(No Model.)

3 Sheets—Sheet 1.

J. STUMPF.

CUT-OFF MECHANISM FOR STEAM ENGINES.

No. 603,475. Patented May 3, 1898.

Fig. 1.

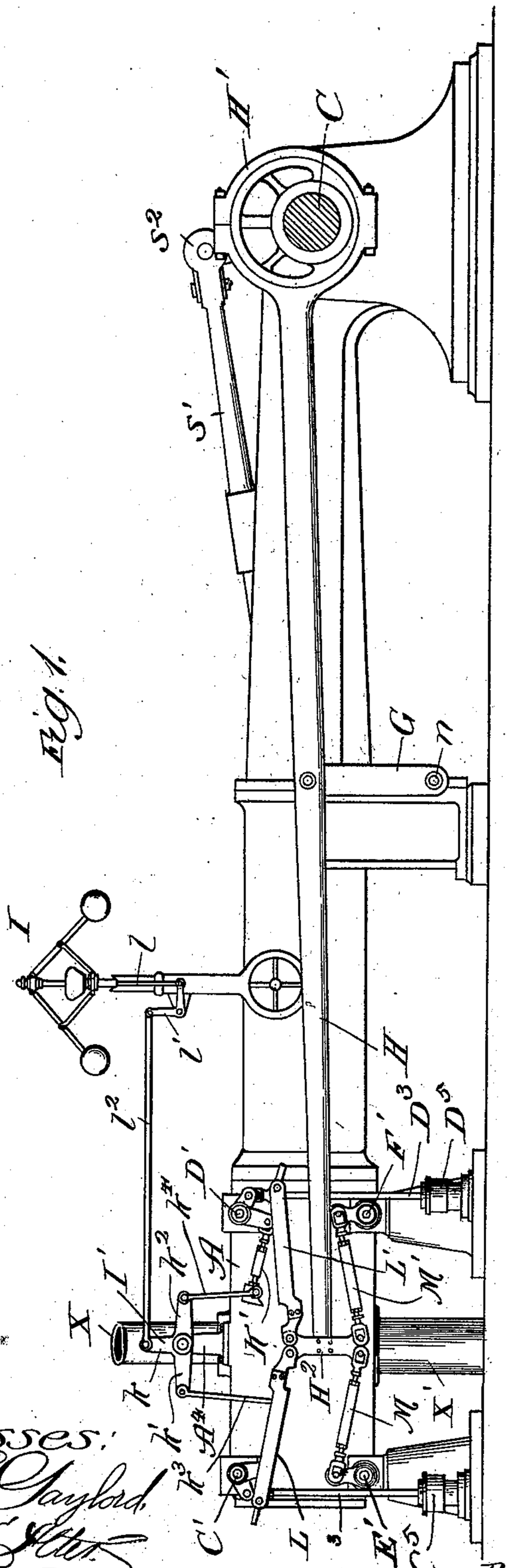
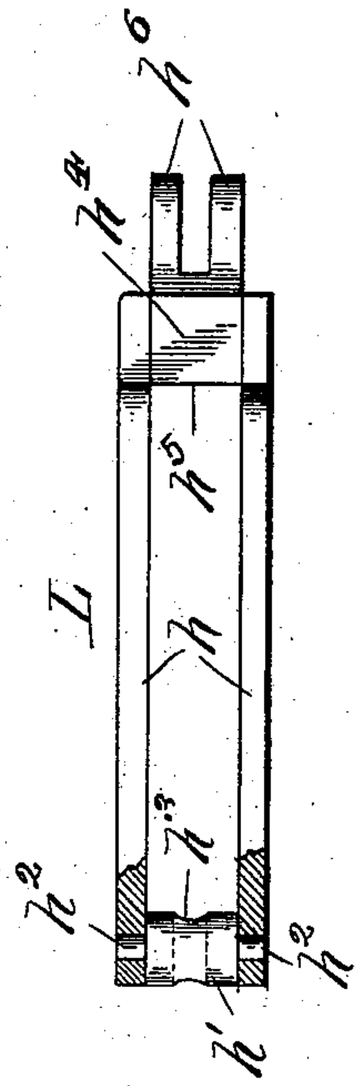


Fig. 2.



