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(54) **KILN LID LIFT APPARATUS**

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(57) **ABSTRACT**

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A ceramic kiln of the kind having a body provided with an internal chamber to which access may be had via an opening which normally is closed by a closure that is movable from a closed position to an opened position. Lift apparatus is provided to effect movements of the closure between its closed and opened positions. The lift apparatus includes an arm which overlies the closure and is pivoted to a support independently of the kiln body for rotation about a second axis which is spaced a selected distance from the axis about which the closure rocks. The lift arm is connected to the closure by a pivot coupling which maintains the lift arm and the closure substantially parallel and uniformly spaced apart throughout the rocking movements of the closure. The pivotal connection of the lift arm to the closure enables bodily relative movement of the lift arm and the closure during rocking movements thereof in such manner as to avoid imposing appreciable stress on either the arm or the closure.

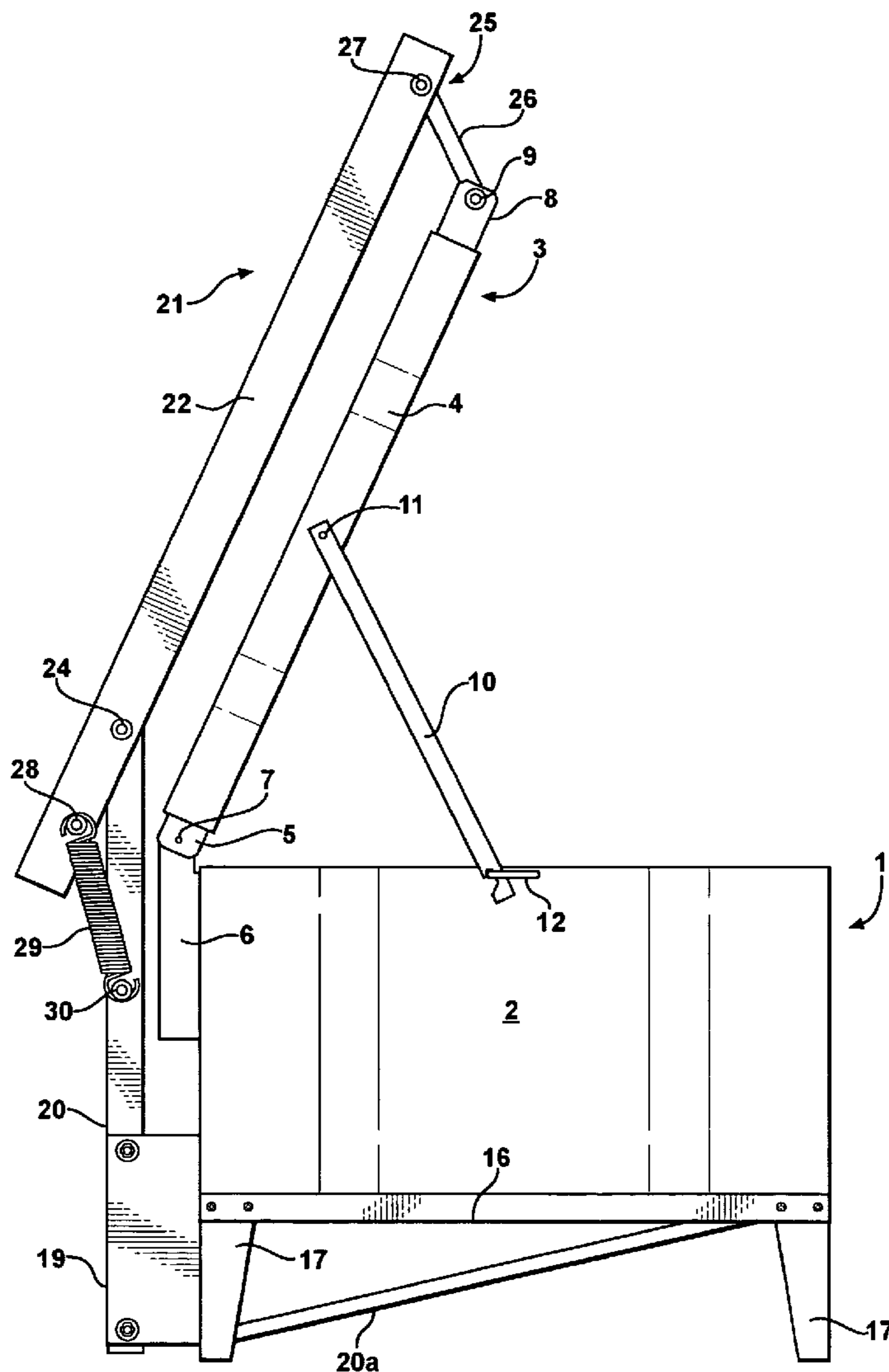
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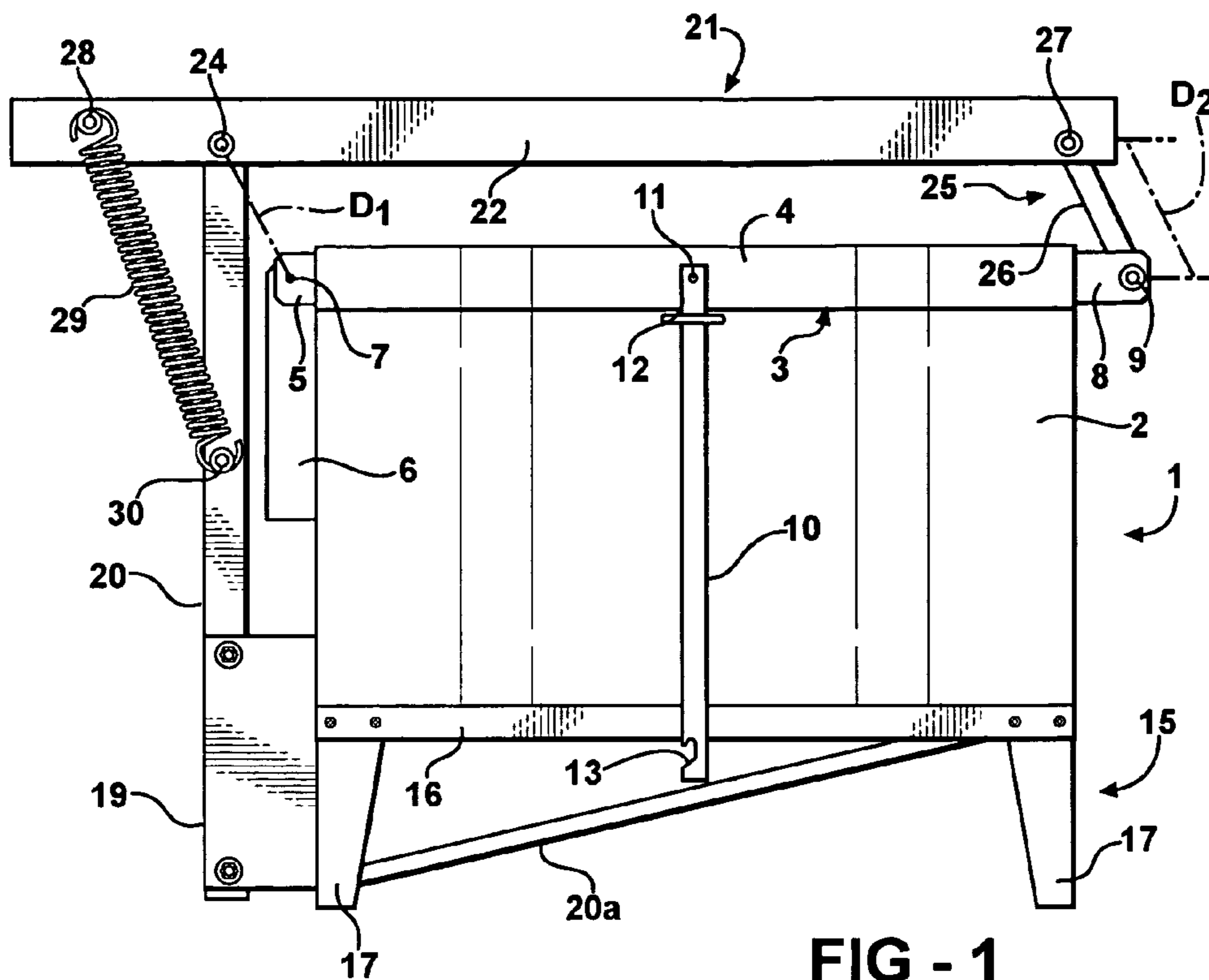


