(No Model.)

3 Sheets—Sheet 1.

E. CHESHIRE.

STEAM ENGINE.

No. 538,818. Patented May 7, 1895.

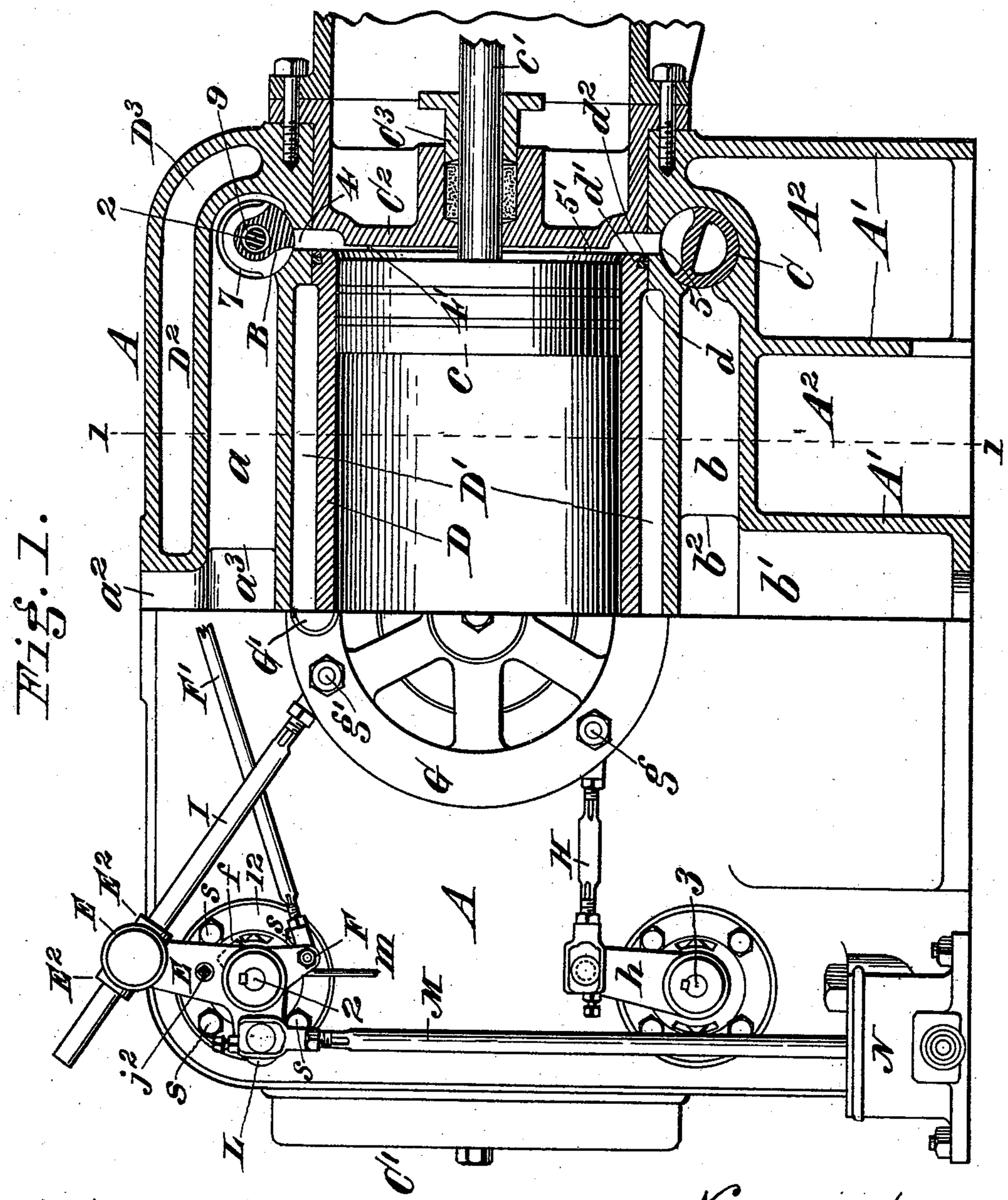

Fig. 1.

Attest

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(No Model.) 3 Sheets—Sheet 2.

E. CHESHIRE.

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Fig. 2.

