

June 13, 1944.

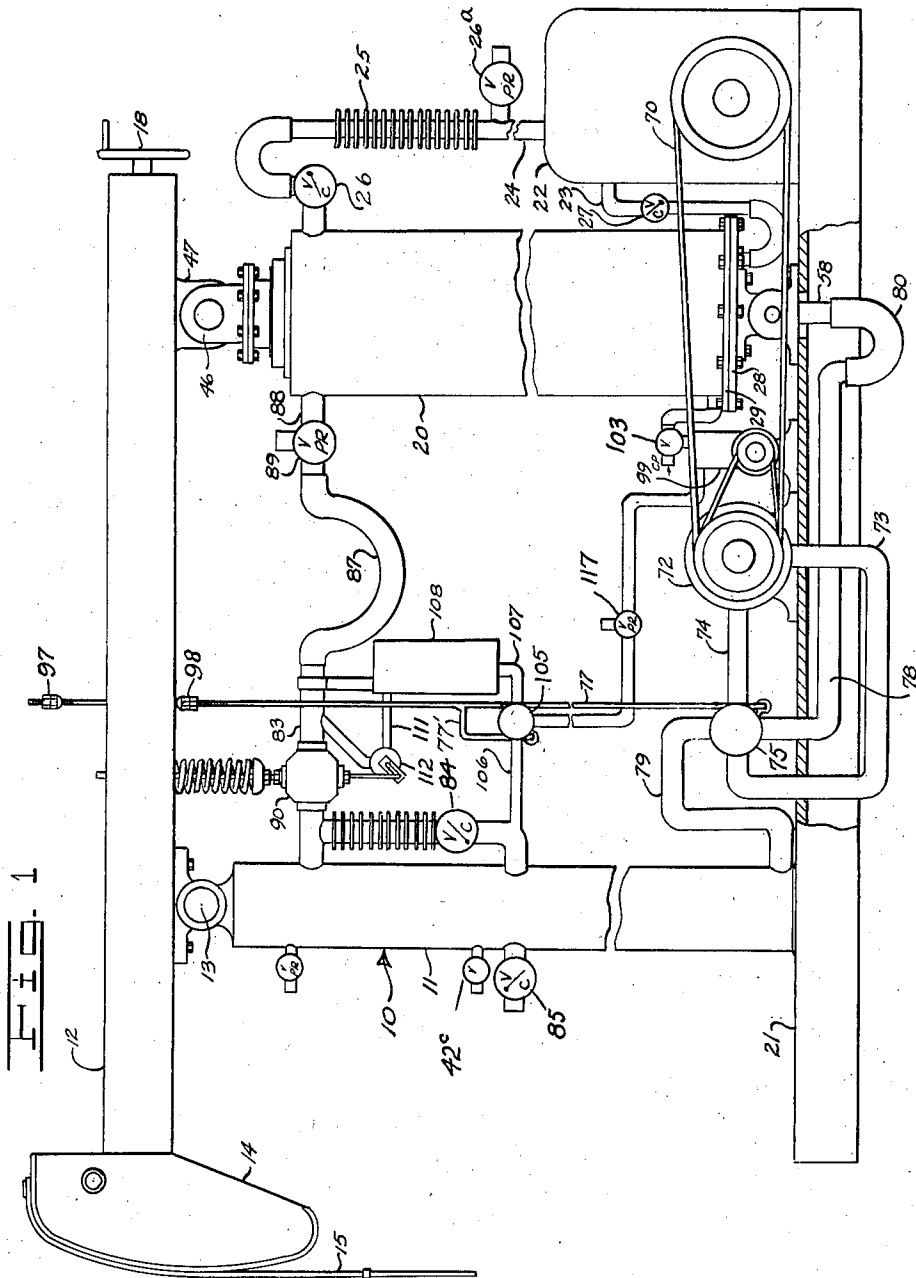
C. R. BUCHET

2,351,398

HYDROVACUUMATIC BALANCE

Filed Dec. 29, 1941

6 Sheets-Sheet 1



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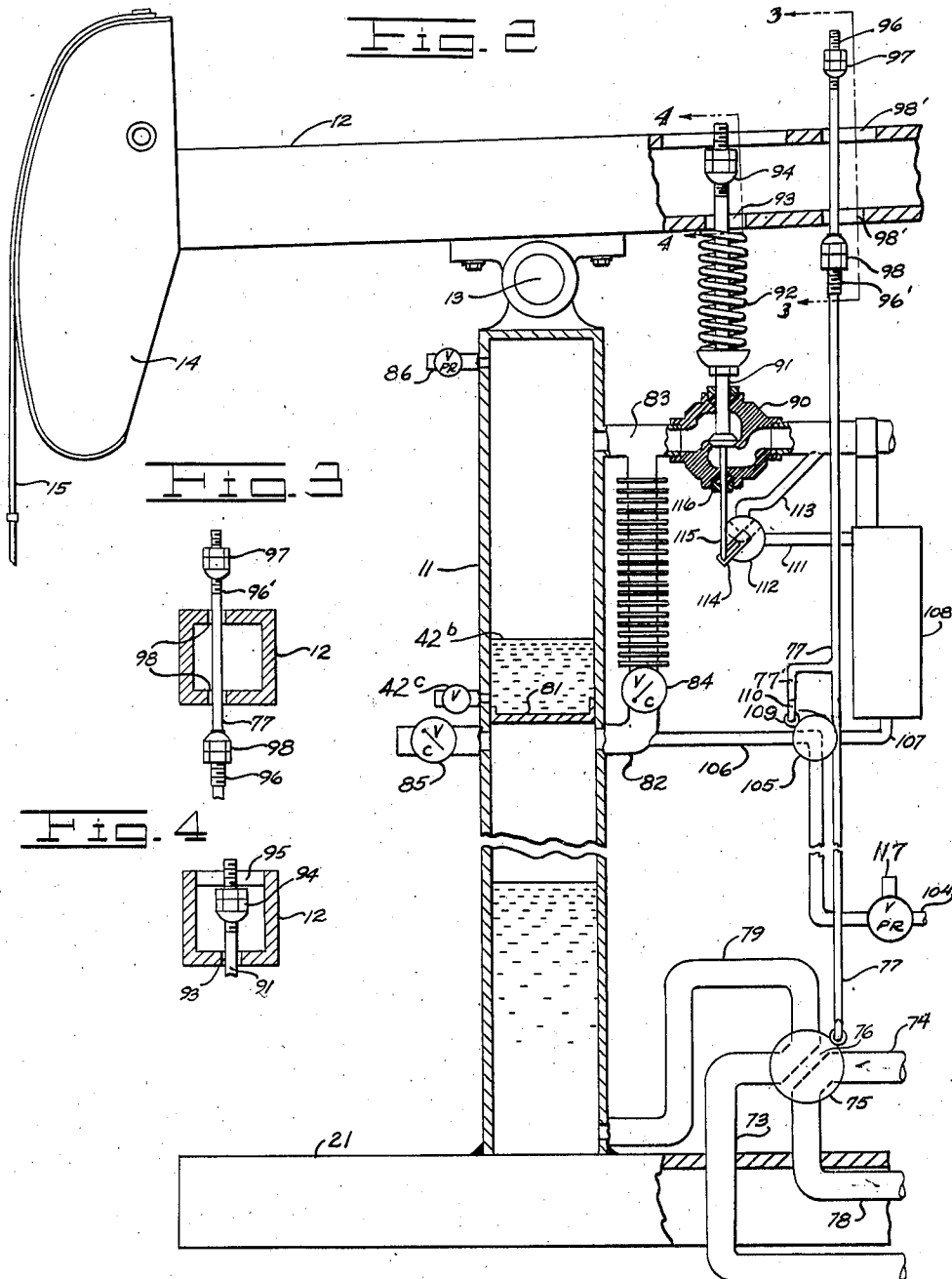