FIG - 1

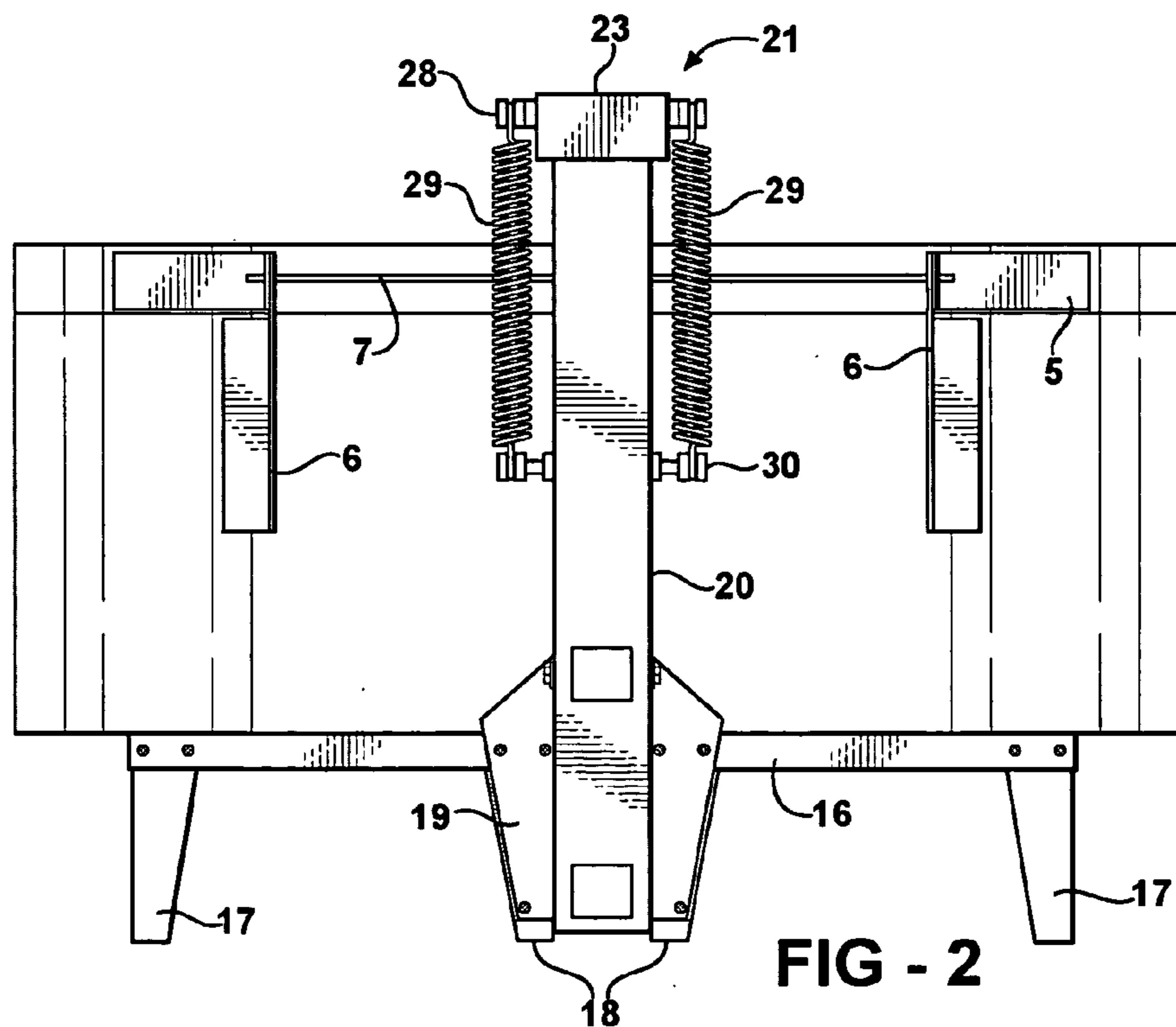


FIG - 2

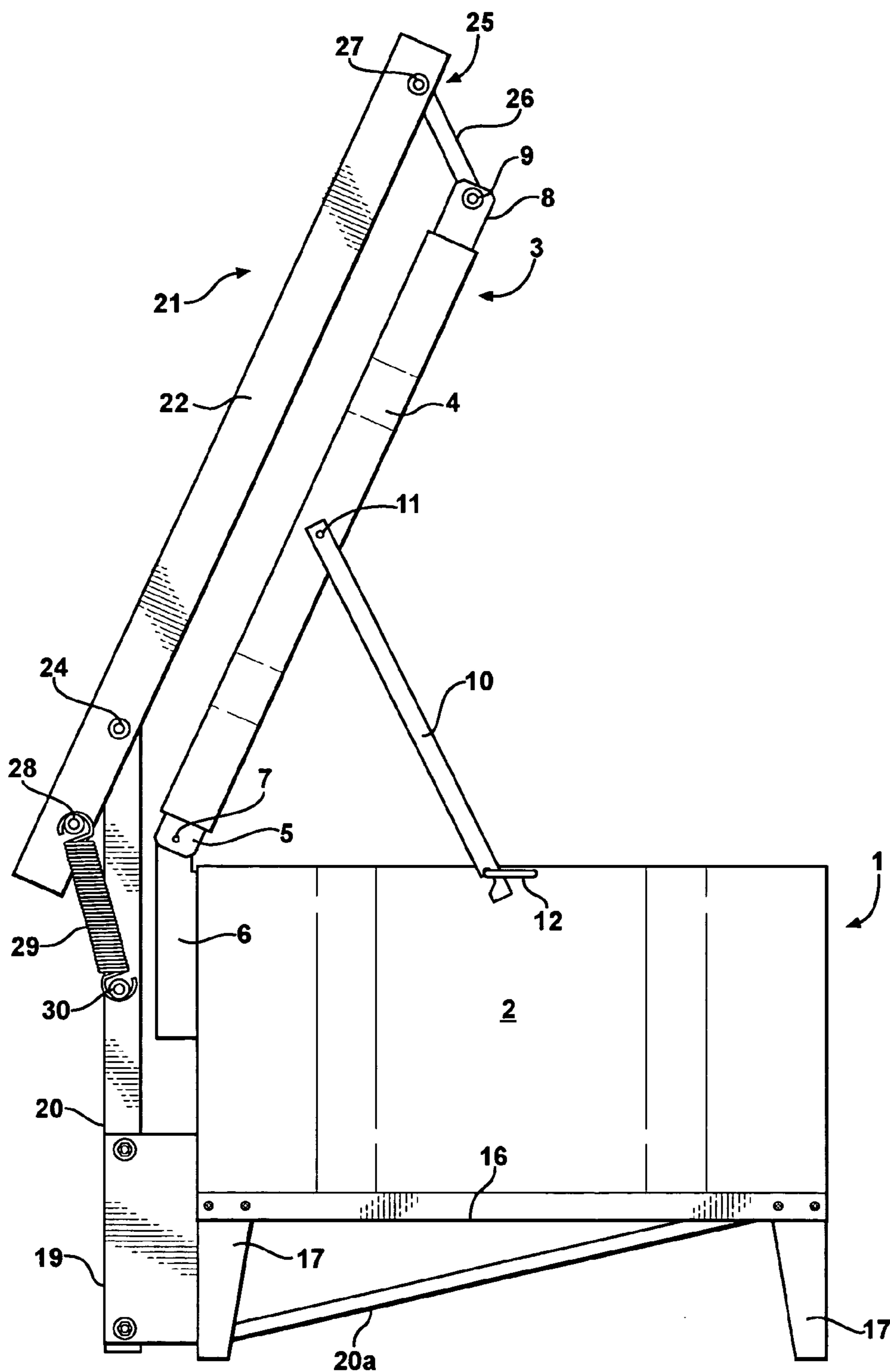


FIG - 3

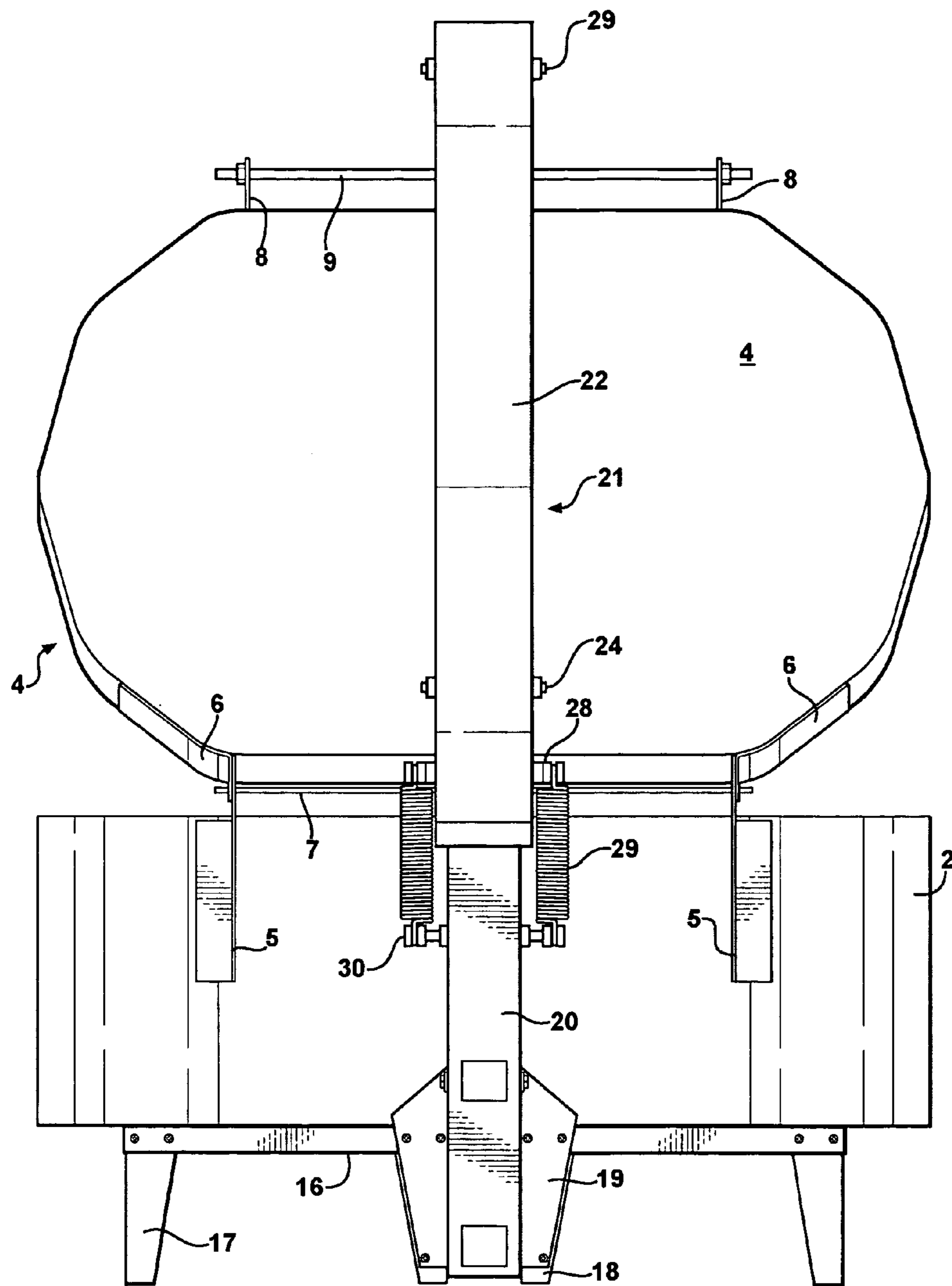


FIG - 4

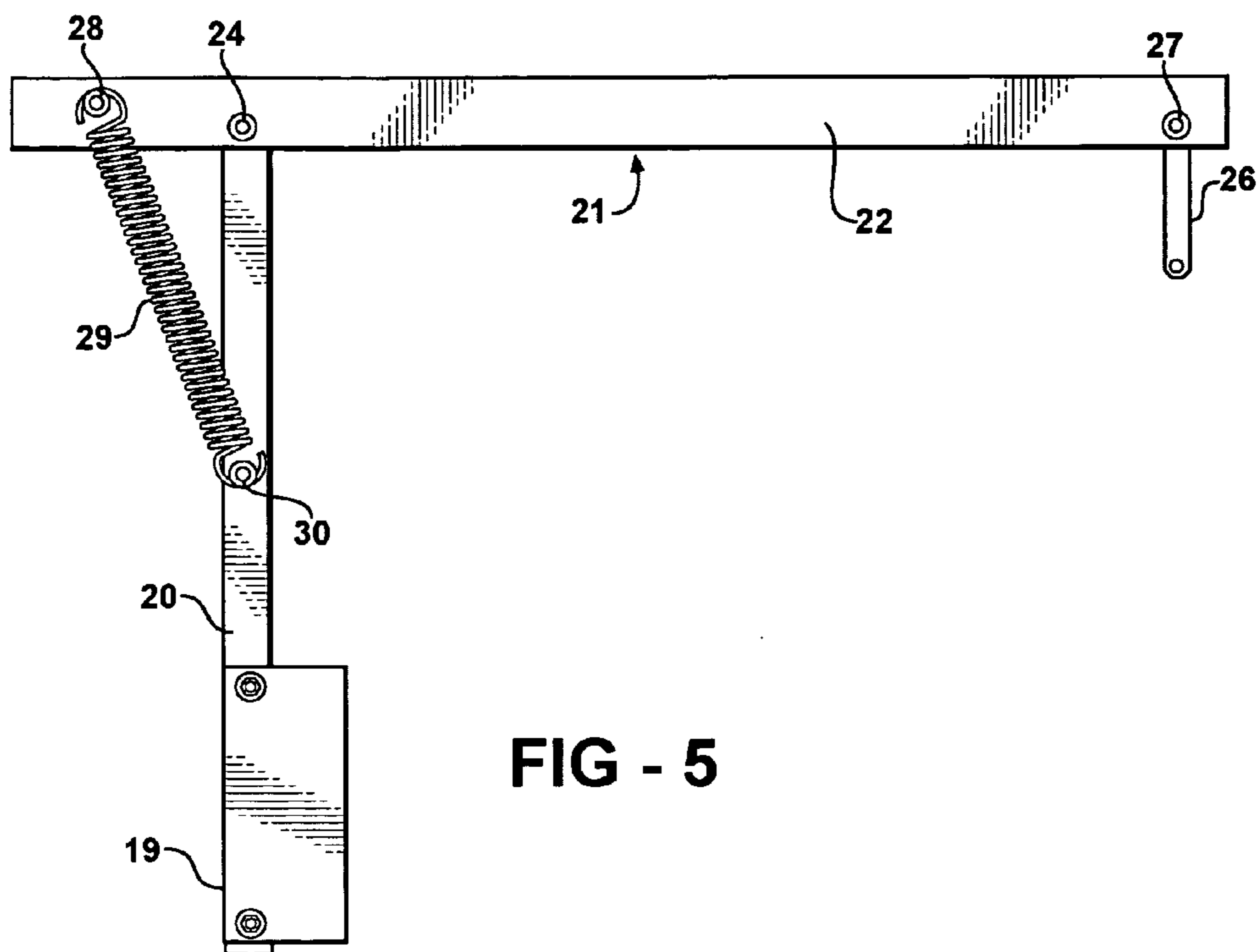


FIG - 5

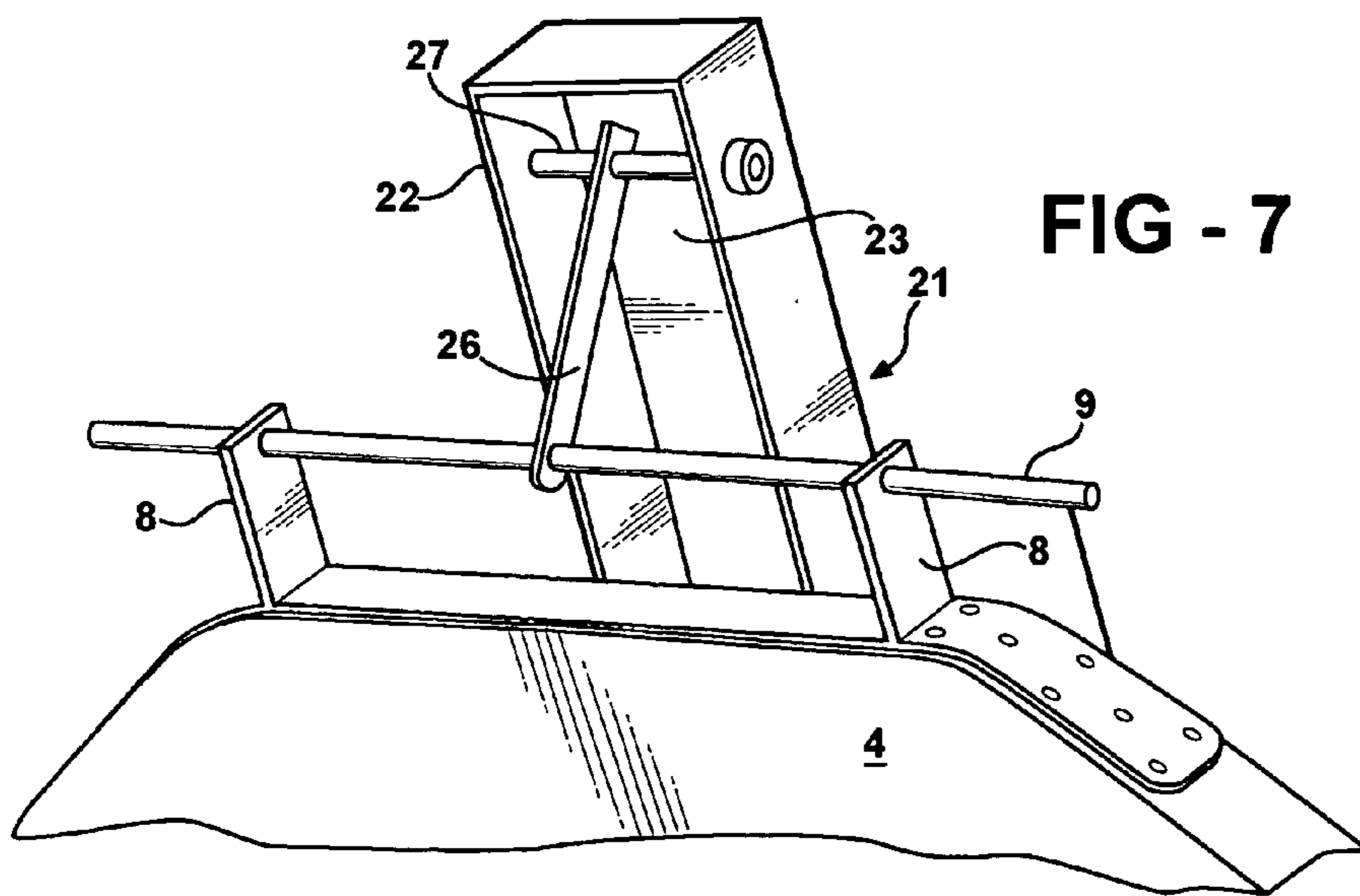


FIG - 7

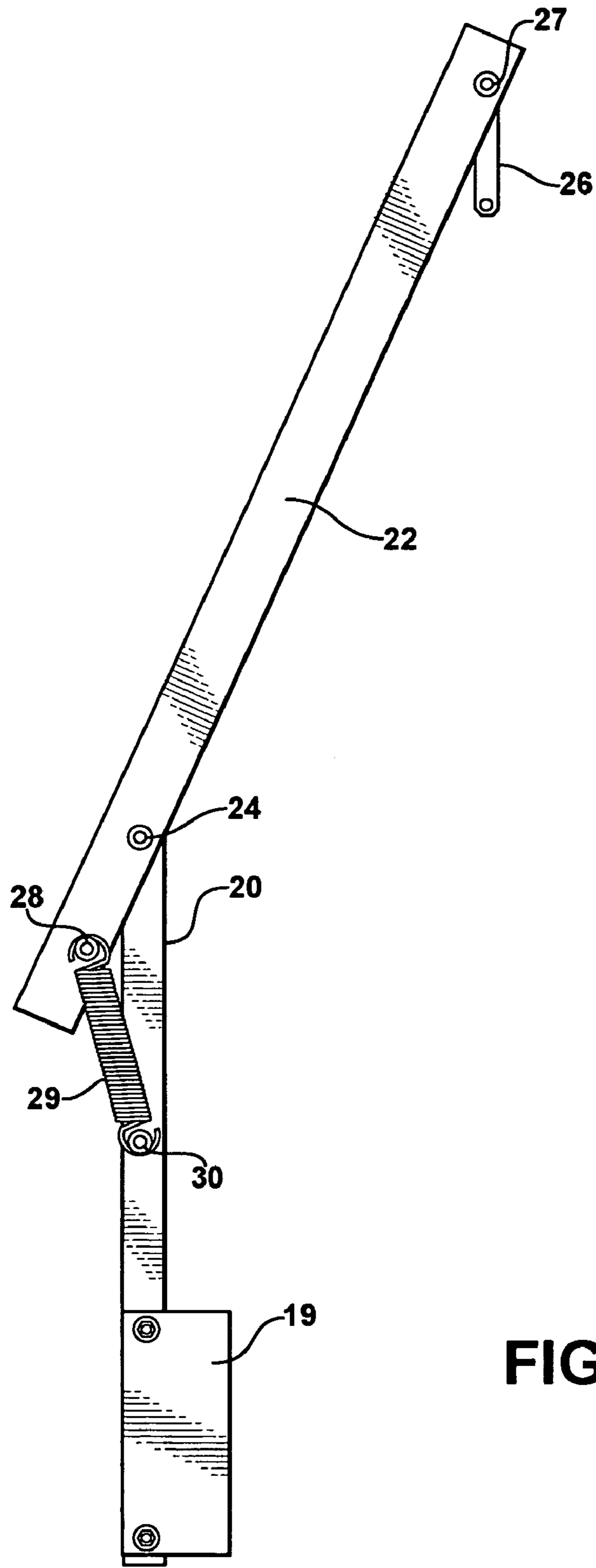


FIG - 6



## KILN LID LIFT APPARATUS

[0001] This invention relates to apparatus for use in moving a ceramic or glass kiln lid between open and closed positions.

### BACKGROUND OF THE APPARATUS

[0002] Kilns of the kind used in the manufacture of ceramic or glass items conventionally have a body provided with a chamber in which the items may be fired. Access to the chamber is provided via an opening, and such opening is selectively opened and closed by a closure or lid which is pivoted on the body for movements between its open and closed positions.

