Feb. 14, 1933. L. J. BLACK 1,897,108

PUMP OPERATING MECHANISM

Filed Dec. 2, 1930 2 Sheets-Sheet 1

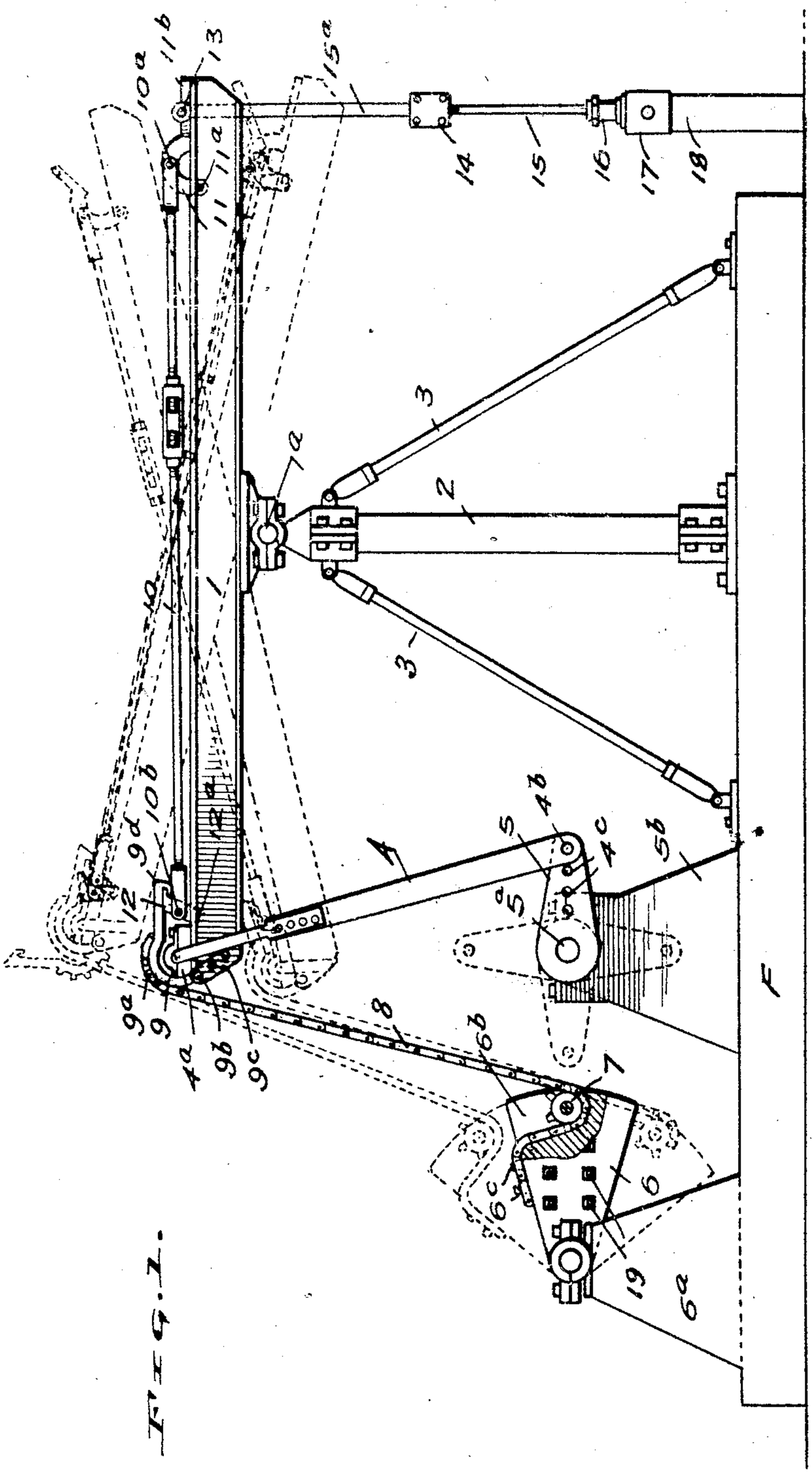

FIG. 1.

