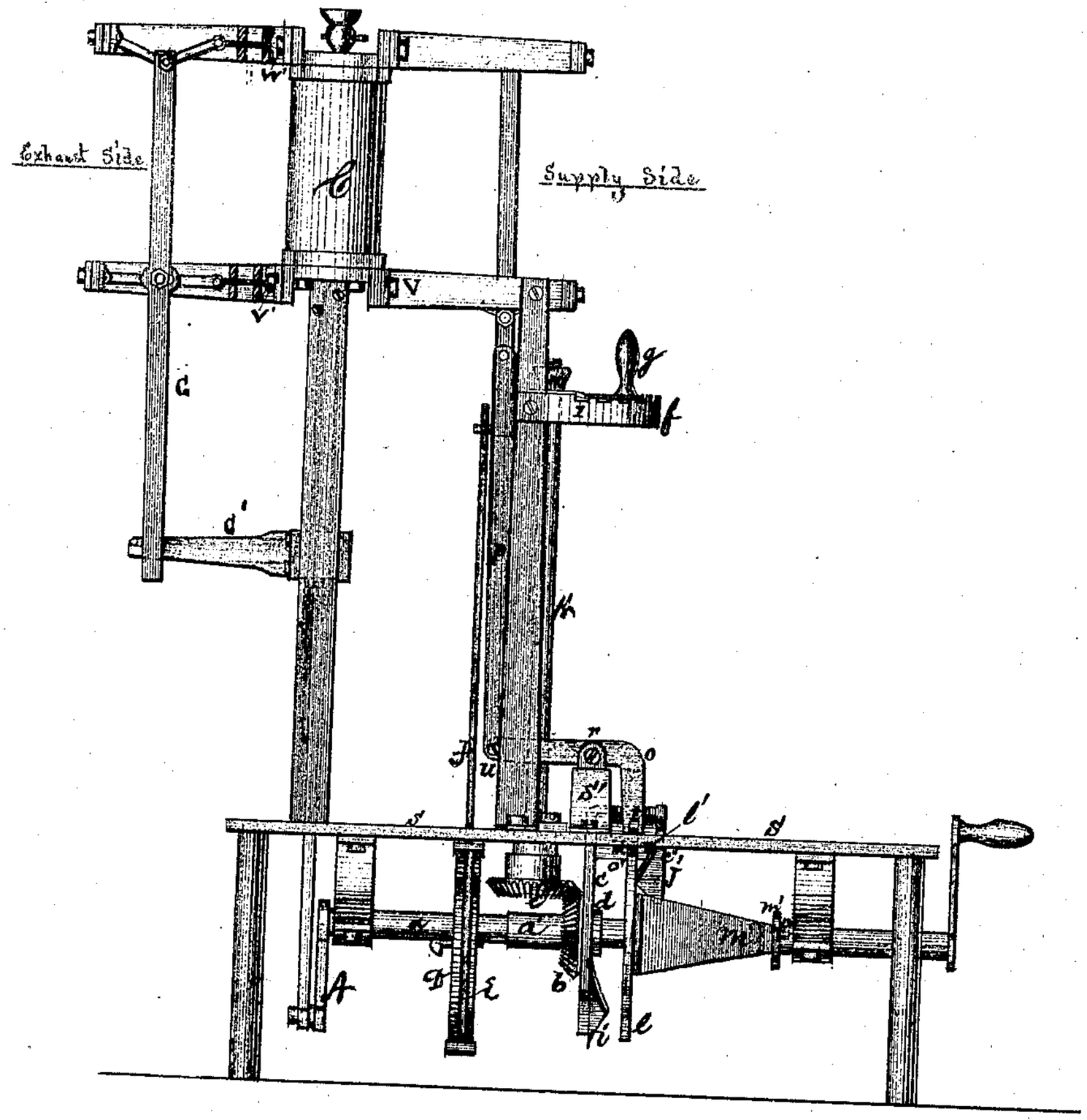
C. W. Wailey,

Cut Off Valve.

No. 98,724. Patented Jan. 11. 1870.



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Letters Patent No. 98,724, *dated January* 11, 1870.

CUT-OFF VALVE-GEAR.

The Schedule referred to in these Letters Patent and making part of the same.

I, CHARLES W. WAILEY, of the city of New Orleans, State of Louisiana, have invented a certain Mechanical Arrangement and Movement, to Operate the Cut-Off Valves, for which Letters Patent were granted to me on the 15th day of September, 1868, said letters being numbered 82,184, of which the following is a specification.

Nature and Objects of the Invention.

