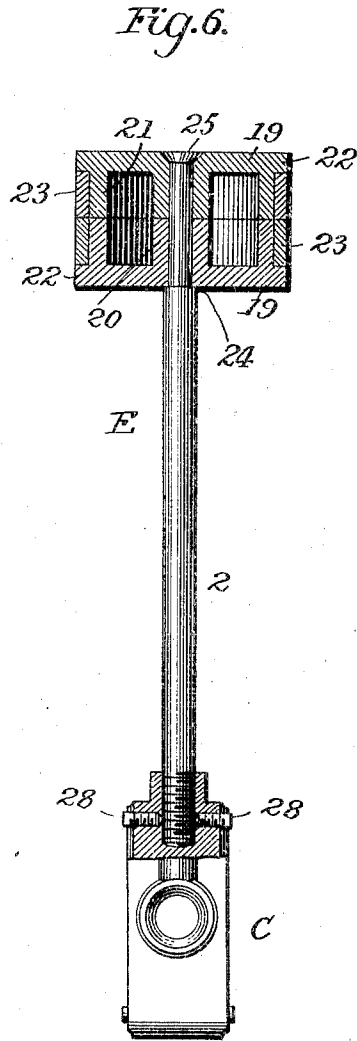
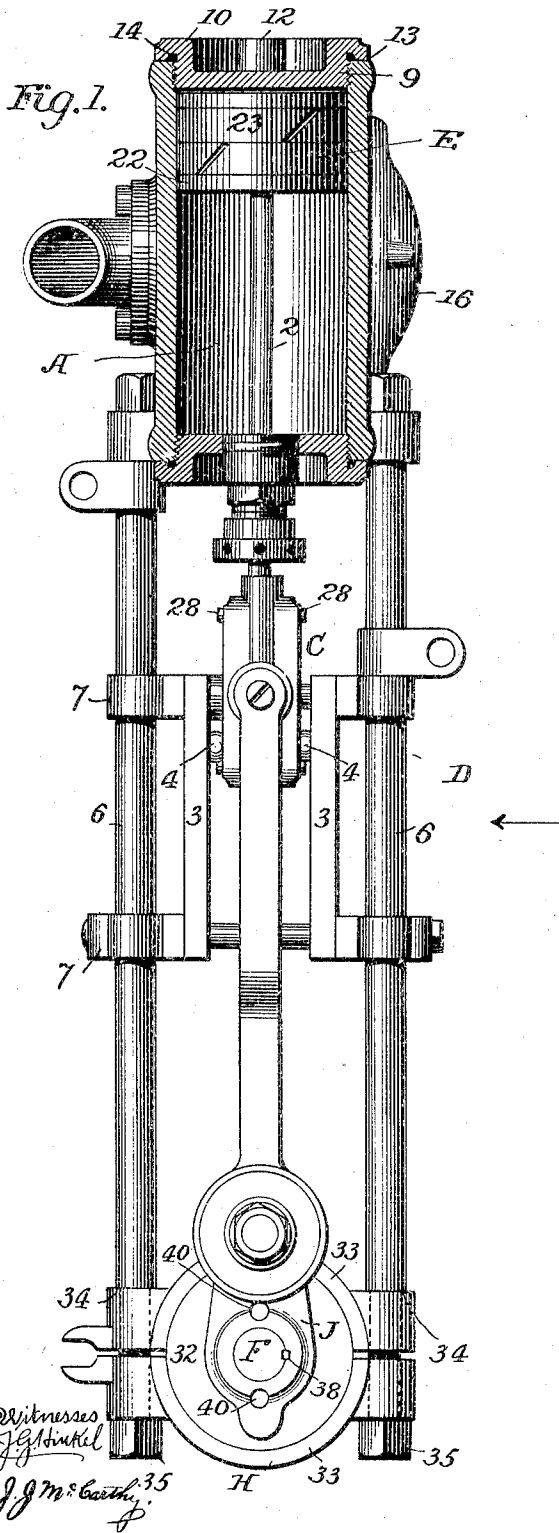


F. E. STANLEY.
ENGINE.

APPLICATION FILED JAN. 30, 1903.

