Nov. 2, 1943. R. KLOSSNER 2,333,316

AUTOMATIC COAL STOKER

Filed Oct. 9, 1939 3 Sheets-Sheet 1

FIG. 1

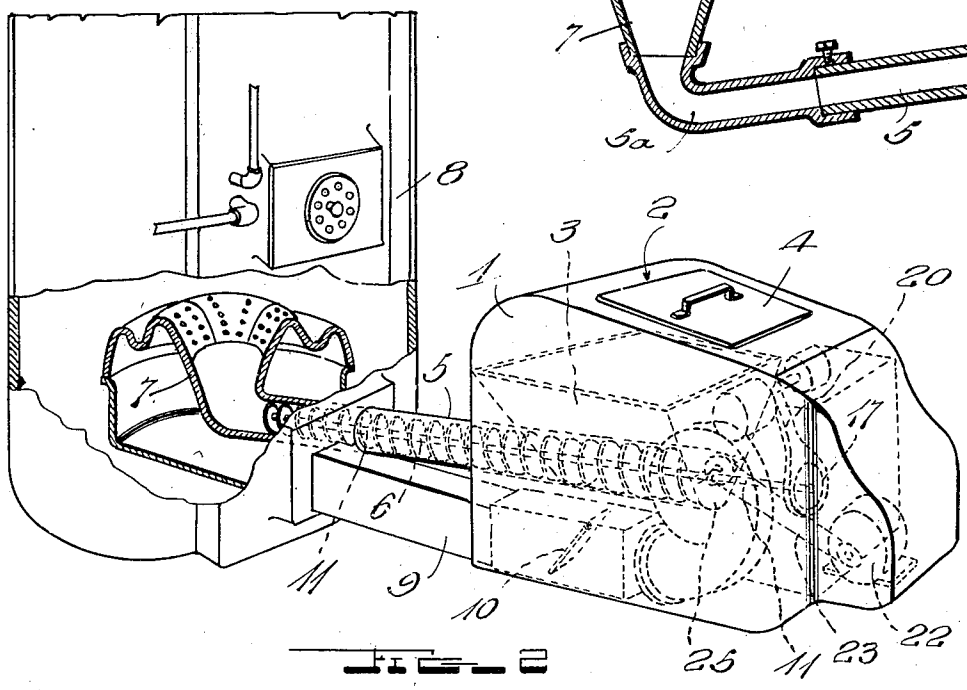
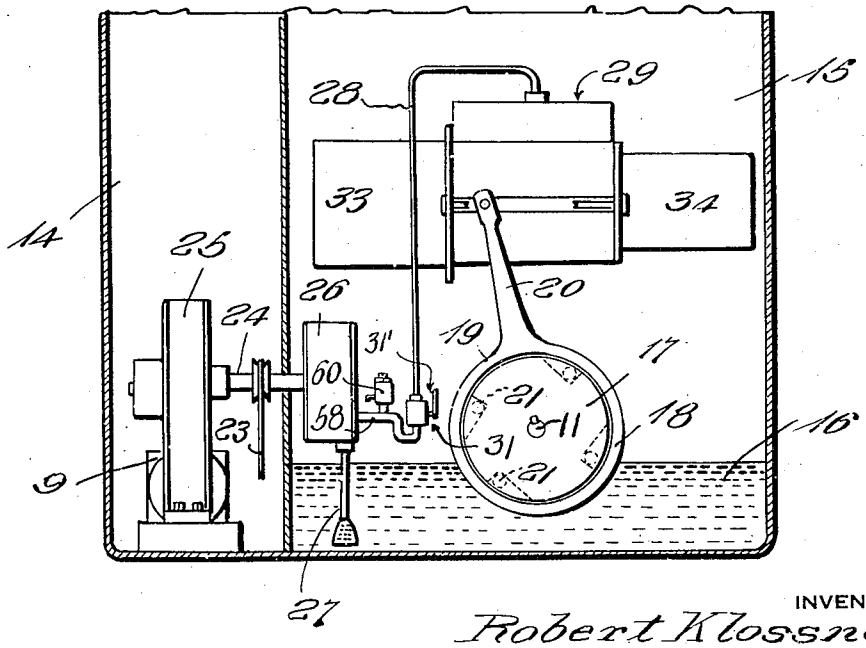