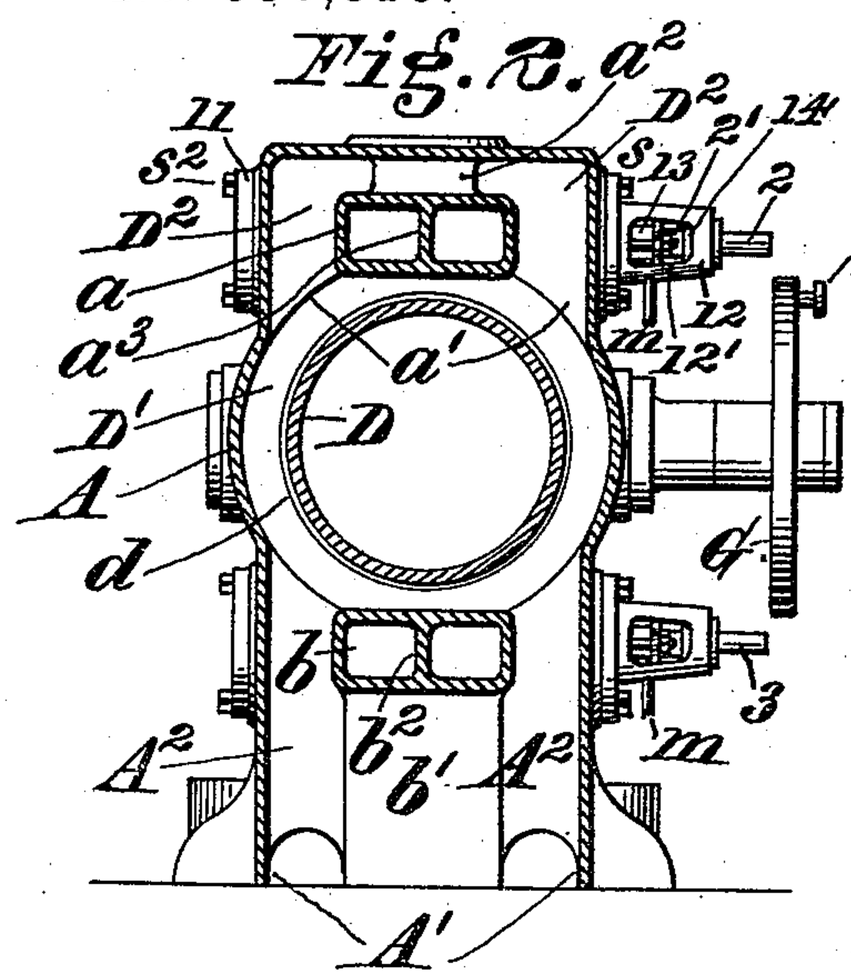


Fig. 5.

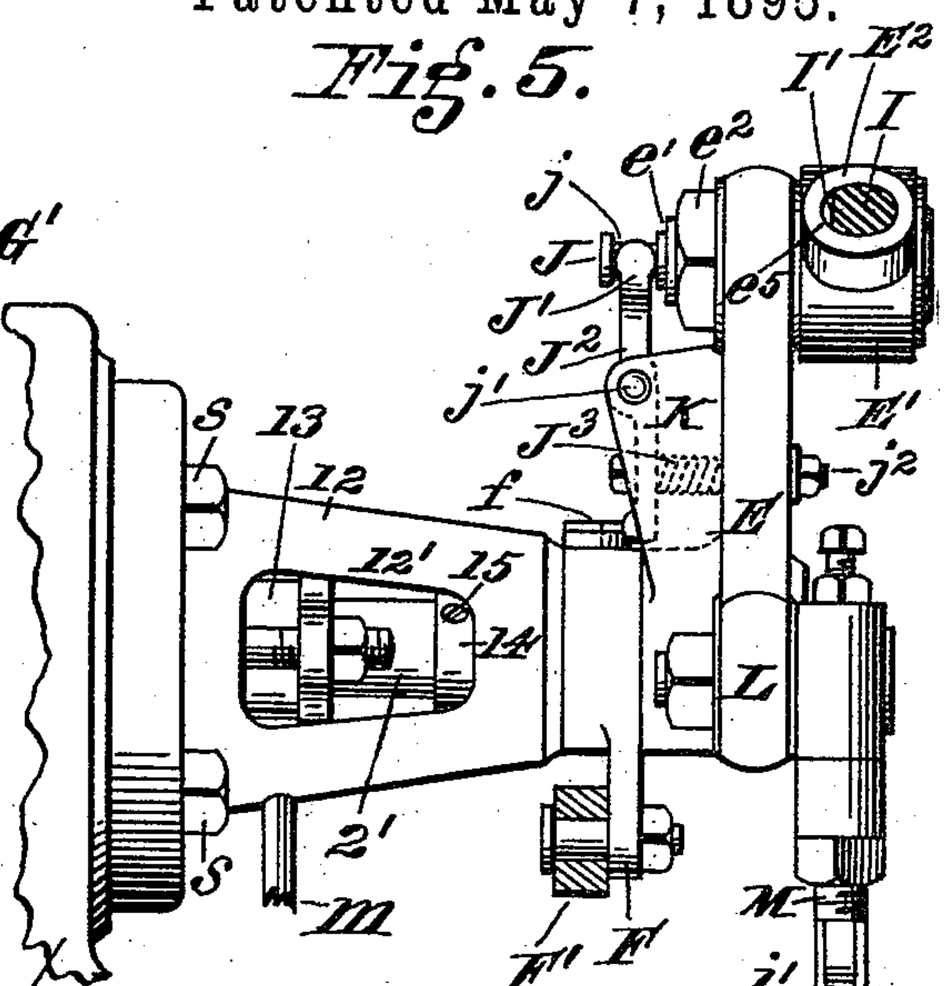


Fig. 3.

