Nov. 29, 1938. R. L. BEERS 2,138,722

VARIABLE FEED MECHANISM FOR STOKERS

Filed Sept. 14, 1936 3 Sheets-Sheet 1

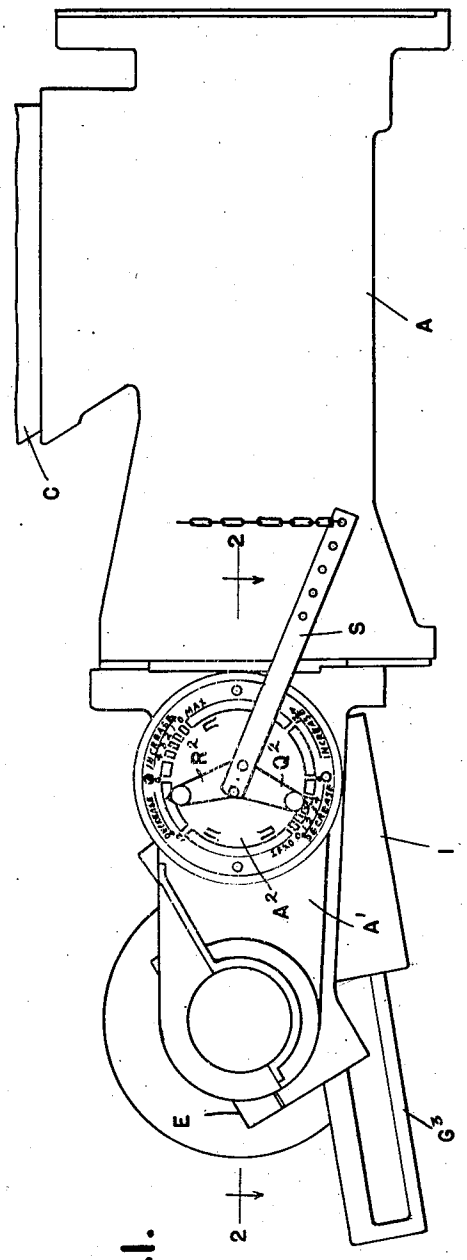


FIG.1.

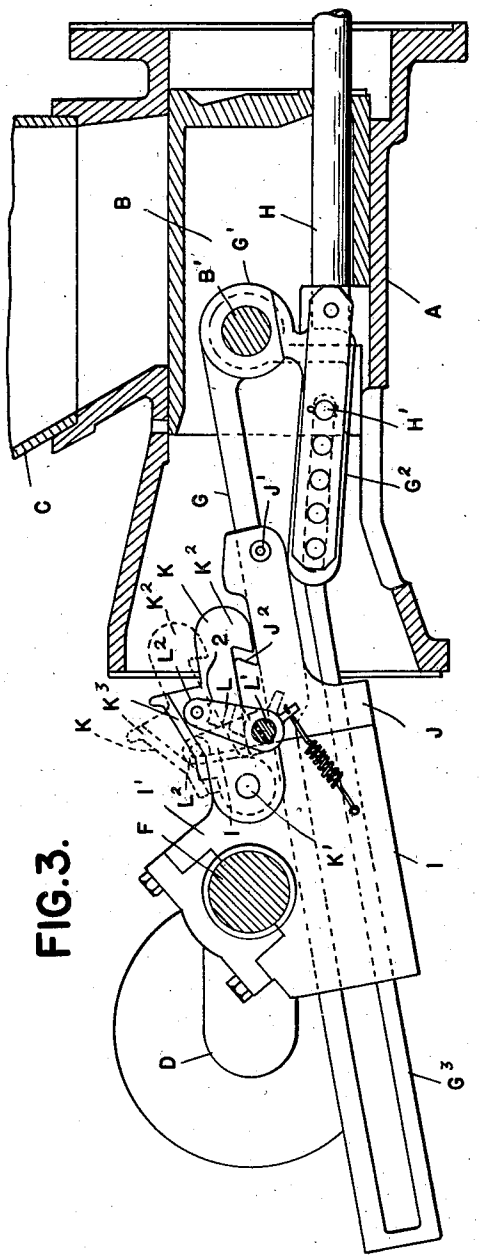


FIG.3.