FIG. 10

FIG. 2



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Filed Oct. 9, 1939 3 Sheets-Sheet 2

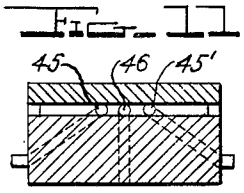


FIG. 11

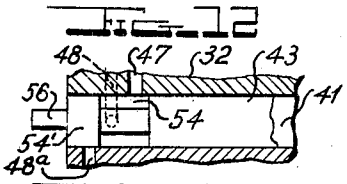


FIG. 12

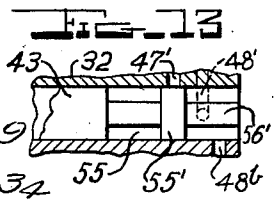


FIG. 13

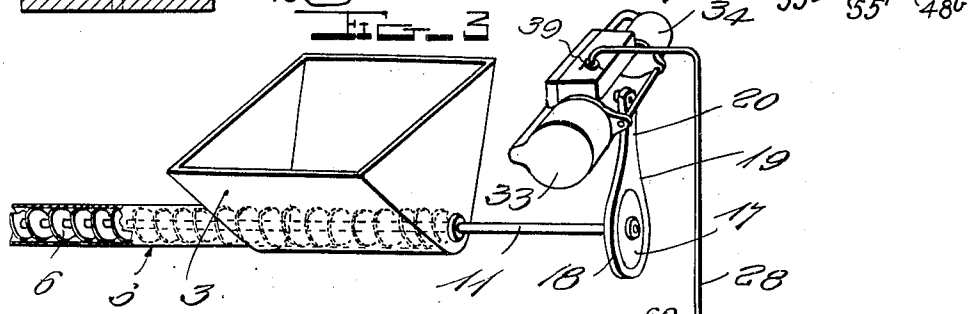


FIG. 2

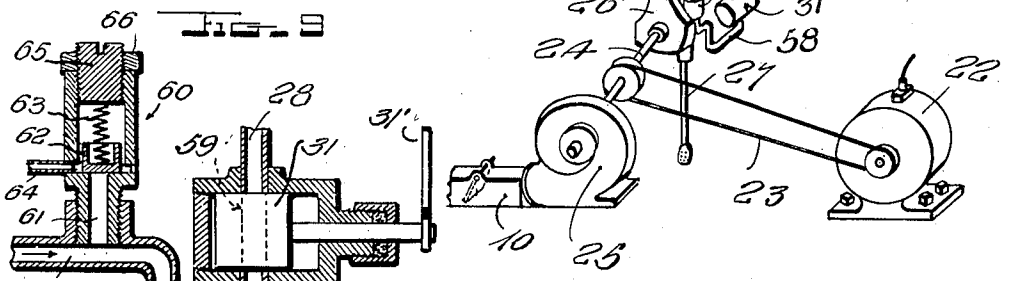


FIG. 3

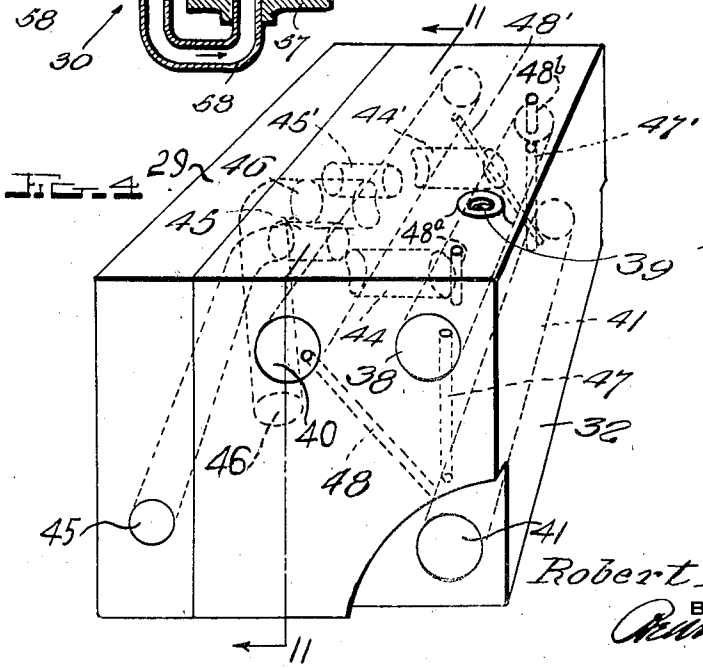


FIG. 4

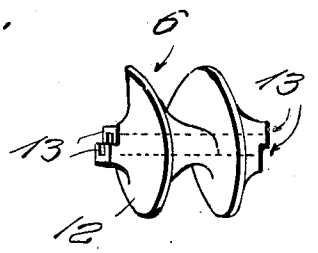


FIG. 8

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AUTOMATIC COAL STOKER

Filed Oct. 9, 1939 3 Sheets-Sheet 3

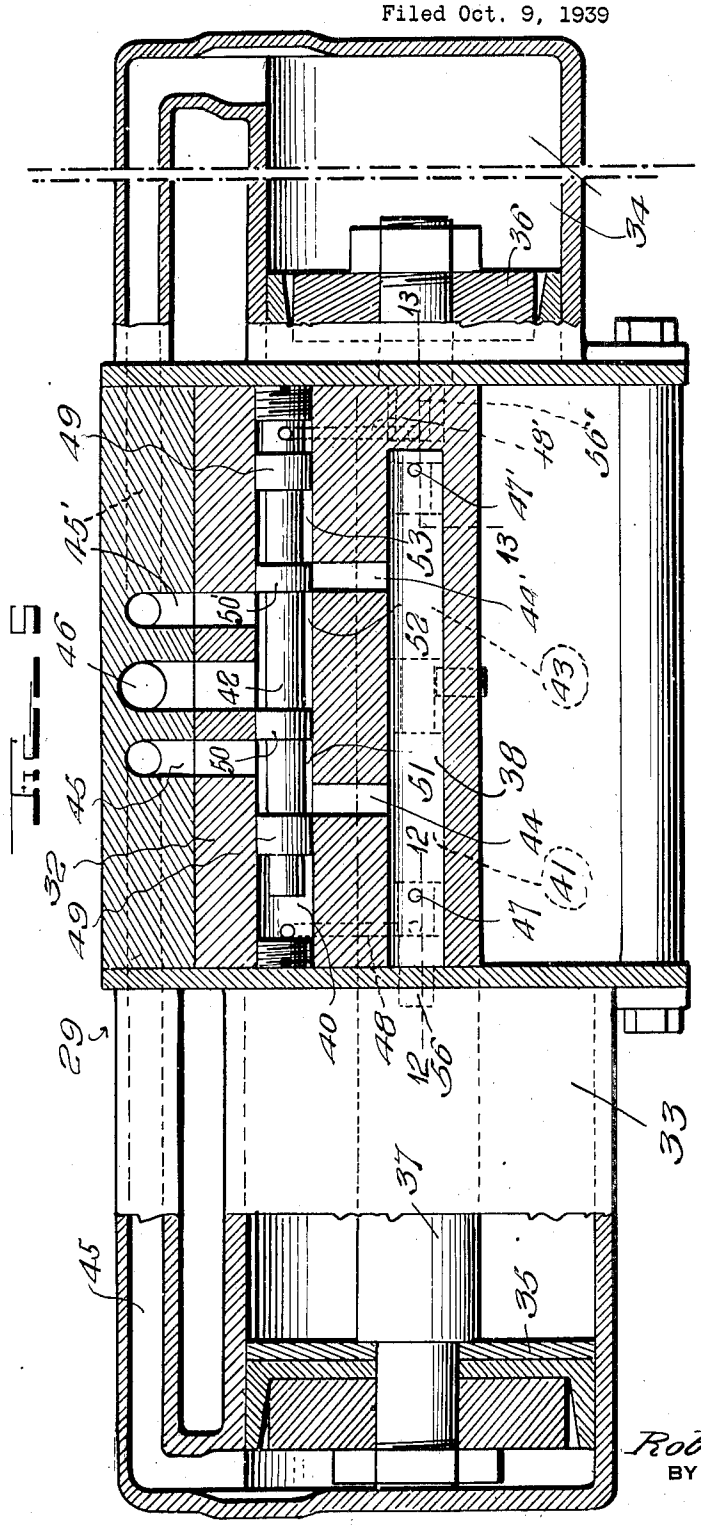


FIG. 5

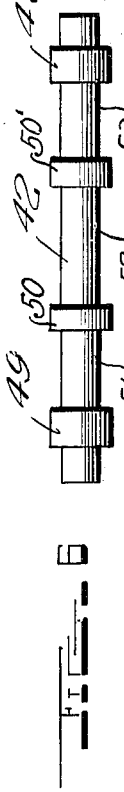


FIG. 6



FIG. 7

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Patented Nov. 2, 1943

2,333,316

UNITED STATES PATENT OFFICE

2,333,316

AUTOMATIC COAL STOKER

Robert Klossner, Alliance, Ohio

Application October 9, 1939, Serial No. 298,702

2 Claims. (Cl. 121—157)

This invention relates to improvements in automatic coal stokers especially designed for household furnace use, and particularly to stokers of that type embodying a feed screw intermittently operated at a low rate of speed from an electric motor, or other relatively high speed motor, continuously driven in one direction at a constant speed.

