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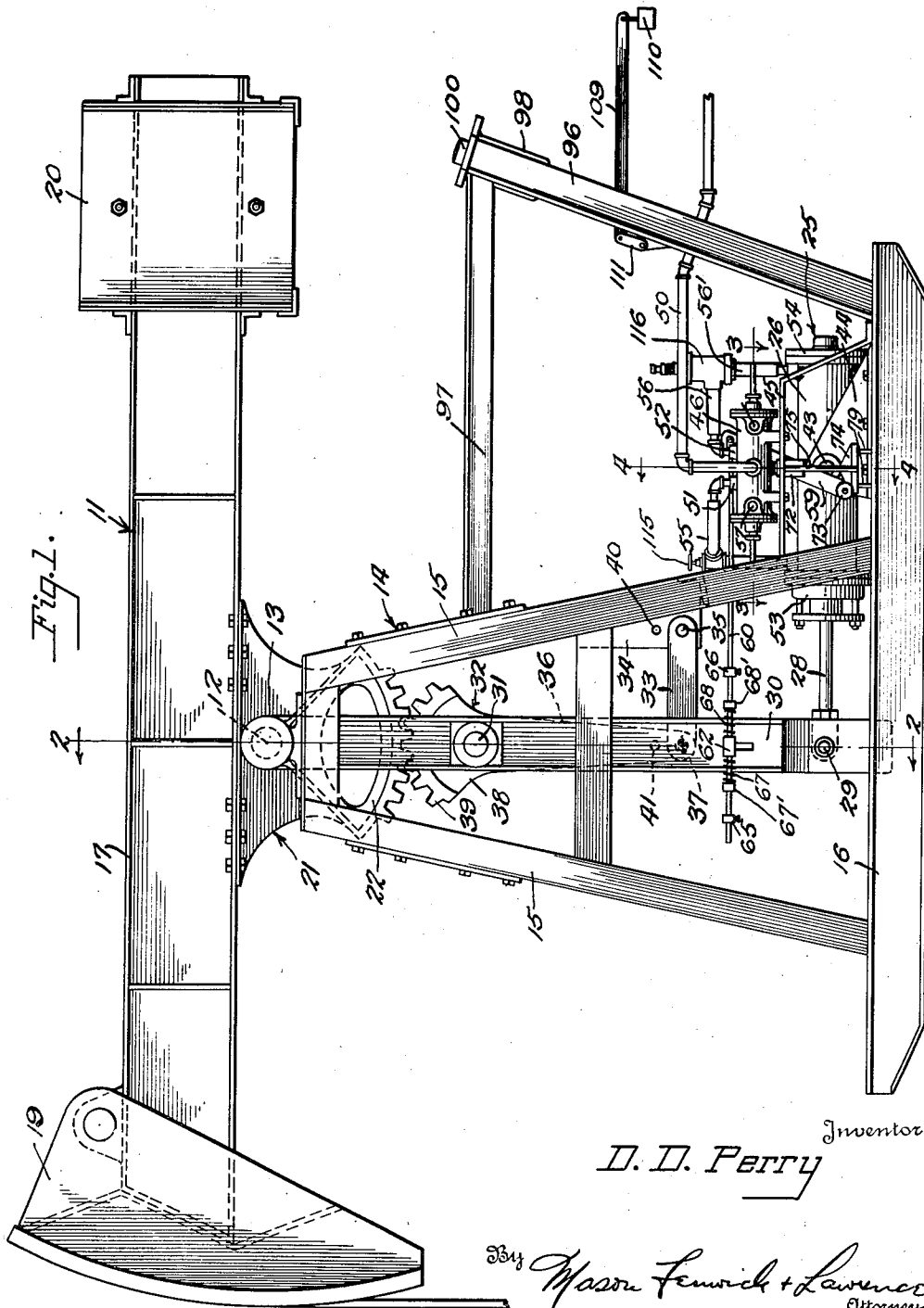
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WELL PUMPING MECHANISM