3 SHEETS—SHEET 1.



Inventor
Francis E. Stanley

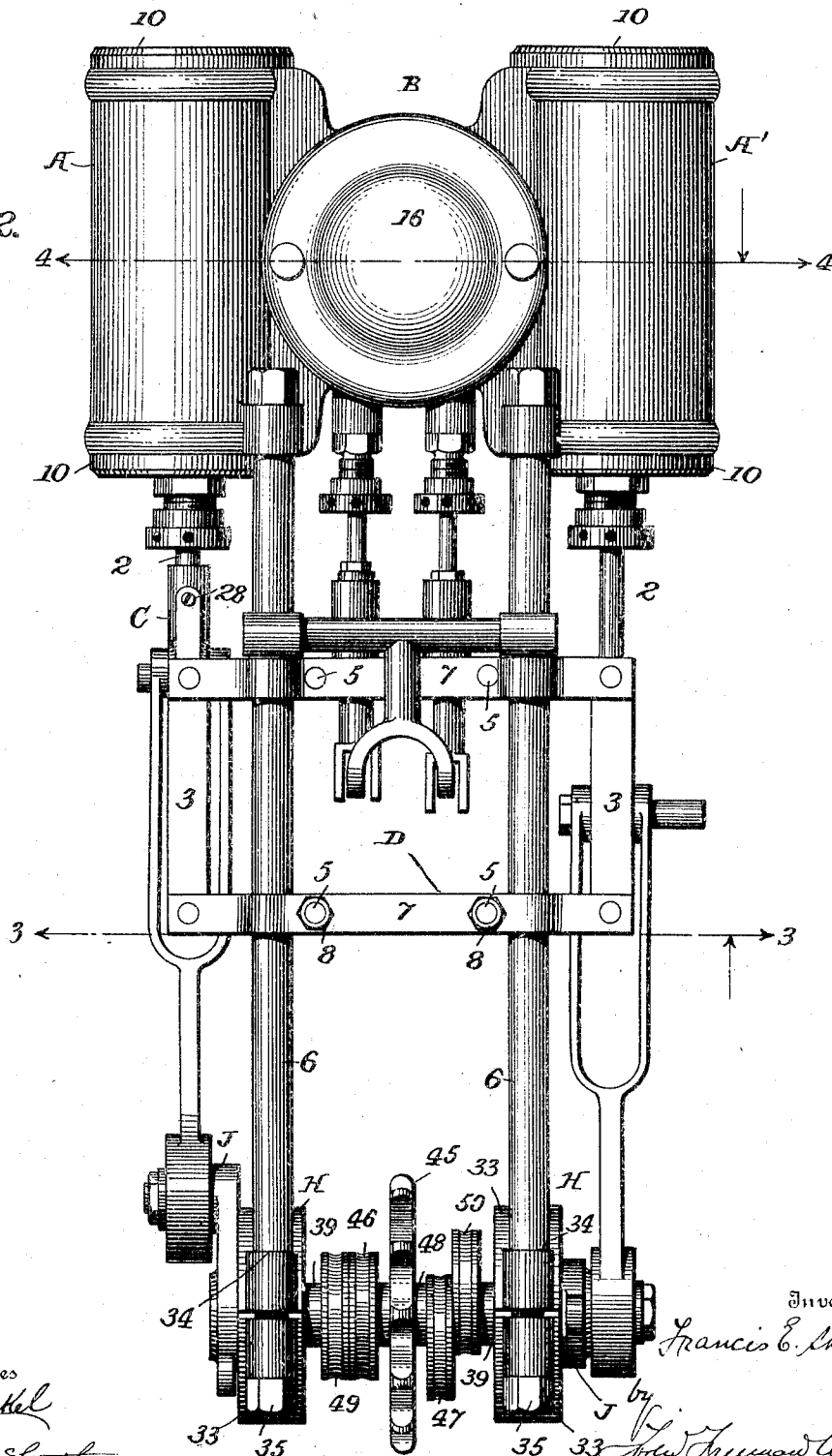
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3 SHEETS—SHEET 2.

