Feb. 9, 1932. S. L. CAMPBELL 1,844,379

GATED SLIP ELEVATOR

Filed Dec. 5, 1928 2 Sheets-Sheet 1

Fig. 2.

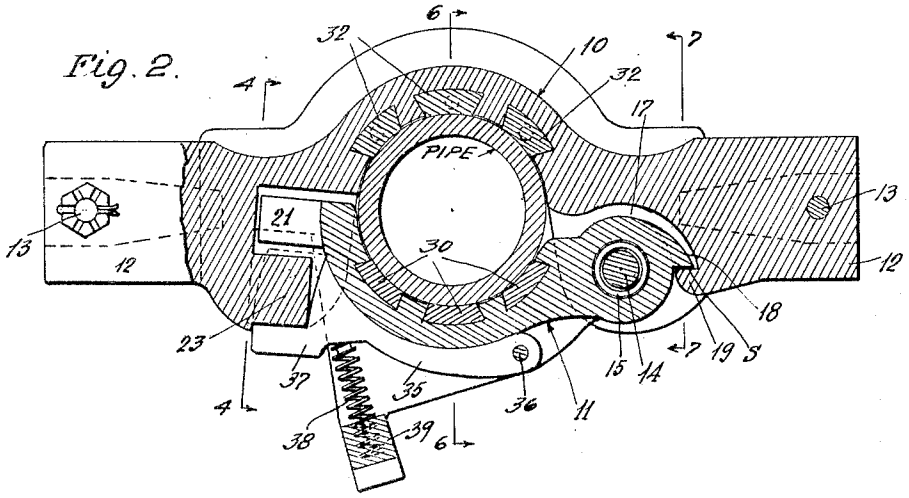

Fig. 1.

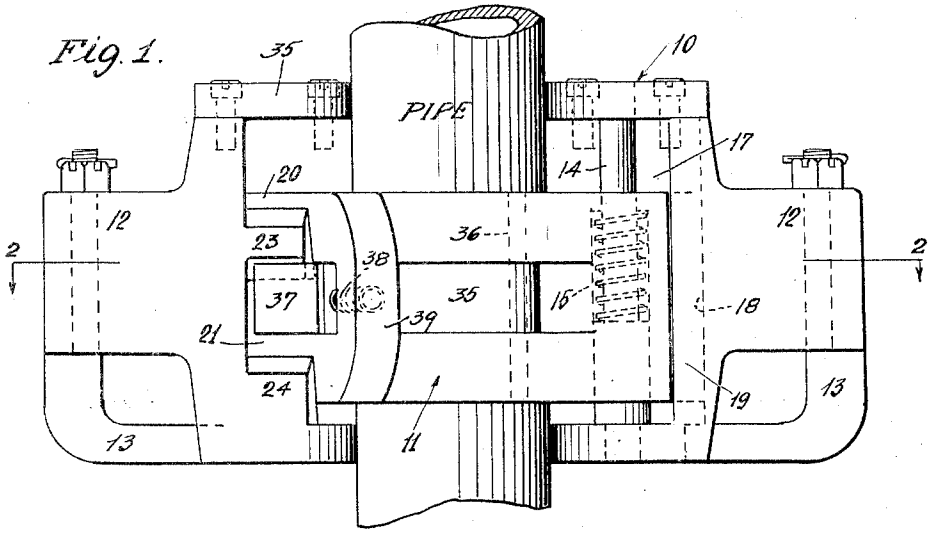

Fig. 3.

