Oct. 22, 1940. C. R. ATHY ET AL 2,218,967

COUNTERBALANCING DEVICE

Filed Aug. 31, 1938 2 Sheets-Sheet 1

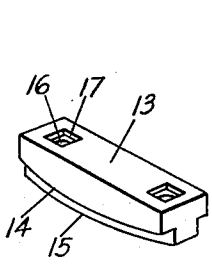


Fig. 5

Fig. 1

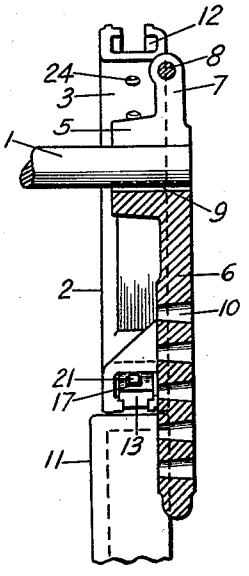


Fig. 2

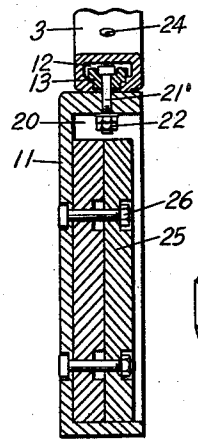


Fig. 3

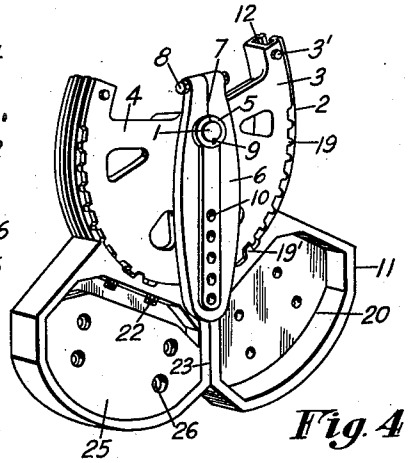


Fig. 4

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Filed Aug. 31, 1938 2 Sheets-Sheet 2

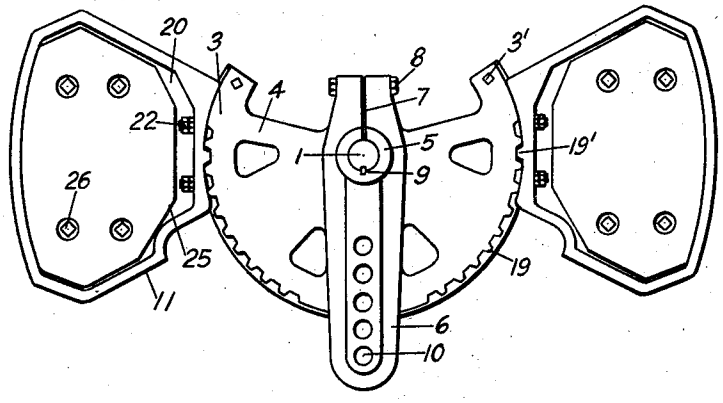


Fig. 6

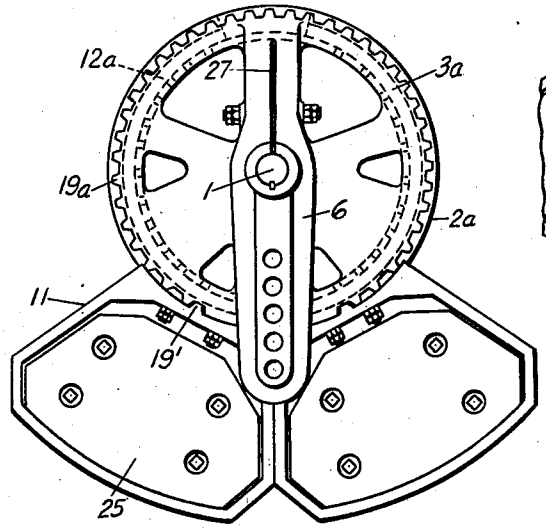


Fig. 7

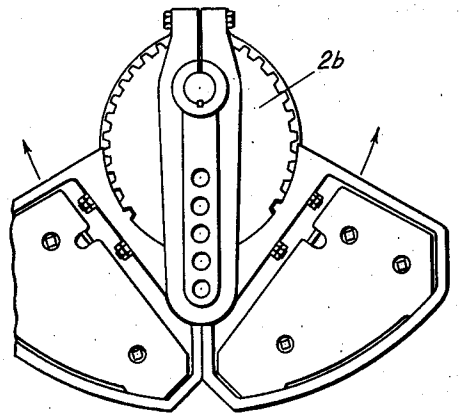


Fig. 8

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COUNTERBALANCING DEVICE

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7 Claims. (Cl. 74—591)

Our invention relates to a counterbalancing device. It has to do, more particularly, with a counterbalancing device that is adapted to be used in conjunction with an oil well pumping mechanism, although it is not necessarily limited thereto.

