Feb. 23, 1943. J. P. BRANDT 2,312,234

ACCELERATION RESPONSIVE DEVICE

Filed Oct. 31, 1940 3 Sheets-Sheet 1

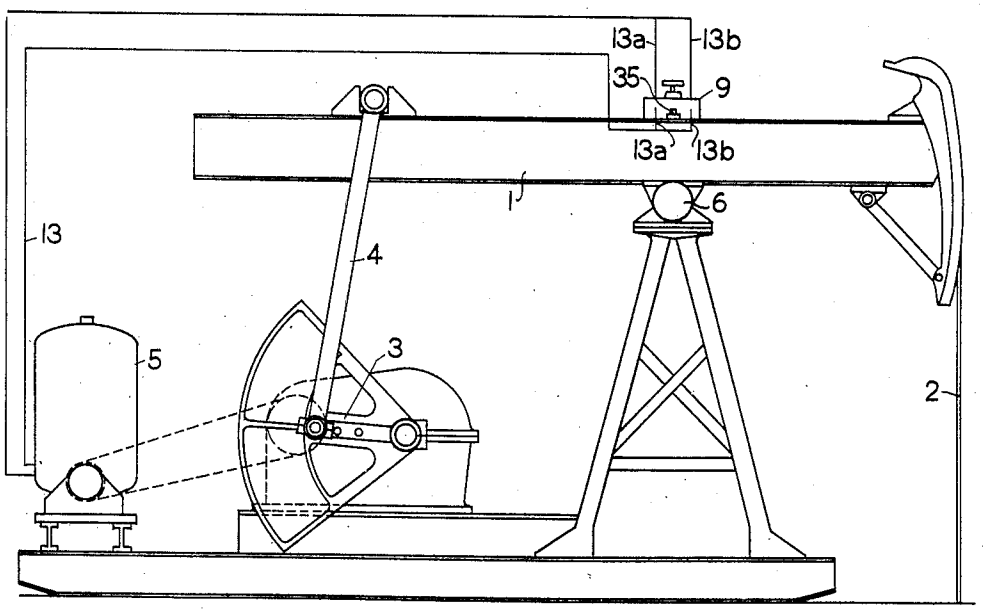


Fig. 1

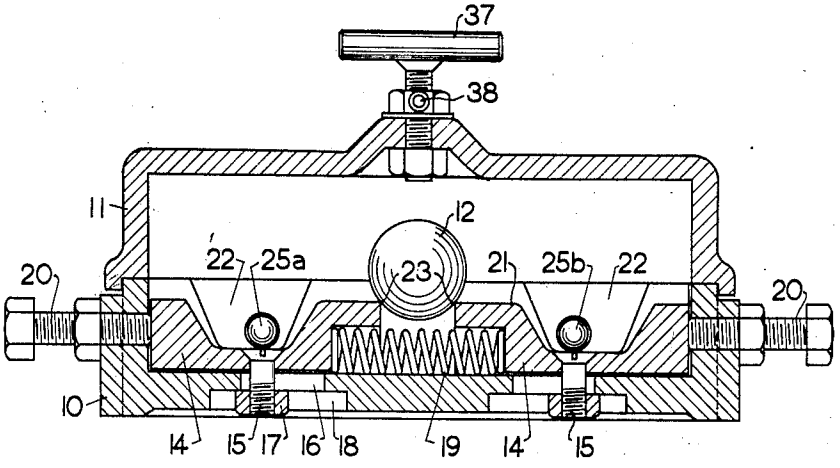


Fig. 2.

