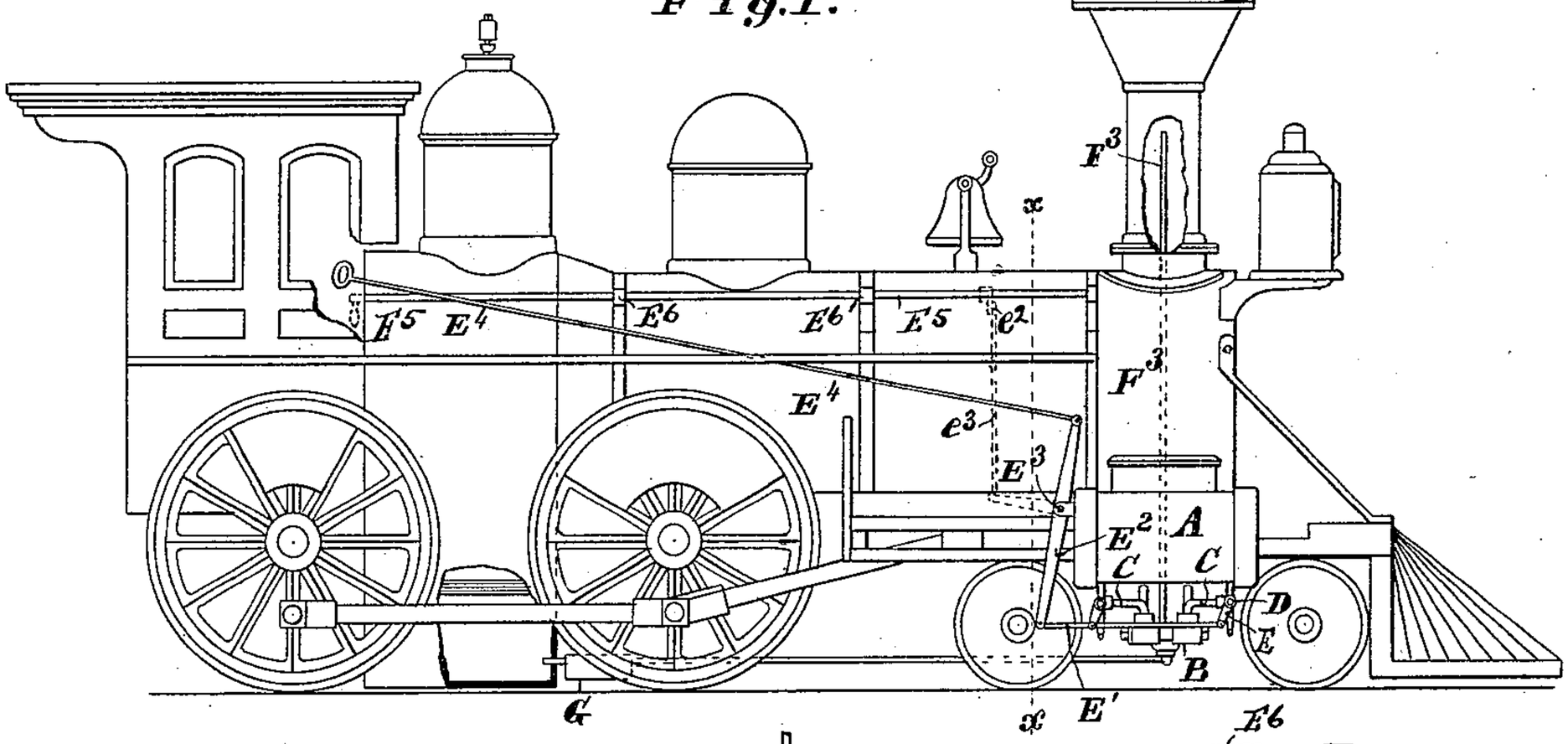
(No Model.)

J. RYAN.

LOCOMOTIVE CYLINDER AND BLOW-OFF COCK.

No. 246,640. Patented Sept. 6, 1881.

Fig. 1.



