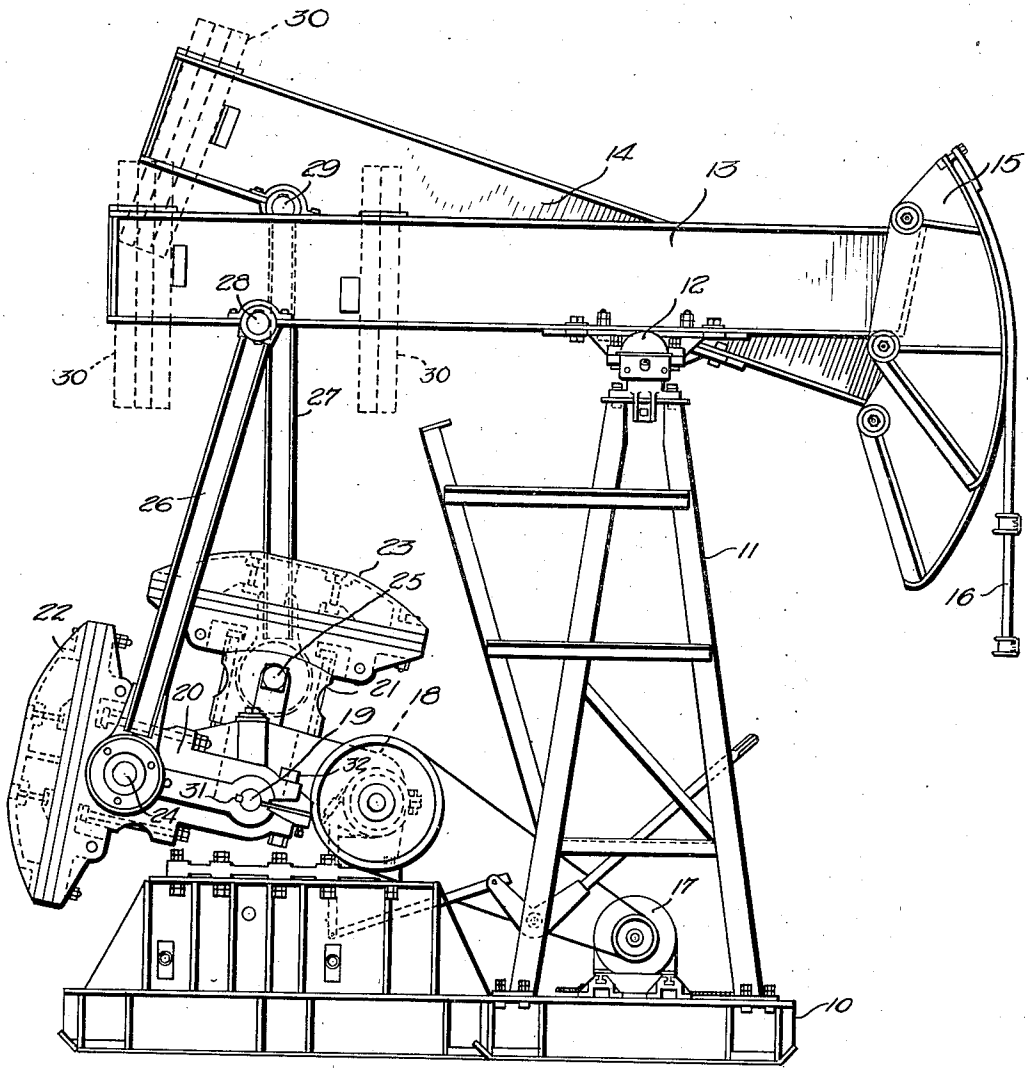
Dec. 9, 1941. J. A. LYNE 2,265,379

PUMPING MECHANISM

Filed July 26, 1939 3 Sheets-Sheet 1

Fig. 1.