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6 Sheets-Sheet 2



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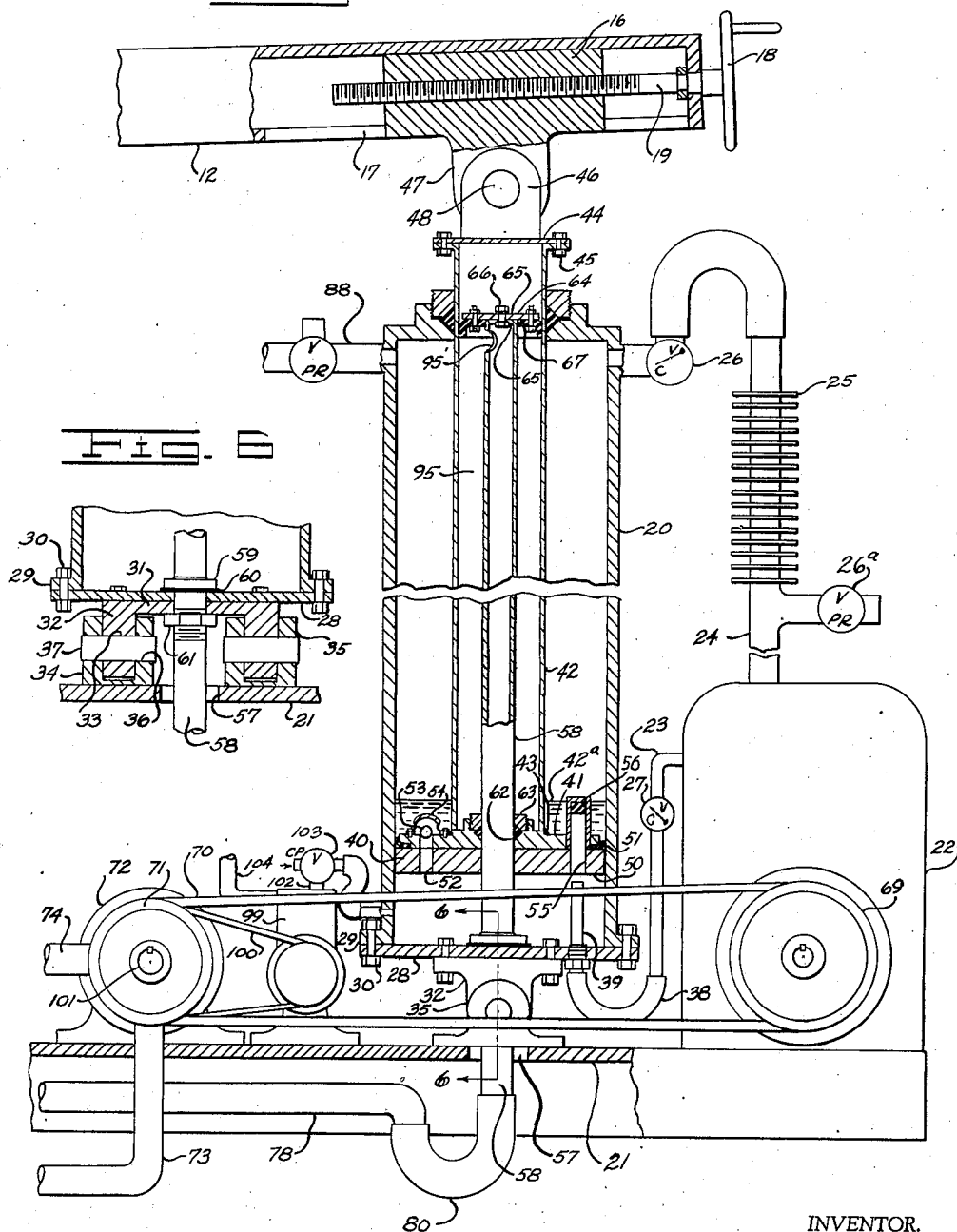
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HYDROVACUUMATIC BALANCE

