Sept. 24, 1940. G. E. MULLINIX 2,215,649

WELL PIPE ELEVATOR

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Fig. 1

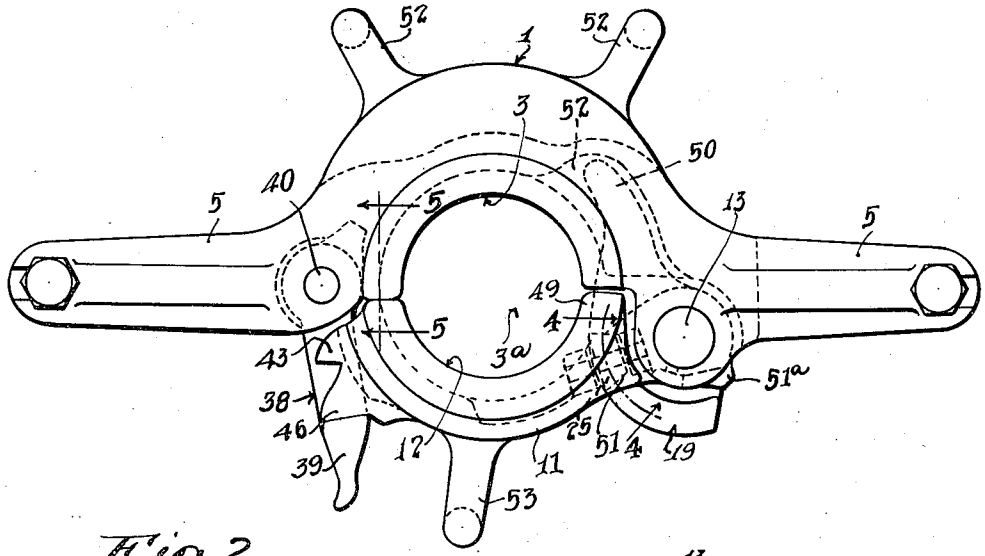
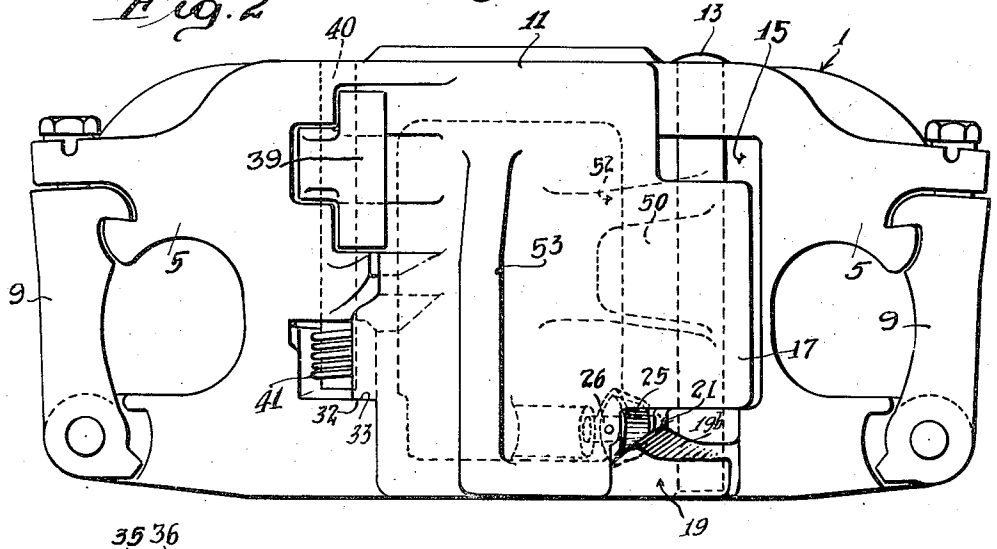