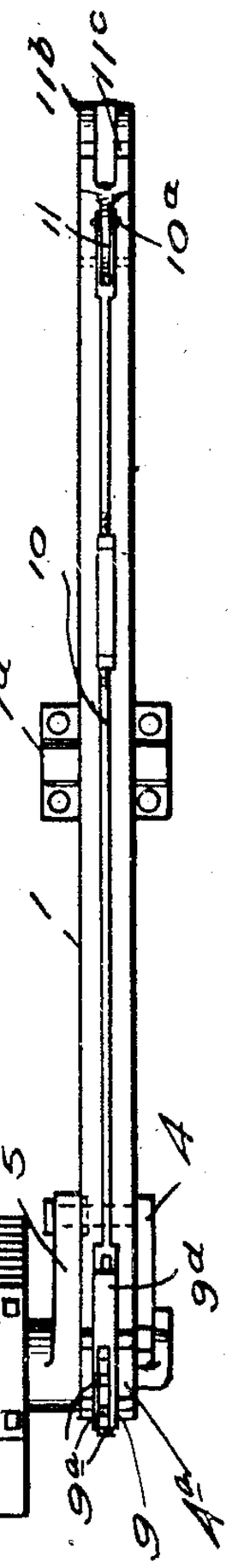

FIG. 2.

Inventor

L. J. BLACK

By Eugene D. Peterson

Attorney

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PUMP OPERATING MECHANISM

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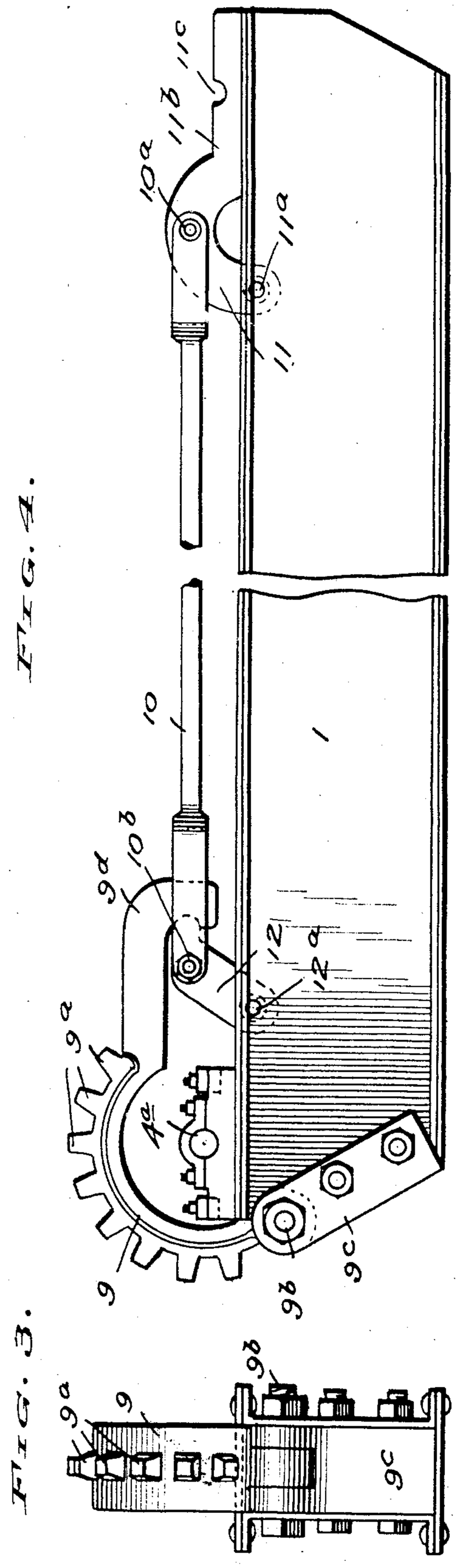

FIG. 4.