One of the objects of our invention is to provide a counterbalancing device which may readily be applied to or removed from the crank shaft of oil well pumping mechanism and which is of such a nature that it will effectively counterbalance a portion of the well load.

Another object of our invention is to provide a counterbalancing device of the type indicated which is of such a nature that the counterbalancing effect thereof may readily be varied.

Another object of our invention is to provide a counterbalancing device with a crank associated therewith, the device being of such a nature that a long pumping stroke is provided without an unnecessarily heavy counterbalance.

Another object of our invention is to provide a crank counterbalance which is so constructed that the counterbalance weights associated therewith will have a maximum effect.

Another object of our invention is to provide a crank counterbalance of the type indicated which includes weights that are adjustable to various positions to vary the counterbalance effect and which is provided with safety means for locking such weights in position to prevent vibration, etc., from moving them out of position.

The preferred embodiment of our invention is illustrated in the accompanying drawings wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a front elevation of a counterbalance device constructed in accordance with our invention.

Figure 2 is a vertical section taken substantially along line 2—2 of Figure 1.

Figure 3 is a vertical section taken substantially along line 3—3 of Figure 1.

Figure 4 is a perspective view of the structure illustrated in Figure 1.

Figure 5 is a perspective view illustrating a member used in mounting weights on our counterbalancing device.

Figure 6 is a view similar to Figure 1 but showing the weights in a different position on the counterbalancing device.

Figure 7 is a front elevation of a slightly modified form of our counterbalance device.

Figure 8 is a similar view of another modified form of our device.

With reference to the drawings, we have illustrated our device mounted on the crank shaft 1 of a well pumping mechanism. Our device comprises a segmental crank member 2 which includes an annular rim 3 and an apertured plate-like portion 4 integrally joined together. A split hub 5 is formed on member 2 and is disposed in surrounding relationship to the outer end of the shaft 1. The crank arm proper 6 is formed as an integral portion of the member 2. This crank arm at its upper end is associated with the split hub 5 and has a split 7 in its upper end which is in alignment with the split of the hub 5. A bolt structure 8 extending transversely through the upper end of the crank arm 6 serves to draw the split upper end of the crank arm tightly together and simultaneously draw the split hub 5 tightly around the shaft 1. A key 9 may be provided for aiding in securing the member 2 non-rotatably on the crank shaft 1. Due to the split hub construction and the associated split portion of the crank arm, it will be apparent that the counterbalance device may readily be applied to or removed from the shaft 1. The crank arm 6 and the member 2 may be cast as a single unit.

The crank arm 6 is provided with a plurality of radially spaced openings 10 each of which is adapted to receive the wrist pin which is commonly used for connecting the pitman of a well pumping mechanism to the crank arm. It will be noted that the crank arm protrudes beyond the periphery of the member 2. This is an important feature inasmuch as it results in longer crank radii without increasing the radius of the member 2. Thus, with this device a long pumping stroke is provided while at the same time a counterbalance having an unnecessarily large radius is avoided. Thus, a great saving in space also results.

It will be noted that the crank is of wheel-like structure but that a segment of the rim 3 of the member 2 is omitted at a point diametrically opposite to the protruding portion of the crank arm. Thus, the rim 3 extends upwardly on both sides beyond the crank shaft 1 but is not continuous. This facilitates the application of counterbalance weight units 11 to the member 2. Also, due to the fact that this portion of the rim is omitted, the counterbalance weight units 11 are more effective when they are on the crank arm side of the shaft 1 since any weight on the opposite side of the crank shaft from the counter-

weight units 11 tends to counteract the effect of such weight.

The counterweight units 11 are attached to the member 2 by the structure which will now be described. It will be apparent from the drawings that the rim 3 of the member 2 has a continuous slot 12 formed in its peripheral edge on each side of the crank arm 6. These slots are substantially T-shaped in cross-section. Each slot extends along the rim 3 from a point adjacent crank arm 6 to the end of the rim and is open at its outer end due to the fact that the segment of the rim is omitted. Each slot is adapted to receive member 13 of the shape illustrated in Figure 5, one of which is provided for each counterweight 11. Each member 13 is substantially T-shaped in cross-section. Its lower surfaces are curved as at 14 and 15 in accordance with the curvature of the rim 3. The upper or inner surface is provided with a bolt hole 16 adjacent each end and a countersunk socket 17 in association therewith for receiving a square head formed on the inner end of a bolt 18 used in securing a counterweight 11 to the member 2.