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Nov. 29, 1938. R. L. BEERS 2,138,722

VARIABLE FEED MECHANISM FOR STOKERS

Filed Sept. 14, 1936 3 Sheets-Sheet 2

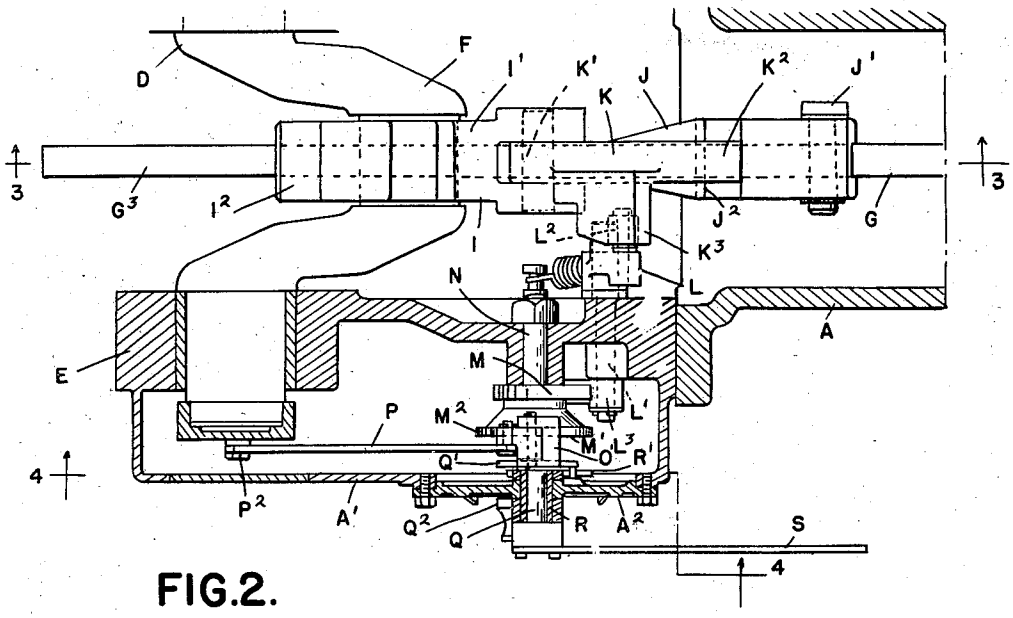


FIG.2.

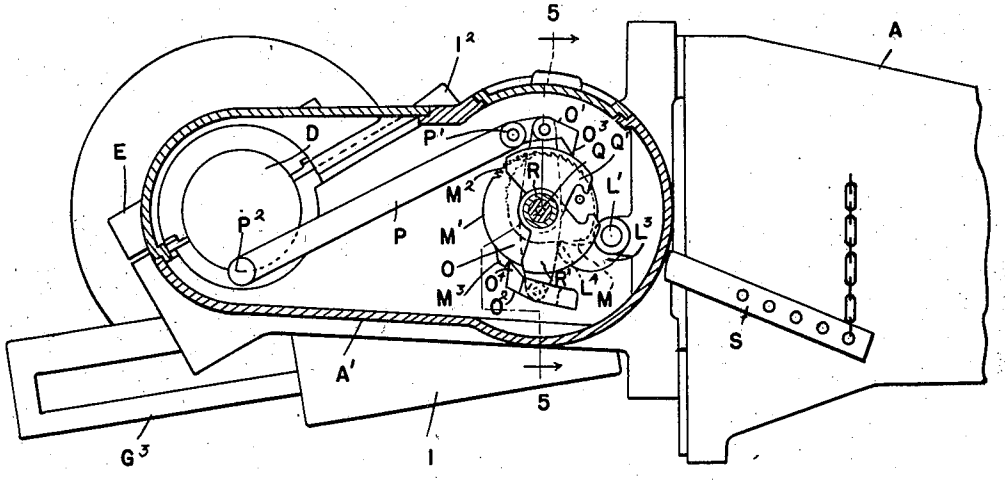


FIG.4

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Nov. 29, 1938. R. L. BEERS 2,138,722