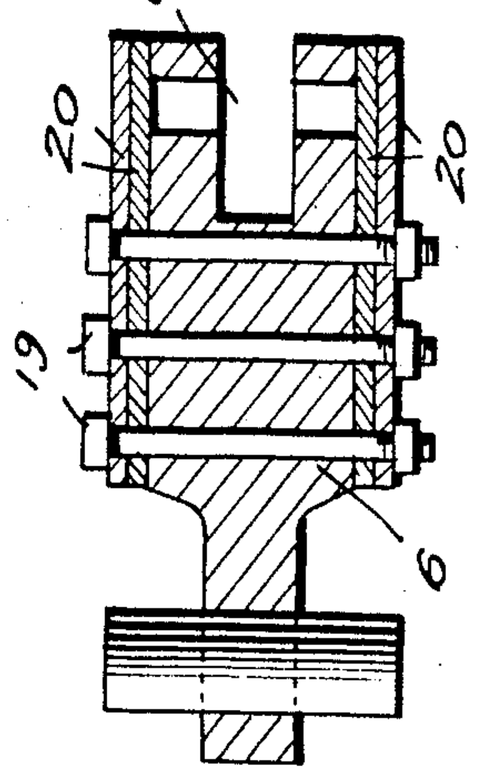

FIG. 6.

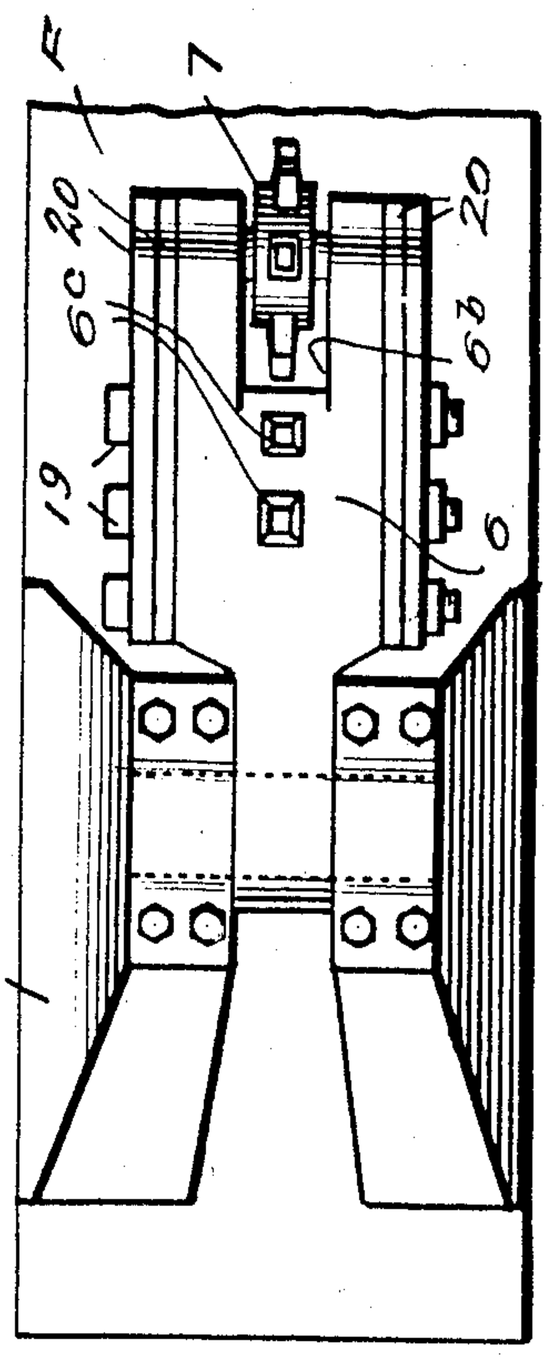

FIG. 5.

FIG. 3.

Inventor
L. J. BLACK
By Eugene Stetson
Attorney

Patented Feb. 14, 1933 1,897,108

UNITED STATES PATENT OFFICE

LEE J. BLACK, OF BEAUMONT, TEXAS

PUMP OPERATING MECHANISM

Application filed December 2, 1930. Serial No. 498,589.

My invention relates to improvements in pump operating mechanism of the type, suitable for example, for operating reciprocating deep well pumps for the pumping of oil and other liquids, such pumps involving the use of a string of sucker rods and a polish rod at the upper end thereof.

In the pumping of oil wells it is essential that the load on the polish rod be counterbalanced, not only from the standpoint of increased power efficiency, but also from the standpoint of smooth, uniform operation. When pumping at great depths the rod load on the polish rod end of the walking beam will often amount to 6000 pounds, which means that the pitman end of the beam should carry a weight approximately 5000 pounds to assure smooth and efficient operation of the apparatus.