Fig. 2.



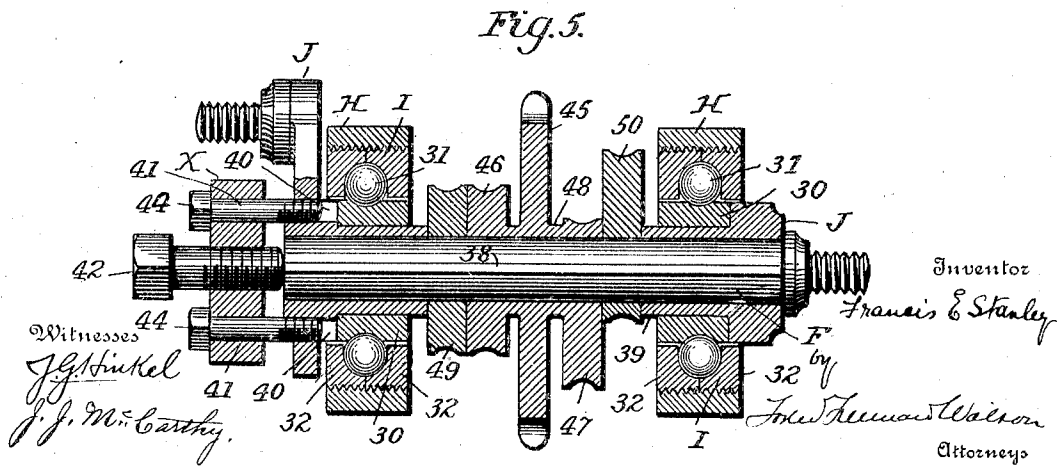
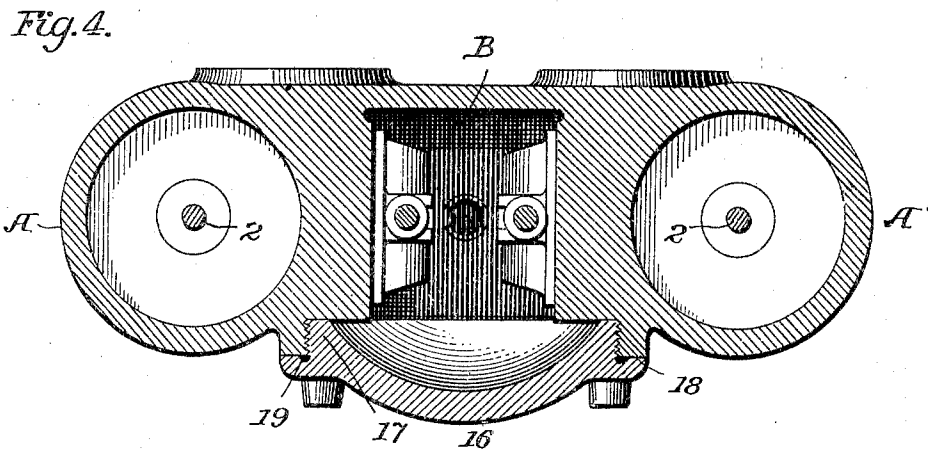
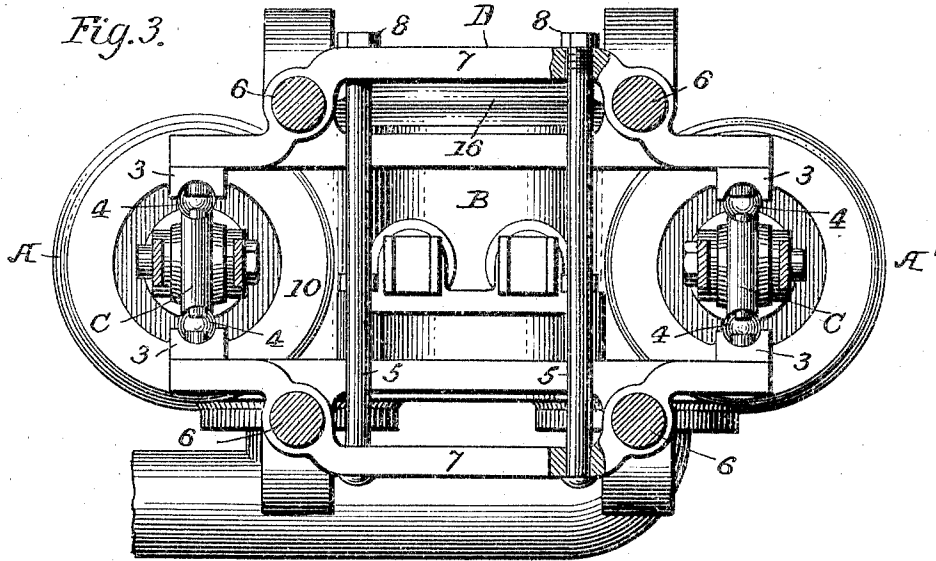
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ENGINE.