Fig. 2



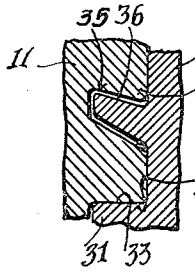


Fig. 5

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Fig. 3

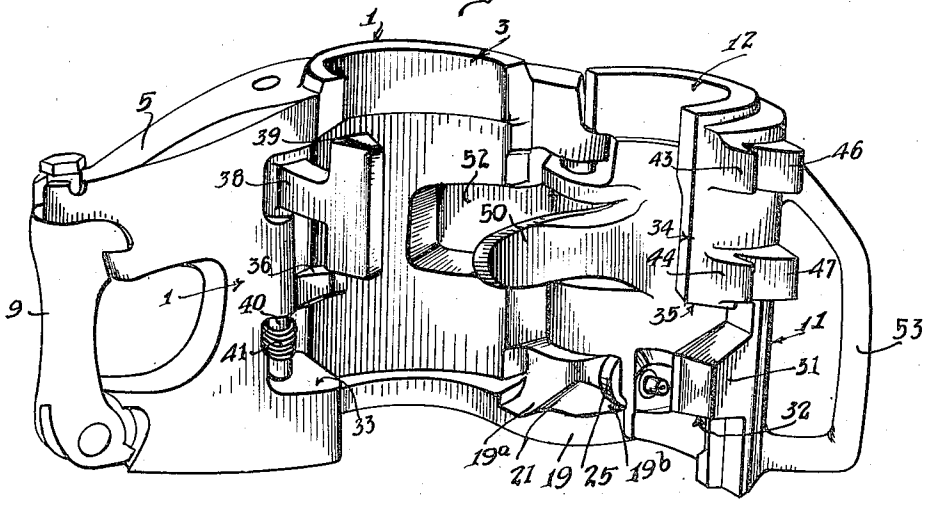

Fig. 4

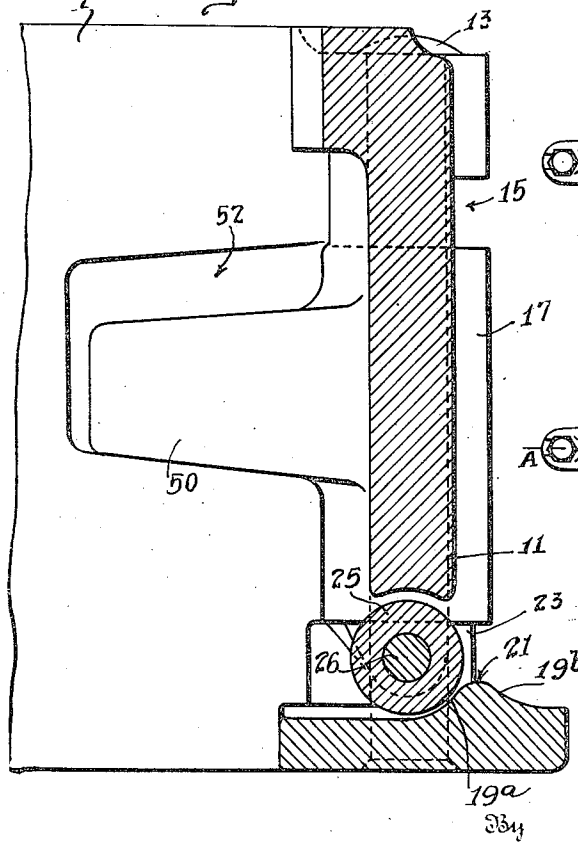

Fig. 6

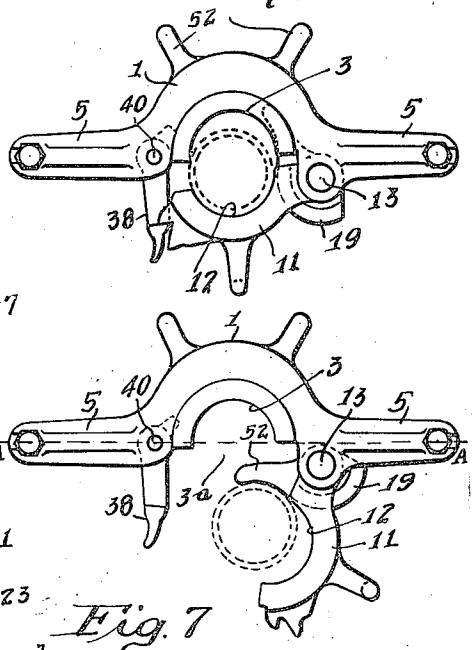

Fig. 7

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UNITED STATES PATENT OFFICE

2,215,649

WELL PIPE ELEVATOR

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8 Claims. (Cl. 294—90)

This invention relates to elevators for raising and lowering pipe in deep wells such as oil wells. More particularly the elevator relates to improvements in "collar" elevators, that is to say, elevators that engage, and lift, under the lower end of a pipe collar. The invention is particularly useful in the construction of elevators popularly called "side-door" elevators. These elevators are characterized by a body having a bore with a forwardly opening throat adapted to receive the pipe, and the elevator body is usually provided with a pair of laterally extending trunnions, lugs, or ears, adapted to be hung on hoisting links. The door is hinged to the body at one side of the throat and provided at its free end with a suitable latch.

Elevators for handling oil well drill pipe, casing or tubing must withstand very heavy loads, must operate quickly and easily, and must be safe, that is to say, they must be so constructed that they cannot drop the pipe accidentally. All of these requirements are essential and no one of them is permitted to be attained at the expense of either of the others. It is an object of the present invention to provide an improved side door elevator meeting all three of these requirements more fully than has been done heretofore.

Another object is to improve the general construction of elevators of the so-called "rising door" type such as shown in Nelson K. Smith Patent No. 1,766,556. The Smith patent illustrates a side door elevator in which the door rises and falls on its hinge pin during the opening and closing movements. The elevator body is provided with a raised cam surface, and the door with a roller riding on the cam. When the door is in its closed position, the end of the door interlocks with the body so that the door can not be opened as