No. 624,698. Patented May 9, 1899.

R. SPRADO.

CUT-OFF MECHANISM FOR ENGINES.

(Application filed Feb. 23, 1899.)

(No Model.) 2 Sheets—Sheet 1.

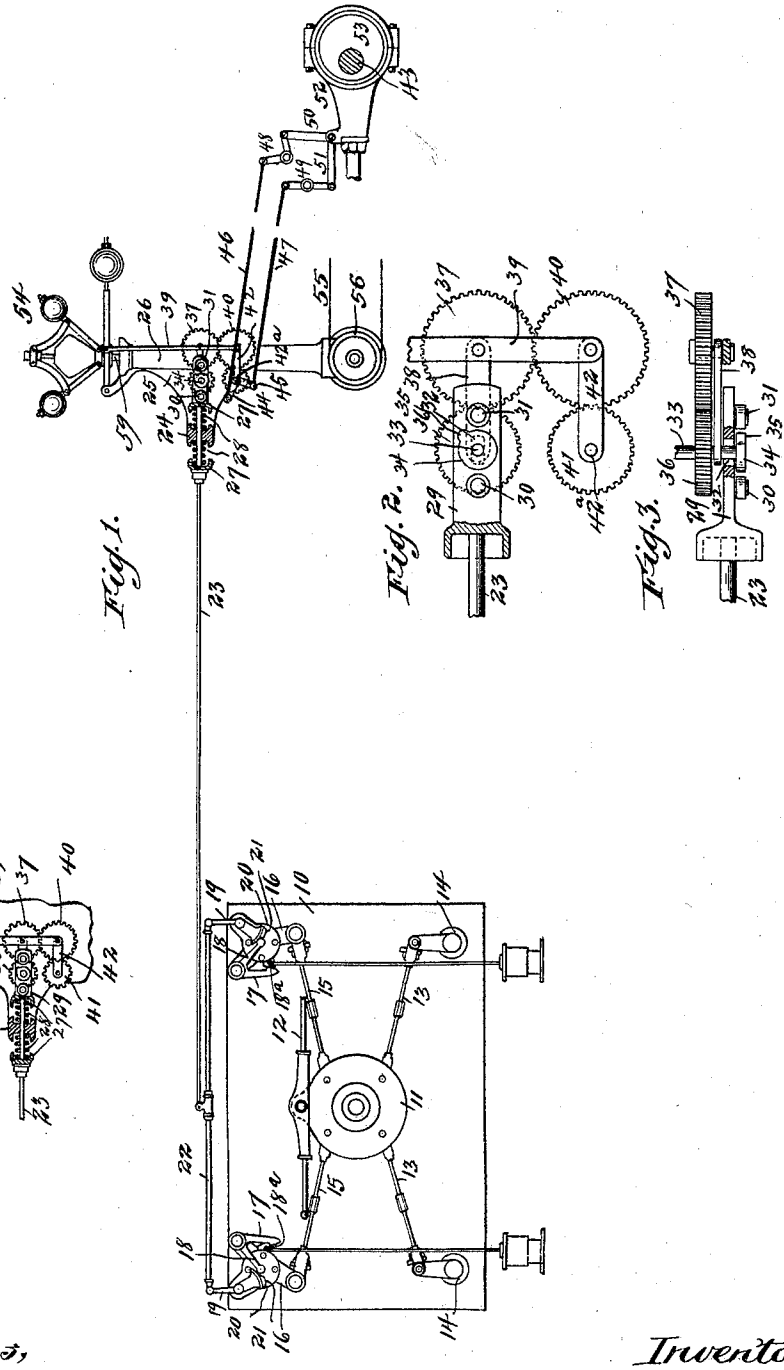

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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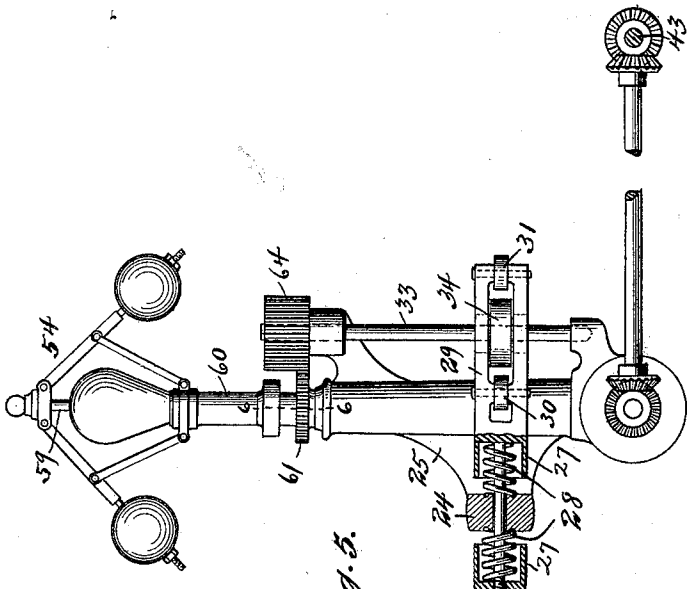

Fig. 5.

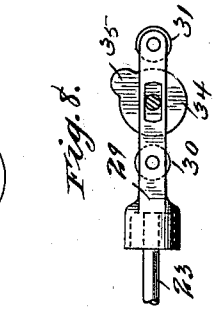

Fig. 8.

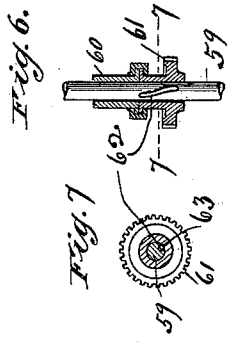

Fig. 6.

Fig. 7

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UNITED STATES PATENT OFFICE.

RALPH SPRADO, OF CHICAGO, ILLINOIS.

CUT-OFF MECHANISM FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 624,698, dated May 9, 1899.

Application filed February 23, 1899. Serial No. 706,538. (No model.)

To all whom it may concern:

Be it known that I, RALPH SPRADO, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Cut-Off Mechanism for Corliss Engines, of which the following is a specification.

This invention relates to cut-off mechanism for Corliss engines, and has for its object to provide a variable cut-off, either automatic or hand-regulated, whereby the steam may be cut off at any point from zero to the point where the steam-valves are closed by the valve-motion of the ordinary Corliss gear.

Heretofore in the valve-gear of Corliss engines as ordinarily constructed, wherein the cut-off is controlled by a governor, the range of cut-off lies entirely within the upstroke of the steam-hook, or, in other words, during the first half of the movement of the piston of the engine in one direction. There have also been devised cut-off mechanisms, known as "full-stroke" cut-offs, wherein the cut-off could be made effectual at any point of the stroke; but these mechanisms have been open to several objections, among which may be