APPLICATION FILED JAN. 30, 1903.

3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

FRANCIS E. STANLEY, OF NEWTON, MASSACHUSETTS.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 788,610, dated May 2, 1905.

Application filed January 30, 1903. Serial No. 141,176.

To all whom it may concern:

Be it known that I, FRANCIS E. STANLEY, a citizen of the United States, residing at Newton, county of Middlesex, and State of Massachusetts, have invented certain new and useful Improvements in Engines, of which the following is a specification.

My invention relates to steam-engines, and more especially to that character of steam-engines employed for driving the parts of motor-vehicles; and my invention consists in making the various parts so as to simplify and reduce the cost of construction, to secure increased strength and more positive and fixed connections, and to facilitate adjustment, as fully set forth hereinafter and as illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional elevation of a steam-engine illustrating my invention, the links and connections being omitted. Fig. 2 is an elevation looking in the direction of the arrow, Fig. 1. Fig. 3 is a cross-section on the line 3 3, Fig. 2. Fig. 4 is a cross-section on the line 4 4, Fig. 2. Fig. 5 is a sectional plan on a plane including the axis of the crank-shaft. Fig. 6 is a section illustrating the construction and connection of the piston, piston-rod, and cross-head.

The engine may have one or two cylinders. As shown there are two cylinders A A' and an intervening steam-chest B, and each piston-rod 2 is connected with a cross-head C, moving between guides 3 3, with intervening ball-bearings 4 4, as in the engine for which Letters Patent were issued to F. E. Stanley on the 16th day of April, 1901, No. 672,337. In the construction of said Letters Patent springs were used as a means of pressing the guides against the balls. To avoid the necessity of this arrangement, I support the guides upon a frame D, so constructed that the parts of it may be drawn together to bring the guides to bear properly upon the balls, the guides being preferably supported by yielding portions of the frame, so that there is a slight spring-pressure, sufficient to yield to any necessary extent to insure a continued pressure upon the balls at all times. The frame may be constructed in different ways to secure this result. As shown, the frame consists (where

two cylinders are employed) of four rods 6 6, extending through ears upon the cylinders and through ears upon the blocks supporting the crank-shaft bearings, and cross-pieces 7 7, supported upon the rods 6 6 and projecting at each end beyond the same and supporting the guides 3 3. Through the opposite cross-pieces extend bolts 5 5, provided with nuts 8, which are a means of drawing toward each other the cross-pieces, the frame yielding sufficiently to thereby secure the desired pressure upon the balls 4 4, while the ends of the cross-pieces 7 7 project to a sufficient extent to afford the slight yielding action required.

In the case of an engine having a single cylinder there will of course be but two rods 6 6, with connections between the same and the guides constructed to afford the yielding pressure required.

