United States Patent [19]

Kerr

[11] **3,783,976**

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[54] **SAFETY DEVICE FOR HYDRAULICALLY OPERATED LIFT**

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[22] Filed: **July 26, 1972**

[21] Appl. No.: **275,279**

[52] **U.S. Cl.**..... **187/8.45,** 187/8.47, 92/15, 188/67, 91/41

[51] **Int. Cl.**..... **B66f 7/00,** F15b 15/26

[58] **Field of Search**..... 187/8.45, 8.47; 92/24, 25, 27, 28, 15; 188/67; 91/41; 254/93

[56] **References Cited**

UNITED STATES PATENTS

3,096,075	7/1963	Brown	188/67
3,695,144	10/1972	Goiffon	91/41

FOREIGN PATENTS OR APPLICATIONS

1,103,862	6/1955	France	187/8.47
697,244	9/1962	Italy	187/8.47

Primary Examiner—Robert S. Ward, Jr.
Attorney—Charles R. Rutherford

[57] **ABSTRACT**

The device is shown as associated in the usual subfloor pit with a conventional hydraulically powered lift mechanism to check fall of a lift or elevator in the event of an emergency loss of pressure or overspeed. A fixed housing is mounted atop the lift's power cylinder super-structure; and a pivotal, bifurcated arm or fork-shaped actuator head embraces the fixed housing, an operating extension tail of said head projecting from one side of the latter. The furcations of said pivoted head carry trunnion-like actuator pins, which extend through vertically elongated slots in opposite sides of the fixed housing; and the ends of said trunnions are received in outer side openings of each of a pair of identical collets. These are actuable in the fixed housing parallel to the axis of the lift's hydraulic power rod or piston for releasable frictional radial engagement with said rod of arcuate inner collet areas, thus to safety-halt an undesired downward retrograde movement of the latter. To this end external tapered collet wedge surfaces engage correspondingly tapered internal wedge surfaces of the fixed housing. The same source of hydraulic power which operates the lift rod is at all times in communication with a spring return-type safety cylinder unit of the device; and the plunger of this unit is connected to the extension tail of the pivotal actuator head. This is in a manner such that normal hydraulic pressure urges the head in a direction to de-wedge the collets from clamping engagement with the lift power rod, through the agency of the head's trunnions. A loss of substantial droppage of the hydraulic pressure correspondingly depressurizes the safety cylinder unit, enabling its built-in return spring to operate the actuator head in the opposite direction and cause the collet members to grip the power rod against fall. Supplemental spring means normally assist in insuring separation of the collets from the rod when the device is not in operation.