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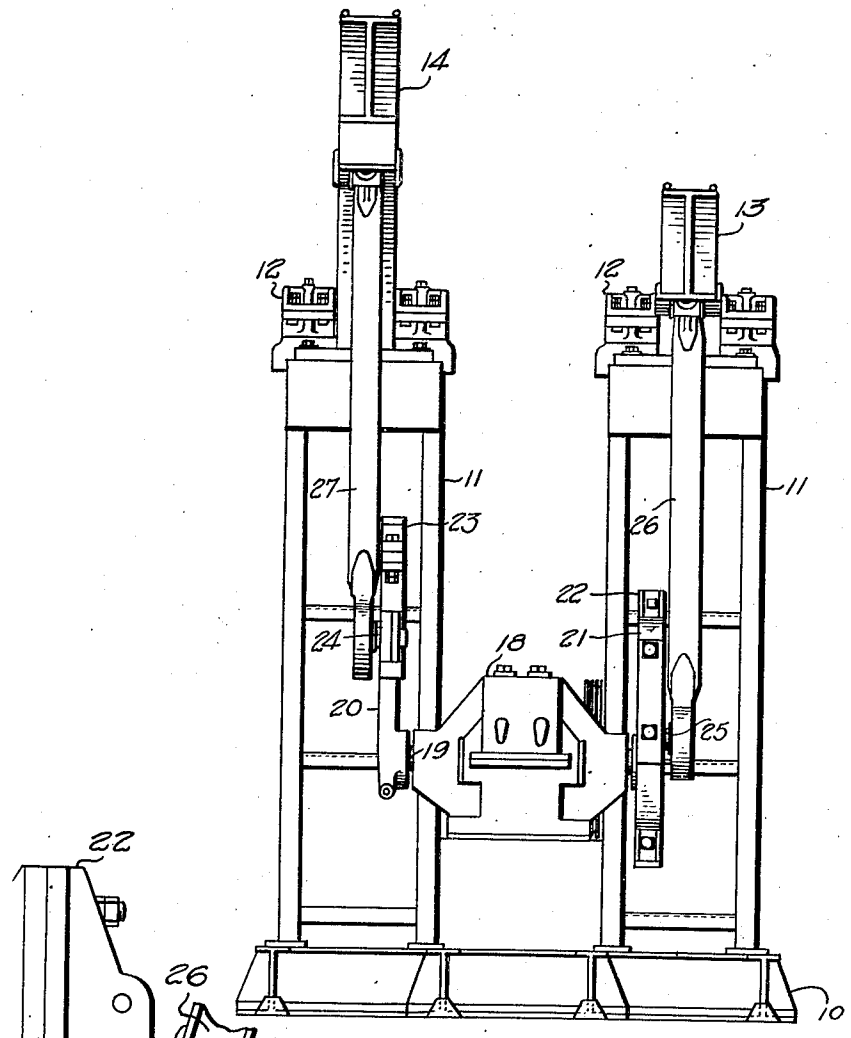
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PUMPING MECHANISM

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Fig. 2.



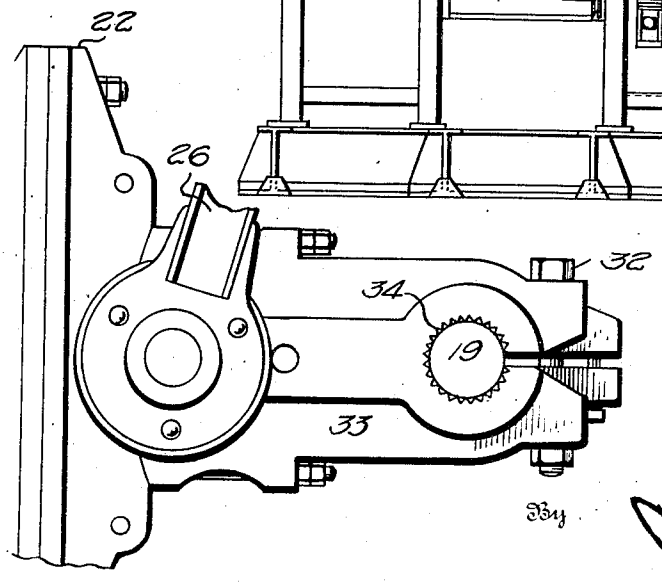


Fig. 3.