The matter of loading the pitman end of the walking beam with so great a counterbalance will almost invariably result in damage to the beam, pitman and other parts of the machinery in the event that the sucker rod string breaks near the top. This is especially so when the weight is adjustably carried by the top of the walking beam or suspended between guides from the end of the beam, because the breaking of the sucker rod string places the whole counterweight load on the pitman and its operating means. Also where the weight is on top of the beam, the sudden breaking of the sucker rod string will frequently jar the weight loose resulting in the shearing of the pitman from the beam,—the weight falling down and injuring the apparatus below.

Some efforts have been made to meet the problem by attaching the counterweight to the band wheel or crank which operates the pitman, or even to the pitman itself. There, of course the weight will travel in a circular, or elliptical path so that the weight thereof need not be overcome at the end of each stroke. Obviously, this line of structure will appreciably reduce jar, but it is equally clear that the load on the crank, band wheel or pitman will be terrific, making it necessary to greatly increase the size of the parts. Even so, the strain thus placed upon the band wheel shaft, crank, wrist pin, the wrist pin bearings, and the jack post bearings will result in frequent breakage,—unless, of course the parts are constructed with a margin of strength well beyond extreme load conditions. Such construction will be most costly.

Location of the counterbalance weight on the band wheel or crank element also means that the crank shaft will be so badly out of balance that it cannot be used for pulling tubing or similar purposes. To remove the counter weight from the band wheel or crank is an expensive and time consuming task, requiring in some instances an hour or more.

Having in mind the foregoing, it is the primary object of this invention to provide a counterbalance for the pitman end of the walking beam, which is supported independently of the beam, pitman and associated parts and which incorporates a connection with the beam which will be automatically broken in the event that the sucker rod breaks,—thus obviating any likelihood of injury to the machinery, and the necessity of constructing the crank, pitman, etc. to withstand extreme overloads,—while at the same time leaving the crank or band wheel shaft free at all times for pulling tubing and similar uses.

The invention also resides in a novel counter weight and walking beam connection, per se.

The invention further resides in certain novel features of construction, combination, and arrangement of the various parts, and in certain novel modes of operation,—all of which will be readily understood and appreciated by those skilled in the art upon reference to the accompanying drawings in connection with the detailed description to follow.

It is to be understood, that while I disclose herein what is regarded as a preferred form of the invention, the same is susceptilble of many other mechanical expressions within the spirit and scope of the subject matter claimed hereinafter. The disclosures herein are therefore to be considered as illustrative, rather than limitative.

In the drawings, wherein the same refer-

ence characters have been used to designate the same parts in all views,—

Figure 1 is a side elevational view illustrating a walking beam pumping rig incorporating my invention;

Figure 2 is a top plan view of the walking beam and counterbalance support;

Figure 3 is an end view of the beam as disclosed in Figures 2 and 3 and showing the beam and counterbalance connection;

Figure 4 is an enlarged side elevational view of the walking beam and counterbalance support;

Figure 5 is a top plan view of the counterweight and its mount, and,

Figure 6 is a cross sectional view through the counterweight showing the attachment of the weight elements.

Referring specifically to the drawings by reference characters, numeral 1 denotes the usual walking beam having the conventional intermediate bearing connection 1^a with the Sampson post 2 which is braced as at 3.

At one end of the walking beam is the bearing 4^a for the stirrup end of the pitman 4, whose opposite end is pivoted as at 4^b in one of the holes 4^c of the crank 5, which is carried on the shaft 5^a journalled in the jack post or support 5^b, which is mounted on the foundation F.

Mounted on foundation F rearwardly of the crank 5 is mount 6^a in which is journalled the vertically swingable weight 6, whose forward end has the vertical recess 6^b housing the sprocket pinion 7. A sprocket chain 8 has one end engaged with teeth 6^c at the top of the weight and rearwardly of the slot or recess 6^b, while the adjacent portion extends into said recess and about the pinion 7,—the other end of the chain 8 engaging the teeth 9^a of a swingable sprocket quadrant 9.

Sprocket quadrant 9 is pivoted upon the hinge pin 9^b carried by bracket plates 9^c secured to the end of the walking beam 1 as shown. The sprocket quadrant 9 has a hook-like rear extension 9^d which is normally engaged by the latch member 12 which is pivoted as at 12^a to the walking beam 1 and controlled by the rod 10.