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Fig. 5



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HYDROVACUUMATIC BALANCE

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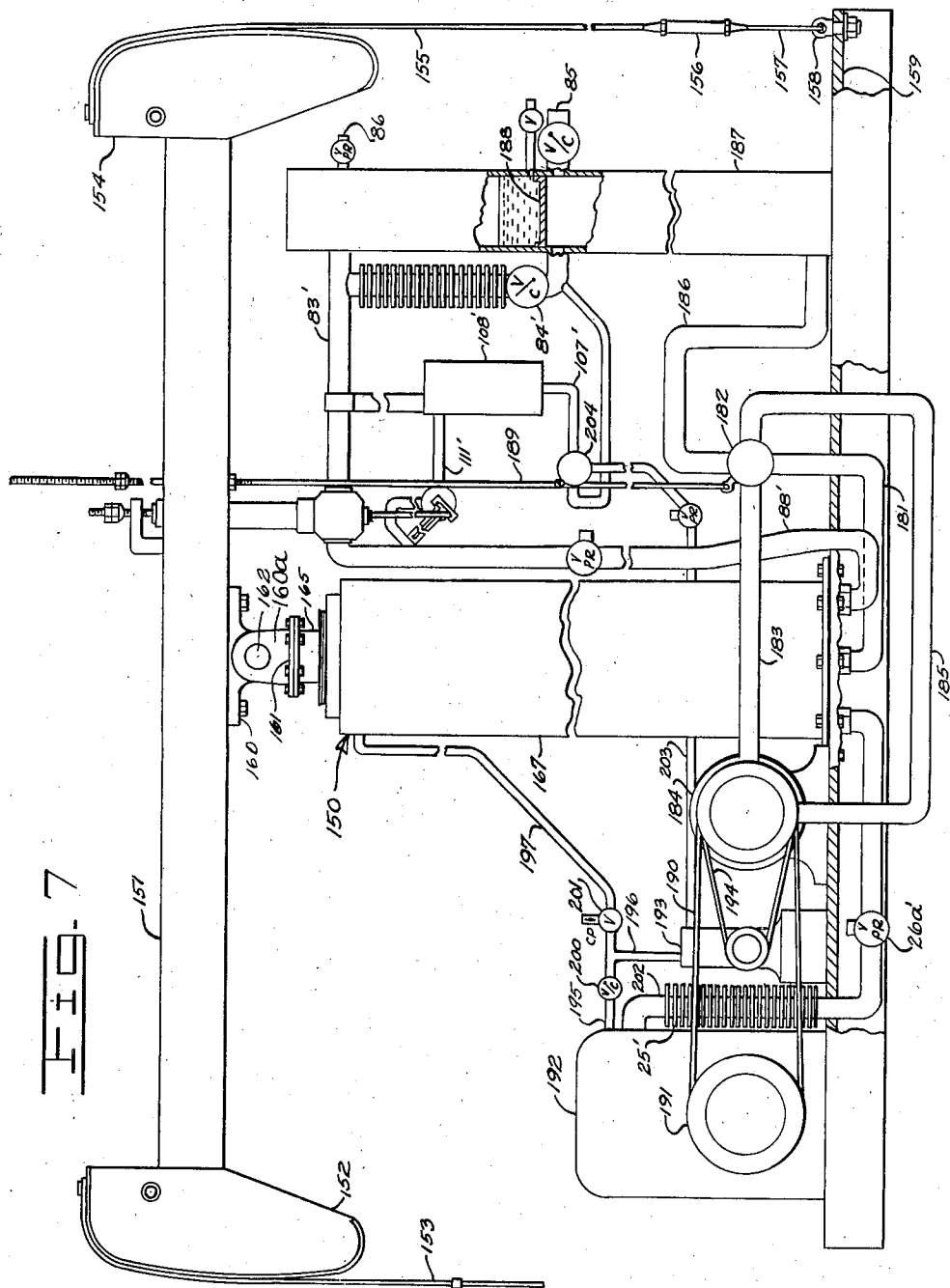


FIG. 7

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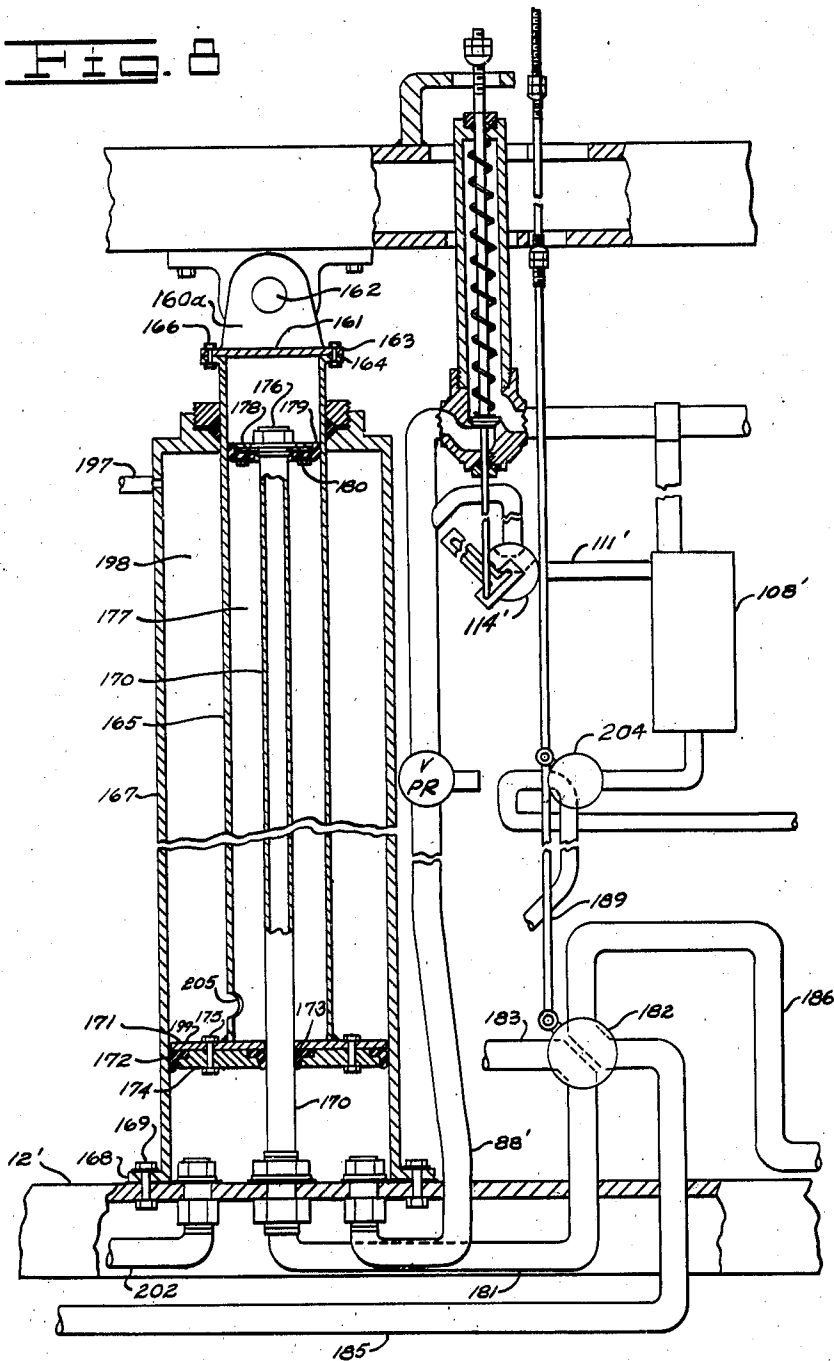
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HYDROVACUUMATIC BALANCE

