Dec. 3, 1968 J. H. WILSON ET AL 3,413,766

STABILIZERS FOR FLUID CYLINDER PLUNGERS

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Fig. 1

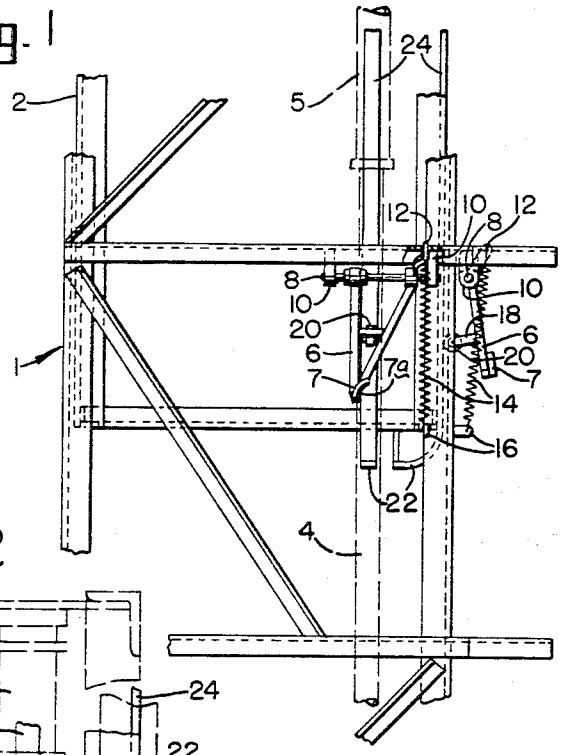


Fig. 2

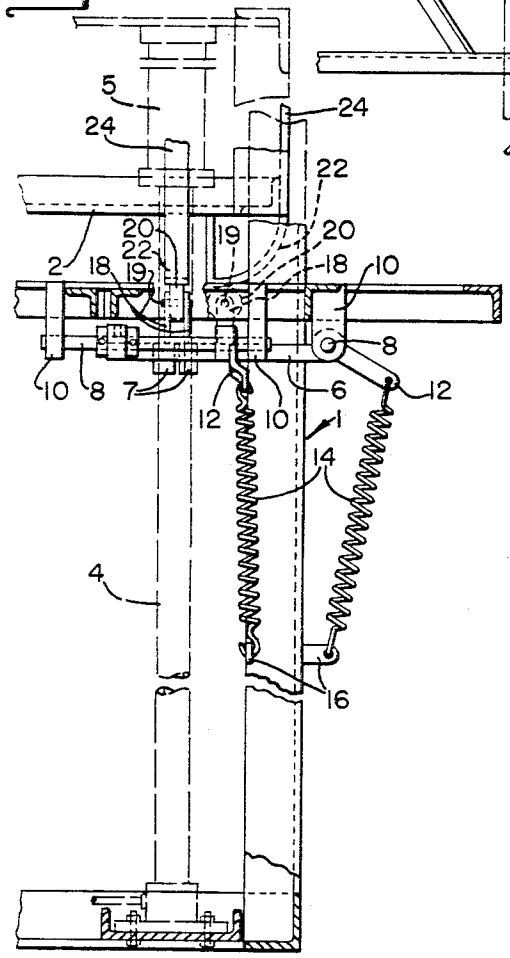
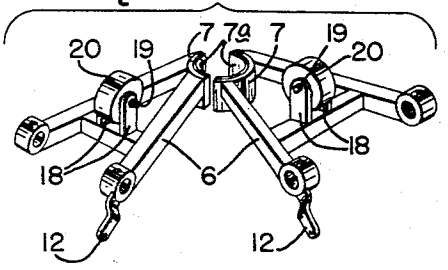