To avoid the necessity of confining the cylinder-heads by a series of bolts and save the time and labor incident to removing the bolts or nuts in order to detach the heads and also to avoid the difficulty of such manipulation where the engine is in a confined space, I thread the cylinder internally at each end and fit thereto the inner projecting boss 9 of the head 10, which may thus be screwed in place, the head being recessed on the outside and being provided with lugs 12, which may be engaged by a spanner, affording a ready means of applying and detaching the head. The end of the cylinder is nicely fitted to afford a seat or bearing for a shoulder 13 upon the head, securing a close-fitting joint, in order to avoid any possibility of leakage an annular recess 14 is made in the shoulder adjacent to the threaded boss to receive a packing of asbestos or other material which will be firmly compressed when the head is in place. It will be seen that by providing the central boss it may be made of sufficient length to insure a connection that will resist all possible pressure, that it may be readily removed and applied, that the outer dimension of the engine is substantially that of the cylinder instead of having to provide for the space occupied by the usual external flanges bolted together, and that the necessity of employing bolts and flat packings and of depending upon

the packing as a means of maintaining a joint are avoided. I also avoid the necessity of bolting the cap 16 of the valve-chest and of depending upon a flat packing to close the joint by making the said cap with a threaded boss 17, adapted to a threaded opening in the valve-chest, and with a shoulder 18, arranged to afford a nicely-fitting seat or face upon the valve-chest. In this case, as in the construction of the heads, the extended threaded boss secures of itself a joint which tends to prevent the escape of steam, while the shoulder 18 and its seat insures a close joint, a groove 19^a, however, being provided for receiving a packing to avoid any possibility of leakage in case there is not an exact fitting of the parts.

It will be seen that by providing a screw-cap for the valve-chest, as above described, the valve-chest need not extend beyond the limits of the outer periphery of the shoulder 18, thus avoiding the extension required where screws or bolts are needed for securing the cap and affording abundant room for access to the various packing-boxes. It will also be seen that the construction described permits the machining by circular motion, avoiding the use of planing for any of the parts described.

To cheapen and facilitate the construction of the piston and the application and securing of the split rings thereof, I make each piston E of two similar sections 19 19, each with a central perforated or hollow hub 20 and an annular flange 21, with a shoulder 22 outside the flange, and by placing the two sections so that the hubs meet there is formed a space between the two shoulders 22, in which to place the usual split rings 23 23 without the necessity of expanding the same, and the parts may then all be secured together by passing the piston-rod 2 through the two hollow hubs and securing the parts in place. One means of securing a positive connection is to reduce the end of the piston-rod forming a shoulder 24, against which the inner section 19 bears, and flaring the outer end of the opening in the outer section, so that by upsetting the end of the piston-rod there is formed a head 25, filling said opening and confining the parts in place.

To secure a firm connection between the piston and the cross-head, I provide the latter with a threaded socket to receive the threaded end of the rod and pass a screw-pin 28 through the cross-head, so that its inner end will bind upon the end of the piston-rod, said inner end preferably being conical to engage the threaded groove of the rod and the pin projecting beyond the edge of the cross-head to make contact with the ball 4 for the purposes set forth in the aforesaid Letters Patent.

The crank-shaft may be supported in blocks of any suitable character; but for the purpose of providing ball-bearings I prefer to construct the parts as shown, in which the crank-

shaft F carries a part 30 with an annular recess to receive antifriction-balls 31. The ring-bearing I for each series of balls 31 is made in two sections 32 32, each recessed, so that when the two are together, as shown in Fig. 5, there is a proper groove or channel for the ball, and these sections 32 are threaded externally to fit the threaded socket formed in the blocks H, each of which consists of two sections 33 33 with ears through which pass the rods 6 6, the latter being reduced where they pass through the ears to form shoulders 34 and threaded at the outer ends to receive nuts 35, by means of which the two sections may be brought forcibly together to bear so firmly upon the threaded ring-sections as to hold them firmly in their sockets. By loosening the nut 35, however, either ring-section may be readily withdrawn by turning it in the proper direction, thus affording easy access to the balls, or the nuts may be removed, permitting the removal of the block-sections and easy access to the parts.