mentioned the following: First, the point of cut-off is not always equal on both sides of the engine for all points of cut-offs, so that while the mechanism may be effective in cutting off equally at both ends of the cylinder at a given point of cut-off it will cut off unequally at other points of cut-off, and, second, such mechanisms having heretofore been driven from a reciprocating or oscillating part, the movement is such that the knock-off levers are not always moved out of the way of the knock-off toes in time to permit the steam-hooks to reëngage the drop-arms at the proper place and moment.

It is the particular object of my present invention to provide a cut-off mechanism of the full-stroke type which shall be free from these objections and which shall be adapted to cut off equally at each end of the cylinder at all points of cut-off, thereby adapting the device for use with a reversing-engine, and which shall insure the quick return of the knock-off lever in time to permit the steam-hook to engage the drop-arm even when the mechanism is set for the latest cut-off possible.

To these ends my invention consists in certain novel features which I will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a mechanism embodying my invention in one form. Fig. 2 is an enlarged view of a portion of the same; Fig. 3, a detail plan view of the portion of the mechanism shown in Fig. 2; Fig. 4, a detail view similar to Fig. 1 and illustrating a modification of the device to adapt it for use as a hand cut-off. Fig. 5 is a view similar to Fig. 1, illustrating a modified form of my invention. Fig. 6 is a detail sectional view taken on the line 6 6 of Fig. 5. Fig. 7 is a plan section taken on the line 7 7 of Fig. 6, and Fig. 8 is a detail plan view of the cam and its yoke.