Filed Oct. 3, 1940

2 Sheets-Sheet 1



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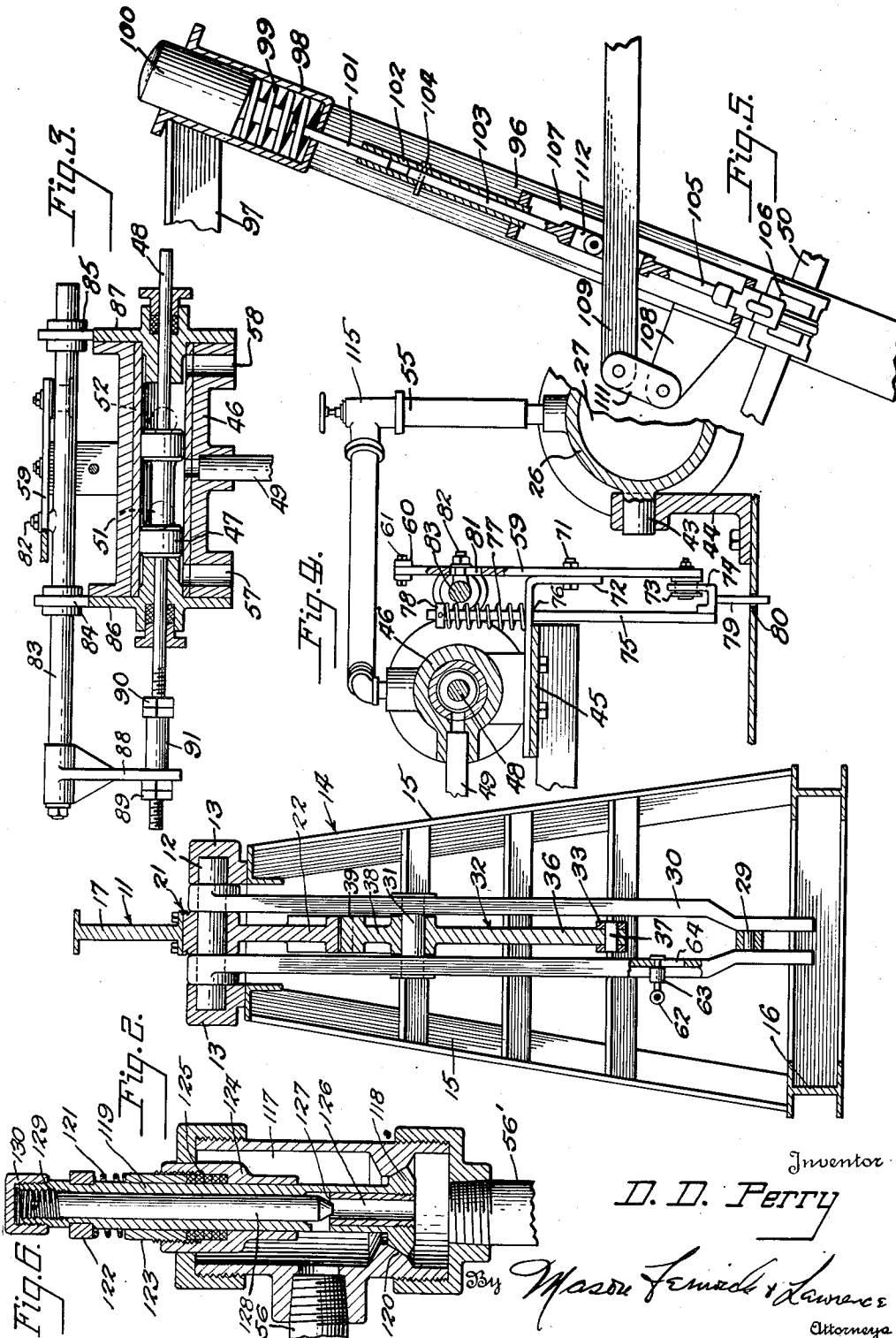
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WELL PUMPING MECHANISM

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16 Claims. (Cl. 121—164)

The invention pertains to pumps such as are used for pumping subterranean fluids, and is especially directed to pumping mechanism of the type required for pumping oil, gas, water or other fluid substances obtained from wells.

The invention is directed particularly to the pumping engine and drive, and comprises a novel operating mechanism to actuate the polished or sucker rod. This construction conventionally includes an oscillating member, usually consisting of a walking beam, so-called.

One purpose of the present invention is to greatly increase the pumping stroke of the oscillating member relative to the driving stroke of the prime mover. Conversely, the present invention enables the employment of a prime mover of a lesser stroke than is commonly used.

Another object of the present invention is to provide a mechanical movement between the driving element comprising the prime mover, and the driven element comprising the oscillating member, for the purpose of increasing the pumping stroke of the oscillating element relative to that of the prime mover.