long as the weight of the pipe collar is resting on the upper end of the door. Such elevators are safe against accidental opening after they have been fully closed, but they have not found a very wide acceptance by the trade because they are more cumbersome and slower in operation than the commonly used elevators. Furthermore, as heretofore constructed, the lifting force exerted by the cam tends to tilt the door out of its proper plane, thereby increasing wear on the hinge pin of the door, and exerting forces tending to bind the door on the hinge pin.

An object of the present invention is to improve the construction of elevator doors of this type, more prticularly as regards the location of the anti-friction roller to facilitate operation of the door.

Practically all side door elevators as heretofore constructed have had a common weakness in that if the door were not fully closed and latched the body of the elevator might engage the pipe collar and pick up the pipe momentarily and then drop it accidentally. Such accidents usually occur when running tubing into the well hole, because in this operation the elevator must be clamped around the pipe at the top of the derrick where the hoist operator can not see the latch clearly. Nearly all efforts to construct safer elevators have been along the lines of improved latches or by using secondary safety latches. Obviously such efforts must fail to accomplish the desired results if the latch does not engage.

It is an object of the present invention to provide an elevator construction such that the elevator can not pick up the pipe unless the door is either fully closed or sufficiently closed so as to close automatically when the elevator engages the pipe collar.

Another object is to provide an elevator in which the door will close automatically when the elevator door engages the pipe collar or coupling, provided the door has already been sufficiently closed to insure operation of the automatic closing feature.

Another object of the present invention is to provide an elevator in which the door will not close, and the elevator will "fall away" from the pipe collar or coupling if the door has not been already sufficiently closed to insure operation of the automatic closing feature.