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6 Sheets-Sheet 5

FIG. 5



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HYDROVACUUMATIC BALANCE

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FIG. 9

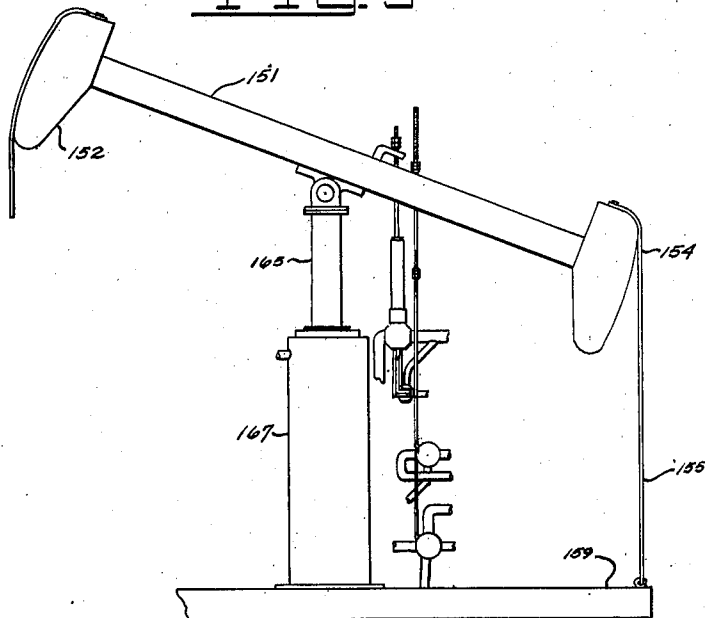
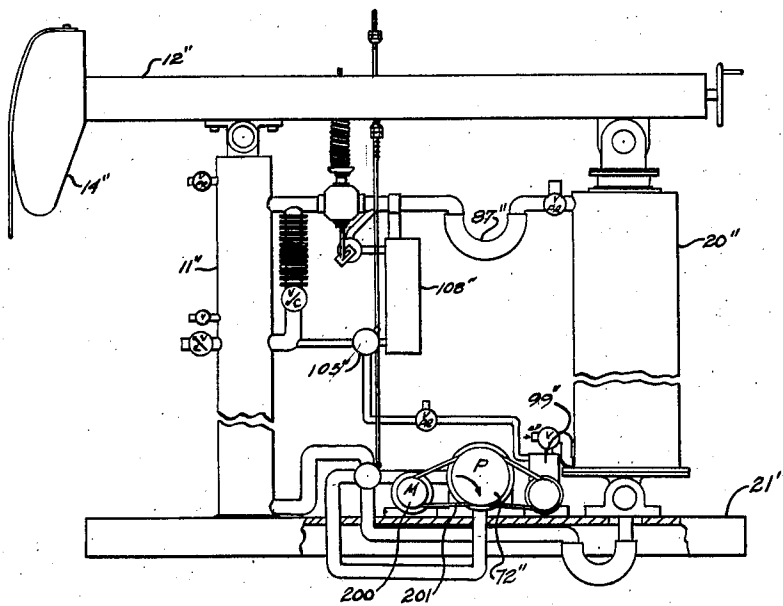


FIG. 10



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2,351,398

HYDROVACUUMATIC BALANCE

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Application December 29, 1941, Serial No. 424,761

4 Claims. (Cl. 60—51)

This invention relates to hydrovacuumatic balances.

The general object of the invention is to provide a novel balance or lifting member which is particularly adapted for use in pumping wells such as oil wells.

A more specific object of the invention is to provide a novel cylinder apparatus which is particularly adapted for reciprocating the walking beam of a pump jack.

Another object of the invention is to provide a well pumping apparatus wherein a walking beam supported by a hollow Samson post is employed and wherein the beam is reciprocated by a piston and cylinder construction which is actuated by fluid which passes to and from the interior of the Samson post during the pumping operation.

Another object of the invention is to provide a novel Samson post for an oil well pumping apparatus.

Another object of the invention is to provide a cylinder construction for operating a walking beam, wherein the cylinder is actuated by different fluids under pressure.

A further object of the invention is to provide a cylinder construction for operating a pump jack walking beam and wherein the device may be operated by liquid under pressure, and/or compressed air and/or by a partial vacuum, all acting simultaneously.