Under conventional practice the walking beam is driven by a prime mover comprising a crank gear unit, commonly so-called. The prime mover usually comprises a reciprocating engine of the gas expansion type, employing steam, air, gas, or some other suitable expansible fluid as its power source. The practice of the present invention contemplates a novel prime mover construction operative integral with walking beam mechanical movement. The engine of conventional prior art practice includes a distributing valve for distributing the power fluid to the respective engine heads timed to the operation of the engine. The present invention includes inter-drive mechanism between the distributing valve and the oscillating member, specifically between the valve and the drive mechanism of the walking beam, to operate the distributing valve from the oscillating member. This presents a departure from prior art practice, under which the prime mover is a self contained engine. The strokes of the engine of the present are timed to the strokes of the oscillating member, and power fluid distribution to the engine is directly responsive to the power requirements of the several strokes of the oscillating member. The reverse strokes of the oscillating member, as is well known, are respectively incident to the up and down strokes of the sucker rod, or power and idler strokes of the pump. Under the practice of the present invention, adjustment of the distributing valve is made in accordance with the power requirements of the respective strokes of the oscillating member.

The invention contemplates a novel distributing valve construction and operation by which

the valve is rendered quick acting, which affords a minimum loss of expansion fluid, and a corresponding saving of power. The quick action mechanism comprises an over-drive of the inter-drive between the oscillating member and the valve. The novel interconnection between the oscillating member drive and the distributing valve times the valve operation adjustably to the end of the stroke of the oscillating member, the timing being directed to the operation of the over-drive mechanism.

Valves in the power fluid lines between the distributing valve and the respective engine heads insure smooth action in both the downstroke and the upstroke of the pump. The valve for the downstroke head may be a hand operated throttle valve, preferably of ordinary construction, and operable to regulate the quantity of pressure fluid fed to the downstroke head of the engine to regulate the speed of the walking beam during the downstroke. On the upstroke side a specially constructed choke valve is provided which prevents jerking of the sucker rod in a manner to cause it to part.

The invention includes mechanism operable responsive to a failure of the subterranean pump, such for example, as the parting of the uprod or sucker rod, to shut off the power fluid supply to the distributing valve and to stop the pump operating engine.

The invention comprising the above mentioned novel embodiments affords a number of advantages which will be obvious from a fuller understanding thereof to be derived from the preferred embodiment, as shown in the accompanying drawings, and described in detail hereinafter. In the drawings

Figure 1 shows a side elevation of the pumping mechanism;

Figure 2 is a cross sectional elevation taken on line 2—2 of Figure 1;

Figure 3 is a cross sectional plan view taken on line 3—3 of Figure 1;

Figure 4 is a cross sectional elevation taken on line 4—4 of Figure 1;

Figure 5 is a cross sectional elevation through the center plane of the valve cutoff mechanism; and

Figure 6 is a cross sectional elevation of the choke valve to the engine head for the pump power stroke.

As illustrated in the drawings, the invention comprises an oscillating member 11, in the instant case comprising a walking beam mounted to pivot at 12 on the pivot journals 13 which rest fixed to the Sampson post or similar support structure 14. The support structure comprises upright beams 15 projecting upwardly from the base member 16 which, in the instant case, is in the form of a skid.

The oscillating member comprises a longitudinal beam 17, which terminates at one end in a mulehead 19, the operation of which is conventional and the specific structure of which forms no part of the present invention. On the opposite end the longitudinal beam 17 carries the adjustable counterweights 20 which are of well known construction and require no further explanation in this application. The beam 17 is fixed to the rocking bracket 21 which pivots on the pin 12 and which includes the driven gear segment 22 as an integral part thereof.

The beam 17 is driven by the engine, generally indicated by reference numeral 25, which is of the fluid expansion type driven by steam, compressed air, gas, or some other expansible fluid. The engine is of the two-stroke, double-action type and is, therefore, equipped with a cylinder 26 and a piston 27 attached to the piston rod 28. As the engine operates it reciprocates the rod 28 longitudinally to drive the beam 17.