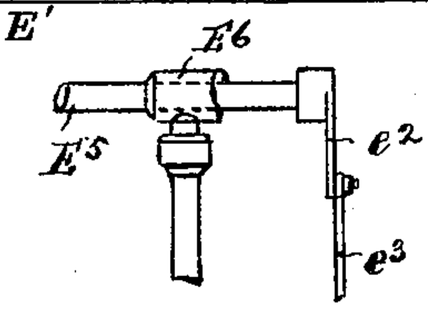
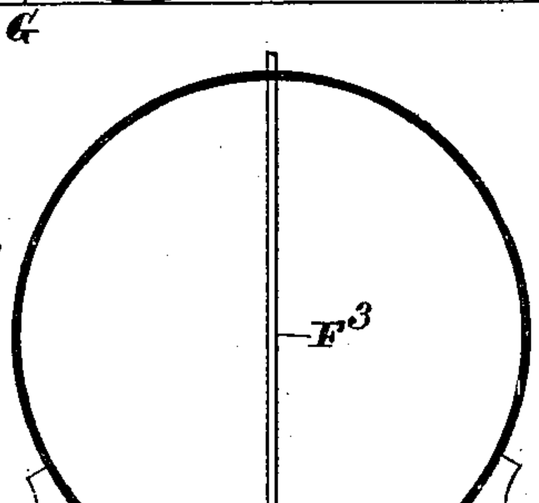


Fig. 5.

Fig. 2.