13 Claims, 4 Drawing Figures

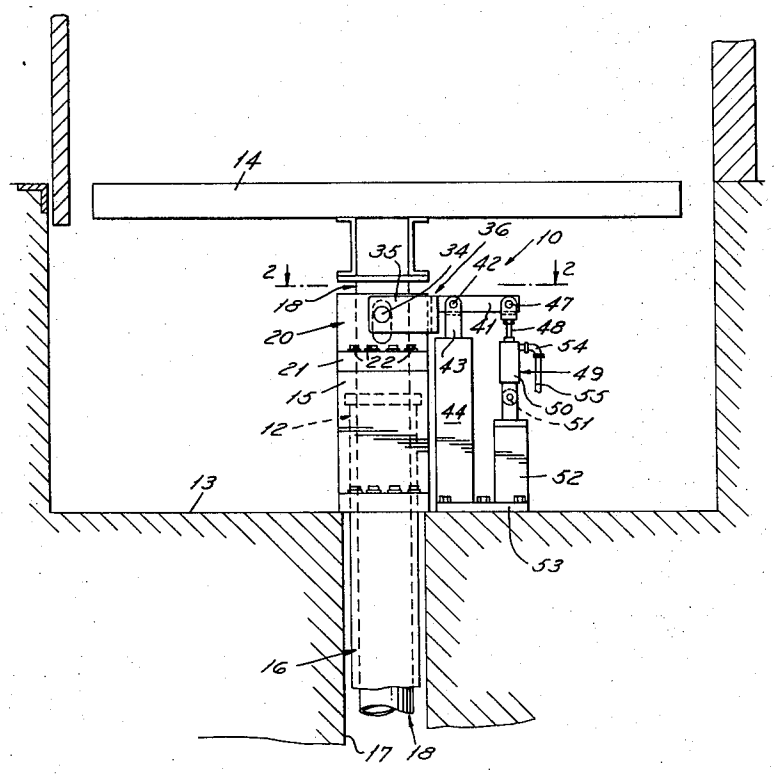


FIG. 1

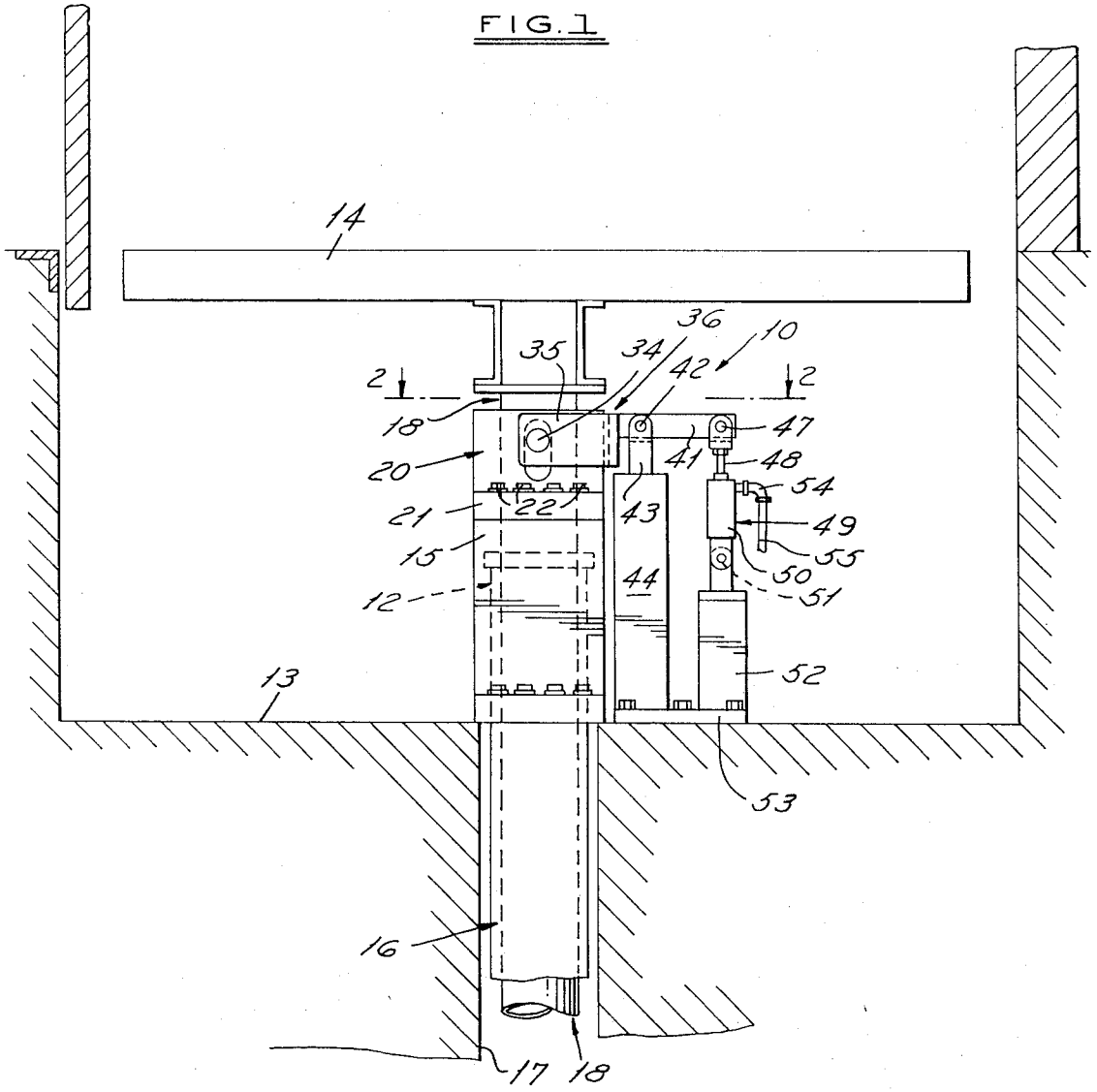

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FIG. 4