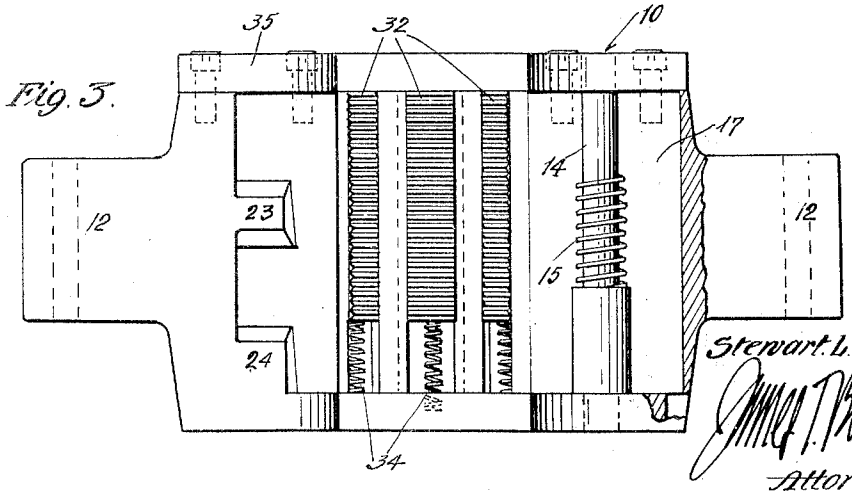

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Fig. 4.

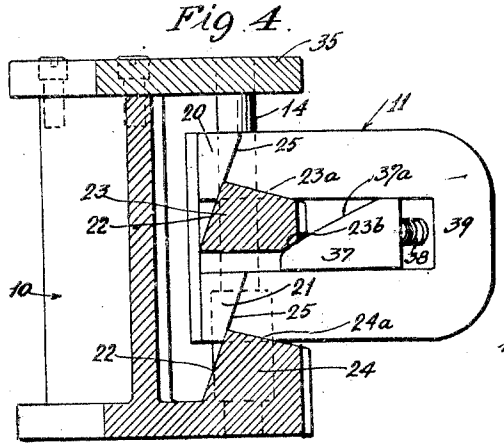


Fig. 5.

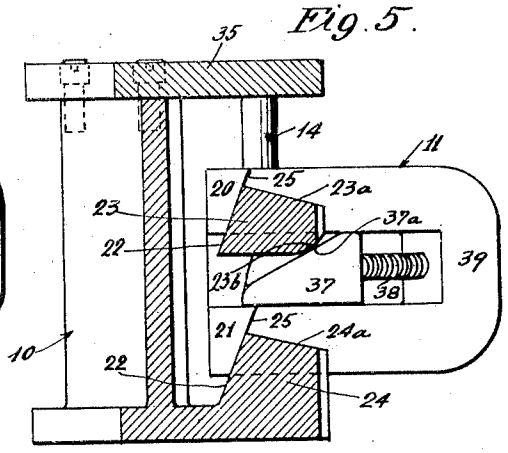


Fig. 6.

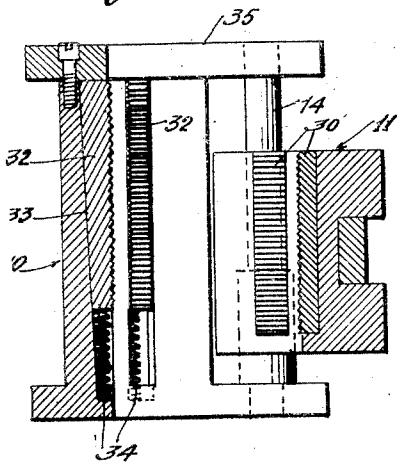


Fig. 7.

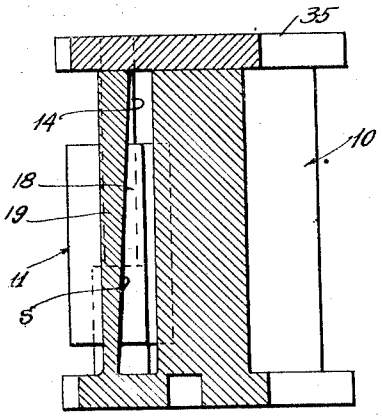
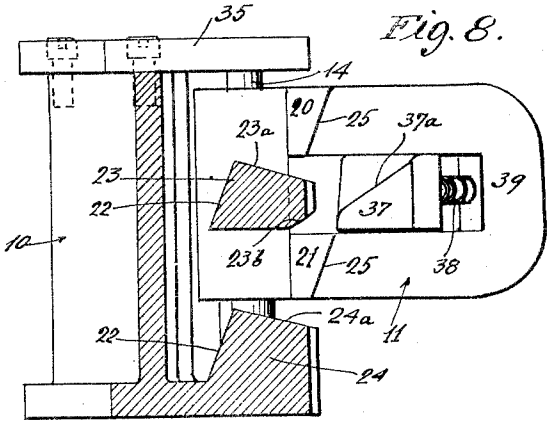


Fig. 8.