One object of the invention is to provide a stoker mechanism which may be easily regulated as to feed speed, which is simple in construction and composed of parts not liable to easily get out of order, which may be manufactured and sold and kept in working order at a comparatively low cost, and which allows easy and inexpensive replacement of those parts most subject to wear when occasion requires.

A further object of the invention is to provide a novel, reliable and efficient type of hydraulically operated transmission mechanism for actuating the feed screw from the electric motor or prime mover.

A still further object of the invention is to provide a transmission mechanism of the type described which is wholly or largely self-lubricating, and to provide a sectional construction of feed screw and other parts most liable to wear whereby these parts when worn may be replaced in an easy, convenient and inexpensive manner.

With these and other objects in view, the invention consists of the features of construction, combination and arrangement of parts, hereinafter fully described and claimed, reference being had to the accompanying drawings, in which:

Fig. 1 is a perspective view of an automatic stoker embodying my invention shown in connection with a furnace, with parts broken away and in section.

Fig. 2 is a vertical transverse section through the stoker casing showing parts of the stoker mechanism in end elevation.

Fig. 3 is a perspective view of parts of the stoker mechanism disassociated from the casing.

Fig. 4 is a perspective view of the valve block per se.

Fig. 5 is a sectional plan view on an enlarged scale through the hydraulic motor.

Fig. 6 is a view of the distributor valve.

Fig. 7 is a view of the reversing valve.

Fig. 8 is a perspective view of one of the sections of the feed screw showing the construction thereof.

Fig. 9 is a sectional view through the pressure speed regulator.

Fig. 10 is a view showing a modification.

Fig. 11 is a vertical section on line 11—11 of Fig. 4.

Figs. 12 and 13 are detail vertical sections through the opposite ends of the pilot valve chamber, taken respectively on lines 12—12 and 13—13 of Fig. 5, showing the ends of the valve as they appear in one of the operative positions of the valve.