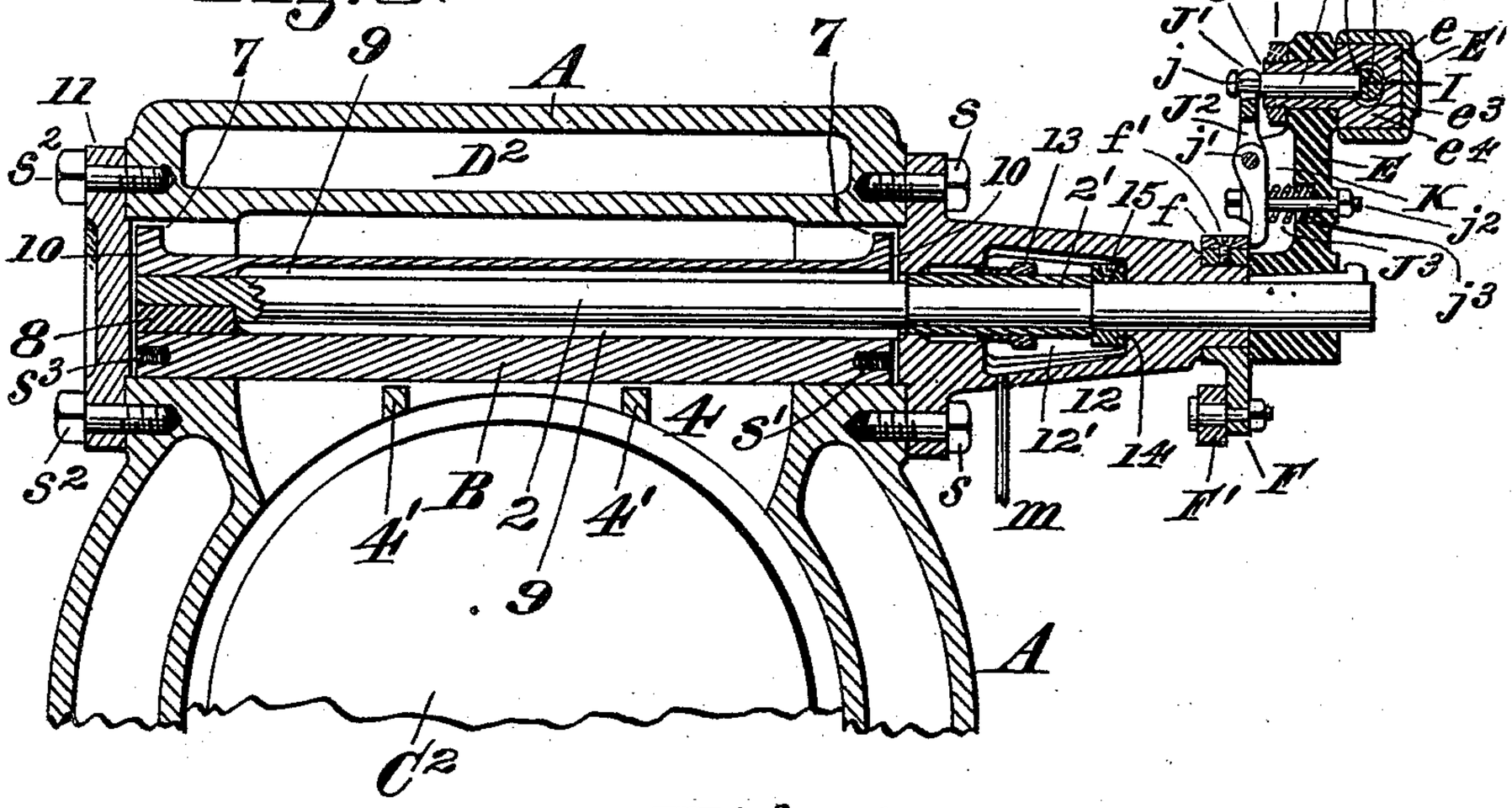
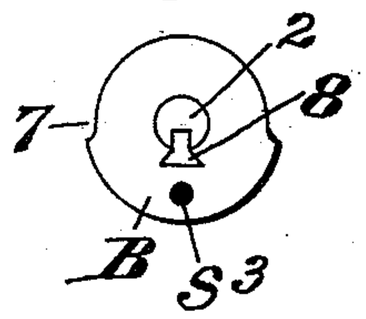


Fig. 4.



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(No Model.) 3 Sheets—Sheet 3.

E. CHESHIRE.

STEAM ENGINE.

No. 538,818. Patented May 7, 1895.