Witnesses:
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Leslie J. Peters

Inventor:
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Att'ys

(No Model.)

3 Sheets—Sheet 2.

J. STUMPF.

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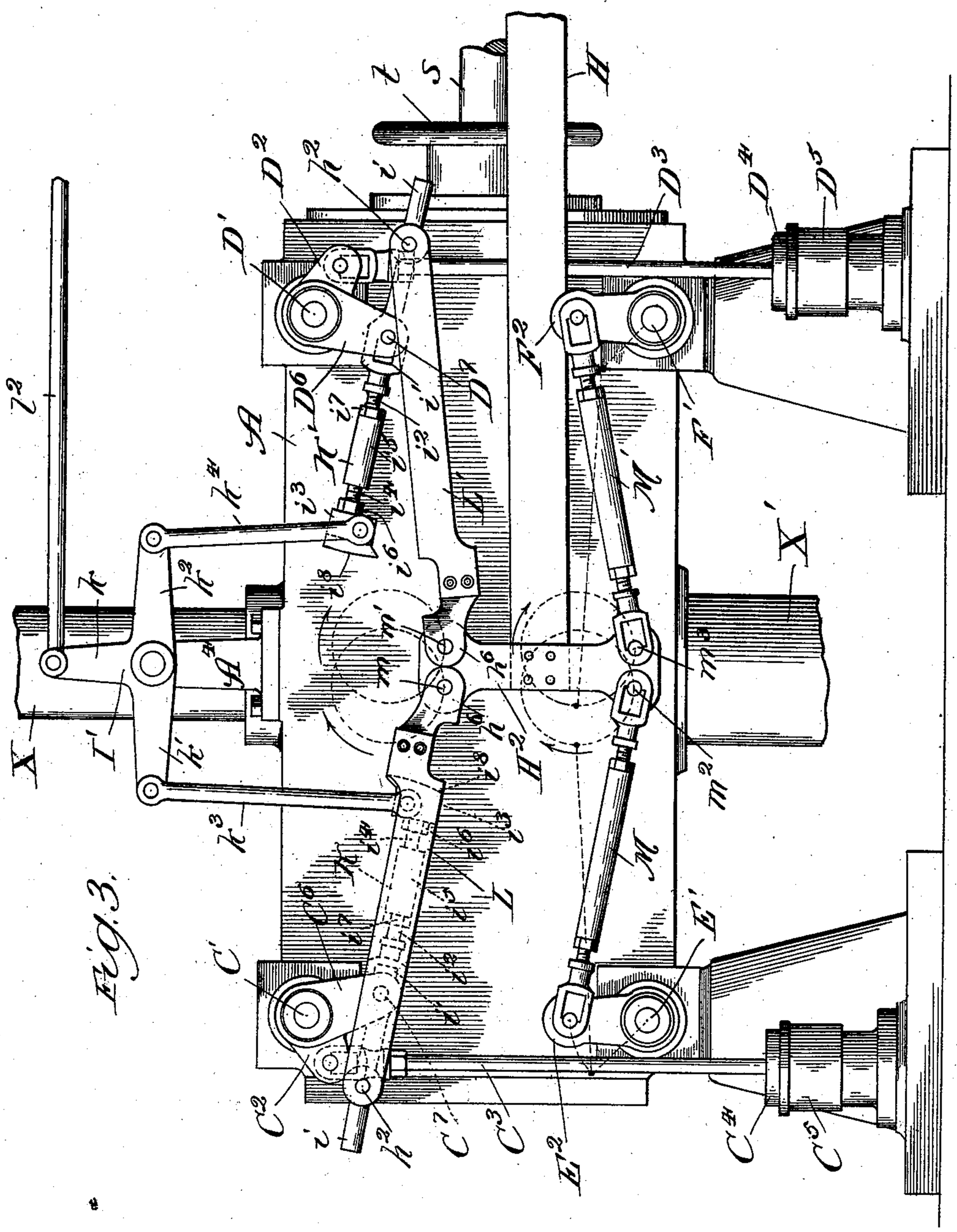

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

J. STUMPF.

CUT-OFF MECHANISM FOR STEAM ENGINES.