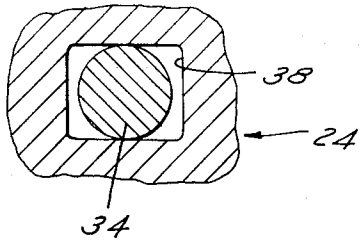

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FIG. 2

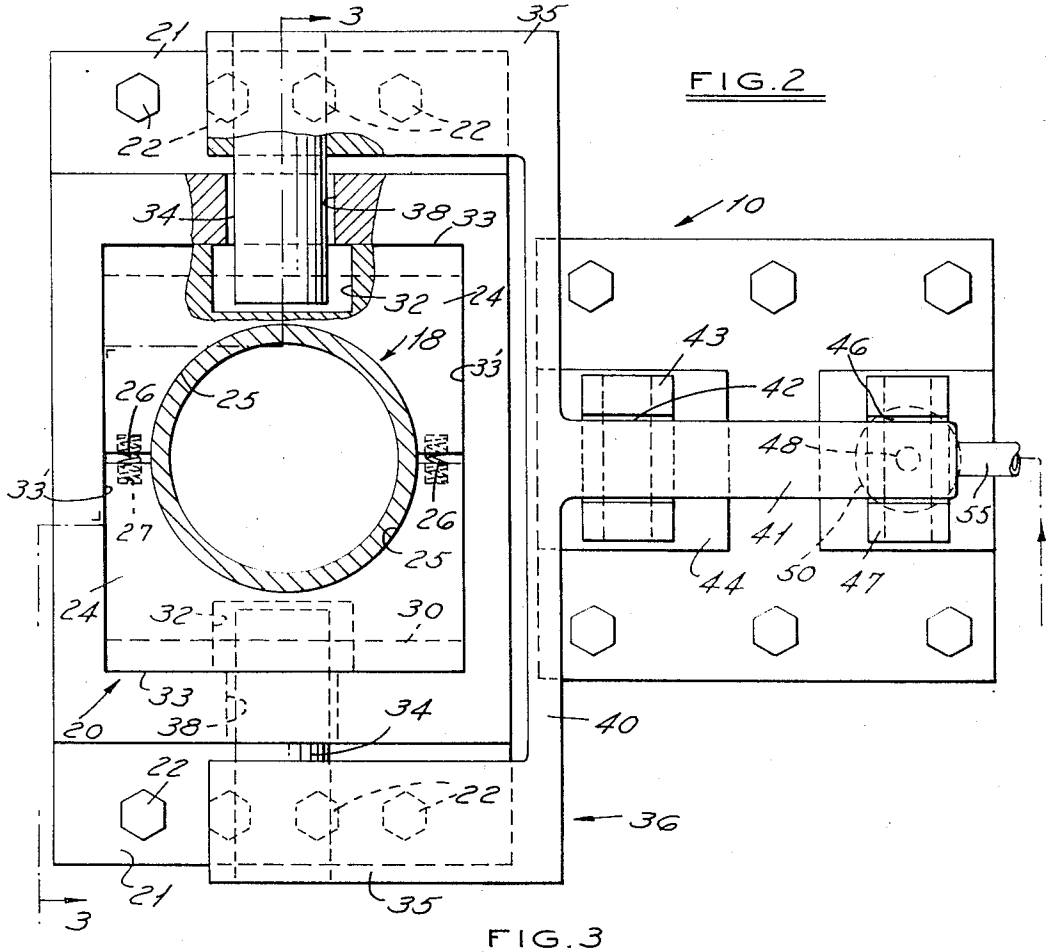
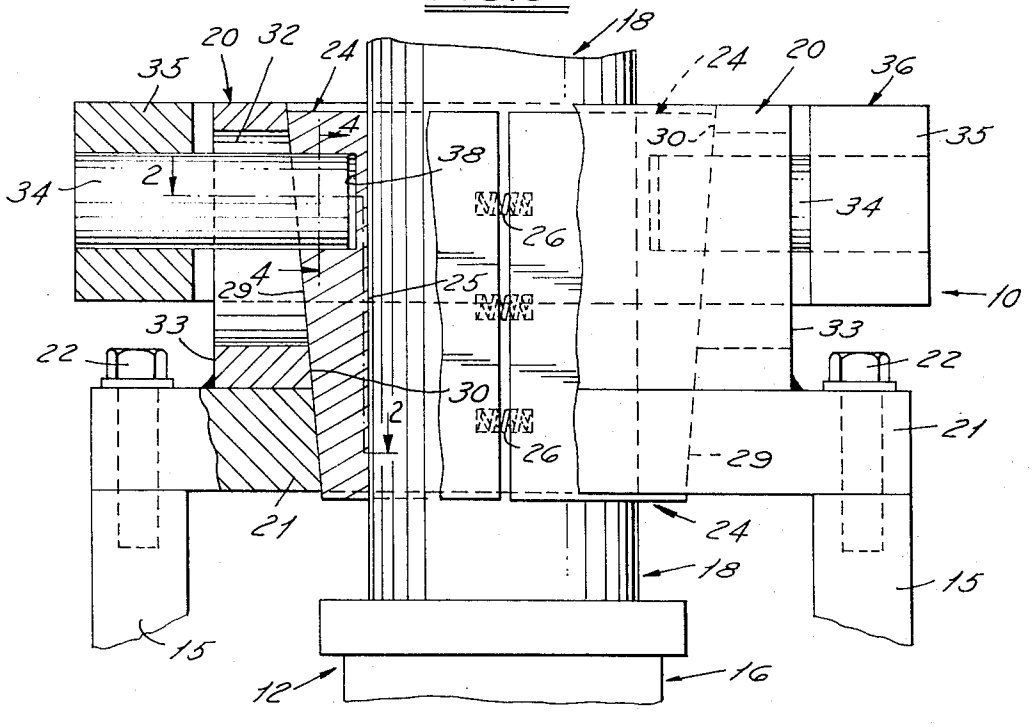