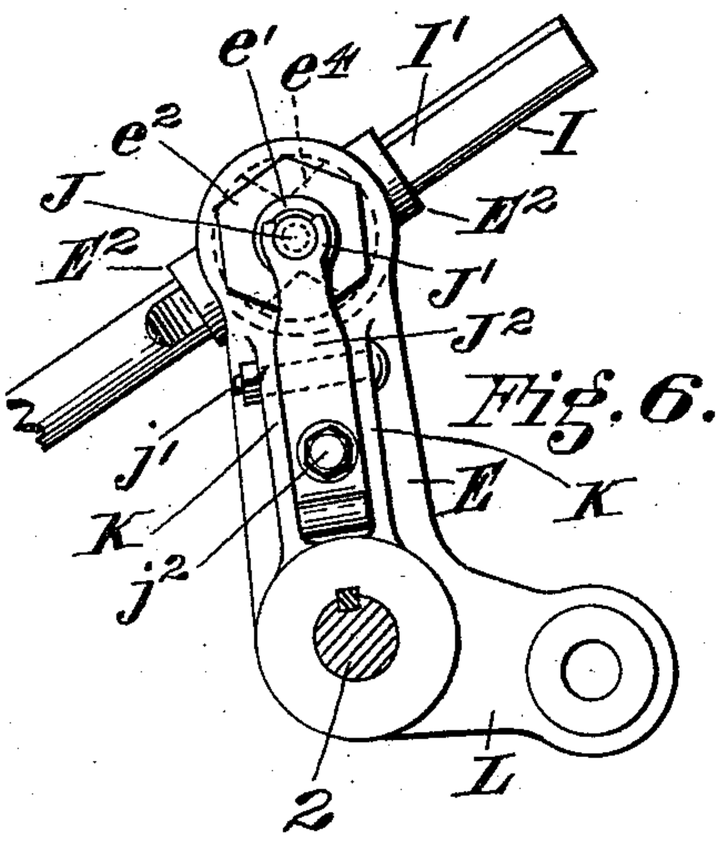

Fig. 6.

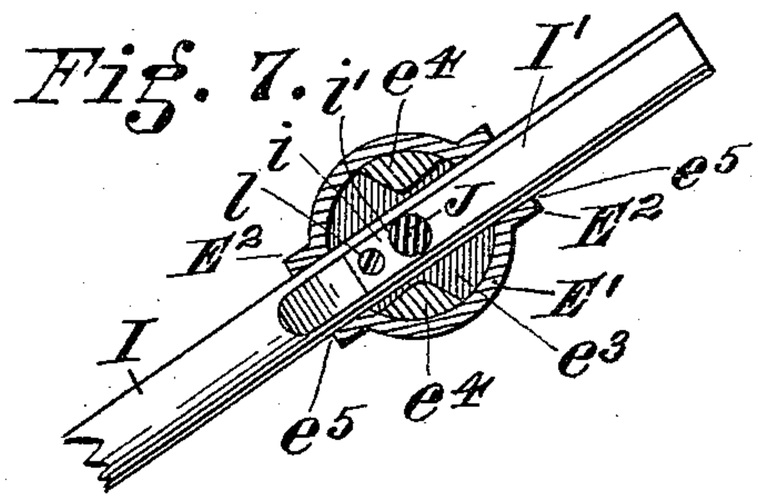

Fig. 7.

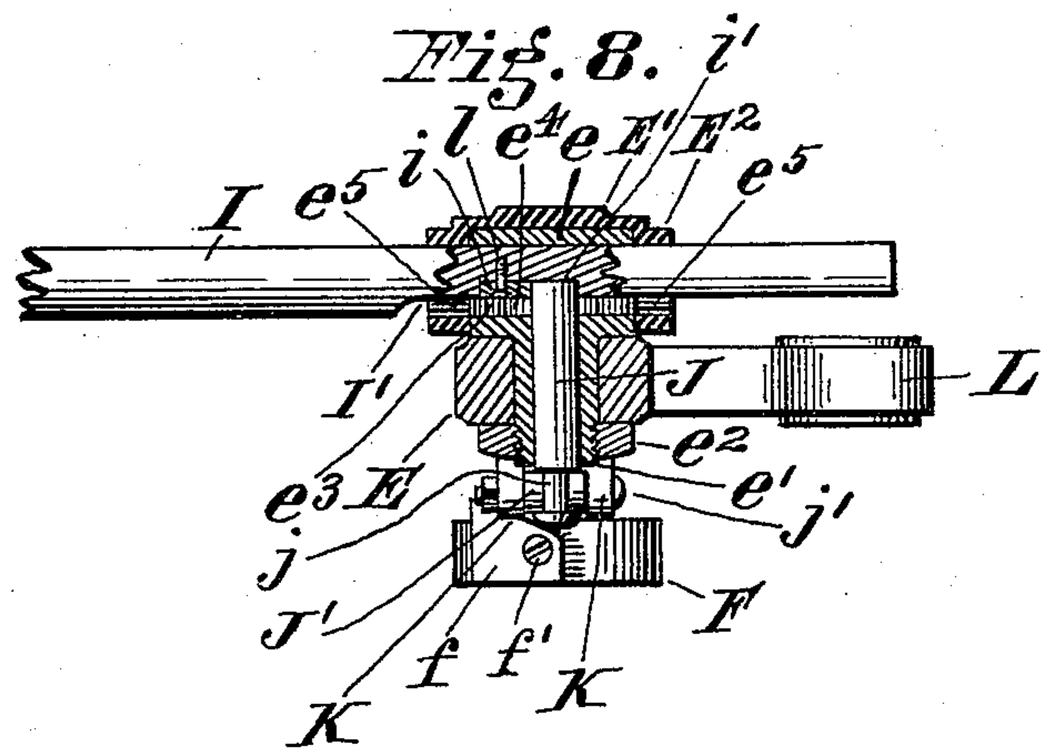

Fig. 8.

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J. C. Robinson Jr.

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by John E. Jones,
his Attorney.

UNITED STATES PATENT OFFICE.

EDWARD CHESHIRE, OF COVINGTON, KENTUCKY.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 538,818, dated May 7, 1895.

Application filed April 11, 1894. Serial No. 507,086. (No model.)

To all whom it may concern:

Be it known that I, EDWARD CHESHIRE, a citizen of the United States, residing at Covington, in the county of Kenton and State of Kentucky, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification.