In the practical embodiment of my invention as herein disclosed, 1 designates a casing having an opening 2 in its top for the introduction of coal into a hopper 3 arranged therein, which opening may be normally kept close by means of a cover 4. The hopper 3 communicates at its bottom with a feed conduit 5 in which is arranged to operate an auger or screw conveyor 6 which is rotated in a manner hereinafter described to feed the fuel to the bottom of a tuyère grate structure 7 arranged within a heating furnace 8. The grate 7 herein shown is of the so-called under-fed type. The conduit 5 extends forwardly from the casing 1 above or alongside an air feed conduit 9 whereby air to promote and support combustion of the fuel is supplied to the grate, said conduit 9 having arranged therein a suitable type of valve 10 to permit flow of air to the grate and to prevent its return therefrom. In Fig. 1 the grate structure 7 is shown as integral with the conduit 5, but, as shown in Fig. 10, a replaceable elbow 5a may be arranged between the conduit and grate to allow this part of the conduit, most subject to wear, to be economically renewed whenever required.

The auger or screw 6 comprises a suitably journaled shaft 11 on which the screw proper 6 is mounted. This screw proper comprises a series of sections 12 each longitudinally bored axially to receive the shaft and permit slidable fitting of each auger section on or its removal from the shaft. The series of auger sections may be retained on the shaft against displacement by holding means of any suitable type to prevent their longitudinal displacement while permitting of their removal when required. The meeting faces of adjacent auger sections are constructed to interfit, or they are provided with clutch surfaces 13 for interengagement with each other to hold the sections coupled together. The construction described provides for the ready removal of any portion of the conveyor screw which may become unduly worn or damaged in service and its replacement by a new section without the necessity of the owner of the stoker being compelled to buy a new fully renewal screw. In practice, the shaft may be made of angular shape in cross-

section and the bores of the auger section correspondingly shaped so as to adapt the sections to be held against independent rotation on the shaft and to rotate positively with the shaft as the latter is operated.

A part of the casing 1 is interiorly partitioned to provide a fan or blower chamber 14 communicating with the air duct 9 and a transmission housing or chamber 15 separate from said fan or blower chamber, and which chamber 15 is suitably formed or constructed to provide at its base a reservoir for a storage of a body of oil 16. The outer end of the shaft 11 extends into the chamber 15 and has mounted thereon a disk or head 17 enclosed within or encircled by the annular body portion 18 of an oscillator 19 having a motion transmitting arm 20 projecting therefrom. The outer peripheral surface of the disk 17 and the inner peripheral surface of the annular body 18 are formed with pockets having abutment shoulders and inclined surfaces and receiving ball or roller members 21 forming a ball or roller type of ratchet connection between the shaft and oscillator whereby intermittent or step by step rotation may be imparted to the shaft 11 to drive the conveyor 6 on its speed motion. It will be obvious that in one direction of motion the oscillator through the ratchet connection will impart a partial rotation to the shaft in one direction, and that in its other direction of motion the ratchet connection will permit the oscillator to move in the reverse direction without operating the shaft. The elements 17 and 19 constitute parts of a hydraulic transmission mechanism for imparting from a drive motor, revolving constantly in a single direction at a relatively high speed, an intermittent or step by step rotation to the screw conveyor 6 which is rotatable in its feeding operation at a much lower rate of speed.

The electric motor or prime mover 22 employed for driving the feed screw through such transmission mechanism may be of a conventional standard speed phase and constant speed type. This motor 22 by means of a belt 23 or other type of gearing drives a shaft 24 suitably journaled within the casing. The shaft 24 in turn operates a blower or fan 25 which supplies air to the conduit 9 and also operates the impeller of a rotary oil pump 26 which communicates with an oil feed or supply pipe 27 which dips down into the body of oil 16 in the oil reservoir. The oil so taken up by the pump is forced through a delivery pipe 28 to the feed valve mechanism of a hydraulic motor, generally designated 29, which operates the oscillator 19. The oil on its flow to the pipe 28 from the pump 26 passes through a pressure speed regulator 30 of suitable type, and which may include a regulating or throttle valve 31, whereby the volume and working pressure of the oil delivered to the pipe 28 may be regulated and controlled to govern the action of the hydraulic motor and the speed of the oscillator 19 and consequently the speed of rotation of the feed screw 6.