VARIABLE FEED MECHANISM FOR STOKERS

Filed Sept. 14, 1936 3 Sheets-Sheet 3

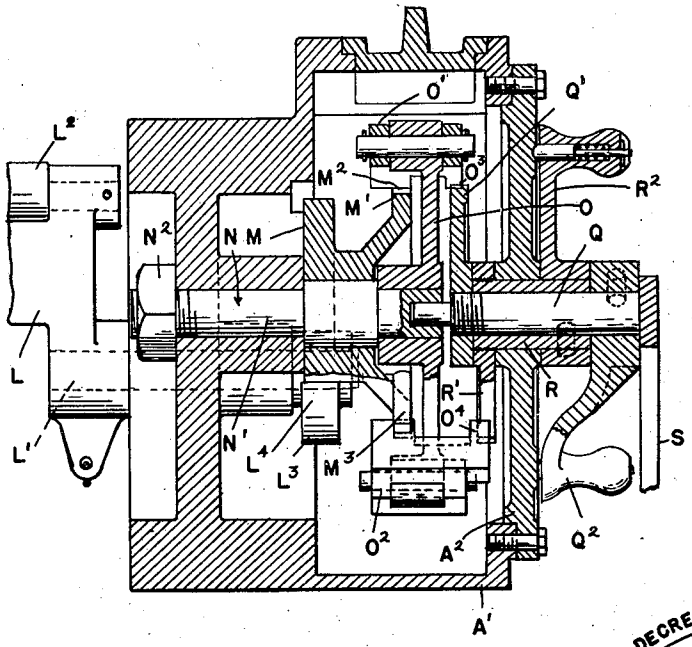


FIG.5.

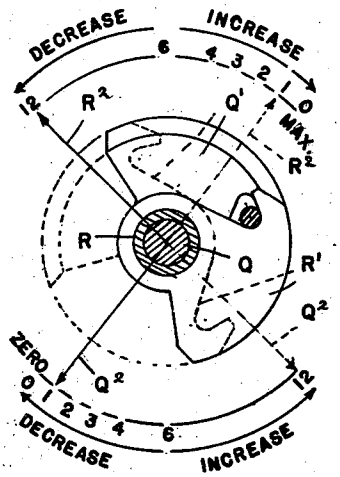


FIG.7.

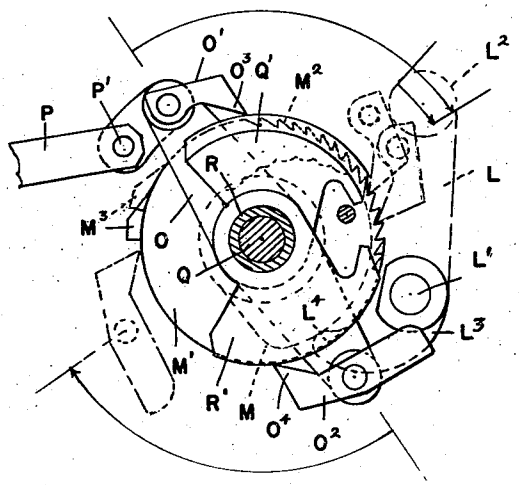


FIG.6.