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Patented Feb. 9, 1932 1,844,379

UNITED STATES PATENT OFFICE

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GATED SLIP ELEVATOR

Application filed December 5, 1928. Serial No. 324,006.

This invention has reference to elevators for pipe, tubing, casing or the like, as used in deep well work. The invention is not necessarily limited to use in connection with deep wells, but may be used in any other work where desirable. The invention, however, is most easily explainable in connection with deep well work.

A general object of the invention is the provision of an elevator that combines the advantageous features of both the gated or opening type of elevator and also those of the slip type of elevator. The slip type of elevator has, of course, the advantage that it can grip the pipe at any point along the pipe length; but it has the disadvantage, as now generally in use, that it must be put into place by movement downwardly over the upper end of the pipe. The gated or opening type of elevator has the advantage that it can be placed or closed around the pipe rather than having to be put over the end of the pipe; but it has the disadvantage that it can only lift the pipe by engagement with the pipe collar. The present invention, among other things provides an elevator structure in which the advantageous features of both types of elevators are combined.

A characteristic feature of the present invention resides in the fact that the two relatively movable pipe encircling parts are so interconnected and so interact that these parts not only have relative movement for opening and closing the elevator structure but also have relative movement for causing the wedging action that grips the pipe. In this type of construction it is not necessary, although the invention is not limited against this, that the gripping slips or dies themselves move in wedge fashion relative to the body parts of the elevator; the wedging movement being supplied by the relative movement of the body parts themselves.

Another feature of the invention resides in the latching or locking arrangement; this being so provided that it locks the parts in whatever position they may reach in closing on the pipe, and also that it has an action to close or aid in closing the parts in their final closing movement. And in this feature the invention is not necessarily limited to an elevator having a slip or wedge action; this feature may be applied as well to the ordinary type of opening and closing elevator that does not grip the pipe.

In illustrating and describing a typical and illustrative embodiment of the invention, I have chosen to illustrate that type of elevator known as the gated type—that is, the type of elevator in which one of the pipe encircling parts, usually known as the body, is supported by the hoisting bails, while the other part, usually known as the gate, has no direct connection to the hoisting bails. But this particular design or type of elevator is not a necessary limitation upon my invention, as will be readily understood by those skilled in this art; it only being necessary for the purposes of my invention that two pipe encircling parts, however, supported by the hoist, have the relative movements which are to be hereinafter described.

In the accompanying drawings,

Figure 1 is a side elevation of my improved elevator closed around the pipe.

Fig. 2 is a horizontal section taken on line 2—2 of Figure 1.

Fig. 3 is an elevation, similar in aspect to Fig. 1 but with the gate of the elevator removed and with certain parts broken away for illustrative purposes.

Fig. 4 is a sectional elevation on line 4—4 of Fig. 2, showing the elevator partially closed.

Fig. 5 is a similar view, showing the parts in a typical closed position.

Fig. 6 is a vertical section on line 6—6 of Fig. 2.

Fig. 7 is a vertical section on line 7—7 of Fig. 2.

Fig. 8 is a view similar to Figs. 4 and 5 but showing the parts open.

In the drawings the two parts designated generally by the numerals 10 and 11 are the parts which encircle the pipe. In the particular form of elevator which I have here chosen for illustration, the part 10 is called the body, it having the bail engaging lugs 12 at its opposite ends. Any suitable means for preventing displacement of the bails may be used; I show for instance a pair of hook bolts 13.