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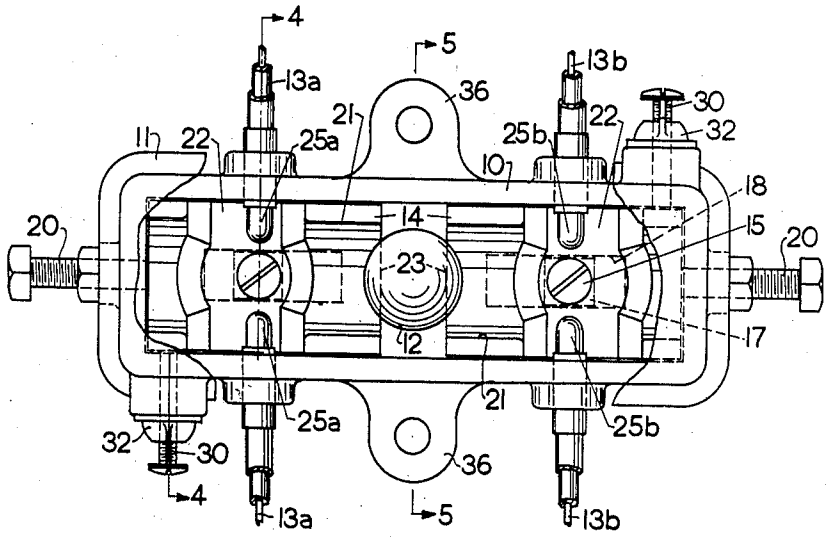


Fig. 3.

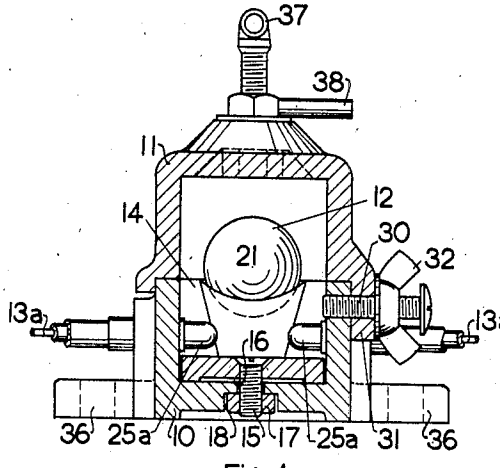


Fig. 4

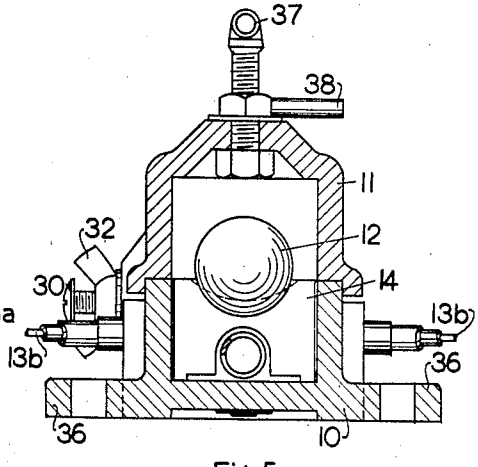


Fig. 5.

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ACCELERATION RESPONSIVE DEVICE

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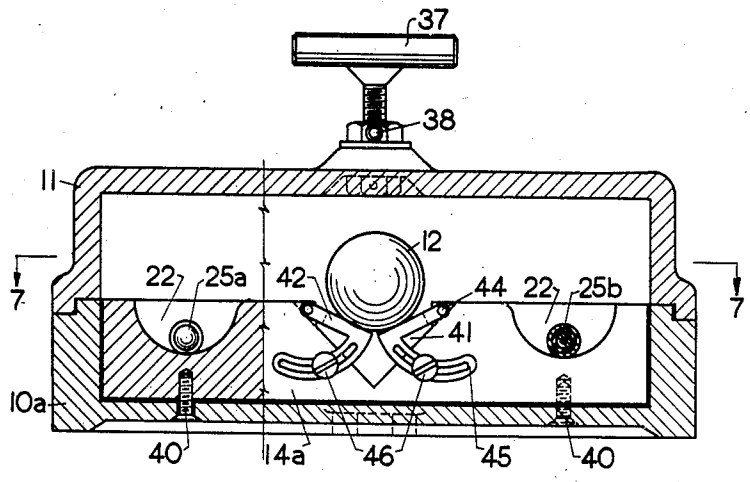