The hydraulic motor 29 comprises a central valve block or casing 32 at opposite ends of which are arranged cylinders 33 and 34, which parts are bolted together or otherwise suitably united. In the cylinder 33 operates a load piston 35 and in the cylinder 34 operates a reverse or return piston 36. These pistons are of single acting type, piston 35 operating on its inward movement to transmit a working motion to the oscillator 19 and piston 36 operating on its inward movement to transmit an idling or return motion to the oscillator. A rod 37 couples the pistons for movement in unison and this rod is suitably coupled to the arm 20 to transmit motion to the oscillator.

In the valve block or casing 32 are formed a manifold chamber 38 having an intake port 39 connecting with pipe 28, a distributor valve chamber 40 and a pilot or reversing valve chamber 41, in which chambers 40 and 41 are arranged sliding distributor and pilot valves 42 and 43. Connecting chambers 40 and 38 are feed ports 44 and 44', and connecting chamber 40 with the outer ends of the respective cylinders are feed and return passages 45 and 45', between which lies an exhaust passage 46 for the return of oil from the cylinders and chamber 40 back to the oil reservoir. In addition to the aforesaid ports and passages the valve casing is provided with passages 47 and 47' connecting opposite ends of the manifold chamber 38 with opposite ends of the pilot valve chamber 41, passages 48 and 48' connecting opposite ends of the distributor valve chamber 40 with the ends of the pilot valve chamber 41, and vent ports 48*a*, 48*b* for cooperation with passages 48, 48'.

The distributor valve 42 is provided with similar annular end enlargements or heads 49 which always close communication between the ends of the chamber 40 and the ports 44, 44', 45 and 45'. Between these enlarged end portions or heads 49 the valve is provided with a pair of spaced heads 50, 50' forming between them annular ports 51, 52 and 53, which heads 50 and 50' and ports 51, 52 and 53 control communication between the center ports 44, 45 and 44', 45' and the ports 45 and 45' and port 46. The pilot valve 43 is provided adjacent its ends with annular ports 54 and 55 for cooperation respectively with the sets of ports 47 and 48 and 47' and 48'. The valve 43 is also provided with reduced end extensions or abutments 56 and 56' which project through end walls of the valve casing into the respective cylinders 33 and 34 for the contact therewith of the pistons 35 and 36 to shift the valve 43 in opposite directions for effecting a reversing operation of the valve 43. These reduced ends 56, 56' of valve 43 also provide for the exhaust of oil through ports 48, 48' and the vent ports 48*a*, 48*b* from chamber 41 in the reversing movements of the valve 43. The valve 43 is further provided between the respective ports 54 and 55 and the respective end extensions 56 and 56' with heads 54' and 55' to control communication between the ports 47, 48, 47', 48', 48*a* and 48*b*, as hereinafter described. It will be understood that in practice the electric motor 22 is driven constantly in one direction and operates the shaft 24 which drives the fan 25 to continuously supply air to the furnace grate, the shaft 24 also driving the pump 26 to supply oil from the oil reservoir to the valve chamber for controlling the working operations of the pistons 35 and 36. Through the medium of the regulator or speed controlled device the amount of oil supplied to the valve chamber and its pressure may be regulated to control the speed of operation of the hydraulic motor, any excess oil not allowed to pass by the regulator being returned to the oil reservoir. The supply of oil from the pump to the controlling valves and cylinders effects first a working motion of the oscillator in one direction and then a return motion of the oscillator, or its movement in the opposite direction, the oscillator in its working movement transmitting motion in