Also as shown in this particular design the part designated 11 is the gate of the elevator and is preferably a swinging gate, being mounted at one end on the hinge pin 14 so that its free swinging end may swing out to an open position as will readily be understood, and also swing in to a closed position such as shown in the drawings. This gate is so constructed and mounted, in accordance with the present invention, that it not only moves in and out—specifically swings in and out—but also has a vertical movement. Thus the gate is so mounted on hinge pin 14 that it both swings horizontally and slides vertically on that hinge pin, a spring 15 being preferably utilized to counter-balance or over balance the weight of the gate so as normally to hold it in an upper position, or at least so as to require only a small manual effort to move the gate to its upper position. The hinged end of the gate is preferably housed in a recess 17 in the body, and the gate has, at its swinging end, a projecting lug 18 which, when the gate is closed, bears outwardly against an overhanging lug or rib 19 of the body, so that outward thrust on the gate at that hinged end is taken directly on the lug or rib 19 of the body rather than on the hinge pin 14. The interengaging surfaces (see S in Figure 7) of lug 18 and rib 19 are preferably not exactly vertical but somewhat diagonal, so that these surfaces can be in engagement as the swinging end of the gate moves down and inwardly as will be hereinafter described.

The outer or swinging end of the gate has a wedge lug engagement with the body; and for this purpose the outer swinging end of the gate preferably has two projecting wedge lugs 20 and 21 which are adapted, respectively, to move downwardly and inwardly over the inwardly inclined faces 22 of the two vertically spaced wedge lugs 23 and 24 of the body. The outer surfaces 25 of the wedge lugs 20 and 21 are inclined to bear flatly on the wedge surfaces 22 of the body lugs.

When the elevator is open, the gate occupies such a relative position as shown in Figure 8, the gate being then in its upper position, so that its lugs 20 and 21 have cleared the body lugs 23 and 24 and the gate is then free to be swung outwardly. Figure 8 shows the gate in such uppermost position and swung partly outwardly. With the gate wide open the elevator is then placed around the pipe in the manner ordinary to gated elevators, and the gate is then swung towards its closed position. Reaching a position close to that shown in Figure 4, with the gate lugs 20 and 21 over the inner wedge faces 22 of the body lugs 23 and 24, the gate is then moved downwardly and inwardly until it comes into contact with the pipe—until the pipe is held more or less snugly or tightly between the gate and the body 10. Relative upward movement of the whole elevator on the pipe will then, by reason of frictional engagement of the gate with the pipe, force the gate down, and consequently inwardly, into tighter engagement with the pipe, the gate typically reaching such a position as shown in Figures 1, 2 and 5. In this position the pipe is tightly wedged between the gate and body and, particularly if proper pipe engagement elements are used, the pipe is gripped securely enough to be hoisted.

In order for the body and gate to be brought together to wedge the pipe with sufficient tightness to support its weight, by virtue of the frictional engagement of the pipe gripping faces with the pipe tending to move the gate downward relative to the body, the slope of the wedge faces 22 and 25 must be such as to permit this action. Consequently, there is a limiting minimum slope which these faces may have and below which the downward acting force resulting from friction between the pipe gripping faces and the pipe will be insufficient to cause the body and gate to be wedged together tightly enough to support the pipe. It is generally known that in pipe supporting apparatus wherein the pipe is supported by wedging action between two relatively movable parts, for example by the use of wedge slips, the slope of the inclined wedge surface between the parts must be such that the tangent of the angle which the surface makes with the vertical does not exceed substantially the coefficient of friction between the wedging element and the pipe. Thus, in the present apparatus, in order to insure proper cooperation between the body and gate, the slope of wedge surfaces 22 and 25 will be of such degree, that the tangent of the angle which they make with the vertical will not substantially exceed the coefficient of friction between the pipe gripping faces and the pipe. The expression "coefficient of friction", as commonly defined, will be understood to mean the ratio of the force that would be required to slide one of the wedge slips, when in gripping engagement with the pipe, relatively upwardly along the pipe, to the pressural force which the wedge slip exerts against the pipe by virtue of the wedging action between the slip and the body or gate part carrying the slip.

In order to insure a secure frictional or

biting grip on the pipe I preferably provide the gate with serrated dies 30. Seeing that the gate itself moves downwardly in a wedging action to grip the pipe, it is not necessary that these dies have wedging movement relative to the gate; and so they are here shown as stationarily set in the gate, but they may be removable for replacement. Such provision of pipe gripping or biting elements on the gate may in many instances be sufficient, even though the opposing pipe engaging surface of the body be merely a smooth surface. However, for additional pipe gripping provision, I have shown a set of die slips 32 mounted in the body. These die slips may, like the gate dies 30, be immovable with reference to the body; but they may preferably have vertical wedging movement on the body so that, when the pipe is gripped between the two opposing sets of dies, the body dies may move downwardly in the body as the gate with its dies move downwardly with relation to the body. Thus I have shown the body dies 32 in the form of wedge slips mounted in slots or grooves having diagonal or wedging back surfaces 33, and spring 34 may be used to keep the dies 32 normally in their uppermost positions as shown in Figure 6.