The piston rod 28 is pivotally attached at 29 to the main lever 30 which pivots on the pin 12 and projects downwardly in the manner shown in Figures 1 and 2. Intermediate of its length, between the pivot pin 12 and the pivot attachment 29, the lever 30 carries a pivot pin 31. The auxiliary lever 32 is mounted to pivot on the pin 31, as shown. One arm of the lever is adapted to be held in fixed position by means of the holding arm 33, one end of which is connected to the fixed plate 34 by means of the pin 35, the fixed plate 34 being rigidly attached to one of the upright beams 15 as shown. The other end of the holding arm 33 is pivotally attached to one arm 36 of the lever 32 by means of the pivot pin 37. The other arm 38 of the lever 32 carries the pinion segment 39 which meshes with the gear segment 22, fixed to the beam 17.

It will, thus, be seen that as the piston rod 28 reciprocates under normal reciprocation of the engine it will oscillate the main lever 30, carrying with it the intermediate pivot pin 31. The drive of the beam 17 will, therefore, be transmitted through the mechanism comprising the lever 30, the pivot pin 31, the driving pinion segment 39 and the gear segment 22. This intermediate gear and lever drive of the beam 17 affords a much greater throw than is attainable by a direct lever drive to the beam 17.

The driving mechanism is constructed to permit adjustment of the stroke of the beam 17, this consisting of the holes 40 and 41 in the fixed plate 34 and auxiliary lever 32, respectively, which holes 40 and 41 are adapted to respectively receive the connecting pin 35 and the pivot pin 37 of the holding arm 33. Adjustment of the holding arm 33 adjusts the lever arm between the pivot pins 31 and 37.

The reciprocating engine rocks on the trunnions 43, Figure 4, pivoted in the engine support bracket 44, mounted on the base member 16. The trunnions 43 permit rocking of the engine to allow for deviation from the horizontal of the piston rod 28 which is incidental to the swing of the main drive lever 30.

The engine valve mechanism may obviously be constructed integral with the cylinder, but in the embodiment shown is separately mounted on the support bracket 45 attached to the main base member 16. As clearly illustrated in Figure 3, the valve is of the two-way, two-stroke type and comprises the valve cylinder 46 which receives the valve head 47 fixed to the valve stem 48 to reciprocate therewith.

The valve is provided with the intake port 49 connected with the fluid pressure line 50. The intake port 49 communicates with the respective left and right engine ports 51 and 52 which are connected to the opposite left and right engine heads 53 and 54, respectively, by the respective fluid lines 55 and 56. The engine ports 51 and 52 in the valve communicate with the respective left and right exhaust ports 57 and 58. The valve head 47 controls communication between the intake port 49 and the respective engine ports 51 and 52, and between the engine ports and respective exhaust ports 57 and 58, to distribute pressure fluid alternatively to the respective engine heads 53 and 54 and to exhaust the head which is not operating the power stroke.

When the valve stem moves to the left, in Figure 3, and the valve head 47 attains the position illustrated therein, the intake port 49 is in communication with the left side engine port 51 to feed power fluid to the left side engine head 53. Simultaneously the right side engine port 52 in the valve is in communication with the exhaust port 58 on the right side of the valve, for flushing out the right side engine head 54. The piston 27 now moves to the right under power from the left side engine head 53, flushing out the right side engine head 54 through the line 56, the engine port 52 in the valve, and the exhaust port 58 at the right of the valve. As the piston 27 reaches the end of its stroke to the right, the valve stem 48 moves to the right in Figure 3, carrying the valve head 47 with it, operation of the valve head being performed by mechanism to be described more fully hereinafter. When the valve head 47 attains the right-hand end of its stroke in Figure 3, the intake port 49 is in communication with the right engine port 52, the valve head 47 operating in this position to cut off communication between the engine port 52 and the exhaust port 58. Now power fluid enters the right side engine head 54 to drive the piston 27 to the left. The left side engine port 51 in the valve is in communication with the left side exhaust port 57 to drop the pressure in the left side engine head 53, and to permit the head 53 to be flushed out as the piston moves to the left.

The valve stem 48 is reciprocated by the main lever 30 which is connected to the valve actuating lever 59 by means of the connecting rod 60, pivoted to 59 at 61. The opposite end of the connecting rod 60 slides longitudinally through the sleeve 62 which swivels in the base member 63, the base member 63 being fixed to the lever 30, adjustable longitudinally thereof by means of the slot 64, Figure 2. The rod 60 carries the respective left and right abutment stops 65 and 66 fixed thereto and adjustable longitudinally of the rod, the adjustment being in accordance with the swing of the lever 30. Attached to the sleeve 62 on the left and right side thereof are the respective helical compression springs 67 and 68 which surround the rod 60. Attached to each spring are the respective abutments 67', 68', respectively adapted to engage and actuate the abutment stops 65 and 66.