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FIG. 3


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SAFETY DEVICE FOR HYDRAULICALLY OPERATED LIFT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The safety device of the invention finds application in checking possible dangerous drop of hydraulic lifts or elevators of various types and sizes, for example, in sizes ranging from a use in a gas station repair space up to installations servicing a considerable number of commercial, factory or residential building floors. The device will also have broad utility in other types of motion checking hydraulic or pneumatic pressure operated equipment, in any of which a positive mechanical check of an accidental or emergency-occasioned retrograde movement of an object is desired. This is in particular the case in an installation in which a simplicity of structure and quick, reliable fool-proof operation are essential.

2. Description of the Prior Art

A search has revealed the following U.S. Pats.:

Metz et al, No. 1,938,191, Dec. 5, 1933;
Stukenborg, No. 1,939,420, Dec. 12, 1933;
Ross et al., No. 3,088,546, May 7, 1963;
McAlpine, No. 3,094,192, June 18, 1963;
Woor et al., No. 3,276,548, Oct. 4, 1966.

None of these relate, however, to a simple hydraulically controlled collet-type safety checking mechanism for a lift or equivalent structure which is powered for emergency operation by the power source of said structure.

SUMMARY OF THE INVENTION

The safety device of the invention, as hydraulically operated in the manner just mentioned by a very simple safety cylinder unit, is otherwise mechanically of a very simple nature. In this respect the device comprises a pivotal actuator housing or head fulcrummed atop an upright post or standard for swing in a vertical plane including the axis of the lift's power rod, laterally outwardly to one side of which fulcrum, in relation to said rod an operating arm of said head is pivotally articulated to the plunger of said safety cylinder, which is a very simple spring return type hydraulically coupled to the main fluid pressure power source.