The body of the elevator, as here illustrated, has a top plate 35 which conveniently forms a closure for the grooves in which the die slips 32 are mounted and which also forms an upper or top wall for the body recess 17 over the swinging end of the gate. Such a top plate may thus facilitate assembly; but it is not necessary that it be a piece separate from the remainder of the elevator body.

The elevator may be provided with any suitable latch for holding the gate closed; but I have further provided for this elevator a latch that holds the gate closed in its innermost and lowermost position, whatever that may be when applied to a pipe, and also a latch having an action to move the gate downwardly either as it is swung inwardly by manual force or positively to cause inward closing movement of the gate because of the downward movement induced by the latch action.

It will be remembered that, when the gate is first swung to a position near that illustrated in Figure 4, and particularly if the spring 15 balances or overbalances the weight of the gate so as to keep it normally in upper position, it is necessary that the gate be moved not only inwardly but also downwardly so as initially to move it against the pipe with sufficient pressure that the grip on the pipe will then cause further downward movement of the gate and further wedging action. It will, of course, be readily recognized that the spring 15 may be dispensed with, or may be of such strength as only partially to balance the weight of the gate; but in that case, the gate when hanging open would be in a lower position and would have to be moved upwardly over the body lugs 23 and 24 in order to reach its operative position of closure. In order to lift the gate over the body lugs, these body lugs 23 and 24 may be provided with upper inclined faces 23*a* and 24*a*, to lift the gate in case the spring does not hold the gate up, or in any case to insure that the gate lugs will pass over the body lugs without the necessity of manually lifting the gate.

And, whether or not the spring is used to normally hold the gate up, it is desirable that positive means be provided for forcing the gate down as it is merely swung in by manual action; and this means I preferably provide in the same latch which holds the gate to its final closed position. The latch is here shown as a swinging latch having a shank 35 pivoted at 36 to the gate, the shank carrying a latch head 37 at its swinging end. This latch head 37 has an upper beveled face 37*a* which inclines inwardly and downwardly; and the lower outer corner of the upper body lug 23 is preferably beveled or rounded as shown at 23*b*. The latch head 37 is pressed inwardly by a spring 38 confined between the latch head and a handle yoke 39 mounted on the swinging end of the gate.

As the gate is swung towards its closed position, then swinging in the horizontal plane in which it is shown in Figure 8, the gate lugs 20 and 21 first swing inwardly to a position above the position shown in Figure 4. As the gate lugs swing to this position, the forward lower edge of the beveled latch head 37 moves in under the curved or beveled face 23*b* of the body lug 23. Further inward swinging movement of the gate then, by reason of the downward wedging action of latch head 37 on beveled corner 23*b*, causes the gate to move down toward and to the position shown in Figure 4, until the forward lower edge of the latch head has passed under the beveled or curved face 23*b* of body lug 23 as shown in Fig. 4. In the meantime the latch head 37 has been pushed back relative to the gate, to some such relative position as shown in Figure 4. Spring 38 may preferably be fairly strong; so that when once the parts have reached the position of Figure 4, then further manual inward pushing of the gate is unnecessary. The spring 38 then shoves the latch head relatively forward toward or to the position of Figure 5, and in moving the latch head forward the gate is necessarily moved down by the wedging action of the upper beveled face 37*a* of the latch head. The spring 38, thus acting to move the latch head inwardly, acts to complete the final downward movement of the gate, and therefore to complete the final inward movement of the gate against the pipe, because when the gate moves downwardly it must, by reason of the beveled faces 22, also move inwardly. And when the gate is once closed, the action of

spring 38 on the latch makes it impossible for outward pressure on the gate to move or swing the gate outwardly. The gate cannot swing outwardly without moving upwardly in the direction of the beveled faces 22; and it cannot move upwardly in that direction because of the downwardly wedging action of latch head 37. However, when it is desired to release and open the elevator, it is only necessary to move the latch head 37 outwardly by manual application, and the gate may then move upwardly and outwardly to open position.