[0003] It is conventional to provide a lid or closure lift structure which, for convenience, is fixed to some part of the kiln body. In those instances in which the kiln closure is pivotable between its open and closed positions the movement of the closure frequently imposes stresses on the closure or the kiln body, or both. Over time, these stresses can produce severe damage to the kiln body, the closure, the hinge structure, or all such components.

[0004] In providing apparatus for minimizing the effects of stresses imposed during the opening and closing of a kiln closure, it is possible that the closure and kiln body may not be capable of accommodating dimensional changes which occur during temperature variations resulting from the operation of the kiln. In those instances in which a closure must be forcibly maintained in closed condition, such result usually is ensured by the use of locking or latching mechanisms. These mechanisms, however, may adversely affect the ability of the closure and the kiln to accommodate dimensional changes due to variations in temperature, thereby imposing additional stress on the closure, the kiln body, or the closure hinge structure.

[0005] A principal object of the invention is to provide a kiln body, a closure, a kiln support, and lift apparatus for moving the closure between open and closed positions and which avoids the imposition of stresses of the kind resulting from the use of mechanisms in use heretofore.

### SUMMARY OF THE INVENTION

[0006] Closure lift apparatus constructed in accordance with a preferred embodiment of the invention comprises a base on which a kiln may be supported. A kiln includes a body having a chamber therein to which access may be had via an opening. The kiln includes a closure or lid pivotally mounted on the kiln body for rocking movements about an axis between the closed and opened positions. In many instances the kiln closure is quite heavy. To avoid a person's having to lift a heavy weight, closure lift apparatus is provided to facilitate movements of the closure between opened and closed positions.

[0007] The closure lift apparatus has an upstanding support which is mounted on the base, rather than on the kiln body. At the upper end of the support is pivoted a lift arm which substantially parallels the base. The support is of such height as to enable the lift arm to overlie the kiln body and the closure when the latter is in its closed position. The lift arm is pivoted to the support for rocking movements about an axis which is spaced from the axis of rocking movements of the kiln closure. Consequently, rocking movements of the lift arm and the closure are on different radii as a result of which the paths of movement of the closure and the lift arm are different. To

avoid the imposition of stresses on the arm, the closure, and the coupling therebetween during these rocking movements the lift arm and the closure must be capable of movement relative to each other.

[0008] The lift arm and the closure move concurrently. To avoid requiring a person to overcome the weight of both the lift arm and the closure to effect movement thereof, the lift arm and the closure are counterbalanced.