Each of the counterweights 11 is of substantially the shape illustrated in the drawings. Each counterweight 11 is provided in one face thereof with a socket or receptacle 20 for receiving and holding additional weights. Each counterweight 11 is provided with a pair of openings 21 at its upper end through which the bolts 18 pass. Removable nuts 22 are provided on the outer ends of these bolts and can readily be reached since they are located in the receptacle 20 formed in the counterweight.

In mounting each counterweight 11 on the member 2, the member 13 with the bolts 18 positioned therein and depending from the lower surface thereof is slipped into the open end of one of the slots 12. The member 13 may then be slid through the slot 12 until it is adjacent the lower portion of the member 2 at which time the bolts 18 may be passed through the openings 21 of the counterweight 11 and the nuts 22 may be applied. Since the heads of the bolts fit into the sockets 17, the bolts will not rotate during this operation. The nuts may be tightened to clamp the counterweight 11 tightly against the periphery of the rim 3. It will be apparent that by loosening the nuts, the counterweight unit 11 may be moved on the rim 3 to any desired position. When the nuts 22 are again tightened, the counterweight will again be clamped in adjusted position. Thus, the counterweight units 11 may be adjusted to the position indicated in Figure 1 where they abut each other as indicated at 23 and their counterbalance effect is the greatest, or may be separated to any desired extent to vary the counterbalancing effect. The weights 11, or either of them, may be moved to any selected position between the position illustrated in Figure 1 and the position illustrated in Figure 6. In order to facilitate this adjustment, the inner peripheral wall of the rim 3 is provided with a plurality of circumferentially spaced apertures 24. When the nuts 22 are loosened, the counterweight units 11 may be moved along the rim 3 either by the force of gravity or by prying with a crow bar. Openings 24 will serve as "toe holds" or fulcrum points for the crow bar.

In order to lock the weights 11 in adjusted position so that there will be no danger of vibration, etc., moving them along rim 3, we provide a plurality of teeth 19 which are formed on the rim 3 along the periphery thereof. These teeth are adjusted to interlock with corresponding teeth 19' formed on the inner edge of each of the weight units 11. Thus, even though the nuts on the clamp bolts 21 become loosened somewhat due to vibration, the interlocking structure will prevent movement of the weights along the rim. The rim 3 is provided at each end with transversely extending removable bolts 3' which will normally prevent members 13 from slipping out of the open ends of slots 12.

The socket or receptacle 20 formed in each of the counterweight units 11 is adapted to receive one or more additional weight elements 25. These weight elements are of substantially the same shape as the receptacle and are secured in position by transversely extending bolts 26 which extend through aligning openings in the weights 25 and the units 11. The top edges of the weights 25 are preferably spaced from the top wall of the socket or receptacle 20 so that access to the nuts 22 may be had without removing the weights 25. Thus, the weight of the counterbalance unit may be varied by application of the weights 25 to the units 11 or removal of the weights therefrom.

It will be apparent from the above description that we have provided a counterbalance device having many desirable features. Due to the split hub construction, the device may readily be applied to or removed from the crank shaft. Furthermore, it will be apparent that the counterbalance device is so constructed that the counterbalance effect thereof may readily and quickly be varied by either or both of two methods. That is, by adjusting the angular relationships of counterweight units 11 and/or by adding or removing weight elements 25. Due to the fact that the crank arm 6 protrudes beyond the periphery of the wheel-like portion 2, a long pumping stroke is provided without unnecessarily increasing the radius of the counterbalance device. Due to the fact that the upper portion of the rim of the member 2 is omitted, the effect of the counterweight units 11 is increased. Furthermore, application of the means for securing the units 11 to the rim 3 is facilitated by the omission of the segment of the rim.

For certain uses we prefer to have the crank member 2 of the segmental form as previously described. For example, we prefer this construction for front crank or twin crank applications. In these applications, it is never necessary to swing the counterweight units over the top of the crank. However, for some other uses, a complete circle crank of the type illustrated in Figure 7 may be preferred. For example, this construction would be preferred for back crank applications where it is desirable under certain conditions to swing the counterweight units over the top and clamp both weights to one side of the crank. Thus, in the form shown in Figure 7, the member 2*a* is of disk-like form and has a rim 3*a* in the form of a continuous circle. The inner periphery of this rim is cutaway at the top thereof so that a slot or opening 27 is formed which is just of sufficient length to permit the insertion of each member 13 into the slot 12*a*. The teeth 19*a* are disposed along the entire periphery of rim 3*a*. Thus, it will be apparent that with this structure, the weights 11 or either of them may be adjusted over the top of the crank 2*a* and may be clamped in any desired position. The two weights may be disposed directly opposite member 6 or they may both be

adjusted to one side or the other of the crank arm 6.