When the gate moves in and down, guided by the wedge surfaces 22, it will be understood how the gate lug 18 moves down and laterally and follows the diagonal surface S; so that the abutment surfaces at S are always in engagement to take thrust off the hinge pin, no matter how little or how far the swinging end of the gate may ride down the wedge surfaces 22. And the surfaces at S may be looked at as surfaces that force the gate to swing outward as it moves up, the surfaces at 22 having an action to force the gate to move inward as it moves down.

The invention is not necessarily restricted to the details herein described, nor in all aspects to the elevator being of the pipe gripping type, except in so far as specifically so stated in the following claims. The details may be varied. And in certain features, for instance those having to do with the locking means and other characteristics, the invention is applicable to elevators of the ordinary opening types. The following claims are drawn with such considerations in view.

I claim:

1. An elevator of the character described, comprising two pipe encircling parts having opposed pipe gripping faces, one of said pipe encircling parts having wedge engagement with the other to be guided in a movement downwardly and inwardly toward that other, and pipe gripping wedge slips mounted in the second mentioned part adapted to be brought into biting engagement with the pipe upon downward movement of the first mentioned part relative to the second.

2. An elevator of the character described, comprising two pipe encircling parts having opposed pipe gripping faces, one of said pipe encircling parts having engagement with the other on a surface making an acute angle with the vertical so as to move downwardly and toward that other, and at least one of said parts having a pipe biting element in its pipe gripping face adapted to be brought into biting engagement with the pipe upon downward movement of the first mentioned part relative to the second, and means for locking said parts together at different relative vertical positions thereof.

3. An elevator of the character described, comprising two pipe encircling parts having opposed pipe gripping faces, one of said pipe encircling parts having wedge engagement with the other on a surface making an acute angle with the vertical so as to be guided in a movement downwardly and inwardly toward that other, and at least one of said parts having a pipe biting element in its pipe gripping face adapted to be brought into engagement with the pipe upon downward movement of said first mentioned part relative to the second, and means for locking said parts together at different relative vertical positions thereof.

4. An elevator of the character described, comprising two hingedly connected pipe encircling parts having opposed pipe gripping faces, one of said pipe encircling parts having wedge engagement with the other on a surface making an acute angle with the vertical so as to be guided in a movement downwardly and inwardly toward that other, and the two parts being adapted to wedge the pipe between them upon downward movement of said first mentioned part relative to the second.

5. An elevator of the character described, comprising two pipe encircling parts having opposed pipe gripping faces, means hinging the two parts together at one end to swing horizontally to open and close and said hinge means allowing vertical movement of one part relative to the other, interengaging wedge elements at the free ends of the pipe encircling parts to guide one part in a downward path inclined toward the other, one of the engaging faces of said elements making an acute angle with the vertical and interengaging thrust taking elements at the hinged ends of the two parts acting to take the horizontal thrust off the hinge means.

6. An elevator of the character described, comprising two pipe encircling parts having opposed pipe gripping faces, means hinging the two parts together at one end to swing horizontally to open and close and said hinge means allowing vertical movement of one part relative to the other, interengaging wedge elements at the free ends of the pipe encircling parts to guide one part in a downward path inclined toward the other, and thrust lugs with diagonal interengaging faces located at the hinged ends of the two parts, adapted to keep in contact as the free end of the one part moves diagonally downwardly and to take the horizontal thrust of the parts off the hinge pin.

7. An elevator of the character described, comprising two pipe encircling parts having opposed pipe gripping faces, means hinging the two parts together at one end to swing horizontally to open and close and said hinge means allowing vertical movement of one part relative to the other, interengaging wedge means at the free ends of the parts to force them together as one part moves

down, and interengaging wedge means at the hinged end of the parts to force them to swing apart as the said one part moves up.