[0009] To minimize the possibility of inadvertent movement of the closure from its open position to its closed position, a manually operable prop or stabilizer is provided.

### THE DRAWINGS

[0010] FIG. 1 is a side elevational view of a kiln having a pivotally movable closure occupying its closed position, a pivotally movable lift arm, a support for the lift arm, and a coupling between the lift arm and the closure;

[0011] FIG. 2 is a rear elevational view of the apparatus shown in FIG. 1;

[0012] FIG. 3 is a view similar to FIG. 1, but illustrating the lift arm and the closure in adjusted positions;

[0013] FIG. 4 is a rear elevational view of the apparatus in the positions shown in FIG. 3;

[0014] FIG. 5 is a side elevational view of the lift apparatus itself and the coupling by which the lift arm may be coupled to the kiln closure;

[0015] FIG. 6 is a view similar to FIG. 5, but illustrating the parts in adjusted positions; and

[0016] FIG. 7 is an enlarged, fragmentary, isometric view illustrating the coupling of the lift arm to the kiln closure.

### THE DISCLOSED EMBODIMENT

[0017] Apparatus constructed in accordance with the disclosed embodiment of the invention is adapted for use with a conventional ceramic kiln 1 having a body 2 within which is a chamber for the accommodation of ceramic items which are to be fired. Access to the chamber may be had through a top opening which may be opened or closed by a closure 3 comprising a lid 4 having brackets 5 which cooperate with brackets 6 for the accommodation of a pivot pin 7 constituting a first axis. The lid 4 may rock about the first axis from the closed position shown in FIG. 1 to the opened position shown in FIG. 3. The closure 3 also has brackets 8 at its opposite end for the accommodation of a coupling rod 9. The lid 4 is substantially planar.

[0018] A stabilizer bar 10 is pivoted at one end thereof to the lid 4 by a pivot pin 11 and extends through a retainer loop 12. The opposite end of the stabilizer 10 has a notch 13 therein which may accommodate a portion of the retainer 12 when the closure is in the opened or raised position shown in FIG. 3 to provide support for the closure and minimize the likelihood of its moving inadvertently to its closed position.

[0019] Except for the parts 8 and 9 the apparatus thus far described is conventional.

[0020] The apparatus includes a base 15 having a support member 16 on which the bottom of the kiln body 1 may seat. The base also includes two pairs of supporting legs 17 and two additional supporting legs 18 between two of the legs 17. See FIG. 2. The legs 18 and the member 16 provide support for a bracket 19 from which an upright support 20 extends to a level above that of the lid 4 when the latter is in its closed position. A brace 20a reinforces the bracket 19.



[0021] A channel shaped, planar lift arm **21** has a pair of spaced, parallel sides **22** bridged by a web **23**. Adjacent, but spaced from, one end of the arm **21** is a pivot pin **24** which provides a pivotal connection of the arm **21** to the support **20**, thereby providing a pivotal axis about which the arm **21** may rock. As is best shown in FIGS. **1** and **3**, the axes formed by the pivot pins **7** and **24** are vertically and laterally spaced apart along an imaginary line inclined to the vertical. The spacing between the pivots is a fixed distance indicated in FIG. **1** at  $D_1$ .

[0022] Adjacent the opposite end of the arm **21** is a coupling **25** comprising a link **26** pivoted to the lid **4** by means of the pin **9** and to the arm **21** by means of a pivot pin **27**. The effective length of the coupling **25** is designated  $D_2$  (FIG. **1**), and such length corresponds to that designated  $D_1$ . The arm **21** thus is rockable relative to the kiln and the support **20** about the axis of the pivot **24** and also is rockable relative to the kiln and the lid about the axis formed by the pin **27**.

[0023] As is best shown in FIG. **1** the lid **4** and the arm **21** are substantially parallel when the lid is closed. The link **26** bridges the space between the lid **4** and the lift arm **21** and occupies a position which substantially parallels the imaginary line joining the pivot pins **7** and **24**, and the distances  $D_1$  and  $D_2$  are substantially the same. The geometry is such that the effect of the arrangement is like a parallelogram.

[0024] At that end of the arm **21** opposite the pivot **27** is an anchor post **28** to which corresponding ends of a pair of counterbalance springs **29** are connected. Opposite ends of the springs are connected to a similar anchor post **30** that is carried by the support **20**.

[0025] When the apparatus is in condition for operation the lid will be closed, the arm **21** will overlies the lid, and the link **26** will be coupled to the closure lid and to the lifter arm. The kiln body **2** will be seated on the base **15** and abut the bracket **19**. See FIG. **1**. When the lid **4** is in its closed position the arm **21** is substantially parallel to the lid.

[0026] To move the lid **4** to its open position, a lifting force may be applied manually or otherwise to the coupling rod **9**. Such force will be imparted to the lid via the link **26** thereby effecting conjoint rocking movement of the lid and lift arm about the first and second pivot axes **7** and **24**, respectively. As the lid **4** and the arm **21** rotate about their respective pivot axes the link **26** will rock clockwise about the pivot **27** from the position shown in FIG. **1** to the position shown in FIG. **3**. As a consequence, there will be relative linear movement of the members **4** and **21** in such manner that the pivot axis of the rod **9** will move from a position (FIG. **1**) in which it is beyond the free end of the arm **21** to a position (FIG. **3**) in which the free end of the arm **21** extends beyond the free end of the lid **4**. During such movement the two members **4** and **21** will remain virtually parallel, thereby avoiding the imposition of any significant stress on the lid **4**, the arm **21**, their respective pivots, or the kiln body **2**. Such movement of the members **4** and **21** to their raised positions will be assisted by the counterbalance springs **29**.