No. 603,475. Patented May 3, 1898.

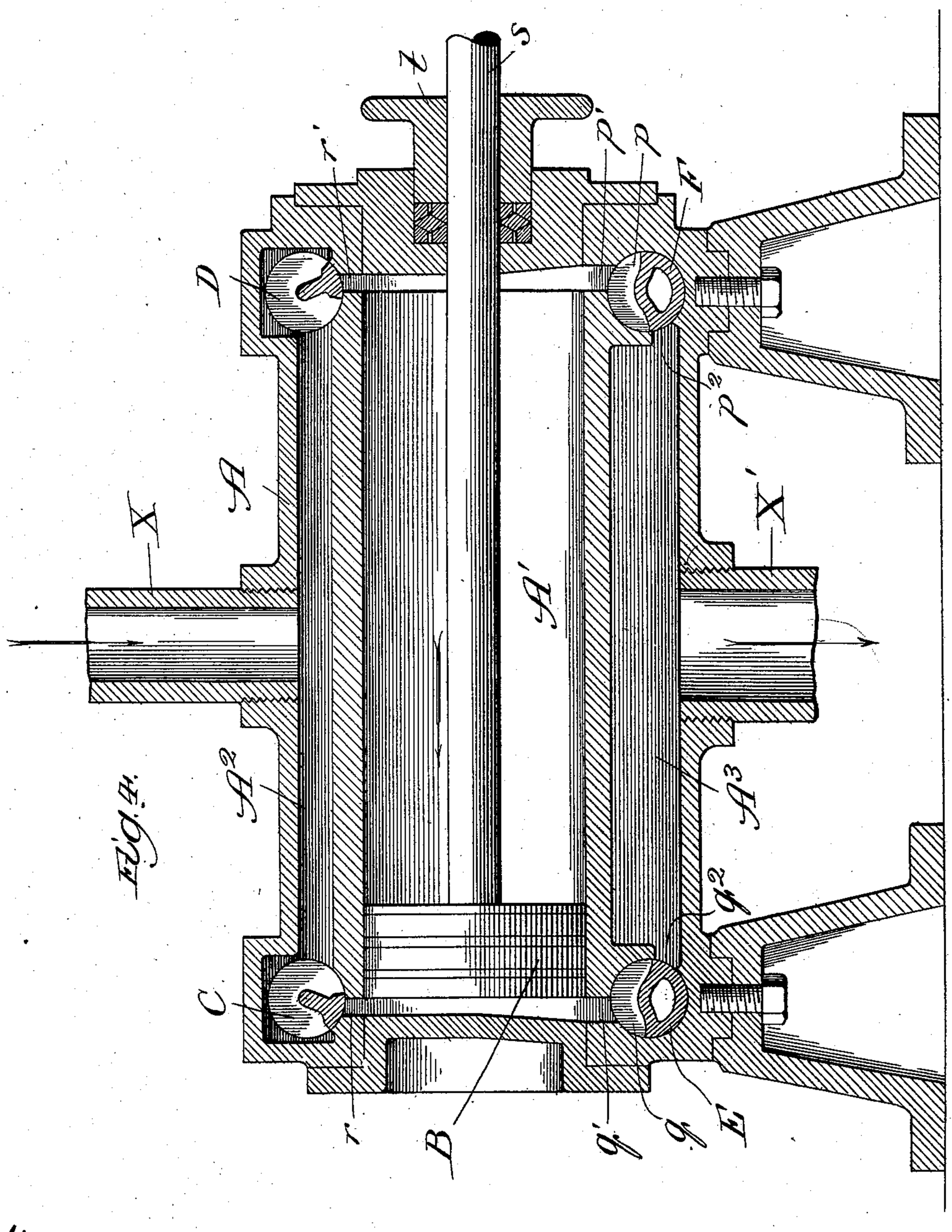

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOHN STUMPF, OF CHICAGO, ILLINOIS.

CUT-OFF MECHANISM FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 603,475, dated May 3, 1898.