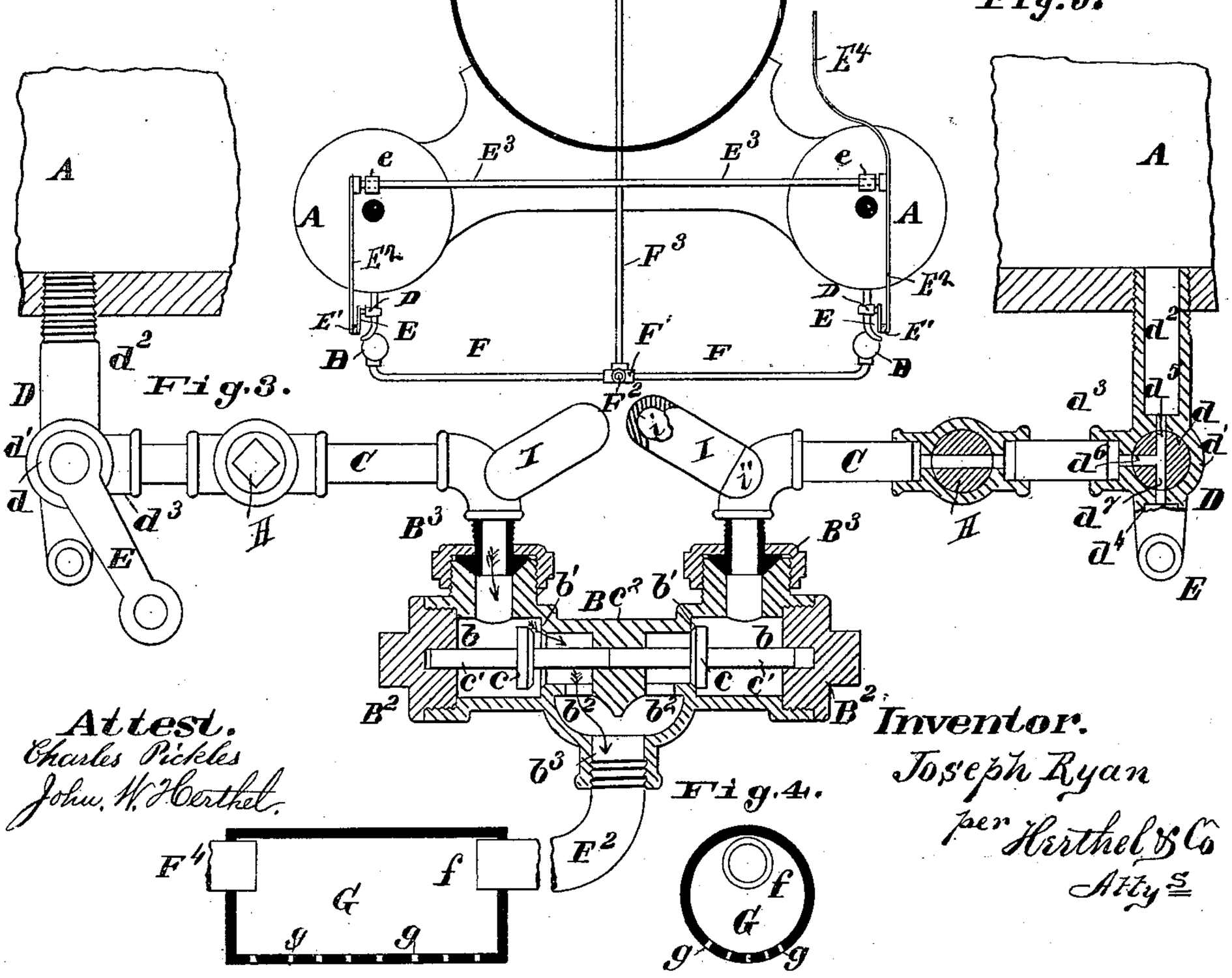


Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOSEPH RYAN, OF ST. LOUIS, MISSOURI.

LOCOMOTIVE-CYLINDER AND BLOW-OFF COCK.

SPECIFICATION forming part of Letters Patent No. 246,640, dated September 6, 1881.

Application filed December 17, 1880. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH RYAN, of St. Louis, Missouri, have invented new and useful Improved Cylinder and Blow-Off-Cock Attachments for Locomotive Steam-Cylinders, of which the following is a specification.

My invention relates to improvements specially designed to be applied to the steam-cylinders of locomotive-engines, although the main devices—such as blow-off cock and automatic cylinder-cock—can be applied to steam-cylinders in general.

The objects of my improvements are, first, to effect a better drainage of the steam-cylinders of locomotives—that is, relieve same of condensation or water, also facilitating the discharge of the exhaust-steam, freeing the cylinder from sediment, &c., and the causes that produce back-pressure; secondly, to enable the engineer, from his position in the cab, to control the action of the respective blow-off and cylinder cocks; thirdly, to effect the discharge of the exhaust or blow-off from steam-cylinders without passing the water, &c., through the cylinder-cock, if so required; fourthly, to cause whatever water or condensation passes through the cocks to be discharged at the lowest point and utilize the exhaust-steam in such a manner that it can reach the furnace, but mainly be discharged into the chimney-stack, (with the main exhaust from steam-cylinder valve-chest;) fifthly, to facilitate combustion in the furnace, also exit of products of combustion from the stack, by means of the pipe-communication existing between said parts, permitting exhaust-steam discharging in said stack to create a better draft or currents of air to reach the furnace; lastly, to obviate the necessity of at all times discharging exhaust-steam directly into the atmosphere, as ordinarily done, hence avoiding the noise and inconveniences arising from such action. I attain these objects by the improvements illustrated in the accompanying drawings, of which—

Figure 1 is a side elevation of my improvements as they appear applied to a locomotive-engine. Fig. 2 is a transverse sectional elevation, somewhat enlarged, taken on line *x x* of Fig. 1. Fig. 3 is chiefly an enlarged sectional elevation of my improvements, shown applied to each end of the steam-cylinder, the parts in section being the respective cocks to the right, also the trap, while the remaining parts to the left are shown in side elevation. Fig. 4 is a cross-section of the trap; and Fig. 5 is a detail view, showing the usual stay-rod on the side of the locomotive fitted to turn in the bearings of its bracket, and by crank attachment to lever below control the operation of the three-way cocks.

Similar letters refer to similar parts throughout the several views.

A represents the steam-cylinders of a locomotive-engine.

B represents my automatic cylinder-cocks.

C represents the connecting-pipes.

D represents the three-way cocks. The three-way cocks (specially shown in section in Fig. 3) are constructed as ordinarily, the cock *d d* proper being fitted to operate in a corresponding barrel, *d'*, having three (3) branches—viz., the inlet-branch d^2, the center branch, d^3, and the lower or outlet branch, d^4. (See Fig. 3.) The cocks *d d* have the three ports d^5 d^6 d^7, which, when positioned in line of communication with the like ports or passages in the respective three branches d^2 d^3 d^4, establish open communication through said parts. (See Fig. 3.) Each three-way cock I connect by their inlet-branch d^2 to the respective ends of the steam-cylinder, or near the ends of the stroke of its piston. (See Figs. 1 and 3.) Further, the respective center branch, d^3, I connect to one end of the respective pipes C C. The other end of said pipes joins in communication with the inlet of the automatic cylinder-cock B. (See Fig. 3.)