Fig. 3



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Fig. 4

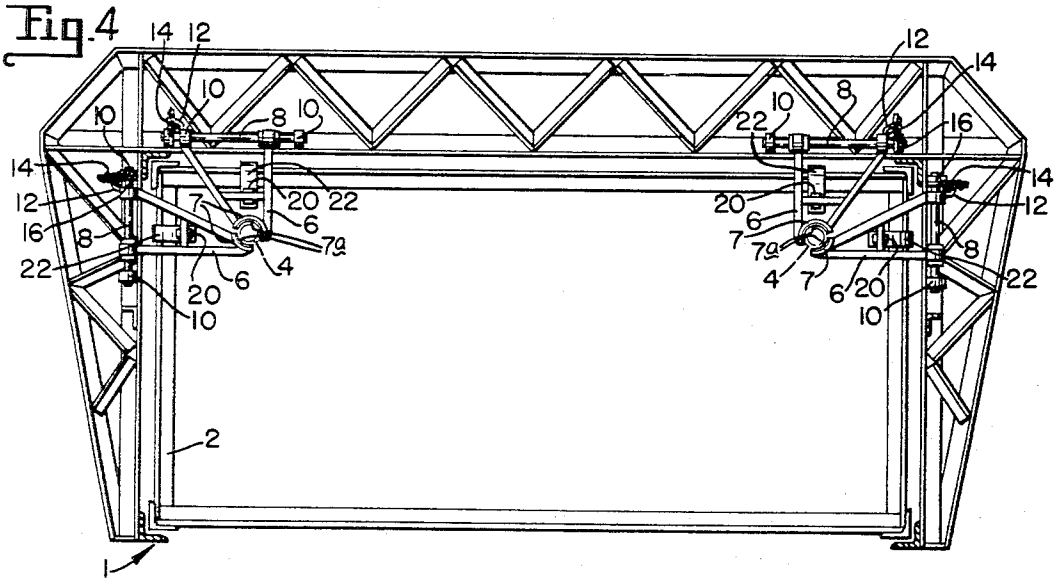


Fig. 5

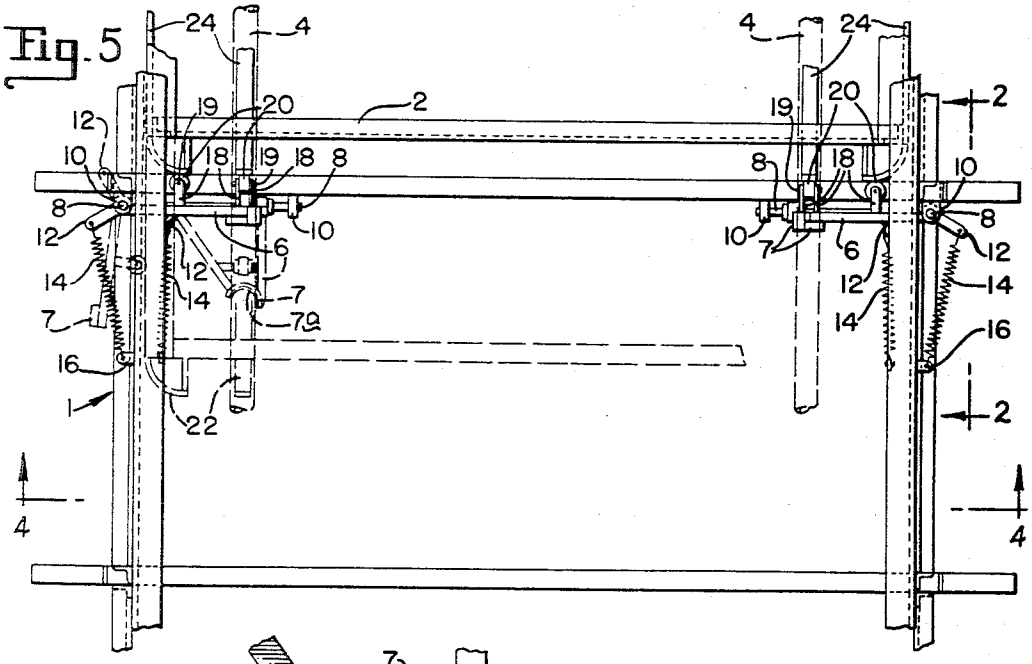
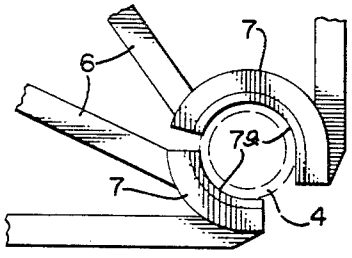