That source normally urges the pivotal actuator head vertically in a direction to raise the two collets, as trunnion-carried on said head, and thereby normally maintain the collets out of wedged clamping engagement with the lift power rod. A failure or a substantial drop in hydraulic pressure on the rod instantly energizes the safety cylinder unit, with the result that the collets are driven down a very short distance to wedge the power rod to halt a drop of the latter in excess of, say 18 inches.

The effectiveness of the subject safety device is such that it will positively clamp and hold the lift or elevator power rod even if all the operating oil is drained from the latter's cylinder, as in the event of bursting of a conduit. The device is capable of installation readily and expeditiously in new or old installations; and its frictional collet-type rod locking operation does not externally score or damage the power rod.

A simple spring means continuously acts between the collets to spread the latter, thus insuring against their freezing to prevent restoration of the safety device to normal. When the device has set for lack of pressure,

as contemplated, it will automatically self-release upon movement of the main power rod upwardly, after working pressure is restored, to the extent of only 1 inch. An attendant is not required to get into the elevator pit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a somewhat schematic sectional view through an ordinary elevator or lift pit, being in a general vertical plane including the axis of the power cylinder assembly of the lift as equipped with the safety device of the invention;

FIG. 2 is an enlarged scale top plan view of said device, being partially broken away and in horizontal section on a line corresponding to broken line 2—2 of FIG. 3;

FIG. 3 is a side elevational view, also partially broken and in vertical section along ine 3—3 of FIG. 2; and

FIG. 4 is a view in transverse vertical section on line 4—4 of FIG. 3, illustrating a detail of connection of an operating trunnion pin of the device's actuator head with a releasable locking collet.

DESCRIPTION OF A PREFERRED EMBODIMENT

FIG. 1 shows the general organization of parts of the safety device, generally designated **10**, as assembled to a hydraulic lift or elevator structure **12**, the latter being typically mounted at sub-floor level on the bottom of a pit **13**. This pit is sized to receive an elevator or lift floor, platform, car track or equivalent support member **14** as raised and lowered by hydraulic power structure or unit **12**. An external superstructure **15** of that unit, as fixedly connected thereto, bottoms on the floor of pit **13**, to which it is bolted; and the unit's vertical sleeve extension **16** goes sufficiently down in a vertical bore **17** of the pit to accommodate the most extended position, in that direction, of the elongated operator rod or piston **18** of power unit **12**. The latter is powered in cylinder structure **15** by hydraulic pressure oil admitted beneath a driven portion of piston **18**, under control of a conventional reversing valve arrangement.

As also appears in FIG. **1**, although better illustrated as to detail in FIGS. **2** and **3**, the device **10** includes a fixed rectangular box - like and open-centered housing unit **20** which is welded at its bottom to a laterally projecting base plate **21**, also open-centered, of substantial thickness. As thus composed, the housing **20** rests (FIGS. **1** and **3**) atop the superstructure **15** and is rigidly secured thereto by a series of studs **22**. Thus it is seen that the device **10** is adapted for ready installation on an existing cylinder assembly, as well as an equipment component of an original installation.

Referring now to FIGS. **2**, **3** and **4** in conjunction with FIG. **1**, the safety device **10** comprises a collet unit including a pair of identical locking collets **24**, each presenting a semi-cylindrical inner frictional locking surface **25** to mate with an approximately equal peripheral area of the power rod **18**, which is shown as tubular in cross-section. Since (FIG. **3**) the collets **24** are also of very substantial axial dimension, large friction areas are present at their rod mating surfaces **25** for releasably locking rod **18** in the manner to be described.

Coil compression springs **26** seat in appropriate recesses **27** of the collets **24**, just diametrically outwardly of the latter's lock surfaces **25**, said springs normally urging the collets for unfailing separation, but of course yielding to permit clamping under the control of the remaining parts of safety device **10**.

Each of the collets has an external, frusto-conical wedging surface **29**, which coacts with a correspondingly angled internal mating wedge surface **30** on the fixed housing member **20**; and the collets **24** are vertically shiftable upwardly to release or disable such wedging engagement, as well as downwardly to restore it, under the control of actuator means of device **10** to be described.