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Patented Nov. 29, 1938

2,138,722

UNITED STATES PATENT OFFICE

2,138,722

VARIABLE FEED MECHANISM FOR STOKERS

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Application September 14, 1936, Serial No. 100,770

13 Claims. (Cl. 74—151)

The invention relates to stokers of that type in which the fuel is periodically introduced into the furnace by the operation of a reciprocating pusher or ram which in turn is actuated by a rotating crank and pitman connection. The rate of feed has been regulated by various means which may be grouped in three classes: first, by changing the speed of rotation of the crank; second, by varying the length of the stroke of the ram; third, by rendering the operation intermittent. The present invention relates to the latter class and consists: first, in the novel means through which the ram is intermittently operated; second, in the timing means for varying the length of the periods of operation and of rest. The invention further consists in various features of construction as hereinafter set forth.

In the drawings:

Figure 1 is a side elevation of the fuel feeding ram and actuating mechanism therefor;

Figure 2 is a horizontal section on line 2—2 of Figure 1;

Figures 3 and 4 are vertical sections on lines 3—3 and 4—4 of Figure 2;

Figure 5 is a vertical section taken substantially on line 5—5 of Figure 4;

Figures 6 and 7 are diagrammatical sectional elevational views showing the operation of the timing mechanism.

As illustrated, A is the casing for the ram B and which is provided with the usual hopper C from which the fuel is fed. D is the crank shaft journaled in bracket bearings E extending outward from the casing A. F is the crank and G the pitman rod which connects the crank with the ram. The ram is also preferably provided with a pusher rod H connected thereto and extending along the bottom of the retort (not shown) for advancing fuel therein.

The pitman rod G has at its inner end a bearing G' which is pivotally connected to the ram by the cross-pin B'. It is further provided with a depending longitudinally slotted portion G^2 to which the rod H is connected by a pin H' permitting of a certain degree of lost motion. Beyond the portion G^2 is a straight shank portion G^3 on which is slidably mounted a block I. This block is formed with a bearing portion I' for engaging the crank pin F' which is secured therein by a detachable cap I^2. J is an abutment member which also is slidably engaged with the shank G^3 but is normally held in fixed position thereon by a cross-pin J'. This pin is sufficiently restricted in cross section so that under an overload, it will shear off, permitting the abutment J to slide upon the shank. K is a coupling member for normally connecting the block I with the member J and thereby communicating the movement due to the rotation of the crank F through the rod G. The member K, as shown, is pivotally connected to the block I at K' and has at its free end a hook K^2 for engaging a cooperating hook portion J^2 on the member J. The member K is further provided with a laterally projecting flange K^3 which as hereinafter described functions in cooperating with a member L to engage or disengage the hooks J^2, K^2.

With the construction as thus far described, it will be apparent that the rotation of the crank F will be communicated to the block I and whenever the hooks K^2 and J^2 are in engagement will impart a reciprocatory movement to the pitman rod G which through its connection with the ram H will actuate the latter through a full stroke. On the other hand, whenever the hooks J^2 and K^2 are disengaged from each other, then the rotation of the crank will merely slide the block I upon the shank G^3 without communicating any reciprocatory movement to the latter. Thus the amount of fuel which is fed by the ram during any given interval of time depends upon the relative length of time that the hooks J^2, K^2 are in and out of engagement with each other. This is controlled by a timing mechanism preferably of the following construction.

The member L is a rockarm mounted on a rockshaft L' which is journaled in the casing A and the free end of said rockarm is provided with a roller L^2 which projects beneath the flange K^3. The opposite end of the rockshaft L' has mounted thereon a rockarm L^3 having a nose portion L^4 projecting into operative relation to a cam M and yieldably pressed thereagainst by a spring L^5. This cam is revolubly supported upon a stub shaft N and is fashioned so that during a portion of its revolution it will hold the roller L^2 in the path of the flange K^3, as indicated at (1), Figure 3 and during another portion of its revolution will hold said roller out of the path of the flange, as indicated at (2). The stub shaft N has a shank portion N' engaging a bearing in the casing A and clamped by a nut N^2. Connected with the cam M preferably integrally formed therewith is a ratchet wheel M' provided with a series of teeth M^2 which extend around only a portion of its circumference, such as one quadrant thereof. O is a ratchet lever which is adjacent to the ratchet wheel M' and is centrally journaled upon an extension of the stub shaft N. At the opposite ends of this ratchet lever are pivotally attached pawls O' and O^2 for alternately engaging the ratchet teeth M^2. There is also a tooth M^3 projecting from the periphery of the wheel M' on the diametrically opposite side thereof from one end of the series of teeth M^2, said tooth M^3 being adapted for engagement with either of the pawls O' and O^2. The lever O is actuated by a pitman P which is pivotally attached to one end at P' thereof, while its opposite end is pivotally attached to a crank pin P^2 on the end of the crank shaft D.