Application filed October 23, 1896. Renewed February 9, 1898. Serial No. 669,712. (No model.)

To all whom it may concern:

Be it known that I, JOHN STUMPF, a subject of the Emperor of Germany, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Cut-Off Mechanism for Steam-Engines, of which the following is a specification.

My invention relates to improvements in cut-offs for steam-engines generally; and my object is to provide cut-off mechanism of a simple, durable, and comparatively inexpensive construction which shall be directly under the control of the engine-governor and particularly sensitive to variations thereof, whereby the engine may be run at high speed with great uniformity and without waste of steam.

In the drawings, wherein my improvements are illustrated as applied, for purposes of illustration, to an engine of the "Corliss" type, Figure 1 is a side elevation of the engine with the drive-shaft in section; Fig. 2, an enlarged plan view of one of the details of my improvement; Fig. 3, an enlarged broken side elevation of the cylinder portion of the engine, and Fig. 4 a vertical section taken longitudinally through the cylinder.

A is the shell or cylinder containing the piston-chamber or steam-cylinder A′, provided in its end with a stuffing-box t, through which works the stem s of the piston B. The stem s connects in the usual way, through the medium of a cross-head and connecting-rod s', with a crank s^2 on the drive-shaft C. In the shell or cylinder A above the chamber A′ is the steam-chest A^2, to which leads the steam-supply pipe X. The steam-chest communicates with the piston-chamber A′ at opposite ends of the latter through steam-induction ports $r\ r'$. In the shell below the chamber A′ is the steam-exhaust chamber A^3, from which leads the exhaust-pipe X′. Between the exhaust-chamber and piston-chamber, at opposite ends of the latter, are valve-chambers $q\ p$, provided, respectively, with the ports $q'\ q^2$ and $p'\ p^2$, the former communicating with the piston-chamber and the latter with the exhaust-chamber. In the steam-chest at the ports $r\ r'$, respectively, are rotary or oscillatory steam-induction valves C D, which open and close the ports $r\ r'$ and are provided with stems C′ D′, which extend through and beyond the side of the shell A. On the valve-stems C′ D′ are cranks $C^2\ D^2$, having the usual connection with vertical rods $C^3\ D^3$, provided at their lower ends with weights $C^4\ D^4$, which work in dash-pots $C^5\ D^5$. Also upon the valve-stems C′ D′ are cranks $C^6\ D^6$. In the valve-chambers $q\ p$ are rotary or oscillatory eduction-valves E F, provided with stems E′ F′, which extend beyond the side of the shell and are provided at their outer end portions with cranks $E^2\ F^2$.

G is a movable support, which may be in the form of a bar, pivotally connected at its lower end portion, as shown at n, with the engine-frame. Pivotally mounted between its ends upon the movable support G is a vibratory bar H, connected at one end by an eccentric H′ with the shaft C. Securely fixed to the opposite end of the bar H at the side of the shell A and in the plane of the cranks $C^6\ D^6$ $E^2\ F^2$ is a head or plate H^2, provided with transversely-extending pins $m\ m'\ m^2\ m^3$.

I is the engine-governor, connected through the rod l, bell-crank lever l', and rod l^2 with the arm k of a double bell-crank lever I′, which also has arms $k'\ k^2$ and is pivoted at its center to a support A^4 on the shell or cylinder A.

K K′ are similarly-constructed reciprocal valve-opening devices, preferably in the form of plunger bars or rods, each formed with a stem i, having an enlarged portion provided with a slot or bearing-opening i' and terminating in a threaded shank i^2, a head or sleeve i^3, screwed upon a threaded shank i^4, a sleeve-coupling i^5, screwed upon the shanks $i^2\ i^4$, jam-nuts $i^6\ i^7$ on the threaded shanks at the sleeves $i^3\ i^5$, and a shoe i^8, fastened against or integral with the sleeve i^3 and having a segmental impact-face. Pivotally suspended from the arm k' of the lever I′ is a link k^3, which at its lower end is pivotally connected with the sleeve or head i^3 of the bar K, and pivotally suspended from the arm k^2 of the lever I′ is a link k^4, which at its lower end is pivotally connected to the sleeve or head i^3 of the bar K′. On the crank C^6 is a pin C^7, which passes loosely, but without lateral play, through the slot or opening i' in the bar K, and on the crank D^6 is a pin D^7, which passes loosely, but without lateral play, through the slot or opening i' in the bar K′.