A further object of the invention is to provide a pump jack including an operating member operable by liquid under pressure and wherein a continuously moving pump is employed to move the fluid to and from the operating member.

Another object of the invention is to provide a pump jack including a liquid operated cylinder and piston device, whereby liquid is pumped to and from the device and wherein the movement of the liquid serves to compress a fluid which aids in the pumping operation.

Another object of the invention is to provide a novel valve control for operating a hydraulic actuated cylinder member.

Other objects and advantages of my invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is a side elevation partly in section showing a well pumping apparatus embodying the features of my invention;

Fig. 2 is a side elevation partly in section on an enlarged scale showing the sucker rod operating end of the apparatus;

Fig. 3 is a section taken on line 3—3 of Fig. 2; Fig. 4 is a section taken on line 4—4, Fig. 2; Fig. 5 is a view similar to Fig. 3 showing the operating end of the apparatus;

Fig. 6 is a section taken on line 6—6, Fig. 5; Fig. 7 is a side elevation partly in section showing a modification of my invention;

Fig. 8 is a sectional view partly in elevation showing a piston construction;

Fig. 9 is a side elevation with parts broken away showing the modification in another position; and

Fig. 10 is a side elevation showing a further modification.

Referring to the drawings by reference characters, I have shown my invention as embodied in an oil well pumping device which is indicated generally at 10. As shown, the device includes a supporting Samson post 11 which pivotally supports a walking beam 12 on a pivot 13. The walking beam includes a saddle 14 which supports a cable 15 which is adapted to be connected to the polish rod of an oil well pump.

At the end of the walking beam, which is remote from the saddle 14, I provide a nut member 16 which is slidably mounted on ways 17 on the walking beam and is movable by means of a hand wheel 18 operating a screw 19 which engages the nut member 16.

Beneath the member 16, I arrange a large cylinder 20. The entire apparatus is shown as mounted on a base 21 which supports an engine, such as an internal combustion engine, 22. The intake manifold of the engine 22 between the carburetor and the engine communicates through a conduit 23 with the lower portion of the cylinder 20 while the exhaust from the engine 22 communicates through a conduit 24 with the upper portion of the cylinder.

The conduit 24 includes a cooling fin 25 and a check valve 26 which permits passage of exhaust gas through the conduit 24 to the cylinder 20 but which prevents passage from the cylinder 20 back to the conduit 24. The conduit 24 also includes a safety valve 26^a which bleeds the conduit 24 to the atmosphere when the pressure in this conduit rises above a predetermined figure.

The conduit 23 includes a check valve 27 which permits flow to the engine but prevents flow from the intake manifold. The detailed construction of the valves mentioned form no part of the present invention, since valves of the character mentioned are old and well known.

The construction is such that when the engine 22 is operating a partial vacuum is produced in

the lower portion of the cylinder 20 and at the same time heated products of combustion under pressure are introduced into the upper portion of the cylinder 20 through the conduit 14. If the pressure in the upper portion of the cylinder becomes excessive, it is relieved through the valve 26^a.

In order that the cylinder 20 may pivot during its slight forward and backward movement, the cylinder is provided with a lower closure 28 which engages a flange 29 on the cylinder and is held in place by bolts 30 (see Fig. 6). The closure 28 includes a plate 31 having a pair of depending ears 32, which are apertured as at 33. The base 21 includes stirrup members 34 which include spaced arms 35 receiving the ears 32. The arms 35 include apertures 36 and in the apertures 33 and 36 I arrange pins 37 which serve to pivotally support the cylinder 20.

To accommodate movement of the cylinder 20, the conduit 23 includes a flexible portion 38 which communicates with an inlet nozzle 39 to the cylinder 20.

Mounted within the cylinder 20, I show a piston construction which is indicated generally at 40. As shown, the construction includes a piston head portion 41 and a tubular piston rod portion 42 welded thereto as at 43. The upper end of the tubular portion 42 is provided with a closure 44 which is held in place as by bolts 45. The closure 44 includes ears 46 which receive an arm 47 shown as integral with the sliding nut 16. A pin 48 pivotally connects the members 46 and 47.

The piston head 41 is provided with a face portion 50 which engages a peripheral packing 51 so that a tight joint is provided. The piston includes a hole 52 which is shown as closed by a one way ball valve 53 which is provided with an apertured guard cap 54.

In operation, when the piston 40 moves to a location adjacent to the lower end of the cylinder 20, surplus liquid in the lower portion of the cylinder will pass through the hole 52 into the upper portion of the cylinder.

In order to prevent liquid in the lower portion of the cylinder from entering the nozzle 39, the latter is shown as extended upwardly into the cylinder and thus its upper end is above the level of any liquid which might be in the lower end of the cylinder. A recess 55 in the lower end of the piston receives the projecting portion of the conduit nozzle 39. A gasket 56 which may be made of soft material and arranged in the recess 55 closes the end of the nozzle when the piston is in the fully lowered position. This prevents liquid from splashing into the nozzle end.

The base 21 is apertured at 57 (Fig. 6) to receive a hollow column 58 which extends into the cylinder 20. In order to support this column fixed with respect to the cylinder 20, the column is provided with a collar 59 which engages a gasket 60. A nut 61 threaded onto the column 58 serves to hold the parts assembled.

The column 58 is spaced from the tubular member 42 and passes through an aperture 62 in the piston head portions 41 and 50. A packing gland 63 on the piston serves to provide a tight joint. The upper end of the hollow column 58 has a closure 64 thereon on which a piston head 65 is secured as by bolts 66. A packing member 67 is provided on the piston head 65 and slidably engages the interior of the tubular member 42.

As shown, the engine 22 drives a V-belt pulley 69 which through the belt 70 drives a pulley 71 on a pump 72. This pump 72 has its inlet con-

nected to a conduit 73, while its outlet is connected to a conduit 74.