The arrangement is such that each rotation of the crank shaft will impart a reciprocatory movement to the pitman P and an oscillatory movement to the lever O, which latter is approximately through 90°. Assuming that one of the pawls O' or O^2 is in engagement with the ratchet teeth M^2 throughout its entire forward movement, this will rotate the wheel M' through one quarter of a revolution. The succeeding reciprocation of the lever O will engage this pawl with the tooth M^3 which will revolve the wheel M' through another quarter of a revolution and will bring the series of ratchet teeth M^2 into engagement with the opposite pawl. This in turn will operate upon the ratchet teeth and upon the tooth M^3 to rotate the ratchet wheel through successive quarter revolutions, thereby completing the cycle. If, however, either of the pawls O' or O^2 is held out of engagement with the ratchet teeth M^2 during a portion of the reciprocation of the lever O then the wheel M' will be rotated through only a fraction of the quarter revolution. Thus the number of cycles of the crank shaft D required to rotate the wheel M' and the cam M attached thereto will depend upon the control of the pawls O' and O^2 and as to what portion of the reciprocation of the lever O they are respectively in engagement with the ratchet teeth M^2.

The operations of the pawls O' and O^2 are independently controlled by a mechanism of the following construction: Q is a shaft axially aligned with the stub shaft N and projecting outward therefrom. On the inner end of this shaft Q is mounted a disk segment Q' and on its outer end there is an adjustable control lever Q^2. Surrounding the shaft Q is a sleeve R having mounted at its inner end adjacent to the disk segment Q' a second disk segment R', while at its outer end is a control lever R^2 similar to the lever Q^2. The shaft Q and sleeve R are journaled in a bearing in a housing A', preferably integral with the housing A and which encloses the timing mechanism above described. Preferably, this bearing is on a detachable disk cover A^2 for the housing A' and which cover is calibrated for the setting of the arms Q^2 and R^2 in different positions of adjustment. The pawls O' and O^2 are respectively provided with fingers O^3 and O^4 which have peripheral contact with the disk segments Q' and R' to thereby hold the pawls O' and O^2 out of engagement with the teeth M^2. Thus by properly adjusting the segments Q' and R' the pawls O' and O^2 can be held out of engagement with the ratchet teeth M^2 for a variable portion of the reciprocatory movement of the lever O, thereby changing the amount of movement imparted to the wheel M' during each reciprocation.

As has been previously described, the cam M cooperates with the arm L^3 to rock the shaft L' thereby moving the member L and roller L^2 into or out of the path of the flange K^3. The form and position of the cam is such that it will move the member L from one position to the other during a portion of the cycle when the member K and flange K^3 are withdrawn. Thus if the member L is in the position (1) the final portion of the forward movement of the member K and flange K^3 will contact the latter with the roller L^2 which will swing the hook K^2 out of engagement with the hook J^2. The parts will be held in this position until after the withdrawal of the member K and flange K^3 thereby preventing reengagement of the hooks K^2 and J^2. On the other hand, when the member L is in the position (2), then it will be out of the path of the flange K^3 so that if the hooks K^2 and J^2 have been previously disengaged they will latch into engagement at the completion of the forward movement. From the description of the timing mechanism previously given it will be understood that the setting of the arm Q^2 controls the operation of the pawl O' and the setting of the arm R^2 controls the operation of the pawl O^2. These arms may be either manually or automatically adjusted, but preferably the arm R^2 is manually adjusted, while the arm Q^2 is either manually or automatically adjusted. To provide for this automatic adjustment a lever S is attached to the outer end of the shaft Q and the outer end of this lever may be coupled with any suitable automatic control mechanism (not shown). The pawl O' will actuate the wheel M' and cam M during the portion of the cycle of the latter when it is holding the member L in the position (1). Thus by either manually or automatically setting the arm Q^2 the number of cycles of the crank F during which the ram is stationary will be determined, while on the other hand, by the setting of the arm R^2 the number of cycles during which the ram is successively reciprocated will be determined. In other words, either adjustment will affect the relative time when the ram is in or out of operation but by the combination of the two a very much larger variation can be accomplished. With one specific construction the variation in timing is indicated by the following table:

Number of teeth engaged	Arm R^2 set at—	Arm Q^2 set at—	Revolutions operating	Revolutions idling	Percent time operating
12	12	1	2	13	13.3
		2		7	22.2
		3		5	28.6
		4		4	33.3
		6		3	40.0
		12		2	50.0
6	6	1	3	13	18.7
		2		7	30.0
		3		5	37.5
		4		4	43.0
		6		3	50.0
		12		2	60.0
4	4	1	4	13	23.5
		2		7	36.4
		3		5	44.5
		4		4	50.0
		6		3	57.2
		12		2	66.6
3	3	1	5	13	27.8
		2		7	41.6
		3		5	50.0
		4		4	55.6
		6		3	62.5
		12		2	71.5
2	2	1	7	13	35.0
		2		7	50.0
		3		5	58.4
		4		4	63.6
		6		3	70.0
		12		2	77.8
1	1	1	13	13	50.0
		2		7	65.0
		3		5	72.2
		4		4	76.5
		6		3	81.2
		12		2	86.6

The variable feed mechanism as above described can be manufactured at comparatively low cost and will provide for a large range of variation in the control. Further advantage of the construction is that the ram is actuated by an harmonic movement and that the coupling and uncoupling is effected at the dead center and when not under load. This is advantageous over such constructions where lost motion is provided and consequently the load is suddenly picked up

developing relatively high stresses in overcoming its inertia.

What I claim as my invention is:

1. The combination with fuel feeding means, of actuating means therefor including a rotary element, means for alternately coupling and uncoupling said actuating means and fuel feeding means, timing means operating after a predetermined number of cycles of said rotary element for effecting the coupling operation of said coupling and uncoupling means and alternately operating after a distinct predetermined number of cycles of said rotary element for effecting the uncoupling operation of said coupling and uncoupling means and adjustment means for said timing means to independently vary the number of cycles during which said actuating means is respectively coupled and uncoupled to said feeding means.

2. The combination with fuel feeding means, of actuating means therefor including a rotary element, connecting means between said actuating means and fuel feeding means, means for alternately coupling and uncoupling said connecting means including a rotary cam having portions for controlling respectively the holding of said connecting means coupled and uncoupled and intermediate portions for effecting the coupling and uncoupling, and timing means driven by said actuating means for operating said rotary cam, said timing means being adjustable to vary the number of cycles of said rotary element during which said connecting means is coupled and being separately adjustable to vary the number of cycles of said rotary element during which said connecting means is uncoupled.

3. The combination with fuel feeding means, of actuating means therefor including a rotary element, connecting means between said actuating means and fuel feeding means, means for alternately coupling and uncoupling said connecting means including a rotary cam having portions for controlling respectively the holding of said connecting means coupled and uncoupled and intermediate portions for effecting the coupled and uncoupling, and timing means driven by said actuating means for operating said rotary cam, said timing means being adjustable to vary the number of cycles of said rotary element during which said connecting means is coupled and being separately adjustable to vary the number of cycles of said rotary element during which said connecting means is uncoupled and being adapted to effect the coupling and uncoupling operations each during a single cycle of said rotary element and when said connecting means is unloaded.