The valve actuating lever 59 is pivoted at 71 to the bracket 72 fixed to the valve support bracket 45, as illustrated in Figure 4. At its lower extremity the lever 59 carries the cam follower roller 73 which operates on the face of the cam 74. The cam 74 is carried by the guide rod 75 which slides vertically in the guideway 76. The guide rod 75 projects through the bracket 72,

and is surrounded by the compression spring 77, the spring 77 being opposed by the bracket 72 and the stop collar 78 fixed to the guide rod 75. The cam 74 carries the guide pins 79 which project downwardly through the apertures 80 in the base member 16. The guide pins 79 cooperate with the guideway 76 to confine movement of the cam 74 in a vertical line.

Between the pivot 71 and the pivot attachment 61 of the connecting rod 60 the lever 59 has a slot 81 disposed longitudinally thereof. The pin 82, Figure 3, projects laterally of the slide rod 83 and extends into the slot 81 to connect the lever 59 and slide rod 83 with freedom of movement of the pin 82 longitudinally of the lever 59 as it swings. The slide rod 83 moves longitudinally of the valve in the respective left and right guide collars 84 and 85 attached to the respective left and right valve heads 86, 87. The cross member 88 is attached to the slide rod 83 and projects laterally therefrom to engage the valve stem 48. Attached to the valve stem 48 and adjustable longitudinally thereof by the respective left and right lock nuts 89 and 90 is the sleeve 91 on which the cross member 88 slides, the movement of the cross member 88 to the left and right being limited by the respective lock nuts 89 and 90.

As the walking beam 17 oscillates its stroke is determined by the oscillation of the main drive lever 30 driven by the engine 25. The abutment stops 65 and 66 are adjusted in accordance with the stroke of the beam 17. As the lever 30 oscillates in apposite directions, in its movement to the left in Figure 1, the abutment 67' engages the abutment stop 65 at a predetermined point in the stroke of the lever 30, and accordingly in a predetermined point in the stroke of the beam 17. The movement of the lever 30 to the right, in a similar manner, causes the abutment 68' to engage the abutment stop 66 at a predetermined point in the stroke of the lever 30 to the right, and accordingly at a predetermined point in the stroke of the beam 17. Upon the abutment 67' engaging the stop 65 as the lever 30 moves to the left, and as the lever moves to the right upon the abutment 68' engaging the stop 66, the respective springs 67 and 68 are compressed against the resistance exerted upon the connecting rod 60 by the valve actuating lever 59 and its operating mechanism. The compression of the respective springs 67 and 68 continues until they develop force enough to overcome the resistance exerted by the lever 59, at which time the lever 59 is actuated to swing on its pivot, to the left in Figure 1, when the lever 30 is moving to the left, and to the right towards the position shown in Figure 1 when the lever 30 is moving to the right. By the mechanism described the actuation of the lever 59 is held in abeyance until the compression of either the spring 67 or 68, which is determined by the lever 30 attaining the left or right limits respectively of its stroke as timed by the adjustment of the abutment stops 65, 66.

As the lever 59 is actuated, in the manner hereinbefore described, the cam 74 is depressed as the cam follower 73 rides up its face. The face of the cam 74 is crowned, as illustrated in Figure 1. The cam follower roller 73 rides up the face of the cam toward the crown against the compression of the spring 77 and as the roller rides beyond the crown the compression spring 77 acts to actuate the lever 59 for the rest of its stroke. Thus the action of the lever 59 is delayed by the described connection between the connecting rod 60 and the lever 30. When actuation of

the lever 59 takes place it becomes a snap action propelled by the combined power of the springs 77 and either 67 or 68 depending upon the direction of the stroke. The sleeve 91 provides lost motion between the slide rod 83 and the valve stem 48 so that actuation of the valve head 47 is delayed until the valve actuating lever 59 is snap actuated by the cam 74 and the cam actuating spring 77. By means of the described mechanism the time of movement of the valve head 47 to the respective left and right limits of its stroke is reduced to a minimum and is delayed to be timed with the completion of the stroke of the walking beam 17 and the stroke of the engine 25.