Fig. 6



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STABILIZERS FOR FLUID CYLINDER PLUNGERS

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5 Claims. (Cl. 52—115)

ABSTRACT OF THE DISCLOSURE

Stabilizers for the plunger of a fluid cylinder, which prevents lateral movement of the plunger, when the plunger is in extended position, of greater length than that at which the unsupported plunger would remain rigid. The plunger is stabilized by pairs of arms pivotally mounted at right angles to each other, which arms move into position around the plunger as the plunger is extended from the cylinder. The stabilizer arms are retained in inwardly extended position, in engagement with the plunger, under the influence of a spring. The stabilizers are moved out of engagement with the plunger by a cam and roller arrangement, as the plunger is retracted.

This invention relates to improvements in stabilizers for fluid cylinder plungers such as used in connection with fluid cylinders for raising masts and extensible towers and the like.

Plunger stabilizers have been proposed heretofore such as disclosed in the patent to John Hart Wilson No. 3,016,992, granted Jan. 16, 1962, for Stabilizer for Fluid Cylinder Plungers of High Slenderness Ratio, and S. N. 619,884 co-pending application filed by John Hart Wilson on Feb. 13, 1967, for Stabilizer for Fluid Cylinder Plungers.

The present fluid cylinder plunger stabilizers are so constructed that a minimum of mechanism is required for the operation thereof, which stabilizers will automatically stabilize a plurality of fluid cylinder plungers used for moving the inner portion of an extensible mast or tower upward past a predetermined point, which plungers are of such high slenderness ratio that they would be unstable if extended without being supported laterally. Furthermore a plurality of plungers can be stabilized laterally within the shaft of an elevator to enable multiple cylinders, of high slenderness ratio, to be used to move elevator cars to heights heretofore not attainable by laterally unsupported fluid cylinder plungers. The stabilizer for elevator plungers is more fully brought out in the above mentioned co-pending application.

The present stabilizer units are shown in conjunction with a mast or tower, such as is generally used with drilling rigs, and, for the sake of clearness, only a fragmentary portion of the mast or tower is shown. to show that portion of the mechanism and the associated parts of the tower or mast necessary to adequately show the operational relationship therebetween.

In the present instance two sets of stabilizers are shown, which lie substantially in a horizontal plane; however as many sets of stabilibers may be utilized within the length of the derrick, tower or elevator shaft, as necessary to stabilize a plurality of fluid cylinder plungers. The present stabilizers are so constructed and positioned as to automatically swing into position to stabilize fluid cylinder plungers against lateral movement as a portion of a mast, tower or elevator car is moved upward, which plungers are maintained in stabilized position until the portion of the mast, tower or elevator car is moved downward, which will cause mechanisms associated with each pair of plunger stabilizers to move from around the fluid cylinder plunger into a position out of the normal path of the mast section, tower or elevator car moving downwardly thereby. By having a mast, tower or elevator car constructed with a portion thereof which moves within the mast, tower or elevator shaft lifted by a hydraulic ram, or plunger, the present device will stabilize the plunger against lateral movement each time the lower end of the inner portion of the mast, tower or elevator car passes a predetermined section or point on the outer mast structure or elevator shaft, upon which the stabilizer is mounted. In this manner a relatively slender plunger, of extreme length may be used, where hertofore the extension of such plunger was limited, if the plunger was not stabilized.

An object of this invention is to provide stabilizers. for the plungers of hydraulic cylinders ,which will prevent an elongated plunger moving laterally as it extends outward from a hydraulic cylinder such as used for mast sections, tower sections, elevator car, or the like.