Further in accordance with the invention, the fixed housing member **20** is provided with a pair of vertically elongated slots **32** which are in diametrically opposed relation to one another across the axis of power piston **18**, as appears in FIG. **2**, the slots **32** opening between the inner wedging surfaces **30** of housing **20** and the latter's upright external side surfaces **33**. The latter, in conjunction with front and rear internal housing surfaces **33'**, define the rectangular housing opening in which collets **24** are laterally confined. The housing base plate **21**, of course, has a similar rectangular opening of smaller side-to-side width similarly receiving and laterally confining the lower collet ends.

The fixed housing slots **32**, as appears in FIGS. **1** and **2**, are not only of substantial vertical height, but also are sufficiently wide to receive with generous lateral clearance a pair of actuator pin or trunnion members **34**, which are fixedly carried by forked arms **35** of a movable actuator housing or head **36** of device **10**, the operation of which is later detailed. For the time being, it suffices to say that the furcation arms **35** have substantial lateral clearance relative to the upright sides **33** of fixed housing **20**, and that their trunnion **34**, as diametrically opposed to one another in relation to the axis of rod **18**, extend through the clearance slots **32**. They have operative engagement at their inner ends in side recesses **38** formed in the collets **24**, said recesses inwardly terminating short of the wedging surfaces **25** of the collet (FIG. **3**).

FIG. **4** shows the recess **38** as receiving the actuator trunnion **34** with substantial horizontal clearance, thus accommodating a small arc of swing of the trunnion as carried by pivotally mounted actuator arms **35**, but with negligible vertical clearance, so that lost motion is substantially nil in the vertical shift of the collet **24** by the actuator arm means.

The arms **35** are integrally connected in their forked relation to one another by a horizontal cross bar portion **40** of the head **36**, which portion in turn presents (FIGS. **1** and **2**) a central, outwardly extending actuator tail bar **41**. This bar portion is journaled for vertical swing by a pivot pin **42** located approximately midway of the distance between actuator trunnion pins **34** and the free end of the tail **41**; the pin being carried by a top clevis part **43** (FIG. **1**) of an upright pedestal or standard **44** supported on the floor of pit **13**; and clevis **43** and pivot **42** are at an elevation to bring the actuator head **36** in a substantially horizontal plane when the safety device **10** is in a released position, with its collets **24** out of wedged checking engagement with rod **18**. This will be in a position of the collets somewhat above the location of the latter shown in FIG. **3**, i.e., with the tops thereof then substantially co-planar with the top of fixed housing **28**.

Adjacent its free end the actuator head tail **41** has a pivotal connection, as at a transverse pin **46**, within a second clevis part **47** which is adjustably connected to the top of the plunger **48** of a spring return-type hydraulic safety cylinder unit **49**. The cylinder proper **50** of said unit has a pivotal rockable connection at **51** to a top part of an upright standard **52** (FIG. **1**) which, in common with the fulcrumming standard **44**, has a bolted connection, through a single base plate **53** for both, to the floor of pit **13**.

A fluid pressure L-fitting **54** operably connects an upper space of spring return cylinder **50** with a pressure line **55** appropriately connected for pressurization from the same source of hydraulic power (not shown) that powers the lift or elevator cylinder assembly **12** to elevate rod or piston **18**; such hydraulic connections for the safety cylinder unit **49** and the cylinder **15** of unit **12** are simultaneously pressurized or not, the latter as in the event of a loss or substantial pre-determined and undesired droppage of pressure of hydraulic power oil.

Thus it is seen that in the normal non-emergency role of the device **10**, its safety cylinder **50** will be pressurized to draw its plunger rod **48** downward, as viewed in FIG. **1**, with the result that the trunnion elements **34** on the arms **35** of its actuator head **36** are raised, correspondingly raising the collets **24** and dis-engaging the latter frictional-wise from piston **18**. The set of compression springs **26** interposed between the collets insure this desired normal radial spacing of the collets relative to the rod. However, upon an emergency droppage of oil pressure beneath power piston **18**, a corresponding pressure droppage in safety cylinder unit **49** occurs, with the result that the latter's built-in return spring (not shown) instantaneously drives plunger **48** and its connection to the tail **41** of actuator head **36** upwardly, swinging the actuator head **36** counterclockwise as viewed in FIG. **1**. This correspondingly moves trunnions **34** downwardly and causes the wedging coaction of collet wedge surfaces **29** and housing wedge surfaces **30** (FIG. **3**) to drive the collets radially for a strong frictional clamping and motion-checking engagement with power piston **18**.