The conduits 73 and 74 are connected to a four-way valve 75. The valve includes a valve member 76 adapted to be rocked by a rod 77 to be presently described. The valve 75 includes four ports one of which communicates with the conduit 73 and another of which communicates with the conduit 74, the third port communicates with a conduit 78 and the other port communicates with a conduit 79. The conduit 78 is connected by means of a flexible conduit 80 with the lower portion of the column 58, previously described.

The conduit 79 communicates with the lower portion of the hollow Samson post 11. The Samson post includes a transverse partition 81 and beneath the partition includes a pipe 82 which communicates with a pipe 83 the latter communicating with the interior of the Samson post above the partition 81. The pipe 82 includes a check valve 84 which permits upward flow of fluid but prevents downward flow. The Samson post just below the partition 81 contains a check valve 85 which permits flow of air into the Samson post but prevents flow therefrom. Above the partition 81, the Samson post includes a pressure operated safety valve 86 which relieves excessive pressure within the Samson post.

The pipe 83 communicates with a flexible tube 87 which in turn communicates with a pipe 88 which communicates with the upper portion of the cylinder 20. The pipe 88 includes an overload, safety valve 89 which opens under excessive pressure in the pipe 88.

The pipe 83 includes a valve 90 which includes a valve stem 91 which extends upwardly. The valve stem 91 is normally urged to valve closing position by a spring 92. The valve stem passes through a slot 93 in the walking beam 12 and the valve is adapted to be moved from its seat by a nut 94 threaded onto the stem 91. The stem 91 and nut 94 pass through a hole 95 in the walking beam. The construction is such that the valve 90 is normally closed.

When the walking beam 12 approaches its extreme upper position, the walking beam engages the nut 94 and lifts the valve stem 91, thus opening the valve 90 and allowing passage from the upper portion of the Samson post through the pipes 83, 87 and 88 to the cylinder 20 so that fluid under pressure in the upper portion of the Samson post will pass to the space between the tubular member 42 and the cylinder 20 and will act upon the portion of the piston 40 which is exposed in the space mentioned and thus will urge the piston downwardly.

The system including the lower portion of the Samson post, the pipes 73, 74, 78 and 79, the valve 75, pump 72, hollow column 58 and space 95 between the hollow column 58 and the tubular member 42 contain a liquid such as oil. A hole 95' affords communication to the space 95 and the relation of the various parts and the amount of oil in the system is such that when the pump 72 operates and the rod 77 is actuated up and down, oil will be pumped from the Samson post to the space 95 and vice versa. When the oil is pumped into the space 95 it acts upon the portion of the piston 41 which is aligned with the space 95, thus forcing the piston downwardly. As the piston moves downwardly, it moves the tubular member 42 downwardly thus rocking the walking beam and pulling the cable upwardly.

The rod 77 extends upwardly and across the

walking beam 12 and the upper end is threaded as at 96 and 96' and receives an upper nut 97 and a lower nut 98 thereon. The nuts 97 and 98 are spaced apart and the portion between the threads 96 and 96' passes through aligned slots 98' in the walking beam. As a result of the construction, when the connecting beam approaches the maximum lift of the cable 15, the walking beam will engage the nut 98 and push the rod 77 downwardly thus reversing the direction of flow through the valve 76.

When the walking beam approaches the position of maximum lowering of the cable 15, the walking beam will engage the nut 97 and thereby reverse the direction of flow through the valve 75.

As a result of this construction, the liquid in the lower portion of the Samson post will be forced to and from the space 95 as described. The amount of liquid which is preferably oil, in the system will be such that when the pump is operating to transfer liquid to the Samson post, and the liquid is rising in the Samson post, the maximum height of liquid will preferably be just below the location where the conduit 82 enters the Samson post just below the partition 81.

As the liquid rises in the Samson post, the valve 90 being closed, the air above the liquid in the Samson post is compressed and is not released until the valve 90 is opened by the engagement of the nut 94 with the walking beam at which time the air which has been compressed in the Samson post passes from the valve 90 through the tube 87 and pipe 88 and into the cylinder 20 where it reacts downwardly against the exposed portion of the piston 42. At the same time liquid is being forced into the space 95 and is also engaging a portion of the piston 42 to move the latter downwardly and thereby the sucker rod and the oil in the well are raised.

The lower face of the piston 40 in the cylinder 20 while this is occurring is subject to the partial vacuum in the cylinder which partial vacuum has been produced partially by the movement of the piston in the cylinder and partially by the action of the engine 22 in withdrawing air through the conduit 23. The action of the compressed air not only increases the efficiency of the apparatus, but it also tends to cushion the effect caused by the pumping of the oil from the container to the cylinder and vice versa. This oil is under considerable pressure and as it is not compressible, there is an interval when the valve member 76 changes its position from one direction to another during which more or less strain is thrown upon the operating parts and with the air cushion, not only is this strain somewhat relieved, but some lifting effect is produced from the compressed air which has reduced the strain.

In order that the amount of compressed air available to pass into the cylinder 20 may be increased I show an air compressor 99 which is driven by a V-belt 100 from a pulley 71 shown as mounted on the shaft 101 of the pump 72. The air compressor has its inlet conduit 102 communicating with the lower portion of the cylinder 20. The conduit 102 includes a one way valve 103 which opens when the partial vacuum in the lower portion of the cylinder increases above a desired amount and allows the compressor to draw air directly from the atmosphere. The outlet 104 from the compressor communicates with a valve 105 which valve permits flow to a pipe 106 which leads to the pipe 82 on the Samson

post below the partition 81 or with a pipe 107 which discharges into a compressed air receiver 108. The valve includes an operating portion 109 which is operated by a pin 110 on an arm 77' which is arranged on the rod 77 previously described. The construction is such that as the liquid level in the Samson post is being lowered, the valve 105 will direct compressed air from the pipe 104 through the pipe 106 in the Samson post and will react upon the liquid therein tending to thereby force the liquid from the Samson post.