Elevators of this type have heretofore been provided with a "closing finger" that is to say, a finger rigid with the door, placed so that when the door is open to receive the pipe, the finger will be struck by the pipe in entering the elevator bore, thereby causing the door to swing closed. But heretofore no importance has been attached to the level at which this closing finger was located, and as usually placed, the pressure of the pipe against it may tilt the elevator out of its normal horizontal plane, and in this way interfere with the closing of the elevator door. And heretofore this "closing finger" has usually been located so that it may interfere with the opening of the door. One of the objects of this invention is to provide a construction in which the closing finger will operate without causing these difficulties.

Elevators of this type as usually constructed are not capable of being handled readily in positioning them around the pipe. One of the objects of the invention is to provide means for overcoming this difficulty.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combinations of parts to be described hereinafter, all of which contribute to produce an efficient well pipe elevator.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Fig. 1 is a plan of an elevator embodying my invention showing the door fully closed and latched in the final latching position.

Fig. 2 is a front elevation of the elevator illustrated in Fig. 1.

Fig. 3 is a perspective view of the elevator with the door fully open.

Fig. 4 is a developed vertical section upon a large scale taken at the location of line 4—4 of Fig. 1 and further illustrating details of the lifting cam and cooperating roller; but this view shows the parts as though the door were fully closed.

Fig. 5 is a developed vertical section upon a large scale taken about on the line 5—5 of Fig. 1 and particularly illustrating the interlocking connection between the free end of the door and the elevator body when the door is in its closed position.

Fig. 6 is a plan on a small scale showing the elevator latched in a primary latching position from which the elevator will latch completely automatically when it starts to lift the pipe.

Fig. 7 is a view similar to Fig. 6 and showing the elevator open to receive the pipe and illustrating how it is impossible to lift the pipe accidentally in this position.

In its preferred embodiment the elevator comprises a body 1 having a substantially semi-circular bore or socket 3 for receiving a pipe (not shown) and having a pair of laterally disposed trunnions, lugs, or ears 5, said trunnions slotted to receive elevator supporting links, not shown, and provided with suitable keepers 9. A door 11 is hingedly connected to the body 1 at one side of the open throat 3a of the bore 3, and preferably loosely mounted on a vertical pin 13. This door is of arcuate form so as to present a substantially semi-circular pipe-receiving socket or half-bore 12.

The door is capable of up-and-down movement. To this end the body preferably is provided with a recess 15 across which the pin 13 extends, and the door is provided with a lug 17 through which the pin extends. The lug 17 fits loosely on pin 13 and is shorter than the recess 15 so that the door can have a limited movement up and down sliding on the pivot pin 13.

The body 1 is provided adjacent the lower end of recess 15 with a cam 19 having cam surfaces 19a, 19b, concentric with axis of the hinge pin 13. The cam surfaces 19a, 19b, meet at a high point or ridge 21. These cam faces are sloping, that is, inclined transversely so that the cam edge remote from the pin 13 is depressed as compared with the other edge, and furthermore, the outer sloping cam surface 19b ends at a higher elevation than the inner sloping cam surface 19a.

The door 11 is provided near its lower and hinged end with a slot 23 tangential to the hinge pin 13 and located directly above the cam 19. An anti-friction roller 25 is secured within the slot 23 by a pin 26 disposed substantially radially with respect to the hinge pin 13.

The roller 25 is preferably a truncated cone with its apex at the center of the hinge pin 13 so that it will have a true rolling motion over the cam surface 19a. The cam surfaces 19a, 19b, preferably have the same inclination as the "cone" of the roller, so that the elements of these cam surfaces if extended would intersect the extended axis of the conical roller at the axis of pin 13, thereby giving perfect contact, and a maximum area of bearing surface. The inner cam surface 19a drops away from the high point 21 at such an angle that it does not support the roller 25 when the door is fully closed. Thus there is no weight upon the roller 25 when the elevator is closed and under load.