What is claimed is:

1. A safety device for a lift or like rod axially powered operationally under fluid pressure in one direction but normally subject to retrograde axial movement in the event of a predetermined droppage of its fluid pressure operating power, said device being actuable to check said retrograde movement and comprising collet-type means releasably engageable with said rod to so check the latter, and means operatively connected to said checking means, being responsibly powered by the source of fluid pressure operating power for said rod, to actuate said safety device in said event of operating power droppage, said collet-type checking means comprising a collet unit including a pair of like collet members disposed radially outwardly of said fluid pressure-powered rod and movable radially inward to grip the latter, and a housing unit within which said collet members operate, said units having coacting axially tapered wedging surfaces operatively engageable with one another upon relative axial shift of said units to releasably radially engage said collet members with said rod, and a single actuator head operatively connecting one of said units to said responsively powered means to effect said relative axial shift of said units, and an attendant radial shift of said collet members to grip said rod, in said event of fluid pressure operating power droppage.

2. The safety device of claim **1**, in which said housing unit is a fixed one within which said collet members operate parallel to the operating axis of said rod, said actuator head operatively connecting both of said collet

members to said responsively powered means to effect axial shift of said collet members in the housing unit.

3. The safety device of claim 2, in which said responsively powered means comprises a fluid pressure cylinder unit having an element operated in one direction only under fluid pressure from said source, said element being operatively connected to said actuator head to effect said releasable checking engagement of said collet members with said rod.

4. The safety device of claim 3, in which said operated element of said cylinder unit is spring-returned in a direction opposite its direction of fluid pressure operation.

5. The safety device of claim 4, in which said operated element of said cylinder unit has pivoted arm means operatively connecting the same with said actuator head and through said head with said collet members for said axial shift of the latter.

6. The safety device of claim 4, in which said arm means has trunnion elements extending through said fixed housing unit for operating engagement with the respective collet members for said axial shift.

7. The safety device of claim 6, and further comprising means acting automatically on said collet members to release them from checking engagement with said rod upon restoration of fluid pressure operating power.

8. The safety device of claim 3, in which said operated element of said cylinder unit has pivoted arm means operatively connecting the same with said actuator head and through said head with said collet members for said axial shift of the latter.

9. The safety device of claim 8, in which said arm means has trunnion elements extending through said fixed housing unit for operating engagement with the respective collet members for said axial shift.

10. The safety device of claim 2, and further comprising means acting automatically on said collet members to release them from checking engagement with said rod upon restoration of fluid pressure operating power.

11. The safety device of claim 1, in which said responsively powered means comprises a fluid pressure cylinder unit having an element operated in one direction only under fluid pressure from said source, said element being operatively connected to said actuator head to effect said releasable checking engagement of said collet members with said rod.

12. The safety device of claim 11, in which said operated element of said cylinder unit is spring-returned in a direction opposite its direction of fluid pressure operation.

13. The safety device of claim 1, and further comprising means acting automatically on said one unit to cause a release of said collet members from checking engagement with said rod upon restoration of fluid pressure operating power.

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UNITED STATES PATENT AND TRADEMARK OFFICE

Certificate

Patent No. 3,783,976 Patented January 8, 1974

James W. Kerr

Application having been made by James W. Kerr, the inventor named in the patent above identified, and Kingsley Corp., Brighton, Mich., a corp. of Mich., the assignee, for the issuance of a certificate under the provisions of Title 35, Section 256, of the United States Code, adding the name of Edward S. Dyszer as a joint inventor, and a showing and proof of facts satisfying the requirements of the said section having been submitted, it is this 27th day of October 1981, certified that the name of the said Edward S. Dyszer is hereby added to the said patent as a joint inventor with the said James W. Kerr.

Fred W. Sherling
Associate Solicitor.