Fig.6

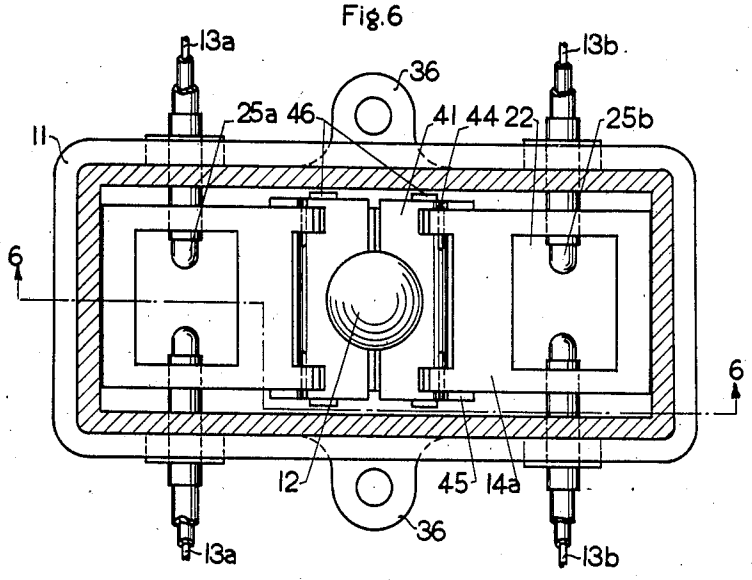


Fig.7

Inventor: James P. Brandt

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2,312,234

UNITED STATES PATENT OFFICE

2,312,234

ACCELERATION RESPONSIVE DEVICE

James P. Brandt, Bellflower, Calif., assignor to Shell Development Company, San Francisco, Calif., a corporation of Delaware

Application October 31, 1940, Serial No. 363,642

4 Claims. (Cl. 200—52)

This invention is an acceleration responsive device, and has for its object to actuate a control whenever predetermined acceleration occurs.

More particularly, it is an object of the invention to retain an operating means in inoperative position throughout normal transition of a movable element, and to shift the operating means to operative position whenever there is predetermined acceleration of the movable element, with a control actuated responsive to shifting of the operating means for indicating that acceleration has occurred or preferably for arresting movement of the accelerated element.

It is a further object of the invention to provide an acceleration responsive device for an oscillating element such as the walking beam of a deep well pump, the device being adapted for oscillation with the walking beam and including an operating means which is retained in inoperative position throughout normal oscillation of the beam, but which in the event of abnormal acceleration of the beam is shifted to operative position for actuating a control which arrests oscillation of the walking beam.

The invention is thus particularly applicable as a safety device for the walking beam of a deep well pump, in that in the event of oscillation of the walking beam at excessive speed, as may result from breaking the string of sucker rods which is reciprocated by the beam, a control is actuated for stopping the driving mechanism for the walking beam before excessive damage has been done.

Further objects of the invention will be readily understood from the following description of the accompanying drawings, in which:

Fig. 1 is a side elevation of the walking beam and driving mechanism for a deep well pump, with the acceleration responsive device mounted on the walking beam.

Fig. 2 is a longitudinal vertical section through a preferred embodiment of the acceleration responsive device.

Fig. 3 is a plan view of the same embodiment of the acceleration responsive device with its cover broken away.

Figs. 4 and 5 are transverse sections on the lines 4—4 and 5—5, respectively, of Fig. 3.

Fig. 6 is a longitudinal vertical section through another modification of the acceleration responsive device.

Fig. 7 is a cross-sectional view taken along the lines 7—7 of Fig. 6.

The invention is particularly applicable and is therefore illustrated and described in connection with the walking beam of a deep well pump. For instance, as shown in Fig. 1, a walking beam 1 is adapted for oscillation for reciprocating a string of sucker rods 2 which extend into the well for operating the pump, the walking beam being oscillated by a usual crank and pitman 3—4, and the crank 3 being rotated by driving mechanism which may be any suitable prime mover, indicated as an internal combustion engine 5. Preferably mounted above the fulcrum 6 and on the walking beam 1 is the present acceleration responsive device, schematically represented at 9.

Referring to Figs. 2–5 showing a preferred embodiment of the present invention, a casing 10 having a removable cover 11 houses the acceleration responsive device. An operating means 12 is mounted in the casing and is normally retained in inoperative position as shown at Fig. 2, but responsive to predetermined acceleration of the walking beam is shifted to one or the other of operative positions for actuating a control which in the illustrated embodiment of the invention is a normally open electrical circuit 13.