Still another object of the invention is to provide plunger stabilize mechanisms which will move into place and surround the plungers of hydraulic cylinders, which plungers are of high slenderness ratio, at spaced intervals along the length thereof as the plunger becomes exposed, so as to prevent lateral deflection of the exposed, extended plunger.

Still another object of the invention is to provide pairs of laterally extending plunger stabilizer arms, each which pair is pivotally mounted at right angles so as to stabilize a plunger located in close proximity to a corner of a mast, tower or elevator shaft, which pairs of stabilizer arms are operated by cams to move the plunger stabilizers out of the path of the mast section, tower section or elevator car as the section or car moves downwardly, and to move the laterally extending arms into place horizontally, by means of springs, to prevent lateral deflection of hydraulic cylinder plunger.

Still a further object of the invention is to provide hydraulic plunger mechanism for a plurality of hydraulic plungers to stabilize the plungers against lateral movement, which mechanism is simple in construction, easy to apply to a mast. tower or elevator shaft, and which will operate automatically as a portion of the mast, tower or elevator car moved upward or downward, thereby, the mechanism requires a minimum of attention and service.

In the manufacture of portable masts or tower structures it is highly desirable to telescope the upper portion of the mast or tower into the lower portion of the structure so that the structure may be moved from place to place over the highways, and be within the acceptable road lengths, but which structures may be raised to an upright position and extended into operating position to present a mast or tower of sufficient height to enable the handling of rotary drill stem or pipe in long lengths, so as to expedite the drilling and/or servicing of deep wells such as oil wells or the like. The present device is capable of being used on hydraulic cylinder plungers, such as used in hydraulic elevators in multi-story buildings, which may exceed twelve stories in height.

An embodiment of the invention is illustrated in the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

FIG. 1 is a fragmentary, side elevational view of a portion of a derrick or tower, showing an inner portion and an outer portion, with the inner portion lowered below the cylinder plunger stabilizers, and showing the cylinder plunger in dashed outline;

FIG. 2 is an enlarged, fragmentary, sectional view taken on line 2—2 of FIG 5, showing a pair of the cylinder plunger stabilizers in position to stabilize a cylinder plunger. The hydraulic cylinder and the cylinder plunger being shown in dashed outline;

FIG. 3 is a perspective view of a pair of complementary cylinder plunger stabilizer arms, shown apart from the mast, tower, or elevator shaft, and showing a cam engaging roller on the upper side of each of the arms;

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 5, looking in the direction indicated by the arrows; and showing the cylinder plunger stabilizer arms surrounding a plurality of cylinder plungers, with the cylinder plungers being shown in dashed outline;

FIG. 5 is a fragmentary front elevational view of a mast or tower, showing a mid-section of the outer mast or tower and the lower end portion of the inner mast or tower, a pair of hydraulic cylinder plungers being shown in dashed outline as associated therewith, the fluid cylinder plunger stabilizers being shown in full outline, in horizontal position, the retracted position thereof being shown in dashed outline, with the inner portion of the mast or tower being shown in an alternate position in dashed outline; and

FIG. 6 is an enlarged fragmentary view of the end portions of a pair of cylinder stabilizers.

With more detailed reference to the drawings, the numeral **1** designates generally an outer mast portion which slidably receives therein an inner mast portion **2**. The inner mast portion **2** has a pair of hydraulic cylinder plungers **4** extending from the respective hydraulic cylinders **5** downward to the base of the mast, when the mast or tower is in upright position, (FIG. 2).

In extending relatively tall masts or towers by hydraulic rams or plungers of hydraulic cylinders, as by sliding one section within another section, it is necessary to stabilize the plungers thereof to prevent the lateral movement of the plungers with respect to the normal axis thereof.