The cranks J are preferably held frictionally upon the crank-shaft F and prevented from turning by means of a spline 38 on the shaft fitting a groove in the hub of each crank, which hub is preferably prolonged to form a sleeve 39, in which case the part 30 may be in the form of a ring encircling the said sleeve. In consequence of the tight fit between the hub of the crank and the shaft considerable power is required to remove the crank from the shaft, and in order that this may be done without battering the parts I provide means whereby a cross-head X may be temporarily connected to the crank in such manner that power may be applied between the cross-head and the end of the shaft to force the crank longitudinally outward upon and from the shaft. Thus the crank may have two threaded sockets 40 40, adapted to receive bolts 41 41 passing through the cross-piece X, through which also extends a heavy screw 42, the end of which can be brought to bear against the end of the shaft F, so that by further turning the screw 42 the head X is carried outward, carrying with it the crank. If it is then desired to force the bearing-ring 30 from the hub, it may be started in this direction by turning the bolts 44 44 until their ends bear on the ring.

It is important to properly adjust and maintain the relation of the eccentrics to each other and the crank-shaft and to firmly connect the parts with the sprocket or other driving-wheel. In order to secure this result without the complicated and expensive fastenings heretofore employed, I forge the sprocket-wheel 45 and the adjacent eccentrics 46 47 on opposite sides of the same all in one piece, with a common hub 48, adapted to receive the shaft F and grooved to receive the spline 38 on the shaft. By thus forging the parts in one piece their proper adjustment is secured and their proper relative arrangement

maintained. There is no possibility of mal-
adjustment, and there are no fastenings to be-
come loose, while the retention of all the parts
in proper position on the crank-shaft is se-
cured by the spline 38. The outer eccentrics
49 50 are more economically formed of sepa-
rate pieces, each bored and slotted to receive
the shaft and its spline, which latter insures
the maintenance of the proper relation to the
other parts.

While I have shown the flexible frame com-
bined with ball-bearings, the same means of
tightening may be used with slide-bearings.

Without limiting myself to the precise con-
struction and operation of the parts described
or to their use in connection with a double-
cylinder engine, I claim as my invention—

1. The combination in an engine of a cyl-
inder, cross-heads, guides therefor, a frame
having yielding members supporting the
guides and means for drawing the members
of the frame toward each other to tighten the
cross-head bearings, substantially as de-
scribed.

2. The combination in an engine of a cyl-
inder, cross-heads, guides therefor and inter-
vening antifriction-balls, a frame having yield-
ing members supporting the guides and means
for drawing the members of the frame toward
each other to tighten the cross-head bearings,
substantially as described.

3. The combination with the cylinder, cross-
head and guides of an engine, of a frame hav-
ing yielding longitudinal members connected
together at their outer ends, and means for
drawing the members toward each other to

tighten the cross-head bearings, substantially
as described.

4. The combination with the cylinder, cross-
head and guides of an engine, of a frame hav-
ing yielding longitudinal members connected
together at their outer ends, and screw-bolts
for drawing the members toward each other
to tighten the cross-head bearings, substan-
tially as described.

5. The combination with the cylinders of a
duplex engine, of a frame consisting of rods
extending from the cylinders and connected
in pairs at their outer ends, and cross-bars
supported by said rods, guides supported by
the cross-bars, cross-heads sliding between the
guides and means for drawing the cross-bars
toward each other to tighten the cross-head
bearings, substantially as described.

6. The combination with the cylinders of a
duplex engine, of a frame consisting of flexi-
ble rods extending from the cylinders and con-
nected in pairs at their outer ends and cross-
bars supported by said rods, guides support-
ed by the cross-bars, cross-heads sliding be-
tween the guides and screw-bolts for drawing
the cross-bars toward each other to tighten
the cross-head bearings, substantially as de-
scribed.

In testimony whereof I have signed my name
to this specification in the presence of two sub-
scribing witnesses.

FRANCIS E. STANLEY.

Witnesses:

J. W. BACON,
C. F. BACON.