piston, said pistons having differential valves coöperating with an opening in a solid piston, a distribution-valve for each cylinder, a steam-pipe provided with an adjustable check-valve connecting the steam-chests of said cylinders, for transmitting steam from the high to the low pressure cylinder through their steam-chests, an exhaust-pipe leading from the valve-chest of the low-pressure cylinder, the means connected to said cylinder and valves for operating said engine as specified.

4. In a compound steam-engine having open-ended cylinders, one high and one low pressure, three movable piston-heads in each cylinder, the two extreme heads being open or skeleton in construction, but integral with a solid piston, said pistons having differential valves coöperating with an opening in a solid piston, a distribution-valve for each cylinder, a steam-pipe connecting the steam-chests of said cylinders, an exhaust-pipe leading from the steam-chest of the low-pressure cylinder, in combination with a skeleton bed or frame consisting of steel tubes, secured at their free ends to castings for supporting said engine as shown and described.

5. In a compound steam-engine having one high and one low pressure cylinder, three movable piston-heads in each cylinder, the two extreme heads in each cylinder being open or skeleton in construction, but integral with a solid piston, said pistons having differential valves coöperating with an opening in a solid piston, a distribution-valve for each cylinder, a live-steam pipe connecting the steam-chests of said cylinders, an exhaust-pipe leading from the steam-chest of the low-pressure cylinder, a double yoke supported upon a skeleton frame or bed, for holding the valve-operating mechanism of said engine as specified.

6. In a compound steam-engine having one high and one low pressure cylinder, three movable pistons with their accompanying head in each cylinder, a piston-valve for each cylinder, a live-steam pipe connecting the steam-chests of said cylinders, an exhaust-pipe leading from the steam-chest of the low-pressure cylinder, a double yoke secured to the skeleton frame or bed, for supporting bifurcated levers pivotally secured to said yokes, for carrying the valve mechanism which is attached to the movable connecting-rods, as specified.

7. In a compound steam-engine having one high and one low pressure cylinder, three movable pistons in each cylinder, steam-chests and distribution-valves for each cylinder, an exhaust-steam pipe connecting the steam-chests of said cylinders, an exhaust-pipe leading from the steam-chest of the low-pressure cylinder to the atmosphere, a double yoke secured to the skeleton frame or bed, for sup-

porting bifurcated levers, pivotally secured to said yokes, for carrying rocking levers which operate said distribution-valves and links, the latter being attached to the movable connecting-rods at one end, the opposite ends pivotally secured to movable rods, as shown and described.

8. In a compound steam-engine having one high and one low pressure cylinder, three movable pistons in each cylinder, steam-chests and distribution-valves for each cylinder, an exhaust-pipe connecting the steam-chests of said cylinders, an exhaust-pipe leading from the steam-chest of the low-pressure cylinder to the atmosphere, a double yoke secured to the skeleton frame or bed for supporting bisected bifurcated levers pivotally secured to yokes, for carrying rocking levers which operate said distribution-valves and links, said links being attached to movable connecting-rods at one end, the opposite ends, connected to pivoted stay-rods, which are hinged to the under side of the steam-cylinders as shown and described.

9. In a compound steam-engine having one high and one low pressure cylinder, three movable pistons in each cylinder, steam-chests and distribution-valves for each cylinder, an exhaust-pipe connecting the steam-chests of said cylinders, an exhaust-pipe leading from the low-pressure cylinder to the atmosphere, a double yoke secured to the skeleton frame or bed for supporting bisected bifurcated levers, which are pivotally secured to said yokes, the latter carrying rocking levers which operate said distribution-valves which are pivoted to blocks operating in ways or guides formed in the legs of said bifurcated levers, of links pivoted to said rocking levers for operating piston-valves through the medium of movable connecting-rods as shown and described.

10. In a compound steam-engine having one high and one low pressure cylinder, three movable pistons in each cylinder, steam-chests and distribution-valves for each cylinder, an exhaust-pipe connecting the steam-chests of said cylinders, an exhaust-pipe leading from the low-pressure cylinder to the atmosphere, a double yoke secured to the engine-bed or skeleton frame for supporting bisected bifurcated levers, which are pivotally secured to said yokes, the latter carrying rocking levers which operate said distribution-valves which are pivoted to blocks operating in ways, formed in the legs of said bifurcated levers, links pivoted to said rocking levers, one end of said links being attached to movable connecting-rods, the opposite ends connected to stay-rods, said stay-rods being hinged or pivoted to the front end of the steam-cylinders as specified.

11. In a compound steam-engine having one high and one low pressure cylinder, three movable pistons in each cylinder, steam-chests and distribution-valves for each cylinder, an exhaust-pipe connecting said cylinders, and

an exhaust-pipe from the low-pressure cylinder to the atmosphere, a yoke secured to the skeleton bed for supporting bisected bifurcated levers, which carry rocking arms, the
5 upper ends of said rocking levers pivotally secured to the connecting-rods of the piston distribution-valve stems, the lower ends secured to links pivoted to the connecting-rods of the steam-cylinders, and also to stay-rods,
10 which are attached to the steam-cylinders as shown and described.

12. In a compound steam-engine having one high and one low pressure cylinder, three movable pistons in each cylinder, steam-chests
15 and distribution-valves for each cylinder, an exhaust-pipe and check-valve connecting said

steam-cylinders, an exhaust-pipe leading from the low-pressure cylinder to the atmosphere, a yoke secured to the skeleton bed for supporting bifurcated levers, which carry
20 rocking arms, the latter operating the piston distribution-valve stems through the medium of the cylinder connecting-rods, and the means for adjusting said piston-valves
25 through the medium of said bifurcated levers as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

EMMETT McCONVILLE.

Witnesses:

W. REES EDELEN,
REEVE LEWIS.