In the present invention the inner portion **2** of the mast or tower is longitudinally movable with respect to the outer mast portion **1** and the plungers **4** are each positioned within the mast structure near two of the corners of the outer mast structure, (FIG. 4), each of which plungers is capable of being stabilized by a pair of stabilizing arms **6**, which arms **6** are pivotally mounted on pivot shafts **8** on the outer mast structure, which shafts are arranged in pairs near two corners of the mast and are at right angles to each other, FIG. 4, and are so journaled in bearings **10** so that the frame or stabilizing arms **6** will swing from a downwardly depending position, as shown in dashed outline in FIG. 5, to the laterial position, shown in full outline in FIGS. 2, 3 and 4. Each arm **6** is so mounted on the respective shafts **8** as to be rotatable about the axes of the respective shafts through an arc of approximately 90 degrees. Each arm **6** has an outwardly extending lever **12** mounted thereon and secured thereto, each which lever is apertured and to which is secured an end of a tension spring **14**, with the other end of each spring being anchored to the respective apertured lugs **16** on the outer mast structure **1**.

Each of the arms **6** has a pair of upstanding, apertured lugs **18** thereon, the apertures of each lug receive a shaft **19** on which a roller **20** mounted in journaled relation.

Upon raising the inner mast section **2** upward within the outer mast section **1**, the rollers **20** will roll off of the ends of the respective trackways **24** onto the respective cams **22**, which cams are arcuate and which will permit the respective arms **6** to move from the position as indicated in dashed outline in FIG. 5 to the full outline therein, and to the full outline position as indicated in FIGS. 2 and 4, as the tension springs **14** act upon the respective levers **12** to rotate arms **6** through an arcuate movement of approximately 90 degrees.

The inner end portion of each arm **6** has an arcuate, parti-cylindrical portion **7** secured thereon, which portions are complementary, and form parti-cylindrical members, which surround more than 180 degrees of the plunger **4**, when the plunger is in extended lateral position. It is preferable that these parti-cylindrical portions **7** be lined with a padding or bearing material, such as woven belting, leather, bronze or the like, as indicated at **7***a* in FIG. 6, so that the parti-cylindrical portions **7** will surround the respective plungers **4** to hold the plungers against lateral movement. As the inner mast portion **2** moves upwardly past successive pairs of arms **6** adjacent each plunger **4**, the arms will swing inward so that the parti-cylindrical portions **7** thereof will surround the plunger to stabilize the plungers against lateral movement.

Normally the arms **6** extend inward in horizontal position, as indicated in FIGS. 2 and 4, under the influence of springs **14** when not constrained to a depending position by cams **22** or trackways **24**. When the inner mast portion **2** is telescoped into outer mast structure **1**, the came faces **22**, which are arcuate, engage the respective rollers **20**, as indicated in FIGS. 4 and 5, and as the inner mast portion **2** moves downward each of the cam faces **22** contacts the respective roller **20** to move the arms **6** from the position shown in full outline in FIG. 5 to the dashed outline position shown in FIG. 5. As the inner mast moves downward, the trackways **24** engage the respective rollers **20** and hold the arms **6** in the position as indicated in dashed outline in FIG. **5**. As the inner mast portion **2** moves by successive pairs of mounted arms **6**, each pair of the arms is acted upon in a similar manner until the inner mast section is fully telescoped into the outer mast portion **1**.

Having thus clearly shown and described the invention, what is claimed as new and desired to be secured by Letters Patent is:

Having thus clearly shown and described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A device for stabilizing a pair of upright, parallel, fluid cylinder plungers; which device comprises in combination:

(a) an upright, outer stationary mast structure,

(b) an inner movable upright, mast portion arranged for sliding movement within said upright, outer stationary mast structure,

(c) a pair of elongated hydraulic cylinder plungers interconnecting said outer stationary mast structure and said inner movable structure,

(d) transversely spaced apart pairs of shafts mounted on said upright, outer stationary mast structure, two near adjacent corners thereof, and lying in a common horizontal plane, with adjacent shafts near the respective adjacent corners having the axes at a right angle to each other, with the pairs of shafts in one corner being complemental to the pair of shafts in the adjacent corner,

(1) pairs of arms, one pair mounted on each of said pairs of shafts at a right angle, one arm of each pair being rotatable about the respective axis of said horizontal shafts,