The cylinder-cocks B here shown and used are similar in construction and operation to the one patented to me bearing date October 29, 1878, No. 209,518, and are here briefly described as follows: The inside of the main barrel B has the valve-chambers *b b*, valve-seats *b' b'*, the passages b^2 b^2, communicating from each valve-chamber to the central discharge or exhaust, b^3. (See Fig. 3.) Further, *c c* are the pair of valves forming part of stems *c' c'*, the inner ends of which are guided by the partition-wall c^2, while the outer ends of the stems are guided by the respective screw-caps B^2 B^2. The arrangement of the valves is such that one closes its seat while the other is away from its seat, the stems of the valves be-

ing, for said purpose, made to come in contact with each other, as shown in Fig. 3. The valves operate simultaneously, the live steam keeping one closed against its seat, the other valve being away from its seat, allowing the water-discharge or exhaust-steam to pass through the open passage of the exhaust-port b^3, as indicated by the course of the arrows. (See Fig. 3.)

The screw-caps B^2 B^2 close the opposite ends of the cylinder-cock, and B^3 B^3 are the farther screw-caps to unite the connecting-pipes C C to the respective inlets of the cylinder-cock. (See Fig. 3.) Thus the complete joining in communication with each other of the respective three-way cocks to the ends of the steam-cylinder and the automatic cylinder-cock to the connecting-pipes is made, and the water of condensation, exhaust-steam, &c., can pass from cylinder through said cocks, pipes, &c., finally out of exhaust-port of cylinder-cock to the respective points of discharge, as will hereinafter appear.

I will now more specifically describe the threefold functions performed by the use of the three-way cocks here presented: first, to effect the usual blow-off from steam-cylinder without passing the discharge through the cylinder-cock, but to discharge directly through said three-way cocks, (which therefore serve as a blow-off cock;) secondly, to close that part of the three-way cocks so constituting blow-off cocks, so as to establish only open communication between cylinder, part of three-way cocks, and thence into cylinder-cock, effecting the discharge of the condensation and exhaust through the cylinder-cock proper; thirdly, to entirely close the communications between cylinder and the respective three-way and cylinder cocks.

To use the three-way cocks as blow-off cocks, each cock *d* is in the position shown in the section of Fig. 3—that is, the three ports are in line with the like number of passages in the three branches; hence the live steam has free passage through each cock *d* into the cylinder-cock B, which action on part of the steam at respective periods of the piston-throw closes the valves alternately against their seats. The steam can then pass and also force the previously-accumulated water, &c., only through the open outlet of the three-way cocks into the atmosphere. It will be noted that thus the blowing off from steam-cylinder is achieved without passing the discharge through the cylinder-cock.

To accomplish the second operation—viz., effect the discharge of the exhaust and condensation through the cylinder-cock—each three-way cock is turned to the left, say, a quarter-movement, to bring its port d^7 where port d^6 was, which action closes that part of the three-way cock that constituted the blow-off cock or outlet to the atmosphere, and still leaves open the ports d^7 d^6 in communication required from steam-cylinder to and out of the cylinder-cock. The cylinder-cock then operates automatically, the steam-pressure closes against its seat, one of the valves at same time thrusting the opposite closed valve away from its seat, thus permitting the condensed steam or water to escape from the exhaust end of steam-cylinder through the open valve-chamber of the cylinder-cock, and finally out of its exhaust-port. (See course of arrows as per Fig. 3.) At the next stroke of the engine the automatic action of the pair of valves is exactly reversed, and so on alternately in manner similar to that shown and described in my former patent above alluded to.

The third operation—viz., to close all communications of the respective three-way cocks (and consequently to the cylinder-cock) with steam-cylinder—can be accomplished by simply turning each three-way cock, say, to the right, or until the metal body of the cocks *d d* and barrel *d'* closes the three ports.

My improvements further relate to the connecting mechanism that enables the engineer, from his position in the cab, to control the communications existing between the three-way cocks and the steam-cylinder.