In the respective lines 55 and 56 from the distributor valve cylinder 46 to the respective engine heads 53 and 54, there are provided the valves 115 and 116. The valve 115 comprises a simple hand operated throttle valve, and may be of any convenient construction. It is operable to regulate the quantity of power fluid fed to the engine head 53 and since the engine head 53 operates as the power source of the downstroke of the mulehead 19, the valve 115 operates to regulate the speed of movement of the walking beam 17 during the downstroke of the pump.

The valve 116 comprises a choke which operates to check the pumping power stroke, which is the upstroke of the mulehead 19, to prevent the mulehead 19 from jerking the sucker rod. Such jerking might cause the sucker rod to part and cause failure of the pump. The choke valve 116, illustrated in detail in Figure 6, comprises a valve chamber 117 in the line 56. The poppet 118, fixed to the stem 119, is spring actuated to closing position against the seat 120 by means of the compression spring 121. The compression spring 121 is confined between the abutment collar 122, fixed to the stem 119, and the gland collar 123. The gland collar 123, together with the housing 124, encloses the packing 125 to prevent the escape of power fluid along the outside of the stem 119. The poppet 118 is provided with a concentric fluid passage 126 and a valve seat 127 positioned to receive the choke valve stem 128. The valve stem 128 is concentric with the valve stem 119 and is held in fixed position within the stem 119 by the screw threads 129. The closure cap 130 is provided upon the valve stem 119 for the purpose of closing the outer end of the bore therein.

Pressure of the power fluid in the line 56 from the port 52 of the valve cylinder 46 to the choke valve 116 lifts the poppet 118 away from its seat 120 against the action of the spring 121. This takes place during the power stroke of the head 54. Lifting of the poppet 118 from its seat 120 permits the power fluid to pass into the line 56' to the engine head 54.

On the power stroke of the head 53, which is the exhaust stroke of the head 54, the power fluid is exhausted into the line 56' and to the line 56 through the passage 126 in the poppet 118 to exhaust the engine head 54. In this manner the action of the engine head 53 in the downstroke of the mulehead 19 is resisted by the constriction of the passage between the valve stem 128 and its seat 127. Thus, the power of the downstroke of the mulehead 19 is opposed, and the sucker rod with the sucker attached thereto is able to drop of its own weight instead of being power driven down. The mulehead 19, therefore, does not override the sucker rod.

The valve 115 in the line 55 to the engine head

53 is adjusted in accordance with this opposition to the power stroke of the engine head 53, to regulate the speed of downward movement of the mulehead 19 in time with the movement of the sucker rod falling from its own weight. By this means, when the sucker reaches the extreme lowermost position of its stroke and the engine head 54 operates to lift the mulehead 19, there is no slack in the line comprising the sucker rod connecting the mulehead with the sucker. When the mulehead 19 begins to rise under power from the engine head 54, there is a uniform pull throughout the length of the sucker rod. There is no jerking in any portion of the length of the sucker rod such as would result from taking up of slack. Slack would develop if the downstroke of the mulehead 19 were to operate to push the sucker rod down, or if the weight of the sucker rod did not hang suspended from the mulehead during the downstroke. In the upstroke the passage of power fluid from the line 56 through the line 56' is not effected by the constriction between the stem 128 and its seat 127 because this constricted passage adds area to the passage between the poppet 118 and its seat 120.

The invention includes a means to shut off the pressure fluid automatically when the pump fails, as for example when there is a break in the sucker rod or somewhere between the mulehead and the subterranean pump. Attached to the base member 16 and projecting upwardly therefrom are the pair of upright support beams 96 held in position by the steadying beam 97 which projects from the upright beams 15 of the main support structure 14. The upright support 96 carries a socket 98 which comprises a housing for the compression spring 99 which backs the buffer button 100. The buffer button 100 is present to absorb the momentum of the counterweight 20 when the walking beam 17 completes a power stroke in the clockwise direction in Figure 1, and goes beyond the end of its normal stroke for any reason, for example, as when the pump fails in a manner as hereinbefore explained.