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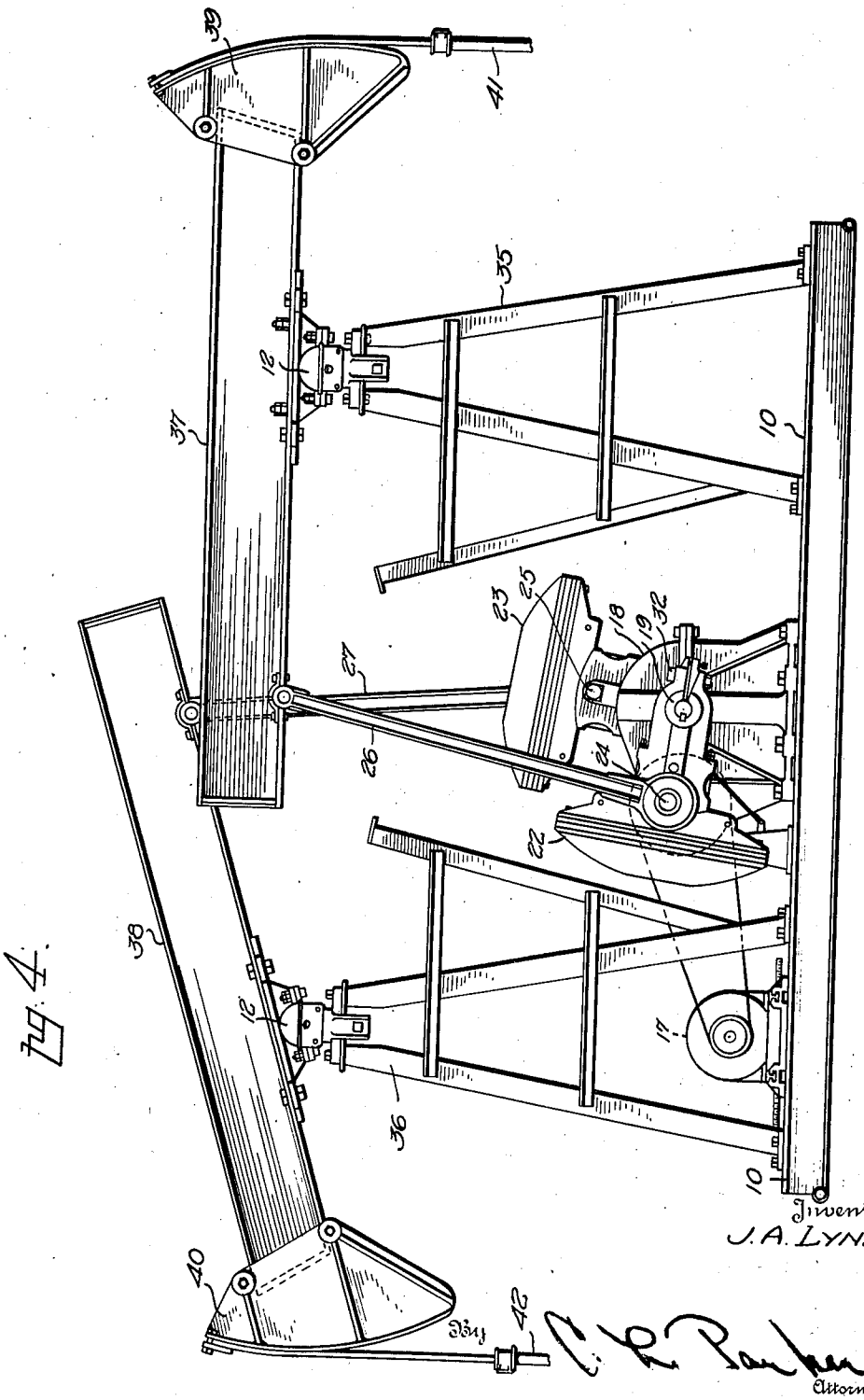


Fig. 4.