L L′ are similarly-constructed impact bars or pieces, each formed with side plates h, an end cross-piece h', mounted, preferably, upon trunnions h^2 in the side plates to rock therein and provided with a central opening h^3 through it, and a head h^4, having an impact-face h^5 and bifurcated projecting portion h^6. The bar L at its bifurcated portion h^6 embraces the head or plate H^2 and is pivoted upon the pin m. At its opposite end it is mounted to slide upon the stem i of the bar K, the said stem passing loosely through the opening h^3. The bar L′ at its bifurcated end h^6 is pivoted to the pin m' on the plate or head h^2 and at its opposite end is supported to slide upon the stem i of the bar k', which passes through its opening h^3.

M M′ are links, preferably so constructed, as shown, that they may be adjusted as to length. The link M is pivotally connected at one end to a pin upon the crank E^2 and at its opposite end to the pin m^2 on the plate or head H^2. The link M′ is pivotally connected at one end to a pin upon the crank F^2 and at its opposite end to the pin m^3 on the plate or head H^2.

The drawings show the parts in the position wherein the piston B has about completed its traverse in the inward direction, the valve C is about to open, and the valve F about to turn to open communication between the ports p' p^2, whereby steam will enter through the induction-port r and the exhaust will take place through the port p'. In the rotation of the drive-shaft C, consequent upon the reciprocation of the piston B, the bar H is rocked and reciprocated by its eccentric connection H′ to swing with the support G on its pivot n and turn the head H^2 in the arc of a circle, whereby the pins m m' m^2 m^3 will describe the circles indicated by dotted lines in Fig. 3, moving in the direction indicated by the arrows at the circles. In the movement of the head H^2 from the position shown in Figs. 1 and 3 the eduction-valve F is turned to uncover the ports p' p^2 and the valve E is turned to continue closing the port q^2. The bar L, sliding upon the stem i of the bar K, engages at its impact-face h^5 the shoe i^8 on the end of said bar and wipes across the same during its movement, forcing the bar K in the direction to the left in the figures, and thereby turning the crank C^6 and valve C to open the induction-port r and admit steam through the latter. The direct force of the steam thus admitted to the piston-chamber A′ moves the piston B to the right in the figures. The bars K K′ swing with the links k^3 k^4 from the lever I′. In the movement of the bar K, brought about by the engagement with it of the bar L, the crank C^2 is turned upward to raise the rod C^3 and lift the weight C^4. When the bar L has been moved so far as to cause its impact-face h^5 to wipe past and release the shoe i^8 on the bar K, the weight C^4 will drop in the dash-pot C^5 and turn the valve-stem and valve C to close the port r and cut off the steam-supply. At the same time the bar K will move to its initial position.

As before stated, the bars L′ and K′ are of the same construction, respectively, as the bars L K, but are relatively upside down, for the reason that while the bar K is actuated in the movement of the head H^2 in the upward direction, the bar K′ is actuated in the movement of the head in the downward direction. In the movement of the head H^2, after the release of the bar K, the impact-face h^5 of the bar L′ moves in a downward direction into engagement with the shoe i^8 on the bar K′, and at the same time the link connections M M′ turn the valve E to open communication between the ports q' q^2 and turn the valve F to close communication between the ports p' p^2, the turning of the valves taking place just as the piston B reaches the forward limit of its traverse. In the further downward movement of the head H^2 the impact-face H^5 wipes across the face of the shoe i^8, forcing the bar K′ to swing upon the link k^4 in the direction to the right in the figures to turn the valve-stem D′, cause the valve D to open the port r', and turn the crank-arm D^2 to raise the rod D^3 and weight D^4. When the impact-face h^5 has passed and disengaged the shoe i^8, the valve D is returned to its initial position by the dropping of the weight D^4 to close the port r' and cut off the steam-supply.