In Figure 8 we show another form of our invention. This structure is exactly the same as that shown in Figure 7 with the exception that the member 2b is of elliptical contour rather than of circular contour as illustrated in Figure 8. The weights 11 are mounted on member 2b in exactly the same manner as previously described.

It will be apparent that our structure has many advantages, some of which have been mentioned and others which will be apparent from the drawings and the following claims.

Having thus described our invention, what we claim is:

1. A counterbalance device of the type described comprising a wheel-like structure, a crank arm formed as an integral part of said wheel-like structure, counterweights adjustably secured to the periphery of said structure, said wheel-like structure having slots of T-cross-section formed in its periphery, a separate block of T-cross-section disposed within each of said slots in such a manner that longitudinal movement thereof will be permitted but radial movement will be precluded, said block carrying bolts which project radially through said slot and are attached to one of said weights, said wheel-like structure having a segment thereof omitted so that the ends of said slots will be open to permit positioning of said blocks therein.

2. A counterbalance device of the type described comprising a wheel-like structure, a crank arm formed as an integral part of said wheel-like structure, said crank arm extending from the center of said structure and radially beyond the circumference of said structure, said wheel-like structure having a segmental portion omitted at a point diametrically opposed to the point where said crank arm extends beyond the circumference of said structure, said wheel-like structure having a rim formed on its periphery and having a pair of undercut slots formed in said rim at the outer side thereof, each of said slots extending from the crank arm circumferentially to the end of said wheel-like structure, means for securing a counterweight to the rim at each side of the projecting portion of said crank arm, said means comprising a member fitting into said undercut slot in such a manner that it is free to move longitudinally thereof but is precluded from moving radially thereof, said member carrying bolts which project radially through said slot and are attached to one of said weights, each of said weights being provided with teeth on its inner edge and said rim being provided with teeth on its outer side which interfit with each other when the counterweight is clamped in position.

3. A counterbalance device of the type described comprising a wheel-like structure, said wheel-like structure having a rim formed on its periphery and having an undercut slot formed in said rim at the outer side thereof, means for securing a counterweight to the rim, said means comprising a separate elongated member fitting into said undercut slot in such a manner that it is free to move longitudinally thereof but is precluded from moving radially thereof, said member carrying bolts which project radially through said slot and are attached to said counterweight, said counterweight being provided with teeth on its inner edge and said rim being provided with teeth on its outer side which interfit with each other when the counterweight is clamped in position by said bolts.

4. A counterbalance device of the type described comprising a crank structure having a rim on its periphery, a counterweight unit mounted on said rim and being supported solely by said rim, adjustable bolts for clamping said counterweight unit to said rim, said counterweight unit being provided with teeth on its inner edge and said rim being provided with teeth on its outer side which interfit with each other when the counterweight is clamped in position by said bolts.

5. A counterbalance device of the type described comprising a wheel-like structure, a crank arm formed as an integral part of said wheel-like structure, said crank arm extending from the center of said structure and radially beyond the circumference of said structure, said wheel-like structure having a segmental portion omitted at a point diametrically opposed to the point where said crank arm extends beyond the circumference of said structure, said wheel-like structure having a rim formed on its periphery and having a pair of undercut slots formed in said rim at the outer side thereof, each of said slots extending from the crank arm circumferentially to the end of said wheel-like structure, means for securing a counterweight to the rim at each side of the projecting portion of said crank arm, said means comprising a shoe member fitting into said undercut slot in such a manner that it is free to move longitudinally thereof but is precluded from moving radially thereof, said member having an arcuate surface which contacts with the adjacent arcuate surface of said rim and carrying detachable bolts which project radially through said slot and are attached to one of said weights.

6. A counterbalance device of the type described comprising a wheel-like structure, said wheel-like structure having a rim formed on its periphery and having an undercut slot formed in said rim at the outer side thereof, means for securing a counterweight to the rim, said means comprising a separate elongated shoe member fitting into said undercut slot in such a manner that it is free to move longitudinally thereof but is precluded from moving radially thereof, said shoe member carrying detachable bolts which project radially through said slot and are attached to said counterweight.

7. A counterbalance according to claim 6 wherein the inner wall of said rim is provided with apertures at spaced intervals through which a tool may be inserted into contact with said elongated shoe member.

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