When the valve 76 is reversed by the rod 77 and the liquid is caused to rise in the Samson post, the valve 105 will also be reversed and will cut off the pipe 104 from the pipe 106 and place it in communication with the receiver 108 so that air pressure is stored in the receiver 108.

The receiver 108 has an outlet 111 which communicates through a valve 112 with the pipe 113 which extends to the pipe 83. The valve 112 includes an operating portion 114 which is connected to the lower portion 115 of the stem 91 of the valve 90 so that when the valve 90 is operated, the valve 112 will also be operated. A suitable packing gland 116 on the valve 90 prevents leakage about the stem 115.

The construction is such that when the valve 90 releases the air compressed in the upper portion of the Samson post, the valve 112 will release the air in the tank 108 and this air will pass through the pipe 113 into the pipe 83 where it will be free to enter the cylinder 20 to thus aid in pushing down the piston. The pipe 104 includes a safety valve 117 which opens to the atmosphere when pressure in the pipe 104 becomes excessive.

Above the piston head 40 and between the outer cylinder 20 and the tubular piston 42, a liquid such as oil is provided to serve as a lubricant and also as a seal. The upper level of this liquid is indicated at 42^a. In the Samson post liquid such as oil, is maintained above the partition 81. The upper surface of this liquid is indicated at 42^b. A drain valve 42^c is provided in the Samson post above the partition 81.

In the operation of the device, when the motor 22 is operated the intake to the motor causes a partial vacuum to be produced in the lower end of the cylinder 20 while the products of combustion from the motor pass to the upper portion of the cylinder. Thus the piston 40 is urged downwardly in the cylinder 20. At the same time, the pump 72 is operated and liquid is pumped back and forth between the space 95 (between the column 58 and the tubular member 42) and the lower portion of the Samson post. This liquid acts upon the top of the inner portion of the piston head 41 and urges the same downwardly.

The liquid in the Samson post compresses air below the partition 81 and this compressed air finds its way to the upper portion of the cylinder 20. Air is also compressed by the compressor 99 and this compressed air (when the liquid level is falling in the Samson post) enters the Samson post and thus increases the action of the pump 72. At another time the compressed air of the compressor 99 enters the container 108 to be released therefrom so that it may act upon the upper surface of the piston 41 as previously described.

In Figs. 7, 8 and 9 inclusive, I show a modification of my invention which is indicated generally at 150. In this modification, the walking beam 151 is provided at one end with a saddle 152

engaging a cable 153 which is adapted to be connected to the polish rod of the well pump. At its other beam, the walking beam is provided with a saddle 154 over which a cable 155 extends. This cable 155 is connected by a turnbuckle 156 to a cable 157 which is anchored in an eye member 158 secured to the base 159 of the apparatus. The cable 155 is substantially vertical.

The walking beam 151 includes a bracket 160 which is connected to an ear 160^a on a closure member 161 by a pin 162. The closure member 161 includes a flange 163 connected to a flange 164 of a tubular member 165 as by bolts 166.

The tubular member 165 is arranged in a cylinder 167. The tubular member 165 is similar to the tubular member 42 previously described and the cylinder 167 is similar to the cylinder 20 previously described. The cylinder 167 is secured to the base 12 by a flange 168 and bolts 169.

Within the cylinder 167 and within the tubular member 165 I show a column 170 which is similar to the column 58 previously described. The tubular member 165 includes a piston head 171 with annular packing member 172 and 173 therein which engage the inside of the cylinder 167 and the outside of the column 170 respectively. The packing members 172 and 173 are held in place by a clamping plate 174 which is secured to the piston 171 by bolts 175. The column 170 is open at its upper end as at 176 and beneath the open end includes a piston head 178 and a packing 179 held on the piston head by bolts 180.

The column 170 is connected by a conduit 181 with a valve 182 which is similar in all respects to the valve 75, previously described. The valve 182 communicates through a conduit 183 with a pump 184. The pump communicates with a conduit 185 which also communicates with the valve 182. The conduit 183 constitutes the pump outlet and the conduit 185, the pump inlet.

The valve 182 communicates through a conduit 186 with the lower portion of a container 187 which container is similar to the hollow Samson post previously described. The container 187 includes a partition 188.

When the valve 182 is in the position shown in Figs. 7 and 8, liquid is drawn from the container 187 through conduit 186, valve 182, conduit 185, pump 184, conduit 183, valve 182, conduit 181 and into the column 170, whence the liquid acts upwardly against the end closure 161 thus urging the walking beam upwardly.

When the valve 182 is rocked by the rod 189 flow of liquid proceeds downwardly through the column 170, conduit 181, valve 182, conduit 183, pump 184, conduit 185, valve 182, conduit 186 and into the container 187 where air above the entering liquid is compressed.

The pump 184 is driven by a belt 190 from a pulley 191 driven by a motor 192.

An air compressor 193 is driven by a belt 194. The intake pipe 195 of the engine and the intake 196 of the compressor communicate with a pipe 197 which opens into the upper portion of the cylinder 167, so that a partial vacuum is created in the space 198 between the tubular member 165 and the inner wall of the cylinder 167. This partial vacuum acts upon the top portion 199 of the piston head 171 thus tending to raise the piston head and the tubular member 165. The intake pipe 195 includes a check valve 200 which prevents passage outwardly from the engine while the pipe 197 contains a valve 201 which opens when the partial vacuum in the

pipe 197 drops below a predetermined amount.

The motor exhaust pipe 202 communicates with the lower portion of the cylinder 167 and delivers the heated products of combustion into the lower portion of the cylinder and the pressure of these gases aids in forcing the piston 171 upwardly.

The outlet pipe 203 from the compressor communicates with a valve 204 which is similar to the valve 105 previously described. The valve 204 is part of a system which is similar to the system shown in the embodiment first described and in this modification similar parts have been designated by similarly primed reference numerals.