Each end of the rod 10 is bifurcated,—one end being pivoted as at 10^a to the arched portion of a control member 11, while the other rod end is pivoted as at 10^b intermediate the ends of latch 12. The control member 11 has the lower end of its arched portion pivoted as at 11^a to the walking beam, and is further provided with a bifrcated rear extension 11^b adapted to lie flatly upon the walking beam and having seats 11^c for supporting the cross pin 13 carried by the upper end of the polish rod extension 15^a. Such extension 15^a is preferably connected to the polish rod 15 by the grip adjuster 14,—the polish rod working through the usual stuffing box 16 in the head 17 of the well casing 18.

The weight 6 may be provided with cross bolts 19 as shown in Figure 6 which serve as the supporting means for auxiliary weights 20.

The operation of the device may be briefly summarized as follows:

So long as the weight of the tubing or sucker rods suspended from polish rod 15 is present, it is obvious that pin 13 will hold the control member 11 of rod 10 in flat contact with walking beam 1 to maintain the engagement of latch 12 with the hook portion 9^d of the swingable sprocket quadrant 9,—the weight 6 holding the chain in engagement with the teeth 9^a of quadrant 9. The counterbalancing function of weight 6 will be obvious from the dotted line showing in Figure 1, it being particularly pointed out that the weight 6 will have its axis coincident or parallel with crank 5 when the latter is horizontial.

Since the rod connection 10^a is disposed well beyond the pivot point 11^a, the breaking of the sucker rod string to lighten the load on polish rod 15 will immediately enable the weight 6 through chain 8 to rock the quadrant 9 against the action of latch 12, rod 10, and control element 11 to lift the latter to the dotted line position shown in Figure 1. Release of latch 12 from the hook portion 9^d of quadrant 9 results in instantaneous movement of quadrant 9 to the dotted line position in Figure 1, which throws the chain out of engagement with the quadrant teeth 9^a, permitting the weight 6 to drop without damage to its lowermost position.

Manifestly, it is a simple matter to disengage the weight from the walking beam when it is desired to use the crank mechanism for other purposes than pumping. The crank shaft 5 will be driven in the usual or any preferred manner.

The use of my invention keeps installation and maintenance costs down to a minimum, in that a heavy original installation is unnecessary and expensive damage eliminated in case of string breaks.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a pumping apparatus, the combination of a pump operating member and actuating means therefor, a counterbalance supported independently of said operating member and its actuating means, and means on said operating member for releasing said counterbalance from said member upon a predetermined diminishment of the pump load on said pumping connection.

2. In a walking beam pump having a pumping connection at one end and a counterbalance connection at the other end, means operable upon a predetermined diminishment of the load on said pumping connection for releasing the counterbalance connection from said beam.

3. In a walking beam pump having a pumping connection at one end and a counterbalance at the other end, the combination of a counterbalance support on said beam and movable to release said counterbalance under the weight thereof, and means controlled by a predetermined pumping connection load for holding said support against counterbalance-releasing movement.

4. In a walking beam pump having a pumping connection at one end and a counterbalance at the other end; the combination of a counterbalance support on said beam and movable to release said counterbalance under the weight thereof, and lever means carried by said beam and acted upon by said pumping connection, said lever means and support having interengaging holding portions.

5. In a walking beam pump, a pumping connection at one end of the beam, a crank-operated pitman connected to the other end of the beam, a foundation supporting said pump and crank, a vertically swingable weight supported upon said foundation independently of said crank and pitman, a swingable lever carried by said beam at the pitman end thereof, a connection between said weight and lever, said lever tending to move under the influence of said weight to release said connection, and holding means for said lever including said pumping connection, said holding means and lever having interengaging latch portions.

6. The combination set forth in claim 5,—and said weight and crank lying in substantially the same vertical plane with their axes in substantially the same horizontal plane, and said connection being of a length to dispose the weight parallel with the crank when the latter is horizontal.