E E are cranks having one end secured respectively to the cranks *d d*. The other end of each crank is pivoted to a horizontal rod, E'. (See Figs. 1 and 3.) To the inner end of rod E', I pivot the lower arm of the lever E^2, having for its fulcrum a transverse rock-shaft, E^3, which turns in bearings *e e*. (See Figs. 1 and 2.) The upper arm of lever E^2 connects, further, to one end of the main rod E^4, which extends within reach inside the cab of the locomotive. (See Figs. 1 and 2.) It is only necessary to have the main rod E^4 on one side, since on the opposite side of the locomotive the three-way cocks connect, by like cranks, horizontal rod, and the lower arm of lever E^2, to the opposite end of the rock-shaft E^3, as shown in Fig. 2. As apparent, a forward thrust imparted to the main rod E^4 causes the cranks simultaneously to turn all the three-way cocks to the left, and, vice versa, by a backward pull of the said main rod the cocks are partially turned to the right. The opening and closing of all the three-way cocks can thus be controlled from the cab—that is, more specifically stated, the engineer, from the cab, can effect the blow-off from steam-cylinder, or, secondly, discharge its exhaust, &c., through the cylinder-cocks, or, lastly, close all the ports and passages existing in the three-way cocks.

In the place of the main rod E^4, the usual stay-rod, E^5, (which ordinarily exists on each side of a locomotive-engine,) can be utilized for the same purposes just stated. The stay-rod E^5 is fitted to turn in the bearings of its brackets E^6, and to the outer end of stay-rod I secure the like crank e^2. The lower end of this I pivot to the top end of the farther connecting-rod, e^3, which has its lower end connected to the lever E^2, but made a bell-crank. (See Figs. 1 and 5.) Instead of the push motions used

in the case of the main rod E^4, the stay-rod E^5 is turned either right or left to operate the respective three-way cocks. The stay-rod E^5 also answers for its ordinary purposes of a guide and holdfast.

My improvements further relate as follows:

To the exhaust-port of each cylinder-cock I prefer to join transverse branch pipes F F and join same in the middle in open communication with a cross-casting, F′, from which the farther respective pipes F^2 F^3 extend, the former at bottom along the boiler, the latter pipe extending upward into the stack. (See Figs. 1, 2, 3.) The main function of the horizontal pipe F^2 is to pass off the water at its lowest point. The main function of the vertical pipe F^3 is to discharge the vapors, exhaust-steam, &c., into the chimney-stack, while both said pipes in conjunction further establish an open communication from the furnace to the stack. (See Figs. 1 and 2.) The inner end of the pipe F^2 discharges into a trap, G, which is simply a tubular boxing having perforated bottom *g*, out of which the water, sediment, &c., can pass. As shown in Figs. 3 and 4, the inner end, *f*, of the pipe F^2 projects inside and near the upper corner of the trap, this arrangement being to break the force of suction lodging matter or liquid into the pipe F^2 or cylinder-cock.

F^4 is another but shorter pipe, which likewise has one end projecting inside the trap G, but at the opposite side, while the remaining end of said pipe I extend either under or above the grate of the furnace. (See Fig. 1.) By such an arrangement of the pipes F^4, trap G, and pipe F^2 F^3, a communication exists between the furnace and chimney-stack. In operation part of the exhaust-steam may enter the furnace. This I deem advantageous and productive of greater draft and consequent better combustion; but mainly the exhaust-steam ascends up the pipe F^3, discharging into the stack, while the condensation or water circulates along the lower pipe, F^2, into the trap G, and out of its perforations.

The exhaust-steam can be made to discharge through the pipe F^3 at the same point with the usual discharge of exhaust from the valve-chest of the steam-engine, and in so doing greatly relieve the engine from back-pressure, and afford additional means of permitting the exhaust-steam to be quickly discharged from the steam-cylinder. Here, be it noted, the exhaust-steam discharging or escaping into the chimney-stack through the pipe F^3 is that part of the steam derived after its work upon the cylinder-piston has been done, and said exhaust is therefore here further utilized to facilitate the exit of the products of combustion from the stack at same time when both pipes F^2 F^3 are used. Said exhaust-steam further serves to better the draft for the furnace, owing to its constant tendency to produce a vacuum in the pipes so extending from furnace to stack. By this method, also, the great noise and inconveniences of discharging or blowing off the exhaust-steam into the atmosphere are avoided by forcing the exhaust into the stack.