My invention consists of certain mechanical parts, peculiarly constructed and arranged, or combined together, with the object of regulating the cut-off of the motor, whether compressed air or steam, after it enters the cylinder, in such manner that the operator of the engine may, at his pleasure, or whenever circumstances may require it, in an instant of time, change the cut-off from the point at which the expansive energy of the motor, (compressed air, or steam, as the case may be,) constitutes nearly the whole force exerted to operate the engine, to any other point, very nearly down to the end of the stroke of the piston, and thus be able to apply the positive force of the motor in addition to its expansive power, during the whole stroke, or at any point short of the full stroke, accordingly as the requirements of the occasion may render the development and application of the whole power of the engine, or of any proportion of the same less than the whole, expedient or necessary.

My invention is designed for use in connection, especially with my pneumatic engine for the propulsion of street-railroad cars, and to operate the toggle-valves secured to me by my said patent of the 15th September, 1868, but it may obviously be employed, without essential modification of any of its parts, or of its general principles of operation, to many existing well-known valves, and I reserve the right, accordingly, of applying it to the operation of any other valve, if I shall think proper to do so.

The drawing presents a side elevation of my invention, in connection with a pneumatic cylinder, which we may suppose to be on a street-car, for the propulsion of the same.

My invention will be better and more quickly understood by referring to the drawing.

a is the driving or crank-shaft, on which is placed the mitre or bevel-cog wheel, *b*, on the back or rear face of which is permanently secured a wide, flat bar, *c*, which, at one of its extremities, is bent so as to project at right angles, as shown at *c'*, from the plane of the bar *c* proper, and then again downwardly, as shown at *c''*, sufficiently to allow the double-incline block *j* to be fixed transversely to it, as shown. At the other extremity of the bar *c*, a similar incline block, *i*, is fixed, with its point or apex pointing in precise opposition to that of block *j*.

The bar *c* and mitre-wheel *b* are mounted on a sleeve, *a'*, which, fitting loosely on shaft *a*, permits them to rotate easily on said shaft, whilst a collar, *d*, that is immovably fixed in its place, in connection with the mitre-wheel *e* on the lower end of shaft H, prevents said wheel and bar from having any longitudinal traverse motion, on said shaft *a*, beyond what is requisite to the easy working of the two mitre-wheels together.

To further secure this end, I may fix on shaft *a*, a collar, similar to *d*, at the opposite end of sleeve *a'*.

The mitre-wheel *e*, on the end of shaft H, is held in the various positions which determine the point of the cut-off, through the agency of other parts, to be presently described, by the crank *g*, which is supported on an arc, *f*, on which it rests, and is retained in any position that may be required, by means of suitable notches in the upper edge of said arc, as shown.

On the main driving-shaft *a* is placed a disk-wheel, *l*, having a diameter which will bring its periphery very near the section *c'* of the arm or bar *c*.

This wheel *l* is provided with a long, open hub or bearing, *m*, that terminates in a collar, *m'*, which has a notch in it to receive a feather-key, *n*, to compel its rotation with the shaft *a*, but yet at the same time to permit it to have a reciprocating longitudinal traverse-motion on the shaft *a*.

This wheel *l* carries a friction-roller, *l'*, near its periphery, which is placed on its axis in such manner as to rotate at right angles, or perpendicularly, to the plane of the said wheel, and at that point which will bring it in contact with the double incline-plane blocks *j* and *i*.

The roller *l'*, in the practical operation of the machine, impinging against said angular blocks *j* and *i*, becomes the means, in connection with said blocks, of actuating other parts, which, being directly connected with the cut-off valves, give motion to the same, so as to cut off the motor after entering the cylinder, at a greater or lesser distance from the ports of induction, accordingly as a greater or lesser measure of the positive force of the same is requisite to fulfil the requirements of the time and occasion, under the changing conditions to which the engine is subjected, whatever the special duty it is intended to perform; for we have seen that the wheel *l* is prevented from revolving on the shaft *a*, by a feather-key, and that, therefore, the roller *l'* must necessarily have a fixed position in relation to the crank A, on the end of that shaft, whatever that relative position may be.

The best relation is to have the roller so placed that it will occupy an exactly vertical position over the centre of shaft *a*, when the crank A is at its lower dead-point, as shown by the drawings, because, under this arrangement, any accidental dislocation or displacement of the parts will be more quickly

discernible and rectified; but any relation will answer, provided only, it secures the shortest cut-off, when the crank *g* occupies one or the other of the terminating notches, in the traverse, are supporting-bar *f*.

Above the shaft *a* is a bed-plate, S, from which projects upwardly a standard, S′, to which is pivoted a bent lever or rock-arm, *o*, at *r*, the pendent arm of which is notched at its extremity, to receive the periphery of the disk-wheel *l*, which comes above the upper surface of the bed-plate S, a little way, through a narrow cleft or opening in the same, as clearly seen on the drawing.