In order to provide the best castor action and the best balance, the axis of the roller hinge pin 26 is placed as nearly as possible substantially in line with the gravity axis of the door 11, that is to say, in the vertical plane passing through the center of gravity of the door and through the axis of pin 13. In the elevator shown, because of space limitations, the axis of hinge pin 26 is about 20° forward of the weight axis of the door. Furthermore, this position of the roller 25 places it inside the elevator where it is protected from damage and debris.

The door 11 is preferably provided with some form of pressure lubrication fitting (not illustrated).

In closing the door the cam 19 raises the door to enable it to make interlocking connection with the body at the free end of the door. In order to accomplish this, the free end of door 11 is provided with an outwardly extending lug 31 having a flat under face 32 adapted to swing over and seat on a corresponding shoulder or ledge 33 formed on the body 1. (See Figs. 3 and 5.) Hence when the door is in its closed position, the weight on the door is transferred from the cam 19 to the body by the lug 31 on the door and the shoulder 33 on the body.

The free end of door 11 is also provided with an outwardly extending lug 34 having an outwardly and downwardly inclined under face 35 adapted, when the door is fully closed, to overlie, but not quite touch, a similarly inclined face 36 formed on the body 1. Hence when the door is in its closed position, it can not be opened except by raising the door sufficiently for the surface 35 to clear the surface 36, and this can not be done when the weight of the pipe is resting on the door.

The body 1 is provided with a suitable latch, which in the present instance is in the form of a horizontally swinging bar 38 having a T shaped head 39. The latch is mounted on a vertical pivot pin 40 and is provided with a spring, preferably a torsion spring 41 adapted to urge the latch toward the locked position.

My invention involves a construction producing a primary latching effect and a final and complete latching effect. For this purpose the door 11 is provided with spaced inner latch lugs 43 and 44 and spaced outer latch lugs 46 and 47 adapted to engage the T head 39 of the latch. The outer latch lugs 46 and 47 engage the latch head when the door is fully closed as shown in Figs. 1 and 4. The inner latch lugs 43 and 44 engage the latch head when the door is nearly closed, and when the roller 25 has passed inwardly beyond the ridge 21, (see Figs. 4 and 6). At this moment the inclined surface 35 on the door lies above the inclined surface 36 on the body. When the door is in this position the latch engaging the primary latching lugs 43 and 44

holds it against opening and when the weight of the pipe collar comes onto the top of the door, it will force the door down along a path parallel to, but not quite touching, the inclined face 36 on the body to the fully closed position, whereupon the latch engages the outer lugs 46 and 47 to finally latch the door in the fully closed position. The angle and position of the cam face 19a are preferably so located as to hold the inclined surface 35 on the door slightly above the inclined surface 36 on the body. The inclined surfaces 35 and 36 could be allowed to engage each other but this is not so desirable because the surfaces 35 and 36 may become burred and cause sticking of the door. In any event the angle of the inclined faces 35 and 36 is made steep enough (about 16°) to insure that the door will slide down on the body when the weight of the pipe collar is applied to the door.

If the door should be closed insufficiently to enable the latch to engage the primary latching lugs 43 and 44, and so that the inclined face 35 on the door has not yet arrived above the inclined face 36 on the body, the door would not close when the weight of the pipe collar comes onto it. But in this position of the door the elevator might accidentally commence to lift the pipe and drop it. Such an accident is prevented, as will now be explained.