My invention relates, more especially, to steam-engines of the Corliss-type having variable, automatic cut-off valve-gear and suitable dash-pot mechanism; and it consists in a novel construction of valve releasing-gear, and valve as will be fully hereinafter described and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a longitudinal elevation, partly broken and in section, of my invention herein, showing the piston at the beginning of a forward stroke, just after the acting valve has opened or had the usual short lead, and also showing the exhaust-valve at the same end of the cylinder a short lap beyond its closing-point; Fig. 2, a transverse sectional elevation, on line 1 1 of Fig. 1, on a reduced scale, of my cylinder and its surrounding chest, but with the valve-gear (excepting the wrist-plate, valve-stems, and bonnets) omitted; Fig. 3, a longitudinal section of one of the steam-valves and its outer bonnet, including also a cross-section of its surrounding shell or chamber and its outer automatic releasing mechanism; Fig. 4, a rear end view of the steam-valve and stem seen in Fig. 3 to clearly show the spline connection and withdrawing-implement socket; Fig. 5, an elevation, partly broken and in section, of said steam-valve releasing-gear, the said bonnet, and a small portion of the valve-chamber seen in Fig. 3, but on a larger scale; Fig. 6, an elevation of the inner side or back of said valve-releasing gear seen in Figs. 3 and 5, including therein a cross-section of the valve-stem and a broken elevation of the steam connecting-rod which leads to the usual oscillating wrist-plate; Fig. 7, a similar broken elevation of the said steam-rod, showing thereon a longitudinal section of the sleeve or encircling box and automatic latch-pin forming part of said valve-releasing gear; and Fig. 8 a broken sectional plan of the parts seen in Fig. 7, but including therewith the oscillating arm or wrist-lever and the bearing-box for said latch-pin, the latter being shown in full plan, together with a plan of the cam which is journaled or otherwise properly mounted on the outer end of the bonnet and operated by the governor-rod for the variable cut-off action of said releasing-gear. Figs. 3 to 8, inclusive, except Fig. 4, show the latch devices in active and firm locking operation for the beginning of the stroke, with the steam-valve open.

A represents the outer shell or chest within which I construct longitudinal tubes or conduits, a and b, respectively, the conduit a being suitably supported by webs a' cast within the upper part of the chest and having a central steam inlet-orifice a^2, and the conduit b similarly supported within the lower portion of the shell and provided with a central exit-orifice b'. Conduit a has within it at either side its said inlet-orifice a^2, a central longitudinal re-inforcing partition a^3, and forms the inlet or live-steam passage leading to the two upper, transverse induction-valves B; and conduit b has a similar partition b^2, and forms the outlet or exhaust-passage departing from the two lower, transverse eduction-valves C.

A′ represents the lower, supporting walls or legs of the chest or shell A.

D represents the steam-cylinder, constructed separate and apart from said shell, and mounted within the latter, between the said upper and lower steam conduits a and b, and in the preferred manner I shall now describe. The internal-bore of the cylinder is the same from end to end, as usual, for the proper fitting and working of the piston c, but its outer-surface is provided with single encircling ridges or elevations d at either end, which elevations are of suitable width and together constitute the only portions of said outer-surface necessary to be planed or dressed for snugly fitting within the bore of the circular-openings in the opposite end-walls of said chest. Said end-walls of the chest or shell are of suitable depth to contain the flanged-heads C′ and C^2, the latter having an ordinary central stuffing-box C^3, for accommodating the piston-rod c', as customary. A semi-dovetail groove or shoulder d' is preferably made around the peripheral-corners of both said ridged-ends of the cylinder, and a pair of soft copper rings d^2 is properly driven or seated into each groove, to form the desired steam packing or gaskets, (as best seen in Fig. 1.)

It will be readily observed that the receding bottom of each of these grooves firmly seats the several gaskets against outward movement or dislodgment in use. This independent cylinder may be very readily finished, and inserted into position within the shell by driving or pressing force, and the said gaskets depended upon to make the proper air and steam tight joints at both its ends. This cylinder may, therefore, be readily removed and replaced without affecting the surrounding shell in the least, and expense attached thereto, including any separate repairs, is materially less, compared to that attending the replacing of an entire new chest, valve-chambers and cylinder, in case the latter should be defective and all were cast integral, as heretofore made. Being constructed independent of said shell, as stated, it can be cast on end, perpendicularly, and a better distribution of the material can thus be had therein over that of a cylinder cast horizontal integral with its shell and valve-chambers and in a horizontal manner or position, as hitherto practiced.

The bulk and weight of my cylinder, independent of its shell and valve-chambers, are evidently such that it can be readily dressed and bored, and the shell with its valve-chambers being also independent of said cylinder, any dressing thereto or boring therein, especially to said valve-chambers, can be more readily accomplished than if the presence and weight of said cylinder were added, if cast integral, as is clearly obvious. Thus time, labor, and expense are saved to a marked degree in this construction, while on a bulky and very heavy combined-piece, as heretofore made, the work has been difficult and tedious, and therefore much more expensive.

Spaces D′, filled with confined air, are provided between the cylinder and the respective upper and lower steam-conduits *a* and *b*, and the sides of chest A, (best seen in Figs. 1 and 2,) whereby a non-conducting air-jacket entirely surrounds the cylinder and properly insulates it and the steam inlet-conduit, thus effectually obviating any undue cooling of the steam in said cylinder and induction-passage, and preventing radiation of heat or condensation of said steam.