7. In a walking beam pump, a pumping connection at one end of the beam, a crank-operated pitman at the other end of the beam, a foundation supporting said pump and crank, a vertically swingable weight supported upon said foundation independently of said crank and pitman, a sprocket quadrant having its outer end pivoted to the walking beam and having its major portion adapted to rest upon said beam, a sprocket chain, said quadrant having teeth adapted to engage and anchor one end of said chain when the major portion of the quadrant is supported by the beam, said weight having a slot, a sprocket pinion in said slot under which said sprocket chain is trained to engage the teeth thereof, tooth-like lugs formed on the top of said weight rearwardly of said slot and adapted to engage the free end of said chain, the chain serving to operatively connect the weight to said walking beam, the length of said chain being such as to assure ascent and descent of the weight with the corresponding movement of the crank in the operation of the walking beam, a lug pivoted to said walking beam adjacent said sprocket quadrant, said lug and quadrant having interengageable portions whereby the lug may be actuated to hold the quadrant in against said beam in chain supporting position, and a pumping connection-actuated holding means for said lug.

8. In a pumping apparatus including, a pumping connection, an operating member therefor and having a counterbalance weight; the combination of an operable and releasable connection between said operating member and counterbalance weight, and means effective upon the breaking of said pumping connection for automatically releasing said connection from said operating member.

9. In a pumping apparatus including, a pumping connection, an operating member therefor and having a counterbalance weight; the combination of an operable and releasable connection between said operating member and counterbalance weight operable upon a predetermined diminishment of the load on said pumping connection.

10. In a walking beam pump, a pumping connection at one end of the beam, a crank operated pitman connected at the other end of the beam, a foundation supporting said pump and crank; a substantially vertically swingable weight supported upon said foundation independently of said crank and pitman, a swingable lever carried by said beam, a connection between said weight and lever, said lever tending to move under the influence of said weight to release said connection, and a holding means for said lever, said holding means and lever having interengaging latch portions.

11. In a pumping apparatus, including a pump operating member, actuating means therefor, and a counterbalance, the combination of mounting means for said counterbalance independent of said operating member and its actuating means, and an operable and releasable connection between said counterbalance and the operating member operable upon a predetermined diminishment of the load upon said pump operating member.

12. In a walking beam pump, a pumping connection adjacent one end of the beam and driving means adjacent the other end, a movable counterbalance weight, an operative and releasable connection between said weight and the driving means end of said walking beam, said releasable connection including a weight load supporting member normally tending to move to a weight-releasing position, and a holding member operatively engageable with the weight load supporting member for holding it in operative position, and means for releasing said supporting member upon reduction of the pump load to a predetermined amount.

13. In a walking beam pump, a pumping

connection at one end of the beam and driving means at the other end, a movable counterbalance weight, means defining the path of movement of said weight to maintain same clear of said driving means and associated pump elements, an operative and releasable connection between said weight and the driving means end of the walking beam, said releasable connection including a weight load supporting member normally tending to move to a weight-releasing position, a holding member operatively engageable with the weight load supporting member for holding it in operative position.

14. In a walking beam pump, a pumping connection adjacent one end of the beam and driving means adjacent the other end, a movable counterbalance weight, an operative and releasable connection between said weight and the driving means end of said walking beam, and means responsive to a predetermined pumping connection load for permitting release of said weight connection.

15. In a walking beam pump, a pumping connection at one end of the beam and driving means at the other end, a movable counterbalance weight, means defining the path of movement of said weight to maintain same clear of said driving means and associated pump elements, an operative and releasable connection between said weight and the driving means end of the walking beam, and means responsive to a predetermined pumping connection load for permitting release of said weight connection.

16. In a walking beam pump, a pumping connection at one end of the beam and driving means at the other end, a movable counterbalance weight, means defining the path of movement of said weight to maintain same clear of said driving means and associated pump elements, an operative and releasable connection between said weight and the driving means end of the walking beam, said releasable connection including a weight load supporting member normally tending to move to a weight-releasing position, a holding member operatively engageable with the weight load supporting member for holding it in operative position, and means responsive to a predetermined pumping connection load for permitting release of said weight connection.

17. In a walking beam pump, a pumping connection at one end of the beam, a crank operated pitman connected at the other end of the beam, a foundation supporting said pump and crank; a substantially vertically swingable weight supported upon said foundation independent of said crank and pitman, a swingable lever carried by said beam, a connection between said weight and lever, said lever tending to move under the influence of said weight to release said connection, means for holding said lever in operative position to support said weight, said holding means including a portion responsive upon a break in said pumping connection to effect the automatic release of said lever to unload said weight.

In testimony whereof I affix my signature.

LEE J. BLACK.