When the electrical circuit has been closed by shifting the operating means to one or the other of its operative positions, it may indicate that excessive acceleration has occurred, e. g. by providing an electrically responsive signal device (not shown) in the electrical circuit, but as a preferred arrangement closing the electrical circuit stops the driving mechanism for the walking beam 1, e. g. by short-circuiting the ignition system of the internal combustion engine 5 or by energizing a suitable electrically responsive cut-off (not shown) for whatever type of prime mover may be employed.

The operating means 12 is shown as a relatively heavy sphere, normally supported between proximate ends of blocks 14 which are mounted in the respective ends of the casing 10. The blocks are slidably mounted for adjusting the spacing between their proximate ends, and for this purpose have depending screws 15 which are slidable in slots 16 in the base of the casing 10, with retaining heads 17 threaded on the screws and slidable in recesses 18 in the underside of the casing. A spring 19 tends to longitudinally space the blocks 14, and adjusting bolts 20 are threaded through the respective ends of the casing and engage the respective blocks for projecting them toward one another against the tension of their spring.

The upper surfaces of the blocks 14 are longitudinally grooved as shown at 21, and intermediate their ends the upper surfaces of the

blocks are recessed as shown at 22. The sphere 12 is normally positioned between the longitudinally spaced blocks, resting upon supporting edges 23 which are formed at the junction of the grooves 21 with the end surfaces of the blocks, with an appreciable mass of the sphere depending from these supporting edges into the space between the proximate ends of the blocks. The sphere is thus gravitationally retained in this normal inoperative position during longitudinal tilting of the casing 10 with the walking beam 1, as long as this tilting movement is not accelerated beyond a predetermined maximum.

In the event of predetermined acceleration, inertia of the sphere 12 dislodges it from its normal inoperative position and tilts it over one or the other of the supporting edges 23 so as to roll the sphere along the corresponding groove 21 and into the corresponding recess 22, with the relatively steep end walls of the recess then retaining the sphere in the recess. The acceleration which will cause this dislodgment of the sphere may be regulated by adjusting the longitudinal spacing of the blocks 14 so that when the sphere is in normal inoperative position a greater or less portion of its mass lies below the plane of the supporting edges 23.

When the sphere has rolled into one or the other of the recesses 22 it actuates the control which in the present instance is shown as the electrical circuit 13. For this purpose, the recesses 22 open laterally through the sides of the blocks 14 and a pair of transversely spaced electrical contacts project into each of the recesses 22 through the respective side walls of the casing 10, these pairs of transversely spaced contacts being shown at 25*a*—25*b*. The recesses 22 are of a length to aline with the respective pairs of electrical contacts irrespective of the longitudinal adjustment of the blocks 14; and the contacts of each pair are transversely spaced so that in any position to which the sphere 12 may roll in a recess 22 it will engage and bridge the pair of contacts.

The sphere 12 is a metal sphere so that when bridging either pair of contacts it forms an electrical conductor therebetween; and the pairs of contacts 25*a*—25*b* are in series in the circuit 13, as shown at 13*a*—13*b*, so that an electrical circuit is completed whenever the sphere 12 bridges either pair of contacts. In the illustrated embodiment of the invention wherein closing the circuit 13 short-circuits the ignition system of the internal combustion engine 5, the sphere 12 may be grounded via its supporting block 14 and the casing 10 when bridging a pair of contacts; or, if completing the electrical circuit energizes an electrically responsive cut-off for some other type of prime mover, insulation may be provided in the recesses 22 for preventing grounding of the sphere 12 when bridging either pair of contacts, and the contacts may also be suitably insulated from the casing 10.

The cover 11 for the casing 10 is adapted for detachable mounting on the casing. As an instance, screws 30 may extend through slots 31 in depending lugs of the cover and may be threaded through the side walls of the casing 10 so as to engage and clamp the blocks 14 in longitudinally adjusted position, with wing nuts 32 threaded on the outer ends of the screws and clamping against the lugs of the cover for securing the cover in place.

The acceleration responsive device is mounted on the walking beam 1 so that when the beam is horizontal the casing 10 is also horizontal, and when the sphere 12 is in normal inoperative position resting upon the supporting edges 23 the center of the sphere is vertically alined with the axis of oscillation of the walking beam. The casing 10 may be secured in place by bolts 35 extending through ears 36 of the casing, and spirit levels 37—38 may be provided on the cover 11 for indicating when the casing 10 has been so mounted on the walking beam that it is exactly horizontal when the walking beam is horizontal.