It will be understood from the foregoing description that the induction-valves C D are held open against the resistance of the weights C^4 D^4 by the engagement of the impact-faces h^5 of the impact-bars with the shoes of the valve-opening bars, and that the length of time during which the said valves remain open will depend upon the length of time required for the impact-faces h^5 to wipe across the surfaces of the shoes. Turning of the lever I′ in one direction on its pivot will raise the shod end of the bar K and lower the shod end of the bar K′, while turning of the lever I′ in the opposite direction will lower the shod end of the bar K and raise the shod end of the bar K′. The elevation of the bars or devices K K′ determines the area of the shoes across which the impact-faces h^5 wipe, and therefore regulates the length of time of such contact and consequent opening of the induction-valves. The connection between the governor I and lever I′ is such that under increase of speed of the engine the lever I′ is swung to raise the bar K′ and lower the bar K, while under a decrease in speed of the engine the lever I′ will be moved to lower the bar K′ and raise the bar K. Under the first said action the proportion of surface of the shoes, across which the impact-faces h^5 wipe, will be diminished and the induction-valves closed correspondingly soon after being opened. Under the second action described the proportion of surface of the shoes across which the impact-faces wipe will be increased and the length of time in which the

induction-valves remain open correspondingly prolonged. Thus the action of the cut-off is controlled directly by the governor, and the supply of steam through the induction-ports is regulated in accordance with the speed and work required of the engine.

As shown and described, the head H^2, and consequently the impact-faces h^5 of the impact-bars, travels a circular course. This may be changed, however, to an elliptical or other course, if desired, without changing the character of the invention. The support G, instead of being a swinging bar, as shown and described, may be a sliding support, such as a cross-head, or of any other desired form. The valve-opening plungers or bars K K′ may be lengthened and shortened by turning the couplings i^5. This affords a particularly desirable and inexpensive construction capable of ready and perfect adjustment.

My improvement is adapted to take the place of the more expensive and elaborate and less desirable wrist-plate constructions hitherto usually provided.

While I prefer to construct my improvements as shown and described, they may be modified in the matter of details without departing from the spirit of my invention as defined by the claims.

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

1. In a cut-off mechanism for steam-engines the combination with the steam-cylinder and piston, of a vibratory bar movable under the action of the piston and having an impact-piece pivotally attached thereto, an induction-valve-opening device in position to be engaged, moved and released by said impact-piece, an engine-governor operatively connected with said device, to adjust it in the path of said impact-piece and thereby regulate the time of engagement of the impact-piece with said device, and induction-valve-closing means, substantially as and for the purpose set forth.

2. In a cut-off mechanism for steam-engines the combination with the steam-cylinder and piston, of a vibratory bar having impact-pieces pivotally attached thereto at opposite sides, induction-valve-opening devices in position respectively, to be engaged alternately and moved and released by the respective impact-pieces, an engine-governor operatively connected with said devices to adjust them simultaneously in the paths of the said impact-pieces and thereby regulate the time of engagement of the impact-pieces with the devices, and induction-valve-closing means, substantially as and for the purpose set forth.

3. In a cut-off mechanism for steam-engines the combination with the steam-cylinder and piston, of a vibratory bar having an impact-piece pivotally attached thereto and movable at said piece about an endless course under the action of the piston, an induction-valve-opening device adjustable as to length and in position to be engaged at its end, moved and released by said impact-piece, an engine-governor operatively connected with said device to adjust it at its end more or less into the path of said impact-piece and thereby regulate the time of engagement of the impact-piece with said device, and induction-valve-closing means, substantially as and for the purpose set forth.

4. In a cut-off mechanism for steam-engines, the combination with the steam-cylinder and piston, of a rotary induction-valve provided with returning means for moving it normally to one position, a vibratory bar movable under the action of the piston and having an impact-piece pivotally attached thereto, a device eccentrically connected with said valve and extending into the path of said impact-piece to be engaged and moved thereby, to turn said valve from normal position, and then release, to permit the valve-returning means to act, and an engine-governor operatively connected with the cut-off mechanism to regulate the time of engagement between the said impact-piece and device in each operation, substantially as described.