I can dispense with the vertical pipe F^3 by discharging the exhaust-steam, &c., through the lower pipe, F^2, trap G, pipe F^4, into the furnace-chamber. I can dispense with the lower pipes, F^2 F^4, and use only the pipe F^3, by simply joining the trap G to the middle of the transverse pipes F F, permitting the water to discharge through the trap and the exhaust-steam in the stack. I can also directly connect the pipes F^2 to the exhaust-port b^3 of the cylinder-cocks, and thus leave away the transverse branches and the vertical pipe.

The communications through the pipes C C will always remain closed, excepting in cases required to unscrew the cylinder-cocks for repairs, &c.; hence the separate cocks H H, seen in the pipes C C, (see Fig. 3,) are simply to close the pipes C C for the emergencies stated.

I I are respective short tubes, closed at top *i*, having their lower end, *i′*, screwed into the pipes C C, as shown in Fig. 3. I employ said closed tubes to confine air, which serves to cushion the action (especially the closing action) of the valves in the cylinder-cock. The reciprocating action of the said valves is so fast and their closure against the seats is so forcible in engines of this class that there is a liability to breakage of the stems, &c., and the said air cushions act like springs behind each valve, and cause them to more gently strike against their seats.

What I claim is—

1. In combination with a steam-cylinder, the cocks D D, having ports d^7 d^6, the like number of branches d^2 d^3, the pipes C C, the cylinder-cock consisting of the main barrel B, having valve-chambers *b b*, the pair of valves *c c*, their stems *c′ c′*, the screw-caps B^2 and B^3, and exhaust-port b^3, all said parts constructed as shown and described, by means whereof the condensation and exhaust-steam can be discharged through said cocks D D and the cylinder-cock, in the manner and for the purposes set forth.

2. In combination with a steam-cylinder, the three-way cocks D D, having three branches, d^2 d^3 d^4, the pipes C C, the cylinder-cock consisting of main barrel B, having valve-chambers *b b*, pair of valves with stems *c c c′ c′*, the screw-caps at B^2 B^3, exhaust-port b^3, by means whereof the live steam can close against its seat one of the valves in the cylinder-cock, at same time throwing away from its seat the opposite valve, by means whereof the blowing off from steam-cylinder takes place at one end thereof out through one of the cocks D at same time the exhaust from steam-cylinder takes place at the opposite end through and out of the exhaust-port of the cylinder-cock.

3. In combination with a steam-cylinder, the three-way cocks D D, respective branches d^2 d^3 d^4, the pipes C C, with or without the cocks H

H, the closed tubes I I, serving as air-cushions, the cylinder-cock consisting of the main barrel B, having valve-chambers *b b*, the pair of valves and stems *c c c' c'*, screw-caps at B^2 B^3, all said parts constructed and arranged to operate as and for the purposes set forth.

4. In combination with the exhaust-port of a cylinder-cock employed in connection with locomotive steam-cylinders, the branch pipes F F, the horizontal pipe F^2, trap G, having perforated bottom *g*, and extension-pipe F^4, by means whereof the exhaust, &c., from the cylinder-cock can be discharged into the furnace-chamber of the locomotive, as and for the purposes set forth.

5. In combination with the exhaust-port of a cylinder-cock employed in connection with locomotive steam-cylinders, the branch pipes F F, horizontal pipe F^2, vertical pipe F^3, the trap G, and extension-pipe F^4, said parts arranged as shown and described, by means whereof an open communication exists between the furnace and chimney-stack of a locomotive, as and for the purposes set forth.

6. In combination with the steam-cylinders of a locomotive-engine, the three-way cocks D D, cranks E E, horizontal rods E', the bell-crank levers E^2, rock-shaft E^3, connecting-rod e^3, upper crank, e^2, stay-rod E^5, turning in brackets E^6, by means whereof the said stay-rod is utilized to control the operation of said cocks, as well as serving as the guide and holdfast rod for the side passage of the locomotive.

7. In combination with the steam-cylinders of a locomotive-engine, the three-way cocks D D, having the branches d^2 d^3 d^4, ports d^5 d^6 d^7, the connecting-pipes C C, with or without the closed tubes I I and the cocks H H, the automatic cylinder-cock B, the pipes F F F^2 F^3, singly used or combinedly, as described, the trap G, the cranks, rods, levers, and push or turn rod mechanism, substantially as shown and described, as and for the purposes set forth.

JOSEPH RYAN.

Witnesses:
WILLIAM M. HERTHEL,
JOHN W. HERTHEL.