The oscillation responsive device is thus adapted for oscillation with the walking beam; and by adjusting the bolts 20 the longitudinal spacing of the blocks 14 may be adjusted so that during normal oscillation of the walking beam the supporting edges 23 retain the sphere 12 in normal inoperative position, but in the event of predetermined abnormal acceleration of the walking beam, as may result from breaking the string of sucker rods 2, the sphere 12 is dislodged and rolls along one or the other of the grooves 21 and into the cooperating recess 22 for bridging the pair of contacts 25*a* or 25*b*, thereby closing the electrical circuit 13 for stopping the prime mover 5 and thus arresting oscillation of the walking beam before excessive damage has been done.

In another embodiment, as shown in Figs. 6 and 7, wherein like numerals indicate like parts, in place of the two blocks 14 of the first embodiment there is one block 14*a* rigidly fastened to the casing 10*a* by bolts 40 and having a transverse slot 41 approximately midway between the recesses 22. Transverse plates 42 adapted to support the sphere 12 are pivoted from the edges of the slot 41 by means of pins 44 and are adjustably positioned by means of slotted arcuate ears 45 which depend from the unpivoted edge of the plates 42. Screw bolts 46 passing through the slotted arcuate ears 45 and screwing into the block 14*a* are provided to hold the sphere supporting plates 42 in the desired position. It may be seen that the plates 42 may be readily adjusted to regulate the depth of the resting place for the sphere and thereby the acceleration which will cause the dislodgment of the sphere 12 into either of the recesses 22 where the sphere 12 will bridge a pair of the transversely spaced electrical contacts 25*a* and 25*b* projecting into each of the recesses 22.

I claim as my invention:

1. In an acceleration responsive device, longitudinally spaced blocks adapted for oscillation, the upper surfaces of the blocks being longitudinally grooved with recesses intermediate the ends of the grooves, a sphere normally resting upon supporting edges at the ends of the grooves and depending between proximate ends of the blocks, means for adjusting longitudinal spacing of the blocks, and a pair of transversely spaced electrical contacts projecting into each recess, the sphere being adapted for dislodgment from its normal inoperative position responsive to predetermined acceleration of the blocks, so as to roll along one or the other of the grooves and into the corresponding recess for bridging a pair of the contacts, and the pairs of contacts being arranged in an electrical control circuit whereby bridging either pair of contacts closes the circuit.

2. In an acceleration responsive device, longitudinally spaced blocks adapted for oscillation, a sphere normally resting and depending between proximate ends of the blocks, means for adjusting the resting space for the sphere between the blocks, the sphere being adapted for dislodgment

from its normal inoperative position responsive to predetermined acceleration of the blocks, so as to roll along one or the other of the blocks to operative position, and a control adapted for actuation by rolling the sphere to operative position.

3. In an acceleration responsive device, supporting means adapted for oscillation with the walking beam, the upper surface of the supporting means being transversely slotted intermediate its ends and longitudinally grooved with a recess on either side of the transverse slot, means for adjusting the depth of the slotted portion, a sphere normally resting in said slotted portion, and a pair of transversely spaced electrical contacts projecting into each recess, the sphere being adapted for dislodgment from its normal inoperative position responsive to predetermined acceleration of the walking beam and the supporting means, so as to roll along the groove and into one or the other of the recesses for bridging a pair of the contacts, and the pairs of contacts being arranged in an electrical circuit which controls the driving mechanism for the walking beam, whereby bridging either pair of contacts closes the electrical circuit and stops the driving mechanism.

4. In an acceleration responsive device, longitudinally spaced supports adapted for oscillation, the upper surface of each of said supports being longitudinally grooved with a recess at the outer end, a sphere normally resting in inoperative position between said spaced supports but adapted to roll along said grooved surface of either of said supports to operative position into a recess in response to a pre-determined acceleration of said supports, means for adjusting the spacing between said supports, an electrical control circuit, and means for controlling the electrical circuit by rolling the sphere to operative position into either of said recesses.

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