8. An elevator of the character described, comprising two pipe encircling parts having opposed pipe gripping faces, means hinging the two parts together at one end to swing horizontally to open and close and said hinge means allowing vertical movement of one part relative to the other, interengaging wedge means at the free ends of the parts to force them together as one part moves down, and interengaging wedge means at the hinged end of the parts to force them to swing apart as the said one part moves up, both said interengaging wedge means serving to take thrusts that tend to spread the pipe encircling parts.

9. An elevator of the character described, comprising two pipe encircling parts having opposed pipe gripping faces, means hinging the two parts together at one end to swing horizontally to open and close and said hinge means allowing vertical movement of one part relative to the other, interengaging wedge means at the free ends of the parts to force them together as one part moves down, and interengaging wedge means at the hinged end of the parts to force them to swing apart as the said one part moves up, both said interengaging wedge means serving to take thrusts that tend to spread the pipe encircling parts, and pipe gripping wedge slips mounted in the second mentioned part.

10. An elevator of the character described, comprising two relatively vertically movable pipe encircling parts, interengaging wedge means on the two parts forcing the parts toward each other when one part moves down relative to the other, and latch means operable to hold the parts together at different relative vertical positions thereof.

11. An elevator of the character described, comprising two relatively vertically movable pipe encircling parts, interengaging wedge means on the two parts forcing the parts toward each other when one part moves down relative to the other, pipe gripping wedge slips mounted in the second mentioned part, and latch means operable to hold the parts together at different relative vertical positions thereof.

12. An elevator of the character described, comprising two pipe encircling parts, interengaging wedge lugs on the two parts forcing the two parts toward each other when one part moves down relative to the other, and a latch member carried by the first mentioned part and adapted to enter under the lug on the second mentioned part to prevent upward movement of the first.

13. An elevator of the character described, comprising two pipe encircling parts, interengaging wedge means on the two parts forcing the parts toward each other when one part moves down relative to the other, and a horizontally moving latch wedge on the first mentioned part adapted to wedge in under the second mentioned part to hold the first mentioned part down.

14. An elevator of the character described, comprising two pipe encircling parts, interengaging wedge lugs on the two parts forcing the two parts toward each other when one part moves down relative to the other, and a latch wedge carried by the first mentioned part and adapted to wedge under the lug on the second mentioned part to prevent upward movement of the first.

15. An elevator of the character described, comprising two pipe encircling parts, interengaging wedge means on the two parts forcing the parts toward each other when one part moves down relative to the other, a horizontally moving latch wedge on the first mentioned part adapted to wedge in under the second mentioned part to hold the first mentioned part down, and a spring tending to move the latch wedge under the second mentioned part.

16. An elevator of the character described, comprising two pipe encircling parts, interengaging wedge lugs on the two parts forcing the two parts toward each other when one part moves down relative to the other, a latch wedge carried by the first mentioned part and adapted to wedge under the lug on the second mentioned part to prevent upward movement of the first, and a spring tending to move the latch wedge under said lug.

17. An elevator of the character described, comprising two pipe encircling parts, interengaging wedge means on the two parts forcing the parts toward each other when one part moves down relative to the other, a horizontally moving latch wedge on the first mentioned part adapted to wedge in under the second mentioned part to hold the first mentioned part down, a spring tending to move the latch wedge under the second mentioned part, and a spring tending to raise the first mentioned member relative to the second.

18. An elevator of the character described, comprising two pipe encircling parts, interengaging wedge lugs on the two parts forcing the two parts toward each other when one part moves down relative to the other, a latch wedge carried by the first mentioned part and adapted to wedge under the lug on the second mentioned part to prevent upward movement of the first, a spring tending to move the latch wedge under said lug, and a spring tending to raise the first mentioned member relative to the second.

19. An elevator of the character described, comprising two pipe encircling parts, means hinging the two parts together at one end to swing horizontally to open and close and said hinge means allowing vertical movement of one part relative to the other, interengag-

ing wedge lugs on the free ends of the parts acting to force the parts together when the first mentioned part moves down, and a latch wedge on the first mentioned part adapted to move in under a portion of the second mentioned part.

20. An elevator of the character described, comprising two pipe encircling parts, means hinging the two parts together at one end to swing horizontally to open and close and said hinge means allowing vertical movement of one part relative to the other, interengaging wedge lugs on the free ends of the parts acting to force the parts together when the first mentioned part moves down, and a latch wedge pivoted on the first mentioned part to move horizontally and adapted to move in under the wedge lug on the second mentioned part.

