

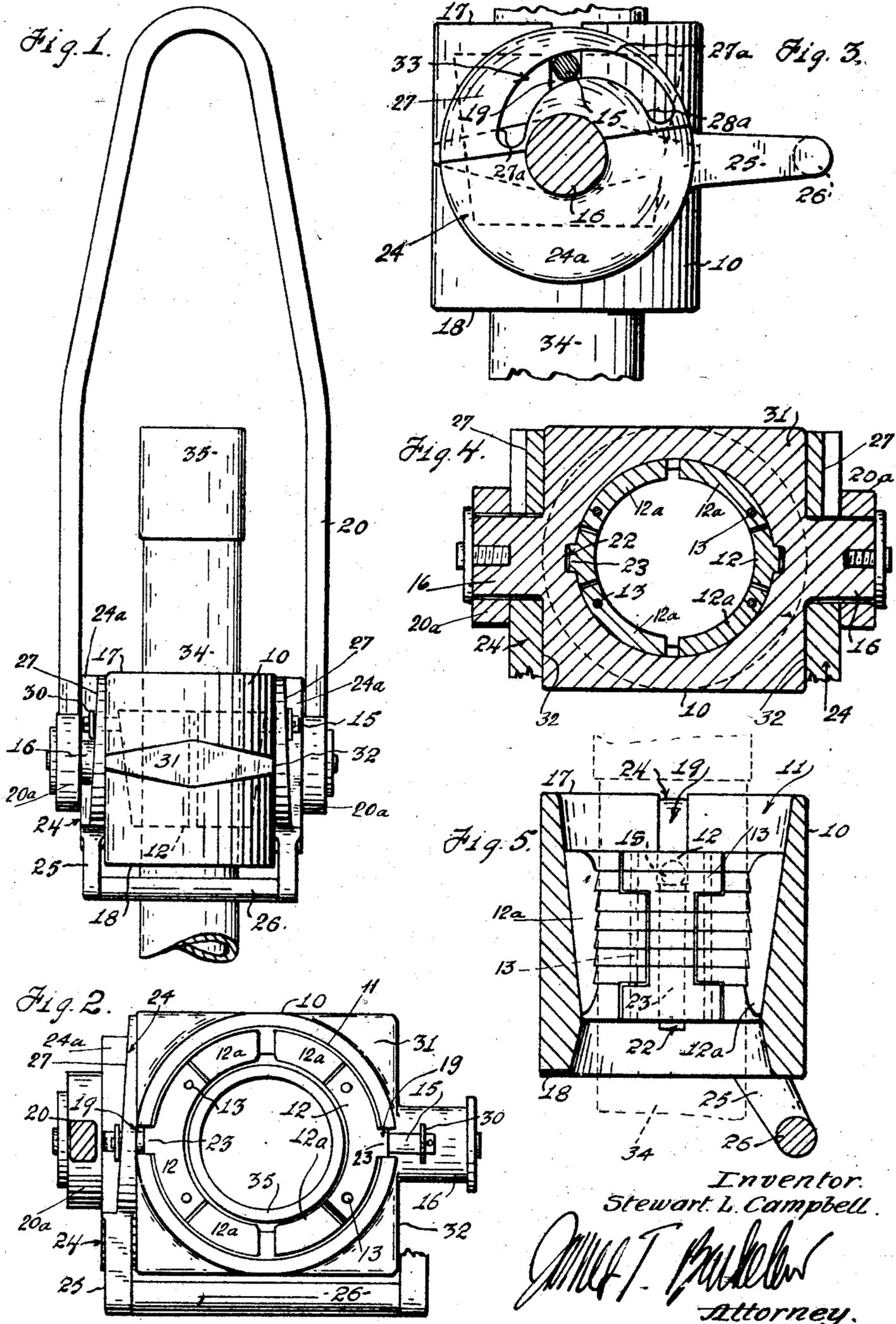
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PIPE ELEVATOR

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# UNITED STATES PATENT OFFICE

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## PIPE ELEVATOR

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This invention relates to pipe gripping and supporting devices and the like, and more particularly to pipe gripping and supporting devices such as are used in well work. A typical and presently preferred embodiment of the invention is herein explained specifically as a pipe elevator, but it will be made hereinafter to appear that the invention is not necessarily limited to such a specific piece of apparatus as a pipe elevator, but may be equally well applicable not only to elevators of types and forms other than that explained herein, but also to pipe supports in general.