(2) one arm of each pair of arms being positioned on the axis of said horizontal shafts adjacent a corner of each of two sides of said outer mast structure,

(3) spring means biased between said outer stationary mast structure and the respective arms to normally urge said arms into a substantially horizontal position,

(4) a parti-cylindrical portion on the outer end of each said arm, the parti-cylindrical portions of each pair said arms being adapted to register with and embrace the plunger of one of said hydraulic cylinders, when said plunger is in one position,

(e) cam means associated with said inner movable mast portion to move said pairs of arms from a position embracing said respective plungers to a substantially vertical position, against the resilient action of said spring means,

(f) trackways on the outer faces of said inner movable mast portion, adjacent said arms, and

(g) means associated with the respective arms to engage and maintain each said arm out of engagement with said respective plungers of said parallel cylinders after said cam means has moved said arms from the position embracing the plungers to a substantially vertical position.

2. A device for stabilizing a pair of upright, parallel, fluid cylinder plungers as defined in claim 1; wherein

(a) said means associated with each said arm is a roller, which rollers are adapted to engage said cam means and said trackways, upon movement of said inner movable mast portion.

3. A device for stabilizing a pair of upright, parallel, fluid cylinder plungers as defined in claim 2; wherein

(a) each said cam means, associated with said inner movable mast portion, has a curved face thereon, each which curved face is adapted to register with one of said trackways,

(b) each said roller being adapted to roll into engagement with said cam means and to roll onto said trackway, when said inner movable portion is moved in one direction, and to roll off of said trackway onto said cam means when said inner movable portion is moved in the opposite direction.

4. A device for stabilizing a pair of upright, parallel, fluid cylinder plungers as defined in claim 1; wherein

(a) each arm of each pair of arms comprises spaced apart, angularly positioned, brace members, and a transverse brace member extending between said spaced apart, angularly positioned, brace members,

(1) said parti-cylindrical portion on each said arm being secured to the adjacent ends of said spaced apart, angularly positioned, brace members,

(2) a bearing on the opposite end of each said spaced apart brace member, each which bearing is adapted to rotate about the axis of said respective horizontal shafts,

(b) roller mounting means on each said transverse brace member and,

(1) a roller rotatably mounted on each said roller mounting means.

5. A device for stabilizing a pair of upright, parallel, hydraulic cylinder plungers, which device comprising in combination;

(a) an upright, hollow outer structure,

(b) an upright, inner, movable structure arranged for guided movement within said upright, hollow, outer structure,

(c) a pair of upright, elongated, hydraulic cylinder plungers within said outer hollow structure, each said elongated hydraulic cylinder plunger being fitted within a hydraulic cylinder and interconnected with said hollow outer structure,

(d) a pair of horizontal shafts mounted on said hollow outer structure on the sides thereof near two adjacent corners thereof, said shafts of each pair being at a right angle, and lying in a common horizontal plane,

(e) pairs of arms mounted on said shafts on said hollow outer structure exterior thereof, and adapted to extend thereinto,

(1) one of said arms being mounted on each said horizontal shaft for arcuate movement about the axis thereof,

(2) the distal end of each of said arms having an arcuate parti-cylindrical portion thereon, which arcuate, parti-cylindrical portion is adapted to automatically embrace a hydraulic cylinder plunger when said arm is moved into one position and to automatically disengage said hydraulic cylinder plunger when said arm is moved into another position,

(f) curved cam means associated with said inner movable structure,

(g) trackways on the outer faces of said inner movable structure, which trackways are adapted to register with said cam means, and

(h) a roller associated with each said arm and adapted to complementally engage said cam means when said inner movable structure is moved relative thereto, and which rollers are adapted to roll on to said trackway upon further relative movement of said inner movable structure relative to said hollow outer structure, said rollers adapted to roll off of said trackway onto said cam means so said arms will move to an outstanding position as said inner movable structure is moved upward so as to surround said respective plungers to stabilize said plungers against relative lateral movement.

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