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2,265,379

UNITED STATES PATENT OFFICE

2,265,379

PUMPING MECHANISM

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Application July 26, 1939, Serial No. 286,707
In Venezuela July 27, 1938

7 Claims. (Cl. 74—41)

This invention relates to pumping mechanisms, and more particularly to pumping mechanisms for oil wells.

As is well known, it has been the common practice to operate the pumps of oil wells by connecting the pump rod to one end of a walking beam which oscillates on a horizontal pivot axis and is driven through a pitman connection. The lower end of the pitman is connected to a crank which is driven from a suitable prime mover through a gear reducing mechanism.

In some localities it is entirely possible and practicable to drill two oil wells in close proximity to each other; this being true, for example, where there are oil-bearing sands at different depths. Under such conditions one well is drilled to tap the sand at one depth and another well is drilled in close proximity to the first well to tap another oil-bearing sand. In the interests of economy it has been proposed to employ a single prime mover for driving a single crank shaft to operate the pumps of two wells in close proximity to each other, but the apparatus heretofore proposed for this purpose has been only partially satisfactory in that they failed to take full advantage of all that may be gained from the pumping of two wells from a single prime mover.

An important object of the present invention is to provide a novel pumping mechanism which is adapted for pumping oil from two relatively adjacent wells through the operation of a single crank shaft driven from a single prime mover.

A further object is to provide an apparatus of this character which is particularly suitable for use since it permits the continued operation of one of the wells while the other is shut down for the purpose of servicing or for any other reason.

A further object is to provide a dual pumping mechanism operable from a single crank shaft wherein the power demands on the crank shaft are rendered as uniform as possible, thus facilitating the operation of the mechanism by a single prime mover and minimizing the loads on various parts of the apparatus.

A further object is to provide such a mechanism wherein manufacturing economies are effected by permitting the same mechanism to be used for driving two walking beams, or for driving a single walking through a dual pitman connection.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawings I have shown several embodiments of the invention. In this showing:

Figure 1 is a side elevation of one form of apparatus,

Figure 2 is an end elevation of the same,

Figure 3 is a fragmentary side elevation of one of the cranks and associated elements showing an adjustable connection for the crank shaft, and,

Figure 4 is a side elevation of a modified form of apparatus.

Referring to Figures 1 and 2, the numeral 10 designates a base structure as a whole upon which is mounted Samson posts 11 which are provided with means 12 for supporting a pair of walking beams 13 and 14 arranged in parallel spaced relation to each other and spaced apart a distance corresponding to the distance between the two wells to be pumped. Each walking beam is provided at one end with a head 15 for connecting the well end of the beam to a polished rod 16. It will be obvious that the particular form of head or similar means 15 is of no importance in connection with the present invention.

A prime mover 17 drives the usual speed reducing mechanism 18 to operate a conventional crank shaft 19 and in the present instance this shaft is shown as being provided with a pair of cranks 20 and 21 carrying weight counterbalances 22 and 23 respectively. The cranks 20 and 21 respectively carry wrist pins 24 and 25 pivotally connected to the lower ends of pitmans 26 and 27 respectively, and the upper ends of the pitmans are pivotally connected as at 28 and 29 to the respective walking beams 13 and 14. Either or both of the walking beams may be provided with auxiliary counterweights as shown in dotted lines and indicated by the numeral 30. It will become apparent that where the wells are of different depths so as to render different counterweighting desirable, the difference may be made up by changing the counterweights 30 on one of the walking beams or the counterweight 22 on its actuating crank or by adjustment of both the beam and crank weights. It also will become apparent that while the cranks 20 and 21 have been shown 90 degrees apart, this is the arrangement for ideal conditions but the invention is not limited to such specific arrangement for a reason which will be referred to below.