The invention applies more particularly to improvements in pipe gripping and supporting devices of the nature employing wedge slips, and the invention resides particularly in the provision of an improved arrangement and mechanism for raising and lowering such wedge slips to move them into and out of operative engagement with a pipe. One of the characteristic features of my invention, as will hereinafter appear, resides in its use of cams or similarly functioning elements which rotate about an axis or axes transverse to the axis of the gripping devices and, specifically, at right angles to or radial to the axis of the gripping devices and of the work. This general characteristic feature of my invention is applicable as well to other forms of pipe gripping and supporting devices as to an elevator; but, as an additional characteristic feature when applied to an elevator, the operating cam devices of which I speak are preferably mounted to rotate about the same axis trunnions that take the elevator supporting bail. Thus the use of my invention as applied to an elevator has characteristics additional to its use as applied to other pipe supporting devices such as spiders, rotary tables, etc., and for that reason I prefer to explain the invention specifically and in detail as applied to a pipe elevator, but without any implication of limitation thereto.

There are other features of the invention which, however, will be better understood from a consideration of the following specific description, reference for that purpose being had to the accompanying drawings, in which:

Fig. 1 is a front elevation of an elevator with my invention applied thereto;

Fig. 2 is a somewhat enlarged plan of the same, but with certain parts removed and other parts in section, for clarity of illustration;

Fig. 3 is a side elevation of the same, showing the bail trunnion in section;

Fig. 4 is a central horizontal section of the same; and

Fig. 5 is a central vertical section in the same aspect as Fig. 3.

In the drawings I show a suitable body at 10, the body in this particular case being shown as substantially cylindrical in form. In this form the body may be taken as typical either of an elevator body without a gate, or as the body of a spider or rotary table or slips-supporting bushing or the like. On the other hand, as applied to elevators, it will be readily recognized from a consideration of the operating structure that the invention is not limited to application to a solid body, but may be applied to bodies which are made to open and close, or with opening and closing gates, as in many types of elevators. In other words, the specific nature of the body is not a limitation on the applicability of my invention.

The bore of body 10 is conical or tapered, as indicated at 11; and the slip sets 12, 12<sup>a</sup> fit in and interact with the body bore in a manner well known and needing no description here; it being only necessary to remember that the slips move outwardly and away from the pipe 34—expand around the pipe when raised, and contract around the pipe when lowered; and that when the slips are in engagement with the pipe the weight of the pipe tends to wedge them down to grip the pipe tightly.

For each slip or slip set there is a pivot trunnion 16 projecting from the body; and in the specific embodiment here shown there are two such trunnions 16 projecting radially and diametrically opposite each other from opposite sides of the body; and correspondingly there are two sets of slips 12, 12<sup>a</sup>. In applying my invention specifically to an elevator and using the trunnions as the centers

of rotation for the cam devices, there are only two sets of slips and two cam devices; and these two slip sets must, for gripping efficiency, encircle a large portion of the pipe periphery. At the same time these slips should, as nearly as possible, fit the varying diameter of the tapered bore 11 so as to be solidly backed by the body in any position in which they may grip the pipe. Consequently, in this two slip-set design, I compose each slip set of a central slip 12 and two wing slips 12<sup>a</sup> pivoted on vertical hinge pins 13 to opposite vertical edges of the main slip 12, as is most clearly shown in Fig. 5.

Each main slip 12 has a projecting lug or pin 15 which extends radially through the wall of the body, the body wall being provided with two open-top slots 19 to pass the pins. These lugs or pins become the connecting media through which the slots are raised and lowered by the cam mechanisms now to be explained. Also, to prevent the slips from moving circumferentially around in the body, and at the same time to take stresses off the pins 15, the back sides of slips 12 are provided with ribs or keys 23 which play vertically in shallow grooves or slots 22 in the body. The slips are thus held against any forcible circumferential movement in the body and pins 15 are protected from being sheared or bent by forcible contact with the walls of slots 19.

Mounted on each trunnion 16 is a cam disk 24, one of which is shown in elevation in Fig. 3. This cam disk has a cam slot 33 through which the corresponding pin 15 projects; and the cam slot presents a cam surface 28<sup>a</sup> which acts to raise the pins and slips and a cam surface 27<sup>a</sup> which acts to lower the pins and slips. At their outer ends pins 15 have heads of some form, here shown as removable washers 30, which prevent the pins and slips from moving inwardly and out of operative engagement with the cams. Also these heads, riding on the outer wedge face 27 of the cam, cause the slips to move outward as they move upward and cause them to draw out away from the pipe as they are raised.