21. An elevator of the character described, comprising two pipe encircling parts, means hinging the two parts together at one end to swing horizontally to open and close and said hinge means allowing vertical movement of one part relative to the other, interengaging wedge lugs on the free ends of the parts acting to force the parts together when the first mentioned part moves down, a latch wedge pivoted on the first mentioned part to move horizontally and adapted to move in under the wedge lug on the second mentioned part, a spring adapted to move the first mentioned part upwardly, and a spring moving the latch lug in its direction of entry under the said wedge lug of the second mentioned part.

22. An elevator of the character described, comprising body and gate pipe encircling parts having opposed pipe gripping faces of a radius of curvature such as to closely fit about and frictionally engage the pipe, hoisting means directly supporting the body only, said gate having wedge engagement with the body along an inclined surface making an acute angle with the vertical, and being adapted to be guided in a movement downwardly and inwardly toward the body to cause said pipe gripping faces to be brought into biting engagement with the pipe, the angle made by said inclined surfaces of engagement between the parts with the vertical being less than 30° and such that its tangent does not exceed substantially the coefficient of friction between said pipe gripping faces and the pipe.

23. An elevator of the character described, comprising body and gate pipe encircling parts having opposed pipe gripping faces of a radius of curvature such as to closely fit about and frictionally engage the pipe, hoisting means directly supporting the body only, said gate having wedge engagement with the body along an inclined surface making an acute angle with the vertical, and being adapted to be guided in a movement downwardly and inwardly toward the body to cause said pipe gripping faces to be brought into biting engagement with the pipe, and pipe gripping wedge slips mounted in one of said parts, the angle made by said inclined surfaces of engagement between the parts with the vertical being less than 30° and such that its tangent does not exceed substantially the co-efficient of friction between said pipe gripping faces and the pipe.

24. An elevator of the character described, comprising body and gate pipe encircling parts having opposed pipe gripping faces of a radius of curvature such as to closely fit about and frictionally engage the pipe, hoisting means directly supporting the body only, said gate having wedge engagement with the body along an inclined surface making an acute angle with the vertical, and being adapted to be guided in a movement downwardly and inwardly toward the body to cause said pipe gripping faces to be brought into biting engagement with the pipe, and a relatively vertically movable wedge slip mounted in one of said parts, the angle made by said inclined surfaces of engagement between the parts with the vertical being less than 30° and such that its tangent does not exceed substantially the coefficient of friction between said pipe gripping faces and the pipe.

25. An elevator of the character described, comprising body and gate pipe encircling parts, one of said parts having a pipe gripping face, said gate being relatively movable downwardly toward the body, a vertically movable wedge slip mounted in the other of said parts and movable downwardly and inwardly relative to that part and means for holding said body and gate parts together.

26. An elevator of the character described, comprising body and gate pipe encircling parts having opposed pipe gripping faces, a hinge connecting one end of said parts, said gate having wedge engagement with the body to be guided in a movement downwardly and inwardly toward said body, interengaging lugs on the ends of the gate and body opposite their hinged connection, vertically movable wedge slips mounted on the body and adapted to move downwardly and inwardly relative thereto, and means carried on said gate and operable to hold the parts together against relative spreading movement at different relative radial positions thereof.

27. An elevator of the character described, comprising two pipe encircling parts, means pivotally connecting said parts at one end, interengaging lugs on the ends of said parts opposite their pivotal connection, and means mounted on one of the parts and operable to hold the parts together at different relative radial positions thereof.

28. An elevator of the character described, comprising two pipe encircling parts, hinge

means connecting said parts at one end, pipe gripping wedge slips mounted on one of said parts and adapted to be brought into biting engagement with the pipe upon closing movement of said parts about the pipe, interengaging lugs on said parts opposite their hinged connection; and means mounted on one of said parts and operable to hold the parts together at different relative radial positions thereof.

In witness that I claim the foregoing I have hereunto subscribed my name this 28th day of November, 1928.

STEWART L. CAMPBELL.