In some installations, peak loads on a well operating mechanism will not occur when the crank is on vertical center, and if this is true of

either or both of the wells operated by the walking beams 13 and 14, the counterweights 22 and 23 should not be arranged exactly 90 degrees apart. However, in many installations the peak loads will occur near enough to vertical centers for the counterweights 22 and 23 to be arranged as shown. Under such conditions, the cranks may be keyed as at 31 to the crank shaft and the cranks clamped in position by the usual clamping bolts 32.

For installations in which it is desired to compensate for the occurrence of peak loads away from vertical centers, the construction shown in Figure 3 may be employed. In such construction the crank 33 and the crank shaft 19 may have suitable splined connection as at 34 to permit the crank to be clamped in any suitable angular position with respect to the crank shaft.

In the form of the invention shown in Figures 1 and 2 the walking beams have been shown side by side, which is the preferred arrangement where two wells have been drilled in close proximity to each other. For example, in certain wells now in use, the pairs of wells are drilled approximately 70 inches on centers, and the structure shown in Figures 1 and 2 is particularly adapted for use with wells of this character. In other installations in which the wells are a greater distance apart, the installation in Figure 4 may be employed. In the modified form of the installation all of the parts may correspond to the parts described in connection with the form of the invention shown in Figure 1 except for the headache posts and the arrangement of the walking beams, and the parts in Figure 4 which correspond to those in Figures 1 and 2 have been indicated by the same reference numerals.

Referring to Figure 4 it will be noted that two longitudinally spaced Samson posts 35 and 36 are employed and walking beams 37 and 38 are pivotally supported by the respective Samson posts. It will be noted that the Samson posts are spaced a suitable distance from each other to support the walking beams in parallel planes but in opposed relation, the pitmans 26 and 27 being connected to the adjacent ends of the walking beams. The outer ends of the walking beams are provided with heads 39 and 40 for connecting the walking beams to the polished rods 41 and 42 of the respective wells.

The operation of the apparatus is as follows:

Referring to Figure 1 it will be noted that the rotation of the crank shaft 19 by the prime mover and its associated gear reducer unit rotates the cranks 20 and 21 to oscillate the walking beams 13 and 14 and thus pump from the two wells. The walking beams are oscillated simultaneously and preferably 90 degrees out of phase under ideal conditions as will be apparent from the arrangement of the cranks 20 and 21. It will be apparent that each crank and its associated pitman and walking beam may be considered as a pumping unit, and the two units are driven from the common crank shaft 19. Each such unit is independently counterbalanced in accordance with load conditions imposed in accordance with the particular well being pumped. Where peak loads do not occur exactly at vertical centers but occur relatively close to such points, the 90 degree arrangement of the cranks may be effectively employed. Under other conditions, the cranks may be set at more or less than 90 degrees out of phase, in which case the crank adjusting feature shown in Figure 3 may be employed. Generally speaking, it may be said that the cranks are arranged 90 degrees out of phase and any variation in such arrangement is for the purpose of compensating for load conditions in individual installations and not with the idea of employing one pumping unit for counterbalancing the other.

In this connection it is pointed out that attempts have been made to follow what would be natural engineering practice in an installation of this character, namely, the balancing of the load of one well against the load of the other. While such an installation would effect economies in the way of pumping two wells from a single crank shaft, the results fall far short of what may be actually accomplished in an installation of this character and what is accomplished with the present apparatus. Where two wells have their pumping units arranged to counterbalance each other, two heavy peak loads occur in the operation of the apparatus and these peak loads are approximately 180 degrees apart, which is also true in the case of a single pumping unit pumping from a single well. Thus the counterbalancing of one pumping unit by the other follows conventional practice in this respect. While in this arrangement one well approximately balances the other and reduces the amount of counterbalancing the counterbalancing effect is not as good as, and the torque loads on the crank shaft during the peak well loads are greater than, if each well were being pumped by an individual and properly balanced unit.