Ordinarily elevators of the body and door type are made with somewhat more than 180° of the pipe-receiving circumference in the body and somewhat less than 180° in the door. In the present elevator the door and body each support approximately 180° of the pipe collar. In addition, the hinge pin 40 is located somewhat nearer the front of the elevator than has been customary. The result of this construction is that when the door is in any partially open position, the portion 49 of the door that might for convenience be called the "heel" of the door, projects out in front of the bore 3 of the elevator and in line with the pipe collar. Because the door is in the raised position when open to any degree whatever the descending pipe collar must strike the extension 49 on the door 11 before it strikes the body 1. Thus, if the door is fully open as shown in Fig. 7, the thrust of the pipe on the elevator will occur on this "heel", and forward of the transverse axis A—A of the elevator passing through the trunnions, and this will tilt the elevator down at the front, causing it to "fall away" from the pipe coupling. Consequently the elevator can not pick up the pipe when it is in the fully open position. Likewise, even if the door is more fully closed, the pipe collar will first engage the extension 49 which is higher than the top of the elevator because the door is held up on the cam, and this will of course tilt the elevator down forwardly and away from the pipe.

Another feature of the present elevator which is desirable though not essential is the closing finger 50 on the hinge end of the door 11. The finger 50 is rigid with the door and serves to close the door by contacting the pipe ahead of the body 1. The finger 50 is located at about mid-height of the door and substantially on the horizontal axis of balance of the elevator, that is, substantially in line with the load supporting surface of the elevator trunnions or ears 5. In this position the contact of the finger 50 with the pipe does not tilt the elevator in such a way as might prevent its application to the pipe as would be the case if it were located substantially above or below the horizontal axis of balance.

The finger 50 is received within a recess 52 in the body 1 when the door 11 is closed. The length of the finger 50 is sufficient so that when the door is fully open (Fig. 7) the pipe can not pass through the throat 3a. Because a closing finger of this length would "hug" the pipe and make it difficult to open the elevator, the finger 50 is located and so curved that when the door is in its closed position, the end of the finger is spaced away from the pipe a substantial distance. In other words, the shape of the finger does not conform to the contour of the pipe and necessitates swinging the door through a slight angle in its opening movement before the curved finger engages the pipe. This insures that the door can always be opened and can not jam. The door and body are preferably provided with stops 51 and 51a to prevent the door from opening too far.

Another feature of the present elevator which is desirable but not essential is the provision of a pair of spaced vertical handles 52 at the back of the elevator (see Figs. 1 and 6). These handles are particularly useful to the floor crew, especially when running pipe out of the hole. As the empty elevator comes down two men grasp the handles 52 from opposite sides and guide the elevator onto the pipe below the collar. Because of the closing finger 50 it is not necessary for a man to close the elevator door and latch from the front. The elevator is pushed against the pipe and the finger 50 swings the door partially or fully closed. In any event, when the elevator is raised against the pipe collar the door is forced closed if not already closed.

For convenience the door 11 is provided with a vertical handle 53.

Although the roller 25 is shown herein attached to the door 11, obviously it could be attached to the body 1, and the cam could be formed on the door. Such a construction however would not be as advantageous as that illustrated because the point of support of the door on the cam could not be kept in line with the gravity axis of the door, that is, the line passing through the center of gravity and radially from the hinge pin 13.

One of the advantages of employing a conical roller with an inclined cam is that a line of contact is established between the roller and the cam, which extends toward the axis of the hinge pin 13. The action of gravity on the door, on account of this contact line, is to cause the door to slide down the incline and away from the hinge pin 13 and this, of course, is resisted by a lateral reaction of the hinge pin against the face of the lug 7 through which it passes. This tends to reduce the binding action of the lug on the pin that would be otherwise developed by the portion of the door that overhangs the point of support.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

What I claim is:

1. A well pipe elevator comprising a body adapted to support a pipe by the collar thereof, a door hingedly connected to said body on a pivotal axis, to swing in a substantially horizontal plane, anti-friction means, including a roller interposed between said body and door, said body having a cam surface to raise and lower the door during

the horizontal swinging movement thereof, said roller having its axis in a substantially vertical plane passing substantially through the center of gravity of the door, and through the said pivotal axis.