4. The combination with reciprocating fuel feeding means, of actuating means therefor including a rotary crank, a pitman, a member pivotally engaging said crank and longitudinally slidable on said pitman, means for automatically coupling said member to said pitman at one end of its sliding movement, a member adapted to extend into the path of said coupling means to hold the same from coupling, means for moving said member alternately in and out of operative position including mechanism driven by said actuating mechanism and adjustment means for varying the number of cycles of said rotary crank during which said member is held respectively in and out of operative position.

5. The combination with reciprocating fuel feeding means, of actuating means therefor including a rotary crank, a pitman, a member pivotally engaging said crank and slidably engaging said pitman, an abutment on said pitman for engaging said slidable member at the forward end of its sliding movement, a latch hook on said slidable member for engaging said abutment to hold the same in fixed relation thereto whereby an harmonic movement is communicated from said crank to said reciprocating feeder, a member adjustable into the path of said latch hook when the latter is adjacent to the forward end of its harmonic movement to hold the same from coupling with said abutment, timing mechanism driven by said actuating mechanism for alternately moving said last mentioned member into and out of operative position, and means for adjusting said timing mechanism to vary the number of cycles of said crank during which said member is held respectively in its operative and inoperative positions.

6. The combination with reciprocating fuel feeding means, of actuating means therefor including a rotary crank, a pitman, a member pivotally engaging said crank and slidably engaging said pitman, an abutment on said pitman for engaging said slidable member at the forward end of its sliding movement, a latch hook on said slidable member for engaging said abutment to hold the same in fixed relation thereto whereby an harmonic movement is communicated from said crank to said reciprocating feeder, a cam flange projecting from said latch hook, a rockarm extending in one position into the path of said cam flange as said latch hook approaches the forward end of its movement and adapted in cooperation therewith to hold said hook from engagement, a rotary cam for controlling the moving of said rockarm alternately into and out of operative position, timing mechanism driven by said actuating mechanism and operating said rotary cam, means for adjusting said timing mechanism to vary the number of cycles of said crank during which said cam holds said rockarm in operative position, and separate means for adjusting said timing mechanism to vary the number of cycles of said crank during which said rockarm is held in inoperative position.

7. The combination with fuel feeding means, actuating means therefor including a rotary element, and means for alternately coupling and uncoupling said actuating means and fuel feeding means including a rotary cam having a portion for effecting the coupling, a portion for effecting the uncoupling and intermediate portions for controlling respectively the holding of said coupling and uncoupling means in coupled and uncoupled positions, of timing means controlling the operation of said coupling and uncoupling means comprising a ratchet wheel connected to said rotary cam and provided with ratchet teeth on a segment thereof, an oscillatory ratchet lever coaxial with the ratchet wheel and extending on opposite sides thereof, pawls connected to the opposite ends of said ratchet lever for engaging said ratchet teeth when in registration therewith, one of said pawls engaging said ratchet teeth only when said actuating means is coupled to said fuel feeding means, and the other pawl engaging the ratchet teeth only when said actuating and fuel feeding means are uncoupled, adjustable means for holding each of said pawls out of engagement with said ratchet teeth during a variable portion of the oscillation of said ratchet lever, and a ratchet tooth alternately engaged by said pawls for actuating said

cam to respectively couple and uncouple said actuating means and fuel feeding means.

8. The combination with fuel feeding means, actuating means therefor including a rotary element, and means for alternately coupling and uncoupling said actuating means and fuel feeding means including a rotary cam having a portion for effecting the coupling, a portion for effecting the uncoupling and intermediate portions for controlling respectively the holding of said coupling and uncoupling means in coupled and uncoupled positions, of timing means controlling the operation of said coupling and uncoupling means comprising a ratchet wheel connected to said rotary cam and provided with ratchet teeth on a segment thereof, an oscillatory ratchet lever coaxial with the ratchet wheel and extending on opposite sides thereof, pawls connected to the opposite ends of said ratchet lever for engaging said ratchet teeth when in registration therewith, one of said pawls engaging said ratchet teeth only when said actuating means is coupled to said fuel feeding means, and the other pawl engaging the ratchet teeth only when said actuating and fuel feeding means are uncoupled, adjustable means for holding each of said pawls out of engagement with said ratchet teeth during a variable portion of the oscillation of said ratchet lever, a ratchet tooth alternately engaged by said pawls for actuating said cam to respectively couple and uncouple said actuating means and fuel feeding means, and means connecting said ratchet lever to said actuating means for effecting an oscillation for each cycle of said rotary element.