In this connection it will be noted that on the lifting stroke of the well rods the load imposed on the pumping unit will be the weight of the rods plus the weight of the fluid column times the acceleration factor. On the down stroke of the well rods, the load imposed on the pumping unit will be the weight of the rods minus acceleration. With a single well, these loads may be counterbalanced by using an amount of counterbalance equal to the average of the two loads. As a typical example, it will be assumed that the load imposed on the up-stroke of the well rods is 15,000 lbs. and the load on the down stroke is 3,000 lbs. A proper counterbalance under this condition would be the average of these two loads (or the total of the two loads divided by 2) or 15,000 plus 3,000 divided by 2, or 9,000 lbs., which would give two net peak loads each of 6,000 lbs. imposed on the pumping unit approximately 180 degrees apart.

With two pumping units driven from a single crank shaft and arranged to counterbalance each other, the net peak loads will be the difference between the peak and minimum loads of the two wells which in this example would be 15,000 lbs. minus 3,000 lbs.=12,000 lbs. for each net peak load. In such case the net loads imposed on the speed reducer and prime mover would be two 12,000 lb. loads approximately 180 degrees apart. Therefore the speed reducer necessarily would have to be of twice the peak capacity in this case over that required for pumping one well in the conventional manner. Also, with an apparatus of this type, the load differential will remain, even though counterbalancing is added, as it is impossible to reduce these net loads by means of such counterbalancing.

In the present case, two pumping units are driven from the single crank shaft with the cranks set 90 degrees apart and preferably with the well loads counterbalanced in the same manner as they would be for separate wells with con-

ventional pumping units. Accordingly there would be four peak loads of 6,000 lbs. each and such peak loads would occur approximately 90 degrees apart. Therefore, no increase in the peak capacity of the speed reducer would be required for pumping both wells over that required for one well. Thus the present apparatus is highly advantageous over an apparatus wherein one pumping unit is counterbalanced by the other. The latter arrangement is also disadvantageous for the reason that both of a pair of wells are not always simultaneously pumped and a mechanism of the character referred to does not permit the pumping of one well while the other is shut down.

A second distinct advantage of the apparatus lies in the fact that the two pumping units, while driven from a common power source, are operative wholly independently of each other, the two units being independently counterbalanced in accordance with their particular needs. In this connection, it is pointed out that the present apparatus is usually employed with two wells of different depths, drilled into different oil-bearing sands, and accordingly it usually is impossible for one pumping unit to effectively counterbalance the other in accordance with the method which has been previously referred to. The present apparatus permits far more effective counterbalancing by providing counterbalancing in accordance with the particular requirements of each well. Moreover, each pumping unit being independent of the other so far as counterbalancing is concerned, it will be obvious that either well may be shut down for servicing or any other reason, in which case the remaining well will be pumped by its pumping unit, which will pump in accordance with conventional practice. Therefore, the apparatus involves two very distinct advantages over the practice of counterbalancing one well against the other.

The apparatus also has an additional advantage in that it effects manufacturing economies aside from the fact that it permits two wells to be pumped from a single crank shaft and power source. It will be apparent that the two cranks 19 and 21 may be set in phase, in which case the apparatus readily lends itself to the driving of a single walking beam through dual pitman connections, which is conventional practice at this time. Therefore, manufacturing economies are effected by permitting the manufacture of a single apparatus which is capable of use for driving a single walking beam through dual pitman connections, or for simultaneously and efficiently driving two walking beams which are connected to pump oil from different wells.

The form of the apparatus shown in Figure 4 functions in the same manner as the apparatus shown in Figures 1 and 2 and need not be referred to in detail. In each case the walking beams are driven from the same crank shaft through similar cranks which are similarly counterweighted, and peak loads are spaced 90 degrees apart with either form of apparatus, thus rendering the power demands more uniform throughout each rotation of the crank shaft.

Generally speaking, therefore, the present apparatus is made up of a pair of individual pumping units driven from a single crank shaft and individually counterbalanced to render the pumping units independent of each other. More specifically the apparatus comprises two pumping units driven from a common source and individually counterbalanced with the two pumping units arranged approximately 90 degrees out of phase to render as uniform as possible the power demands on the crank shaft. In this connection, attention is invited to the fact that the most advantageous results may be obtained in individual cases by arranging the pumping units out of phase more or less than 90 degrees. Accordingly, where reference is made in the appended claims to the arrangement "approximately 90 degrees out of phase" it is understood that this expression means substantially greater than 0 degrees or substantially less than 180 degrees.