its clutch connection to the feed screw for a coal feed action and on its reverse or return motion acting idly or without motion transmitting effect on the feed screw. The hydraulic motor through the action of the oscillator will actuate the feed screw intermittently at a slow rate of speed, while the motor continues to operate at a uniformly high speed, so that a step by step feed action of the screw on the coal is obtained. In the operation of the pump, hydraulic motor and motion transmitting mechanism, these parts are properly lubricated from the oil or motive fluid supplied from the reservoir, thus reducing the number of parts which have to be lubricated, and if desired the remaining parts of the apparatus may be lubricated by automatic means of suitable type from the same source. Thus those portions of the apparatus with the exception of the feed screw which are the most subject to wear will operate for a long period and, as the use of a valve mechanism of the type described obviates the employment of packings or the like, the liability of derangement of the valve mechanism and the necessity of making repairs thereof will be reduced to the minimum. As speed reduction is obtained with my device without the use of planetary gears, internal pumps and the like, and as no springs are used which are liable to break or become inefficient, the construction of the apparatus as a whole is considerably simplified, so that it may be manufactured and sold and kept in working order at a comparatively low cost.

Fig. 5 discloses the parts of the hydraulic motor as they appear when the oscillator and load piston are at the limits of their return movements and about to make a power stroke. In this position of the parts the valve 42 has been moved to the right by oil pressure supplied through ports and passages 47, 54 and 48 so as to establish communication through passages 44 and 45 between the manifold and cylinder 33 and to establish communication between the exhaust port 46 and the passage 45' with the cylinder 34. In this position of the parts the reversing valve 43 is at the limit of its left hand movement, to which it has been shifted by the previous inward movement of the piston 36, so that its port 54 connects the passages 47 and 48 and its head 54' closes vent port 48*a*, while its port 55 lies out of alinement with passages 47' and 48' while its head is in position to close passage 47' and open communication between passages 48', 48*b* to allow oil to exhaust from 48' over reduced projection 56' and out through port 48*b*, as shown in Fig. 13, so valve 42 can shift. The projection 56 in this position of valve 43 extends into cylinder 33 so as to lie in the path of inward movement of the piston 35. Fluid pressure thus being supplied to the outer end of the cylinder 33 the piston 35 is moved inward on its working stroke and actuates the oscillator on its working stroke, piston 36 at the same time being moved outward in its cylinder 34 to force the oil contained therein outward through the exhaust port 46 back to the oil reservoir. When the piston 35 reaches the limit of its inward movement it engages projection 56 of valve 43 and shifts said valve to its right hand end position in which its passage 54 is moved out of alinement with ports 47 and 48 and its passage 55 connects ports 47' and 48', whereby fluid under pressure is supplied to the right hand end of the valve chamber 40 to shift the valve 42 to its left hand position in which it establishes communication between ports 44' and 45' for flow of oil to the outer end of the cylinder 34 and closes communication between ports 44 and 45, while at the same time opening communication between ports 45 and 46 so as to allow exhaust of oil from the cylinder 33 back to the oil reservoir. In such movement of valve 43 its head 54' moves to a position to close port 47 and establish communication between ports 48, 48*a* to allow oil to exhaust from 48 over projection 56 and out through port 48*a*, as shown in Fig. 12, to permit valve 42 to shift to its left hand position. Action of the oil under pressure admitted to cylinder 34 forces the piston 36 inwardly so that the piston 35 will be moved backward to the outer end of its cylinder 33 and so that the oscillator will be moved idly back to its initial position ready for another power stroke. The power stroke movement of the piston 35 which shifts the valve 43 to its right hand end position projects its end portion 56' into the cylinder 34, so that when the piston 36 reaches its inward movement it engages the extension 56' and shifts the valve 43 back to its left hand working position for a repetition of the power stroke action of piston 35 previously described. It will be apparent that in these operations great ease of motion of the pistons and valve elements will be obtained so that the working parts will operate in a practically noiseless manner.