9. The combination with fuel feeding means, actuating means therefor including a rotary element, and means for alternately coupling and uncoupling said actuating means, of timing means for controlling said coupling and uncoupling operations after a predetermined number of cycles of said rotary element, and independent adjustment means for varying the number of cycles during which said actuating means is respectively coupled to and uncoupled from said fuel feeding means.

10. The combination with fuel feeding means, of actuating means therefor including a rotary element, means for alternately coupling and uncoupling said actuating means and fuel feeding means, and timing means controlling the coupling and uncoupling operations including a ratchet wheel segment, a ratchet lever connected for reciprocation during each cycle of said rotary element, pawls carried by said ratchet lever and positioned to alternately intermittently engage with said ratchet wheel segment, means for holding each of said pawls out of engagement with said ratchet wheel segment during a portion of the reciprocation of said ratchet lever, means for separately adjusting said holding means for each pawl, and means operated after the disengagement from said segment by one of said pawls for effecting the coupling operation of said coupling and uncoupling means, and after disengagement from the other of said pawls for effecting the uncoupling operation of said coupling and uncoupling means.

11. The combination with fuel feeding means of actuating means therefor including a rotary element, means for alternately coupling and uncoupling said actuating means and fuel feeding means, and timing means including a member which in one position effects the coupling and in another position effects the uncoupling, and actuating and timing means for said member including a rotary cam, a ratchet wheel segment for rotating said cam, a ratchet lever, means for reciprocating said ratchet lever during each cycle of said rotary member, pawls carried by said ratchet lever positioned to alternately intermittently engage with said ratchet wheel segment, means controlling each pawl for holding the same out of engagement with the teeth of said ratchet wheel segment during a portion of the reciprocation of said ratchet lever, and separately adjustable means for varying a portion of the reciprocation during which each pawl is held out of engagement with said ratchet wheel segment.

12. The combination with intermittent fuel feeding means including a revolving actuating member, of means for timing the feeding and idling periods of said fuel feeding means comprising a rotary member, a ratchet toothed segment on said rotary member, a ratchet lever connected to said revolving member to be reciprocated thereby once each cycle through an angle substantially equal to said segment, pawls carried by said lever spaced to respectively intermittently engage with said segment, each after disengagement therefrom of the other, separately adjustable means for holding said pawls out of engagement with said toothed segment for a variable portion of the reciprocation thereof, means on said rotary member alternately engaged by said pawls to actuate the same during the interval when both pawls are disengaged from said ratchet toothed segment and stopping and starting means for the fuel feeding mechanism controlled by said rotary member when thus actuated.

13. The combination with intermittent fuel feeding means inculidng a revolving actuating member, of means for timing the feeding and idling periods of said fuel feeding mechanism comprising a rotary member, a ratchet toothed segment of substantially 90° on said rotary member, a ratchet lever connected to said revolving member to be reciprocated thereby once each cycle through an angle substantially equal to that of said segment, pawls carried by said lever spaced to respectively intermittently engage with said segment each after disengagement therefrom of the other, separate adjusting means for holding said pawls out of engagement with said toothed segment for a variable portion of the reciprocation thereof, and an additional tooth on said rotary member for engagement with each of said pawls after disengagement thereof from said toothed segment to move said rotary member to a position for engagement of the other of said pawls with said toothed segment, and starting and stopping means for said fuel feeding means controlled by the movement of said rotary member by the respective pawls when in engagement with said additional tooth.

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