D^2 represents an upper air-chamber provided in the shell A above the inlet-conduit *a*, and fully extending over and rounding the corners above the induction-valve chambers, as best seen at D^3 in Fig. 1, and also extending downward at both sides of said conduit *a*, to meet and unite with the said air-chamber surrounding the cylinder, (as best seen in Fig. 2,) whereby a complete insulator or non-conducting jacket, filled with confined warm-air, entirely surrounds said conduit *a* for the proper protection of the live-steam within, and effectually prevents condensation of steam and radiation of heat therein, as aforesaid. The rounding of the corners at D^3, as stated, presents warm-air chambers at both ends, completely over said induction steam-valve chambers, and provides ample air-jacket protection against radiation and condensation in said steam-valve chambers. These air-chambers may, if so desired, be filled with any suitable non-conducting material, to further effect the said advantageous economical results, by way of preventing radiation of heat, and condensation of steam.

The bottom of the shell A is provided with confined-air chambers A^2, (see Figs. 1 and 2,) for further insulation.

The acting-portions of both sets of valves B and C, are of the usual segment-of-a-circle-form, and are mounted on stems or spindles, 2 and 3, respectively.

4 represents the inlet-port leading directly from each of the two induction-valves to the cylinder, being provided with strengthening cross bars or ribs 4′, and having no long passages intervening to be filled with live-steam, (see Figs. 1 and 3;) and 5 represents the exhaust-ports leading directly from the cylinder to the eduction-valves, and thence to and through the exhaust conduit or passages, as usual, and also provided with strengthening cross-bars or ribs 5′. (See Fig. 1.) The opposite, circular ends or heads of the induction-valves are each made with an offset 7 the greater part of their circumference, to provide a suitable space between said offset portions and the wall of the valve-chamber, (see Figs. 1 and 3,) and the central-bore of both said induction-valves is made in two diameters, one diameter, which extends along a very small portion only of the length of said bore and at its innermost or rear end, being made to suit that of the stem 2 operatively connected therewith by means of a spline 8, and the other diameter, which is cored for the remainder or much the greater portion of the length of said bore, being larger, so as to provide an annulus or space 9 around said stem within the valve up to said part of smaller-diameter, such annulus about corresponding to the said space provided at both ends of the valve by the offsets 7. Annulus 9 and the offsets 7 in each induction-valve, are quite shallow, but sufficiently wide, however, to permit upward bend or play of said induction-valves on their stems, in the event of extreme condensation or consequent excess of water in the cylinder, and said excess of water to readily pass upward temporarily in the steam-conduit the instant the acting-portions of said steam-valves rise from their seats, and then to immediately drain downward, to the exhaust below, the instant said steam-valves oscillate to open their ports 4. In order for these steam-valves to thus properly rise from off their seats, there should be sufficient elasticity in their stems, especially for the rear or innermost ends, and the opposite ends of both steam-valves must be clear of the end walls of their chambers, as shown at narrow-spaces 10 in Fig. 3.

11 represents a detachable cap or head at

the inner or rear end of each induction-valve chamber; and 12 is the usual bonnet detachably secured at the outer end of each said chambers. The outer ends of the valve-stems 2 pass through and bear in the bonnets 12, as customary, but are each made with a recess or countersunk portion at their principal journaling points, which recess is provided with a long wearing-sleeve 2′, of bronze or other similar superior bearing-material, cast on or otherwise suitably applied thereto. The usual stuffing-box 13 surrounds part of said sleeve 2′ within the inner portion of each bonnet, and a collar 14 is detachably and adjustably secured by means of a countersunk-screw 15 on the valve-stems 2, intermediate the said sleeves 2′ and the shouldered inner wall of the bonnet, to provide against outward end-thrust, and also to compensate for wear of the valves.

12′ are openings in the sides of the bonnets, to furnish ready access to the parts within. (Best seen in Fig. 5.) The outer bearing-portions of the stems of both the exhaust-valves, lying within the bonnets, are, if desired, made similar to those of the induction-valves, but it is obvious that they may be made in any other similar suitable manner without affecting the objects of my form herein. These valves and their mountings just described, are obviously very simple, and said valves, especially the steam-valves, may be very readily removed from their chambers in either direction thus, viz: The valves being simply splined to their stems, and said splines secured fast in the valves, the sole act of removing the bolts or screws *s* will permit the bonnets and valve-stems to be withdrawn together, without disturbing the valves, or, if the latter are to be withdrawn too, then, by inserting the screw-threaded end or tip of any ordinary rod, or similar suitable hand-implement, (not shown) into a screw-threaded socket *s′* in the fore-ends of the valves, (see Fig. 3,) said valves may be readily withdrawn and replaced from the front, for any desired purpose; or, if it is desired to withdraw the valves solely, without disturbing the stems and bonnets, or any other parts thereof, the screws s^2 of the heads or end caps 11 are removed, and then, by inserting said threaded-implement into the threaded-socket s^3 made in the rear-ends of the valves, (see also Fig. 3,) said valves themselves, but carrying their splines, may be withdrawn from the rear. Thus, the valves, their chambers, and all their parts are easily accessible for adjustment, repairs, replacement and cleaning, and any derangement thereof may be quickly detected and rectified, as is clearly obvious, and is of material advantage.