In the form and arrangement of device herein specifically described the opposite and coaxial arrangement of the two trunnions 16 facilitates the application of a single operating handle to both the cams 24. Thus the cams have extending arms 25 cross-connected at their outer ends by a handle 26; and the arms 25 are so positioned on the cams with relation to the cam slots that the handle 26 in its operating movement moves up and down at one side of the elevator, never moving across either its top or bottom.

On these same trunnions 16 the elevator bail 20 is also mounted, the eyes or loops 20<sup>a</sup> of the elevator bail surrounding trunnions 16 immediately outside cams 24. In order to

properly position the bails and cams on the trunnions and to prevent the bails from striking the projecting ends of pins 15, the cams have suitable outwardly thickened or projecting parts, illustrated in this case as a thickening of that substantially half-circular part 24<sup>a</sup> of the cam which does not contain the cam slot 33. And, to give a good bearing for the cams, which are preferably rather thin in order not to space the elevator bails too far from the elevator body, there may be a central web 31 around the elevator body, substantially square in plan, and which presents bearing faces 32 to the inner faces of the cams.

In the structure as thus described the trunnions 16 are preferably set near the vertical center of the body so that the cams need project neither above or below the body, and also to facilitate swinging of the body from its vertical position, the handle 26 forming a manual means for swinging the body about the trunnions 16. When the handle 26 is at either end of its travel (or when it is in any position, provided the friction of movement of the cams and slips with relation to the body is greater than the friction of the swinging movement of the body on its trunnions, which is usually the case) handle 16 becomes not only an operating handle for the slips, but also a very convenient means of tipping the body to any suitable angle to apply it to a pipe which may not be in a vertical position.

In applying the device to a pipe, handle 26 is moved upwardly and cam face 28<sup>a</sup> then acts to raise the slips to their uppermost and expanded position, in which position they may be passed over collar 35 of a pipe 34. Having been thus placed around the pipe the slips are next thrown into engagement with the pipe by moving the handle downwardly, cam face 27<sup>a</sup> coming into engagement with pin 15 and moving the slips down until they come into contact with the pipe. The length of handle arms 25, and the power multiplying action of the cam face, make it possible to wedge the slips downwardly quite tightly against the pipe; so that when the weight of the pipe is subsequently taken upon the slips they are then moved further down only a short distance. A slight amount of loose motion of pins 15 in cam slots 33 may take care of this further downward movement of the slips, preventing the pins from coming down into forcible engagement with the cam faces 28<sup>a</sup>. However the provision of lost motion may not be necessary and, in fact, is in some ways objectionable. The cam angle may be such that pressure of the pin upon the cam face 28<sup>a</sup> may tend to rotate the cam, and especially so because the handle arms and handle by their weight tend to rotate the cams at all times in the slips-lowering direction. At the same time, with pins 15 tightly fitting

cam slots 33, the slips cannot be disengaged from the pipe if a lowering string of pipe should happen to come to a stop, as often occurs. The engagement of washers 30 against the cam faces 27<sup>a</sup> also serves to hold the slips tight to prevent the elevator from moving or slipping down the pipe.

An operating feature to which I call particular attention is this: that handle 26 is moved in the same general direction as the slips. When it is desired to move the slips down the handle is moved down, and upward movement of the handle causes upward movement of the slips. Again, the relationships of movements are such that, if the elevator is lowered for the purpose of disengaging the slips from a pipe otherwise supported, it is only necessary to hold the handle 26 stationary to cause upward movement of the handle and the slips with relation to the body; and if the body is being raised to take up the weight of a pipe, again it may only be necessary to hold the handle stationary to cause down movement of the handle and slips with relation to the body to cause the pipe to be gripped. This up and down movement of the handle is entirely at one side of the body; and the devices may be so designed that the handle never moves below the plane of the lower end of the body or above the plane of the upper end of the body. On the other hand the design may be such that the handle moves from a more elevated position to a lower position and passes beyond the ends of the body. Thus, for instance, in Figs. 1 and 5 the handle is shown in a depressed position below the end of the body, but still not swung inwardly far enough to swing across the end of the body or to strike the pipe held in the slips. This arrangement of the handle, together with the movement relationships hereinbefore explained, makes it possible to make the elevator slips self-releasing if desired as the elevator is lowered upon a support or table.