In the said drawings, 10 indicates the steam-cylinder, and 11 the wrist-plate, driven by the connection-rod 12 in the usual manner and having the rods 13, whereby it is connected with the exhaust-valves 14, and the rods 15, whereby it is connected with the rocking levers 16 of the steam-valves. Upon these rocking levers 16 are mounted the usual steam-hooks 17 and knock-off toes 18. Each valve is provided with the usual drop-arm 18^a, adapted to engage the steam-hook, and with the usual dash-pot connections. All of these parts may be of any approved construction. The knock-off levers are indicated at 19, being pivoted upon supports 20 and being provided at their lower ends with cam projections 21 to engage the knock-off toes, while their upper ends are connected by a rod 22. To the rod 22 is connected one end of an operating-rod 23, the other end of which passes through a suitable guide or bearing 24, carried by a bracket 25 on the governor-column 26 or in any other suitable manner. The rod 23 is provided on each side of the bearing 24 with a collar 27, and a spring 28 is located on each side of said bearing between it and the adjacent collar, said spring serving to always return the rod to its normal central position when free to move.

At a point adjacent to the governor the rod 23 is provided with a cam-yoke or engaging part 29, having rollers or projections 30 and 31 and slotted, as indicated at 32, for the passage of a cam-shaft 33, carrying a cam-wheel 34, having one or more cam projections 35,

adapted to successively contact with the rollers or projections 30 and 31 and move the rod 23 alternately in opposite directions against the action of the springs 28. The cam-shaft 33 is driven from the main or crank shaft of the engine, either directly or indirectly, or from some part moving in unison or proportionately therewith, so as to have a rotary movement either coincident with or proportionate to that of the said engine or crank-shaft, and in the construction shown in the drawings, wherein the cam has but a single projection, the cam-shaft 33 will rotate once for each rotation of the crank-shaft. In the construction shown in Figs. 1 to 4 of the drawings the cam-shaft 33 is provided with a pinion 36, with which meshes a pinion 37, carried on a link 38, mounted loosely on the cam-shaft at one end and concentrically or loosely connected with the pinion 37 at its other end. The pinion 37 is carried by a connecting-rod 39, which also carries a second pinion 40, meshing with the pinion 37 and also with a pinion 41, to the axis of which it is connected by a link 42. By reason of this construction the rod 39 may be moved vertically, while at the same time the pinions 37 and 40 will remain in mesh with each other, and each of said pinions will remain, respectively, in mesh with its associated pinion 36 and 41. The shaft 42, on which the pinion 41 is mounted, is driven from a crank-shaft 43 in any suitable manner, and in the present instance I have shown for effecting this purpose crank-arms 44 and 45 on the shaft 42, which are connected, respectively, by connecting-rods 46 and 47 with a bell-crank lever 48 and straight lever 49, and these latter are connected by means of links 50 and 51 with the eccentric-strap 52 of the main eccentric 53 on the crank-shaft 43.

In the construction shown in Figs. 1, 2, and 3 the cam 34 is controlled by means of a governor 54, driven from the main shaft 43 in any suitable manner—as, for example, by means of a belt 55, passing over a pulley 56, said governor being connected to the rod 39, as shown in Fig. 1 of the drawings.

By reason of the construction described it will be seen that variations in the speed of the engine affecting the governor will cause this latter to move the rod 39 either upward or downward, and by reason of the gearing mounted on said rod and meshing with the gears 41 and 36 such movement of the governor will cause a corresponding shifting of the position of the cam 34, thereby causing the cut-off to occur earlier or later, as the case may be. It will be observed that the knock-off rod 23 is held normally in a central position by means of the springs 28, and while said rod is in this position the knock-off levers 19 are in such a position that the steam-hooks 17 are free to pick up the drop-arms 18^a. This normal position of these parts exists at all times except during the time when the projection of the cam 34 is in engagement with one or the other of the projections or rollers 30 or 31, so that the pick-up may occur at any point of the stroke immediately after the cut-off. This result is one which is not obtainable with the usual type of full-stroke cut-off, where the knock-off rod is driven from a reciprocating or oscillating part and is practically in continuous movement, except for a brief instant of repose when the direction of said movement is changed. Furthermore, it will be seen that by reason of the employment of a rotating cam in connection with the coöperating mechanism set forth the cut-off cannot fail to be equal at each end of the stroke, and this equality will be maintained throughout the different periods of cut-off within the range of the mechanism, thereby rendering it not only more accurate in ordinary use, but adapting it more particularly for use with reversing-engines, such as hoisting-engines or the like.