E represents an upright crank-arm, keyed to the outer end of the stem of each of the two induction-valves; and F, a short pendent arm or crank journaled on the outer shouldered-end of each of the several bonnets adjacent the attaching-hubs of said arms E, and each provided with an upper cam *f*, detachably secured thereto by means of countersunk-screw *f′*, (Figs. 1, 3, 5 and 8.)

F′ is the ordinary tripping-rod leading from each arm F to the governor.

G represents an ordinary oscillating disk or wrist-plate journaled centrally on the face of the cylinder-shell A and having four pins *g*, *g′*, mounted thereon, (half of the disk and two of said pins, only, being shown in Fig. 1,) the pins *g* permanently-connecting with the crank-arms *h* of the exhaust-valves by means of rods H, as usual, and the pins *g′* detachably connecting with the inlet-valves by means of rods I, crank-arms E and a suitable releasing-gear, the latter of which I shall now describe.

The oscillating wrist-plate is provided, as customary, with the lateral stud or pin G′, to which is pivotally attached the ordinary hook-rod which leads to the lever operated by the engine-shaft eccentric, (said rod, lever, and eccentric, not being shown, as they are common in all Corliss engines and need no illustration or further description herein.)

I′ represents a flattened or milled rear face or offset portion at the outer ends of both the steam-rods I; and *i*, are hardened-steel plates detachably secured by means of screws *l* in said flattened ends, each plate having a concave recess at its inner end forming a semi-circular hole or socket *i′* (best seen in Figs. 7 and 8), for the purpose hereinafter described.

In each of the two steam-valve crank-arms E, I mount a wrist or box *e* having a hollow shank *e′*, which latter passes through the upper end of said crank-arm and is firmly secured thereto by means of a nut e^2. Within the wrist or box *e*, I provide a through-passage or slot e^3 having tri-angular cross-bars or ligaments e^4, above and below, to connect the outer and inner walls of said wrist together, the said slot or opening e^3 freely accommodating the said flattened outer-end of steam-rod I.

E′ is a sleeve, journaling on and encircling the wrist *e*, and provided with elongated bosses E^2 having central openings e^5, which latter register with each other and accommodate the said flattened outer-end of steam-rod I, and thereby furnish the proper bearings or slide-box therefor, the said slot e^3, in the inner box or wrist *e*, compensating for the proper vibratory movements of said steam-rod.

J is a latch pin or bolt engaging within the hollow-shank *e′*, with its inner end normally resting in engagement with the socket *i′* in the steam-rod I (Figs. 3, 7 and 8), and its outer-end grooved at *j*, to pivotally receive the upper fork or bifurcated-end J′ of a lever J^2, the latter being pivotally mounted on a short shaft or pin *j′* whose ends are seated in openings made in the side walls or ribs K constructed on the back of arm E. The lower portion of lever J^2, from its pivotal point downward, lies snugly between the said side-walls K, and its operation is therefore firm and

steady, and free from any wabbling or lateral motion. The lower end of lever J^2 projects slightly outward and engages the said governor tripping-cam *f*, (Figs. 3 and 5,) a coiled-spring J^3 being provided at the back of said lower portion of said lever J^2, whose expansive-action keeps the said lower end in proper contact with said cam, and also shoots the bolt above into instant engagement with the socket *i'* in the outer-end of steam-rod I, for connecting the latter with the steam-valve at the desired time for the pulling-motion in actuating said valve, and allowing the steam to enter the cylinder. A suitable bolt or rod j^2 passes through the lower portion of the lever J^2 and the crank-arm E, to accommodate said spring J^3, and a suitable socket j^3 is also provided in said crank-arm for the seating of the inner end of said spring, (as best seen in Fig. 3.)

L represents a lateral, lower extension or arm on the several crank-arms E, adapted to operatively connect them and their inlet steam-valve with the perpendicular rods or plungers M, the latter leading to the ordinary vacuum and air dash-pots N below, and thus furnishing the customary retractile and cushioning devices employed to automatically and promptly close the steam-valves in the cut-off operation, immediately after either of the latch-pins J has been automatically withdrawn from engagement with its socket *i'* in its steam-rod I, by the variable action of the governor-rods; and said latch-pins readily permitting the sliding of said flattened-end of the steam-rods over their end-faces to the end of the stroke, and, also, readily permitting the return of said steam-rods to normal position for the automatic shooting of the latch, (by means of the spring J^3,) into firm pulling-engagement therewith, (said latch resting within and against the socket-end of the hardened-steel plate,) ready for another acting-movement of the steam-valve and consequent advancing-stroke of the piston.

The usual drain-pipe *m* is provided in the bottom of the several bonnets to carry off any accumulations therefrom.

It will be seen that my construction of shell with supporting sides or legs and its inner steam and exhaust passages, and air-chambers, particularly the latter, and also its independent internal cylinder, enables me to dispense with the customary lagging or cleading, which latter has been unavoidable and necessarily resorted to heretofore for covering the cylinder and valve-chambers, and in a very poor and inefficient manner, only, preventing the radiation of heat and condensation of the steam.

My construction is simple, economical and effective and is, also, very readily produced and properly maintained in order and appearance without great labor and expense.