The horizontal section of the rock-arm *o*, which is somewhat longer than the pendent section, is directly connected, by an articulating or pivoted joint, to the lower end of the bar P, which leads to and operates the cut-off, which I need not describe, since the same is fully described in my patent of September 15, 1868, to which I have already referred.

I now proceed to describe the action or operation of my invention, with reference to the valves described in said patent, although, as I have before remarked, it is equally useful, and may be just as easily applied to other cut-off valves.

Referring to the drawing, we will suppose the position of the parts in an engine in actual use to be the same thereupon represented, the crank being at the dead-point of the downward stroke.

The crank *g* of the cut-off is in the notch marked 1, and the lower induction-valve on the right-hand side of the cylinder C, open.

Now, as the crank moves forward, the angular block *j*, on the bar *c*, comes in contact with the roller *l′*, and forces the disk-wheel *l* to the left, and, with it, the pendent section of the rock-arm *o*. This elevates the horizontal section of said arm, and with it the rod P, and thus closes the valve *v*, before the piston has accomplished more than a few inches of its stroke, and, hence, leaves the expansive force of the compressed air, gas, or steam to finish the stroke.

By changing the crank *g* from notch 1 to the last notch in the other extremity of the supporting-arc *f*, the bar *c* is rotated sufficiently to carry the part *j* around, to a point which will prevent the roller *l′*, in consequence of the relation of the same to crank A, from coming in contact with it, and thus, through the intermediate mechanism, closing the cut-off valve until the piston of the cylinder has accomplished nearly the whole of its stroke; so that the positive force of the motor is added to its expansive power, to drive the piston to that extent, which, obviously, will develop a far greater power in the engine than would be the case if the expansive energy of the motor were chiefly depended on to operate it.

To reduce the measure of the positive or direct force of the motor, that is applied to any point of the stroke less than very nearly the whole of it, it is only necessary to move and fix the crank *g* in that intermediate notch between the two outside notches in the supporting-arc *f*, which will cause the valve to close when the piston-head or follower has reached the desired point in the cylinder. Hence, it will be perceived, my invention puts the control of the cut-off completely in the power of the engineer, and enables him, by a mere movement of the crank *g*, to make the cut-off at any point in the stroke of the piston which he pleases, and thus to economize the power of the engine to the lowest possible limit.

The further advantage results correlatively from my invention, that it brings into development and exercises the expansive principle in air, gas, or steam, when employed as a motive-power, to that extent that the whole power that is contained in either, when at higher pressure than is needed to drive the engine, is utilized and made available in practice.

I am aware that several inventions have been made and patented, which propose to develop or bring into use the complete expansive power of steam, but they are all, when analyzed, mere modifications of the throttle-valve, and there is no existing mechanical arrangement, so far as my knowledge extends, that does develop this principle in point of fact, fully and completely.

To illustrate the value of my invention, I will suppose that I have in the boiler, tank, or reservoir, a pressure to the square inch of three hundred pounds, and that to run my engine, I need only ten pounds to the square inch on the piston.

Now, to husband this excess of power, by letting only just enough of the motor into the cylinder to exert a pressure of ten pounds on the piston by its expansive energy, to the end of its stroke, is what I accomplish by my invention, in connection with my toggle-valves, which open instantly to their widest extent, and hence admit the motor with its full force to start the piston on its stroke.

An eccentric, D, on the driving-shaft *a*, by means of a yoke, E, and cam-rod F, opens the valves *v* and *w* in the usual manner, whilst an arm, G, that is secured on the outer end of the piston-rod, by means of a rod, G′, operates the eduction or discharge-valves *v′ w′*.

I claim, as my invention—

1. The mitre-wheel *b*, and flat bar *c*, in combination with the disk-wheel *l*, and its friction-roller *l′*, when these parts are constructed and arranged on the shaft *a* with respect to each other, and operate as described, for the purpose set forth.

2. The above combination, in combination with the rock-arm *o* and rod P, as described, for the purpose set forth.

3. The shaft *a*, mitre-wheel *b*, arm *c*, with its double incline-plane blocks *j* and *i*, disk-wheel *l*, rock-arm *o*, and rod P, in combination with the mitre-wheel *e*, vertical rod H, crank *g*, and supporting-arc *f*, when these parts are constructed, relatively arranged, and operate as described, for the purpose set forth.

4. The above combination, in combination with the eccentric D, yoke E, and cam-rod F, as described, for the purpose set forth.

5. The combination and arrangement of the parts embraced in the foregoing claims, in combination with the cut-off valves of a steam or pneumatic cylinder, as herein described, for the purpose set forth.

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Witnesses:

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