My invention is also adapted for use in connection with a non-automatic or hand cut-off, and in Fig. 4 of the drawings I have shown a construction which is devised for this purpose and which is substantially identical with that shown in Figs. 1, 2, and 3, with the exception that the rod 39 instead of being connected to a governor is connected by means of a threaded link 57 with a hand-wheel 58, by means of which said rod may be adjusted vertically in order to vary the point of cut-off. It will be understood, of course, that mechanism other than the hand-wheel and threaded link may be employed for effecting the desired changes in the position of the cam.

The particular mechanism for shifting the position of the knock-off cam relatively to the driving-shaft may be varied, and in Figs. 5 to 8 of the drawings I have shown a construction in which another form of controlling mechanism is embodied. In this construction the governor-shaft (indicated at 59) is driven from the main shaft 43 of the engine by means of bevel-gearing, as shown, or in any other suitable manner, and the governor 54, carried by said shaft, is provided with a sleeve 60, to which is coupled a pinion 61, as indicated in detail in Fig. 6 of the drawings, said pinion being caused to move vertically along with the governor-sleeve, but being free to rotate relatively to this latter. The governor-shaft 59 is provided with a spiral groove 62 and the pinion 61 is provided with a projection or antifriction-roller 63, which is adapted to engage said groove. The cam 34 is so arranged that its shaft 33 is vertical instead of horizontal, as in the construction previously described, and said shaft is provided with a pinion 64, which meshes with the pinion 61. The yoke 29 is also horizontally arranged to correspond to the position of the cam 34, the remaining portions of the structure being substantially the same as that already described. It will be seen that with this particular form of mechanism the vertical movement of the governor-arms imparted to the sleeve 60 is in turn imparted to the pinion 61, and such movement of the pin-

ion will vary its angular position on the shaft 59, and owing to such variations the position of the cam 34 relatively to the driving-shaft will be correspondingly varied, thus altering the cut-off to a corresponding extent.

Various other modifications in the particular method of driving the cam and of varying its position relatively to the driving-shaft may be employed, and I therefore do not wish to be understood as limiting myself strictly to the precise details of construction hereinbefore described, and shown in the accompanying drawings.

I claim—

1. A cut-off mechanism for Corliss engines comprising, in combination with a valve mechanism, knock-off levers, a knock-off rod operatively connected therewith, a rotating cam driven from a moving part of the engine and operatively connected with the knock-off rod, and means for varying the angular position of said cam, substantially as described.

2. A cut-off mechanism for Corliss engines comprising, in combination with a valve mechanism, knock-off levers, a knock-off rod operatively connected therewith, a rotating cam driven from a moving part of the engine and operatively connected with the knock-off rod, means for varying the angular position of said cam, and a governor connected with and automatically controlling said varying means, substantially as described.

3. A cut-off mechanism for Corliss engines comprising, in combination with a valve mechanism, knock-off levers, a knock-off rod operatively connected with said levers, a rotating cam driven from a moving part of the engine and operatively engaging said knock-off rod, means for varying the angular position of said cam, and means for returning the knock-off rod and levers to their normal position when said cam is inoperative, substantially as described.

4. In a mechanism of the character described, the combination, with the knock-off levers and knock-off rod, of springs for returning said levers and rod to an inoperative position when free, a yoke connected with said rod and provided with rollers or projections, a rotating cam adapted to alternately engage said rollers or projections, said cam being driven from a moving part of the engine, and means for varying the angular position of said cam, substantially as described.

5. In a mechanism of the character described, the combination, with the knock-off levers and knock-off rod, of a rotating shaft provided with a cam to operatively engage said rod and having a pinion, a second shaft driven from a moving part of the engine and also provided with a pinion, links loosely mounted on said shaft and connected by a shifting rod, and pinions carried by said links and rod and meshing respectively with the first-mentioned pinions and with each other, whereby movement of said shifting rod will vary the angular position of the cam, substantially as described.

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