[0027] As shown in the drawings the linear movement of the lid **4** relative to the lift arm requires the link **26** to rock, thereby causing the rod **9** to partake of slight vertical movement. Such vertical movement may be eliminated in known manner by the provision of a short slot in the lower end of the link through which the rod **9** passes.

[0028] The members **4** and **21** may be returned to the positions shown in FIG. **1** simply by applying a sufficient down-

ward force on the free end of the arm **21** to overcome the force of the counterbalance springs **29**.

[0029] To minimize the possibility that the closure member **3** inadvertently may return from its open position to its closed position, the stabilizer bar **10** may be adjusted so that the retainer **12** is accommodated in the notch **13**. The lid **4** thus will be propped in its open position. The bar **10** may be adjusted to withdraw the retainer from the notch when it is desired to return the lid to its closed position.

[0030] The disclosed embodiment is representative of a presently preferred form of the invention, but is intended to be illustrative rather than definitive thereof. The invention is defined in the claims.

We claim:

1. Lift apparatus for use with a kiln having a body within which is a chamber to which access may be had via an opening, said body including a closure rockable about a first axis between first and second positions in which said closure respectively closes and opens said opening, said lift apparatus comprising a lift arm; mounting means independent of said body mounting said lift arm in a position spaced from said closure and for rocking movements about a second axis vertically and laterally spaced from said first axis; and coupling means coupling said lift arm to said closure for rocking movements of said lift arm relative to said closure, said coupling means bridging the space between said closure and said lift arm, the vertical spacing between said first and second axes and between said lift arm and said closure being substantially the same.

2. Lift apparatus according to claim 1 wherein said lift arm and said closure are substantially parallel to one another in all positions of said lift arm.

3. Lift apparatus according to claim 1 wherein said coupling means comprises a link having two ends and being pivoted at one end to said closure and at the other end to said lift arm.

4. Lift apparatus according to claim 1 including counterbalance means reacting between said lift arm and said mounting means for balancing said closure and said lift arm.

5. Lift apparatus according to claim 1 wherein said closure overlies said body when said closure is in said first position.

6. Lift apparatus according to claim 5 wherein the space between said lift arm and said closure is substantially uniform in all positions of said lift arm and said closure.

7. Lift apparatus according to claim 1 wherein said mounting means comprises a base on which said body may seat, and an upright support member carried by said base and extending beyond said body.

8. Lift apparatus for use with a kiln having a body within which is a chamber to which access may be had via an opening, said body including a closure rockable about a first axis between first and second positions in which said closure respectively closes and opens said opening, said lift apparatus comprising a lift arm; mounting means independent of said body mounting said lift arm in a position overlying, substantially parallel to, and spaced from said closure and for rocking movements conjointly with said closure about a second axis vertically and laterally spaced a fixed distance from said first axis; and coupling means coupling said lift arm to said closure for substantially linear movements of said closure relative to said lift arm, said coupling means bridging the space between said closure and said lift arm, the vertical spacing between said first and second axes and between said lift arm and said closure being substantially the same, whereby the vertical



spacing between said lift arm and said closure remains substantially uniform during said substantially linear movements of said closure relative to said lift arm.

**9.** Lift apparatus according to claim **8** wherein said lift arm and said closure remain substantially parallel to one another in all positions of said lift arm.

**10.** Lift apparatus according to claim **8** wherein said coupling means comprises a link having two ends, said link being pivoted at one end to said closure and at the other end to said lift arm.

**11.** Lift apparatus according to claim **8** including counterbalance means reacting between said lift arm and said mounting means for balancing said lift arm and said closure.

**12.** Lift apparatus according to claim **8** wherein said mounting means comprises a base on which said body may seat, and an upright support member carried by said base and extending beyond said body, said support member forming a positioning abutment engageable by said body.

**13.** Lift apparatus according to claim **8** wherein said first and second axes are spaced apart along an imaginary line inclined to the vertical, and wherein said coupling means includes a link joining said closure and said lift arm and extending substantially parallel to said imaginary line when said closure occupies said first position.

**14.** Lift apparatus according to claim **13** wherein said coupling means includes a link pivoted at opposite ends thereof to said closure and to said lift arm.

**15.** Lift apparatus for use with a kiln having a body within which is a chamber to which access may be had via an opening, said body including a closure rockable about a first axis between first and second positions in which said closure respectively closes and opens said opening, said lift apparatus comprising a lift arm; mounting means mounting said lift arm

in a position overlying, substantially parallel to, and spaced from said closure and for rocking movements conjointly with said closure about a second axis vertically and laterally spaced a fixed distance from said first axis; and coupling means coupling said lift arm to said closure for conjoint movement of said closure and said lift arm about said first and second axes, respectively, said coupling means bridging the space between said closure and said lift arm, the vertical spacing between said first and second axes and between said lift arm and said closure being substantially the same.

**16.** Lift apparatus according to claim **15** wherein said lift arm and said closure remain substantially parallel to one another in all positions of said lift arm.

**17.** Lift apparatus according to claim **15** wherein said coupling means comprises a link having two ends, said link being pivoted at one end to said closure and at the other end to said lift arm.

**18.** Lift apparatus according to claim **15** wherein said mounting means comprises a base on which said body may seat, and an upright support member carried by said base and extending beyond said body, said support member forming a positioning abutment engageable by said body.

**19.** Lift apparatus according to claim **15** wherein said first and second axes are spaced apart along an imaginary line inclined to the vertical, and wherein said coupling means includes a link joining said closure and said lift arm and extending substantially parallel to said imaginary line when said closure occupies said first position.

**20.** Lift apparatus according to claim **15** wherein said link is pivoted at opposite ends thereof to said closure and to said lift arm.

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