The pressure speed regulator 30 may be of any preferred type of construction. As shown in the present instance it comprises a valve casing 57 connected with the outlet or delivery pipe 58 leading from the pump, and which is arranged between said pipe 58 and the delivery pipe 28 leading to the feed valve mechanism of the hydraulic motor. In this casing 57 is arranged the throttling valve 31 which is adjustable by means of an operating handle 31' to cause a port 59 in said valve to register to a greater or less extent with the pipes 28 and 58, whereby the flow of oil from the pump to the hydraulic motor may be controlled by a throttling action to regulate its volume of flow and working pressure as desired. Communicating with the pipe 58 between the casing 57 and the pump is a relief valve chamber 60 having a passage 61 communicating with the pipe 58 and controlled by a valve 62 normally held closed by a spring 63 adapting it to open at a predetermined pressure to provide for the escape of excess oil through an overflow or drain pipe 64 back to the intake of the pump or to the oil reservoir. The spring 63 is disposed between the valve 62 and a threaded plug 65 which is adjustable to enable the pressure of the spring 63 to be regulated and which is adapted to be locked in adjusted position by a lock nut 66.

What I claim is:

1. In a motion transmitting apparatus, a hydraulic motor embodying opposed spaced working and return cylinders and a valve casing between said cylinders, said valve casing having a manifold chamber, a pilot valve chamber opening at its ends into the cylinders, a reversing valve chamber, fluid feed ports connecting the manifold chamber with the ends of the pilot valve chamber, feed ports connecting the manifold chamber with the reversing valve chamber, fluid feed and vent ports connecting the ends of the pilot valve chamber with the ends of the reversing valve chamber, fluid supply and return ports connecting the reversing valve chamber with the outer ends of the cylinders, and a fluid exhaust port leading outwardly from the reversing valve chamber, load and return pistons respectively operating in said cylinders, means

coupling said pistons for movements in unison, a reciprocatory reversing valve in said reversing valve chamber shiftable in opposite directions for alternately controlling the flow of fluid from the second-named feed ports through the supply and return ports to and from the respective cylinders and its exhaust from the cylinders through the exhaust port, and a reciprocatory pilot valve in said pilot valve chamber having opposite end portions exposed in the cylinders so as to be alternately engaged by the respective pistons for shifting the valve in opposite directions, said pilot valve having end portions governing the first-named feed ports and the said fluid feed and vent ports to alternately control the feed of fluid to the opposite ends of the reversing valve chamber and its exhaust therefrom.

2. In a motion transmitting apparatus, a hydraulic motor embodying opposed spaced working and return cylinders and a valve casing between said cylinders, said valve casing having a manifold chamber, a pilot valve chamber opening at its ends into the cylinders, a reversing valve chamber, fluid feed ports connecting the manifold chamber with the ends of the pilot valve chamber, feed ports connecting the manifold chamber with the reversing valve chamber, fluid feed and vent ports connecting the ends of the pilot chamber with the ends of the reversing valve chamber, fluid supply and return ports connecting the reversing valve chamber with the outer ends of the cylinders, and a fluid exhaust port leading outwardly from the reversing valve chamber, load and return pistons respectively operating in said cylinders, a reciprocatory reversing valve in the reversing valve chamber comprising a cylindrical valve body shiftable longitudinally in said chamber and having heads and intervening grooves governing the second-named feed ports, the supply and return ports and the exhaust port for alternately controlling the flow of fluid from said second-named feed ports through the supply and return ports to and from the respective cylinders and its exhaust from the cylinders through the exhaust port, and a reciprocatory pilot valve in the pilot valve chamber comprising a cylindrical valve body longitudinally shiftable in said chamber and having opposite end portions exposed in the cylinders so as to be engaged by the pistons to alternately shift the valve in opposite directions, said valve having end portions provided with heads and intervening grooves governing the first-named feed ports and the said fluid feed and vent ports on its opposite shifting movements to alternately control the feed of fluid to the opposite ends of the reversing valve chamber and its exhaust therefrom.

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