5. In a cut-off mechanism for steam-engines the combination with the steam-cylinder and piston of a rotary induction-valve provided with closing means, a vibratory bar movable under the action of the piston and having an impact-piece pivotally attached thereto, a valve-opening device eccentrically connected toward one end with the valve and provided at its opposite end with a face at which it projects into the path of the said impact-piece to be engaged, moved and released thereby, and an engine-governor operatively connected with said device to adjust the end face thereof in the path of said impact-piece and thereby regulate the time of engagement of the said impact-piece and end face in each operation, substantially as and for the purpose set forth.

6. In a steam-engine, the combination with the steam-cylinder, its induction-valves, the piston and governor, of closing means for the said valves, a vibratory bar having impact-pieces pivotally attached thereto adjacent to the cylinder and actuated from the piston to travel an endless course and operatively connected with the eduction-valves, induction-valve-opening devices in position, respectively, to be engaged alternately and moved and released by the respective impact-pieces, and a governor actuated from the piston and operatively connected with the said devices to adjust them in the paths of said impact-pieces and thereby regulate the time of engagement of the impact-pieces with the devices, substantially as and for the purpose set forth.

7. In a steam-engine the combination with the steam-cylinder, piston and governor, of a rotary induction-valve at the said chamber, valve-closing means, a vibratory bar, operatively connected at one end with the piston to travel an endless course at its opposite end adjacent to the cylinder and having at the

latter end an impact-piece pivotally attached thereto, a valve-opening bar eccentrically connected with said valve toward one end and extending at its opposite or free end into the path of said impact-piece, to be engaged and moved longitudinally thereby, to open the valve, and then released, and suspending means for the bar connected with the free end portion thereof, and operatively connected with the governor to adjust the bar in the path of said impact-piece, under the action of the governor, and thereby regulate the time of engagement between said impact-piece and bar, substantially as and for the purpose set forth.

8. In a steam-engine the combination, with the piston-chamber, piston and governor, of a rotary induction-valve at the said chamber, valve-closing means, a valve-opening bar eccentrically connected with the valve, a head operatively connected with the piston to travel an endless course, a plunger pivotally connected at one end with said head and movably supported at the other end, and provided with an impact-face to engage, move and release said bar, the bar being operatively connected with the governor to be adjusted thereby in the path of said impact-face to regulate the time of engagement of the said face with the bar in each operation, substantially as and for the purpose set forth.

9. In a steam-engine, the combination, with the piston-chamber, piston and governor, of a rotary induction-valve at the said chamber, valve-closing means, a valve-opening bar eccentrically connected with the valve, a head operatively connected with the piston to travel an endless course, a plunger pivotally connected at one end with said head and sliding upon said bar and provided with an impact-face to engage, move and release said bar, the bar being operatively connected with the governor to be adjusted thereby, in the path of said impact-face, to regulate the time of engagement of the said face with the bar in each operation, substantially as and for the purpose set forth.

10. In a steam-engine, the combination, with the piston-chamber, piston and governor, of a rotary induction-valve at the said chamber, valve-closing means, a valve-opening bar eccentrically connected with the valve, a head operatively connected with the piston to travel an endless course, a plunger pivotally connected at one end with said head and sliding upon said bar and provided with an impact-face to engage, move and release said bar, suspending means for the bar operatively connected with the governor and movable under the action thereof to adjust the bar in the path of said impact-face and thereby regulate the time of engagement of the face and bar in each operation, substantially as and for the purpose set forth.

11. In a steam-engine, the combination with the piston-chamber, piston, shaft, governor, induction-valve and induction-valve-closing means, of a vibratory bar eccentrically connected at one end with the shaft, having an impact-piece pivotally attached thereto toward its opposite end adjacent to the cylinder and pivotally and shiftingly supported between its ends, an induction-valve-opening device in position to be engaged, moved and released by said impact-piece, and operatively connected with the governor to be adjusted thereby in the path of said impact-piece and thus to regulate the time of engagement of the impact-piece with the said device in each operation, substantially as and for the purpose set forth.

JOHN STUMPF.

In presence of—
JOSEPH HIRTH,
R. KIOSCHE.