The buffer button has the stem 101 attached thereto which projects downwardly through the end wall of the socket 98 and into the guide tube 102. Extending through the tube from the opposite direction is the stem 103 held in place longitudinally of the guide tube 102 by the shear pin 104. The opposite end of the stem 103 is attached to the stem 105 of the cutoff valve 106 which, in the embodiment shown, constitutes a gate valve. The cutoff valve 106, it will be noted, is in the pressure line 50 of the expansion fluid. A housing 107 attached to the upright support 96 carries the guide tube 102 on one end and a guideway for the valve stem 105 on the opposite end. The housing 107 also supports the pivot bracket 108 which supports the counterweighted arm 109 linked thereto by linkage 111, from the extremity of the arm 109. The counterweighted arm 109 extends through the yoke 112 as a support, the yoke 112 being integral with the stem intermediate the valve stem end 105, and the shear pin end of the stem 103.

If, for some reason, the upstroke on the mulehead loses its resistance, as for example when the sucker rod parts, the counterweight 20 will make a greater downward stroke than is normal and will actuate the buffer pin 100 against the action of the spring 99 with much greater force than in a normal stroke. This force will be sufficient for the buffer pin stem 101 to engage and

actuate the valve operating stem 103 to shear the pin 104. Thereupon the weight 110 will operate to actuate the valve stem 105, to operate the cutoff valve 106. By this mechanism the engine ceases operating immediately upon failure of the pump, and no load operation of the engine 25 with consequent racing thereof and loss of power fluid is eliminated.

The mechanism described and shown in detail in the drawings represents one preferred embodiment of the invention. Obviously persons skilled in the art can modify the structure shown without departing from the spirit of the invention and accordingly the scope of the invention is not to be determined by the details of construction of the preferred embodiment disclosed, but by the accompanying claims.

What I claim is:

1. Mechanism for driving a walking beam or the like comprising, a reciprocating fluid expansion engine, a reciprocating piston rod in the engine, interconnection between the piston rod and the walking beam comprising a lever, a pivot carried by the lever, and intergearing between the pivot and the walking beam.

2. Walking beam drive mechanism and the like comprising, a reciprocating fluid expansion engine, including a plurality of engine heads, a distributing valve for distributing fluid to the respective engine heads in time with the operation of the engine, an inter-drive between the engine and the walking beam to drive the walking beam therefrom, said inter-drive comprising a primary drive member operated by the engine, a secondary drive member actuated by the primary drive member and a gear connection between the secondary drive member and the walking beam, and means connecting one of said drive members with the valve to operate the valve therefrom.

3. In a walking beam operating mechanism or the like, a reciprocating fluid expansion engine, inter-drive mechanism between the engine and the walking beam, comprising a primary drive member operated by the engine, a secondary drive member actuated by the primary drive member and a gear connection between the secondary drive member and the walking beam, a reciprocating valve operating mechanism including a lost motion delayed action device to operate the distributing valve.

4. A well pump drive mechanism comprising, a walking beam or the like, the walking beam comprising a mulehead and counterweight, a bumper for absorbing momentum of the counterweight at the completion of its stroke, a fluid expansion engine for driving the walking beam, a cutoff valve for the expansion fluid, and means to operate the cutoff valve automatically upon failure of the pump.

5. In a well pumping mechanism, a pump, a fluid expansion engine, inter-drive mechanism between the engine and the pump to operate the latter, a cutoff valve for the power fluid of the engine, and means to operate the cutoff valve automatically upon failure of the pump.

6. A well pump drive mechanism comprising a walking beam or the like, the walking beam comprising a mulehead and counterweight, a bumper for absorbing momentum of the counterweight at the completion of its downstroke.

7. A well pump driving mechanism comprising, a walking beam or the like, the walking beam comprising a mulehead and counterweight, a bumper for absorbing momentum of the counterweight at the completion of an abnormally long

downstroke, a fluid expansion engine driving the walking beam, a cutoff valve for the expansion fluid, and means to operate the cutoff valve automatically upon the counterweight making a bumper actuating stroke.

8. Reciprocating drive mechanism comprising, an oscillating driven member, a pivot therefor, a reciprocating engine, a reciprocating piston and rod in the engine, an inter-drive between the oscillating member and the piston rod, the inter-drive comprising a primary lever actuated by the piston rod, a pivot carried by the primary lever, a secondary lever fulcrumed on the pivot of the primary lever, a holding pin engaging one arm of the secondary lever, a driver gear segment carried by the other arm of the secondary lever, a gear segment driven by the driver gear segment, the driven gear segment being carried by the oscillating member and centered on the pivot thereof.