Although I have shown and described a particular form of steam cylinder and surrounding chest or shell, I do not make any claim for the same in this application as I have covered it in application Serial No. 530,716, filed December 3, 1894.

I claim—

1. In a steam engine, provided with cylindrical valve chambers, the combination of a rotary valve in each chamber, the stem of which is flexible, a crank arm secured to the outer end of the valve stem, a wrist plate, and a rod from the wrist plate to each crank arm, substantially as set forth.

2. In a steam engine, provided with cylindrical valve chambers, the combination of a bonnet secured at one end of each chamber, a flexible valve stem journaled in each bonnet, a hollow cylindrical valve secured at its outer end to one end of the valve stem, the diameter of the stem being less than the bore of the valve, whereby the valve may rise from its seat without affecting the outer end of the stem, a crank arm secured to the outer end of the stem, the valve and the crank arm bearing against the opposite ends of the bonnet to prevent longitudinal movement of the stem, a wrist plate and a rod from the wrist plate to each of the crank arms, substantially as set forth.

3. In a steam engine, provided with cylindrical valve chambers, the combination of a hollow bonnet secured at one end of each chamber, a valve stem journaled in the bonnet, having a recessed portion therein, a bushing in the recessed portion, a hollow valve secured at its outer end to the outer end of the stem, a crank arm secured to the outer end of the stem, the end of the valve and the crank arm bearing against the ends of the bonnet, whereby the free end of the valve may rise from its seat, and the valve and the crank arm may be removed with the bonnet, a wrist plate, and a rod from the wrist plate to each crank arm, substantially as set forth.

4. In a steam engine, the combination, with rotary valves, of a crank arm secured to the outer end of each valve stem, a wrist at the outer end of the arm, a steam rod through the wrist, and connected with the wrist plate of the engine, a latch pin through the wrist, one end of which is adapted to engage with the steam rod, a tripping cam, and a lever pivotally secured to the crank arm, one end of which engages with the latch pin and the other end engages with the cam, substantially as set forth.

5. In a steam engine, the combination, with rotary valves, of a crank arm at the outer end of each valve stem, a wrist at the outer end of the arm, provided with angular cross-bars, a sleeve upon the wrist, provided with elongated bosses, a steam rod through the bosses and the wrist, a latch pin through the stem of the wrist, the inner end of which is in engagement with the steam rod, a tripping cam, and a spring actuated lever pivotally secured to the crank arm, one end of which engages with the latch pin and the other end engages with the cam, substantially as set forth.

6. In a steam engine, the combination, with rotary valves of a crank arm secured to the outer end of each valve stem, said arm being provided with perforated side walls, a wrist in the outer end of each arm, the stem of which is hollow, a steam rod through the wrist, a latch-pin through the stem of the wrist, the inner end of which engages with the steam rod, a lever pivotally secured between the walls of the crank arm, one end of which is in engagement with the end of the latch pin, a bolt through the lever and through the crank arm, a spring upon the bolt between the lever and arm, and a tripping cam engaging the other end of the lever, substantially as set forth.

7. In a steam-engine, of the type stated, the combination with a steam inlet-valve having a suitable stem projecting through the bonnet or bearing thereof, a governor-rod and accompanying tripping-cam on said bonnet, a crank-arm on the outer end of said stem adjacent said tripping-cam, a steam-rod operatively connecting the said crank-arm with the usual oscillating wrist-plate, and a suitable dash-pot mechanism, of a releasing-gear composed of an open, slotted wrist or box having a hollow-shank by which it is rigidly mounted in the outer end of said crank-arm, an outer sleeve or slide-box encircling around and journaled on said slotted wrist or box and provided with a pair of registering openings, a horizontal pin or latch-bolt engaging said hollow shank of said slotted-wrist, a vertical lever pivoted between deep continuous ribs or side-walls on the back of said crank arm or lever, and engaging, at its upper, forked-end, the grooved outer-end of said latch-bolt, and, near its lower end, engaging an outwardly expansive-spring mounted on the back of said crank-arm, and said lower end also engaging the said trip-cam on the bonnet, the outer end of said steam-rod being milled or flattened on its back a suitable distance inwardly and provided with a suitable latch-socket, and engaging the said registering openings in the said outer sleeve or slide-box and the said inner slotted wrist or box, and the said latch-bolt engaging said socket in the steam-rod, whereby due allowance and automatic devices are provided for the customary variable cut-off motion controlled and communicated by the governor, substantially as herein set forth.

8. In a steam-engine of the variable cut-off type stated, the combination, with a steam-valve crank-arm, of a releasing-gear composed of a slotted-wrist having a hollow shank attached in the outer end of said arm, an orificed bearing-sleeve on said slotted-wrist, a latch-pin mounted in said hollow-shank, a spring-actuated lever pivoted to the back of said crank-arm and engaging, at its upper end, the said latch-pin, and, at its lower end, engaging any suitable governor trip-mechanism, and said latch-pin operatively engaging a socket in the outer end of the steam-rod, the whole being suitably mounted on the inlet-valve stem and adapted to operate automatically, substantially as herein set forth.

In testimony of which invention I have hereunto set my hand.

EDWARD CHESHIRE.

Witnesses:

CHARLES R. DIEBOLD,

JOHN E. JONES.