2. A well pipe elevator comprising a body adapted to support a pipe by the collar thereof, a door with a hinge connection to said body on a substantially vertical pivotal axis, to swing in a substantially horizontal plane, anti-friction means including a roller interposed between said body and door, said body having a cam surface to raise and lower the door during the horizontal swinging movement thereof, said roller having a truncated cone-shaped peripheral surface with its apex located substantially at the said pivotal axis, said cam and roller having contact along a line extending substantially radially from the pin, operating to support the door and prevent the weight of the door from developing a bending movement on the hinge connection.

3. A well pipe elevator as defined by claim 2 in which the cam surface slants outwardly and downwardly away from the hinge axis in a plane parallel to the contacting surface of the cone-shaped roller.

4. A well pipe elevator for lifting and lowering pipe, comprising a body adapted to support the pipe by the collar thereof, trunnions at opposite sides of said body for supporting the same, a door hingedly connected to said body on a substantially vertical axis to swing in a horizontal plane, means interposed between the body and the door for raising or lowering the door relative to the body during the horizontal swinging movement, said door having an extension at its upper portion and at its hinged end extending rearwardly of the hinge connection, said extension adapted to swing into the path of a pipe collar located above the upper surface of the body and located forward of the axes of the trunnions whereby the door, when in its fully open position, will contact the pipe collar at a point forward of the body so as to tilt the elevator and prevent it from lifting the pipe.

5. A well pipe elevator comprising a body adapted to support a pipe by the collar thereof, a door capable of up-and-down movement relative to the body and hingedly connected to said body to swing in a horizontal plane, means interposed between the body and door for raising or lowering the door relative to the body during the horizontal swinging movement, complementary bearing faces on the free end of the door and on the body, inclined downwardly toward the rear of the elevator and adapted to overlie each other in interlocking relation when the door is sufficiently near to its closed position to be engaged by a latch, a cam on the body and a roller on the door cooperating to hold said inclined faces out of contact when the door is in its nearly closed position, latch means including at spring for securing the door when the door is in its nearly closed position, whereby the weight of the pipe imparted through the pipe collar to the door will force the door down, move the roller down the cam, and bring the door to its fully closed and latched position.

6. A well pipe elevator comprising a body having a bore with an open throat on its forward side adapted to receive a pipe, trunnions at opposite sides of said body for supporting the same, a door hingedly connected to said body to swing in a substantially horizontal plane to close the said throat and cooperate with the body to support the pipe, a pipe contacting finger on the hinge end of said door and rigid therewith, said finger operating to project across said throat when the door is open, said finger operating to swing the door closed when struck by the pipe entering the throat, and being located in a substantially horizontal plane passing through said trunnions, so that the pressure of the pipe against the finger will not tilt the elevator.

7. A well pipe elevator comprising a body having a bore with an open throat on its forward side adapted to receive a pipe, trunnions at opposite sides of said body for supporting the same, a door hingedly connected to said body to swing in a substantially horizontal plane to close the said throat and cooperate with the body to support the pipe, a pipe contacting finger on the hinge end of said door and rigid therewith, said finger operating to project across said throat when the door is opened, said finger operating to swing the door closed when struck by the pipe entering the throat, and being located in a substantially horizontal plane passing through said trunnions, so that the pressure of the pipe against the finger will not tilt the elevator, said body having a recess to receive the finger in the closed position of the door, with the forward face of said finger disposed a considerable distance from the pipe so that in opening the door it will be capable of considerable movement before the finger engages the pipe.

8. A pipe elevator comprising a body having a socket for the pipe with an open throat on its forward side, a door hingedly connected to the elevator at one side to swing in a substantially horizontal plane across the said throat to retain the pipe therein, said door capable of an up-and-down movement relative to the body, means for raising the door as it approaches its closed position, the free end of said door and said body having interlocking means including inclined engaging faces cooperating to prevent opening the door while the weight of the pipe is in the elevator, and latch means for the door including primary latching means for latching the door partially closed, and final latching means operating to latch the door automatically in its fully closed position when the weight of pipe in the elevator is imparted to the door.

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