9. A mechanical movement comprising, a driven member, a pivot providing a center of oscillation for the driven member, a driven gear segment fixed to the driven member to oscillate therewith on its center, a driving lever arm pivoted on the driven member pivot, a pivot in the lever arm intermediate of its length, a driving gear segment mounted to oscillate on the pivot in the lever arm, and in mesh with the driven gear segment.

10. A mechanical movement comprising, an oscillating driven member, a driven gear segment fixed to the oscillating member to oscillate therewith, a driving lever arm pivoted within the curve of the driven gear segment, a pivot in the lever arm intermediate of its length, and a driving gear segment mounted to oscillate on the pivot of the driving lever and in mesh with the driven gear segment.

11. Reciprocating drive mechanism comprising, an oscillating driven member, a pivot therefor, a reciprocating engine, a reciprocating piston and rod in the engine, an inter-drive between the oscillating member and the piston rod, the inter-drive comprising a primary lever actuated by the piston rod, a pivot carried by the primary lever, a secondary lever fulcrumed on the pivot of the primary lever, a holding pin engaging one arm of the secondary lever, a driver gear segment carried by the other arm of the secondary lever, a gear segment driven by the driver gear segment, the driven gear segment being carried by the oscillating member and centered on the pivot thereof, means to adjust the position of the holding pin to vary the stroke of the oscillating member.

12. An oil well pumping mechanism comprising, an oscillating walking beam or the like, a pivot therefor, a reciprocating engine, a reciprocating piston and rod in the engine, an inter-drive between the oscillating walking beam and the piston rod, the inter-drive comprising a primary lever driven by the piston rod, a pivot carried by the primary lever, a secondary lever fulcrumed on the pivot of the primary lever, a holding pin engaging one arm of the secondary lever, a driver gear segment carried by the other arm of the secondary lever, a gear segment driven by the driver gear segment, the driven segment being carried by the oscillating walking beam and centered on the pivot thereof.

13. A reciprocating drive mechanism compris-

ing an oscillating driven member, a double-acting reciprocating fluid expansion engine, a piston and rod in the engine, two heads in the engine, a reciprocating distributing valve for distributing fluid to the respective engine heads in time with the operation of the engine, a reciprocating rod for operating the valve, an inter-drive between the piston rod and the oscillating member for driving the oscillating member from the engine, and means connecting said inter-drive with the reciprocating rod of the distributing valve for operating the distributing valve.

14. A reciprocating driving mechanism comprising, an oscillating driven member, a double-headed, double-acting reciprocating fluid expansion engine, a piston and rod in the engine, a distributing valve mechanism for distributing fluid to the respective engine heads in time with the operation of the engine, the distributing valve mechanism comprising companion ports for the respective heads of the engine, valves for the respective ports, a common valve stem for interconnecting the valves to time the opening of each port with the closing of the other, an inter-drive between the piston rod and the oscillating member for driving the oscillating member from the engine, an inter-drive between the oscillating member and the valve stem to operate the valve from the oscillating member.

15. A reciprocating driving mechanism comprising, an oscillating driven member, a double-headed, double-acting reciprocating fluid expansion engine, a piston and rod in the engine, a distributing valve for distributing fluid to the respective engine heads in time with the operation of the engine, the distributing valve comprising companion ports for the respective heads of the engine, valves for the respective ports, a common valve stem for interconnecting the valves to time the opening of each port simultaneously with the closing of the other, an inter-drive between the piston rod and the oscillating member for driving the oscillating member from the engine, an inter-drive between the oscillating member and the valve stem to operate the valve from the oscillating member, a quick action member to actuate the valve stem over-driving the inter-drive between the oscillating member and the valve stem.

16. A reciprocating driving mechanism, comprising an oscillating driven member, a double-headed, double-acting reciprocating fluid expansion engine, a piston and rod in the engine, a distributing valve for distributing fluid to the respective engine heads in time with the operation of the engine, the distributing valve comprising companion ports for the respective heads of the engine, valve for the respective ports, a common valve stem for interconnecting the valves to time the opening of each port simultaneously with the closing of the other, an inter-drive between the piston rod and the oscillating member for driving the oscillating member from the engine, an inter-drive between the oscillating member and the valve stem to operate the valve from the oscillating member, delayed action mechanism in the inter-drive between the oscillating member and the valve stem to time the valve operation with completion of the stroke of the oscillating member.

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