While "counterbalancing" has been referred to herein and shown in the drawings as being of the counterweight type, it will be perfectly obvious that any type of counterbalancing may be employed such as beam or crank counterweights as shown, or pneumatic, hydraulic or a combination of pneumatic and hydraulic counterbalancing.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same and that various changes in the shapes, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. A pumping apparatus comprising a crank shaft, a pair of cranks carried by said shaft and arranged approximately 90° out of phase with each other whereby the peak torque loads on the crank shaft, applied through said cranks, occur 90° out of phase with each other, a pair of pump-operating units connected to be driven by the respective cranks, and a pair of counterbalancing means effective for separately counterbalancing said units.

2. A pumping apparatus comprising a horizontal crank shaft having a crank at each end thereof, and a pair of pump-operating units connected to be operated by the respective cranks, each unit comprising a pump-operating walking beam mounted to oscillate on a horizontal axis, said cranks being arranged approximately 90° out of phase with each other whereby the peak torque loads on the crank shaft, applied through said cranks, occur 90° out of phase with each other, and counterbalancing means effective for counterbalancing the respective pump-operating units.

3. A pumping apparatus comprising a horizontal crank shaft, and a pair of pump-operating units comprising cranks at opposite ends of said crank shaft, walking beams mounted to oscillate about horizontal axes and connected to be operated by the respective cranks, and counterweight means effective for separately counterbalancing said units, said cranks being arranged approximately 90° out of phase with each other whereby the peak torque loads on the crank shaft, applied through said cranks, occur 90° out of phase with each other.

4. A pumping apparatus comprising a horizontal crank shaft, a crank connected to each end of said crank shaft, and a pair of pump-operating units comprising a pair of parallel walking beams mounted side by side and supported for oscillating movement about a substantially common horizontal axis, one end of each walking beam being connected to one of said cranks, and counterweight means effective for separately counterbalancing said units, said cranks being approximately 90° out of phase with each other whereby the peak torque loads on the crank shaft, applied

through said cranks, occur 90° out of phase with each other.

5. A pumping apparatus comprising a horizontal crank shaft, a crank connected to each end of said crank shaft, and a pair of pump-operating units comprising a pair of parallel walking beams mounted side by side and supported for oscillating movement about a substantially common horizontal axis, one end of each walking beam being connected to one of said cranks, said cranks being approximately 90° out of phase with each other whereby the peak torque loads on the crank shaft, applied through said cranks, occur 90° out of phase with each other, and counterweight means carried by each of said cranks.

6. A pumping apparatus comprising a horizontal crank shaft having a crank at each end thereof, and a pair of pump-operating units comprising a pair of walking beams mounted to oscillate in parallel vertical planes and projecting in opposite directions away from each other, means for supporting each walking beam for oscillating movement on a horizontal axis intermediate its ends, means connecting the adjacent ends of said walking beams for operation by the respective cranks, said cranks being arranged approximately 90° out of phase with each other whereby the peak torque loads on the crank shaft, applied through said cranks, occur 90° out of phase with each other, and counterweight means effective for separately counterbalancing said units.

7. A pumping apparatus comprising a horizontal crank shaft having a crank at each end thereof, and a pair of pump-operating units comprising a pair of walking beams mounted to oscillate in parallel vertical planes and projecting in opposite directions away from each other, means for supporting each walking beam for oscillating movement on a horizontal axis intermediate its ends, means connecting the adjacent ends of said walking beams for operation by the respective cranks, and counterweight means carried by each crank, said cranks being arranged approximately 90° out of phase with each other whereby the peak torque loads on the crank shaft, applied through said cranks, occur 90° out of phase with each other.

JOE A. LYNE.