In the operation of the device in the modification, when the motor 192 is started, the pump 184 and the compressor 193 are actuated. Liquid, which is in the system which includes the valve 182, is pumped back and forth between the interior of the upper end of the tubular member 165 and the lower portion of the container 187. During this operation air is compressed in the upper portion of the lower part of the container 187 beneath the partition 188 and is periodically discharged into the lower portion of the cylinder 167 through the conduit 88'. Air from the compressor is also periodically discharged from the tank 108' through the same conduit 88'. Exhaust gases from the engine 192 are also discharged into the lower portion of the cylinder 167. At the same time a partial vacuum is created in the upper portion of the cylinder so that all of these fluids serve to raise the tubular member 165 and thus lift the pin 162 to thereby rock the walking beam 151. The lengths of the parts as shown in Figs. 7, 8 and 9 are such that the lift of the cable 153 is substantially twice the movement of the tubular member 165, so that my modified structure produces a long stroke pumping effect. To subject the space 177 to a partial vacuum, the tubular member includes a hole 205 in the lower portion thereof.

In Fig. 10 I show a further modification of my invention. The further modification is similar to the modification disclosed in Figs. 1 to 6 inclusive and described above. In the further modification similar parts are designated by similar double primed reference characters. In the further modification the engine 22 is omitted and in place thereof I show an electric motor 200. This motor by means of a belt 201 drives the pump 72'.

Having thus described my invention, I claim:

1. In a well pumping device, a hollow tubular supporting post, a walking beam pivotally mounted intermediate its length on the post, a substantially vertical cylinder adjacent to one end of the beam, a piston slidably mounted in the cylinder, said piston including a head portion within the cylinder and a tubular portion, said tubular portion being spaced from the cylinder and projecting beyond the upper end of the cylinder, the upper end of the tubular portion being closed, means pivotally connecting the projecting portion to the walking beam, a hollow column in the piston tubular portion and spaced therefrom, means to support the hollow column, said column having a closure at the upper end thereof, said closure including a head portion which slidably receives said piston tubular portion, said closure being spaced from the upper end of the tubular portion, said column having an outlet to the space between the column and the piston tubular portion, conduit means connecting the interior of said column

and the lower portion of said post, said conduit means including a pump and a four way valve, means operated by the walking beam to actuate the four way valve so that fluid is alternately moved from the post to the column and vice versa, means whereby passage of fluid into the post compresses air in the upper portion of the post, pipe means to direct air compressed in the upper portion of the post to the upper portion of the cylinder, a valve in said pipe means and means operated by the walking beam to actuate said last mentioned valve, a source of suction, and means to connect the portion of said cylinder below the piston to the source of suction.

2. In a well pumping device, a hollow tubular supporting post, a walking beam pivotally mounted intermediate its length on the post, a substantially vertically arranged cylinder adjacent to one end of the beam, means to pivotally support the lower end of the cylinder, a piston slidably mounted in the cylinder, said piston including a head portion and a hollow piston rod, said rod being spaced from the cylinder, said hollow piston rod projecting above said cylinder, a closure on the upper end of the piston rod, means pivotally connecting said piston rod to the walking beam, a hollow, fixed column arranged in the piston rod and spaced therefrom, a piston head mounted on said hollow column, said piston head working in said hollow piston rod, said column having an outlet to the space between the column and the hollow piston rod, a container, a conduit connecting the interior of said column and said container, means communicating with said conduit to alternately move fluid from the container to the interior of the column and vice versa, means whereby passage of fluid into the container compresses air in the upper portion of the container, means to convey air compressed in the upper portion of the container to the space between the hollow piston rod and the cylinder and means to force fluid under pressure into the space between the piston rod and the cylinder.

3. In a well pumping device, a hollow tubular supporting post, a walking beam pivotally mounted intermediate its length on the post, a substantially vertically arranged cylinder adjacent to one end of the beam, said cylinder having a closure at the upper end thereof, said cylinder having a closure at the lower end thereof, means engaging the lower end closure to pivotally support the cylinder, a piston slidably mounted in the cylinder, said piston including a head portion within the cylinder and a tubular portion projecting upwardly from the piston and spaced from the cylinder, said upper end cylinder closure having a central aperture, the projecting portion of said tubular member extending through said aperture,

means closing and connecting the upper end of said projecting portion to the walking beam, a hollow column in the tubular piston portion and spaced therefrom, said column having a closure on the upper end thereof, a piston head mounted on said column closure, said piston head working in said piston tubular portion, said column closure being spaced from the upper end closure of the tubular portion, said column having an open outlet to the space between the column and the piston tubular portion, a container, a conduit connecting the interior of said column and said container, means communicating with said conduit to alternately move fluid from the container to the interior of the column and vice versa, and means to force fluid under pressure into the space between the tubular portion and the cylinder.

4. In a well pumping device, a hollow tubular supporting post, a walking beam pivotally mounted intermediate its length on the post, a substantially vertically arranged cylinder adjacent to one end of the beam, said cylinder having a closure at the upper end thereof, said cylinder having a removable closure at the lower end thereof, means engaging the removable closure to pivotally support the cylinder, a piston slidably mounted in the cylinder, said piston including a head portion within the cylinder, and a tubular portion projecting upwardly from the piston, said tubular portion being spaced from the cylinder, said upper end cylinder closure having a central aperture, the projecting portion of said tubular member extending through said aperture, a closure on the upper end of the projecting portion of the tubular member, means pivotally connecting said upper end tubular portion closure to the walking beam, a hollow column in the tubular piston portion and spaced therefrom, said removable closure having an aperture through which said column extends, said column having a closure on the upper end thereof, a piston head mounted on said column closure, said piston head working in said piston tubular portion, said column closure being spaced from the upper end closure of the tubular portion, said column having an open outlet to the space between the column and the piston tubular portion, a container, a conduit connecting the interior of said column and said container, means communicating with said conduit to alternately move fluid from the container to the interior of the column and vice versa, means to convey air compressed in the upper portion of the container to the space between the tubular portion and the cylinder and means to force fluid under pressure into the space between the tubular portion and the cylinder.

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