I also call particular attention to the duplex or double-cam action of the cam or cams 24. From what I have said it will be clear that these cams not only by their rotation raise and lower the slips, but also simultaneously move them in and out so as to make them follow the conical bore and draw away from the pipe as they are raised. The angle and disposition of cam faces 27<sup>a</sup> are made such, in relation to the conical angle of bore 11, that when the slips are raised they are positively moved out just the right distance to keep them at all times against the bore surface.

In summary I may say that the devices as here explained are peculiarly adapted to easy and quick manipulation, at the same time allowing substantial power to be applied to the movement of the slips. The up and down movement of the operating handle not only

has its simple relationship to the vertical movements of the slips and body, as before explained, but that handle movement is also one which facilitates the application of maximum manual power. Simple and effective in operation, the device is likewise simple in structure and assembly, involving only a few rugged parts. Complete disassembly for purposes of renewing parts is comparatively simple; but the design makes it possible to remove the slips without disassembling any of the remaining parts. For instance, by raising the slips to their uppermost position, where they are most widely spread from each other, the washer 30 can be removed from pins 15 and then the slip sets, one at a time, can be moved inwardly far enough to disengage their pins 15 from the cams, when the slips can be lifted directly out of the body.

I claim:

1. In a device of the character described, a body having a vertical slip receiving bore, a wedge slip movable vertically in said bore, and slip operating means adapted to move the slip vertically and which includes an operating handle pivoted on a substantially horizontal pivot axis to the body, said axis being substantially radial with respect to the receiving bore.

2. In a device of the character described, a body having a vertical slip receiving bore, a wedge slip movable vertically in said bore, a slip operating means comprising a cam mounted on the body on a substantially horizontal axis of rotation, means on the slip engaging the cam, and an operating handle connected with the cam and adapted to swing pivotally about said horizontal cam axis.

3. In a device of the character described, a body provided with a slip receiving bore, a pair of opposite wedge slips movable vertically in said bore, two separate means located at opposite sides of the body one for operating each wedge slip, each of said means including a handle lever movable vertically, and a cross-connecting handle between said levers and substantially integral therewith whereby the levers may be operated equally and simultaneously.

4. In a device of the character described, a body provided with a slip receiving bore, a pair of opposite wedge slips movable vertically in said bore, two pivot trunnions extending outwardly from opposite sides of the body, one adjacent each wedge slip, a cam member mounted to rotate on each pivot trunnion, connecting means between each cam member and the adjacent wedge slip, and means for rotating the cam members.

5. In a device of the character described, a body provided with a slip receiving bore, a pair of opposite wedge slips movable vertically in said bore, two pivot trunnions extending outwardly from opposite sides of the

body, one adjacent each wedge slip, a cam member mounted to rotate on each pivot trunnion, connecting means between each cam member and the adjacent wedge slip, and means for rotating the cam members, including two handle levers, one for each cam means, and a cross-connecting handle between the handle levers.

6. In a device of the character described, a body with a vertical slip receiving bore, a wedge slip movable vertically in the bore, a rotatable cam member mounted exterior of the body on a horizontal axis of rotation, means connecting the slip with the cam member, and the cam member being adapted by rotation in opposite directions to move the slip up and down.

7. In a device of the character described, a body with a vertical slip receiving bore, a wedge slip movable vertically in the bore, a rotatable cam member mounted exterior of the body on a horizontal axis of rotation, means connecting the slip with the cam member, said cam member having an eccentric cam slot, and the slip having a lug projecting into said cam slot.

8. In a device of the character described, a body with a vertical slip receiving bore, a wedge slip movable vertically in the bore, a rotatable cam member mounted exterior of the body on a horizontal axis of rotation, means connecting the slip with the cam member, said cam member having an eccentric cam slot, and the slip having a lug projecting into said cam slot, the lug having free play in the cam slot to allow limited vertical movement of the slip independently of the cam movement.

9. In a device of the character described, a body having a vertical slip receiving bore, a wedge slip movable vertically in the bore, means for guiding the wedge slip vertically and preventing circumferential movement of the slip around the bore, the body having a vertical slot through its wall, a projecting lug on the slip extending through said slot, a horizontal pivot trunnion projecting exteriorly of the body substantially opposite the slip, a cam disk mounted for rotation on said pivot trunnion, said cam disk having a cam slot into which the slip lug enters, and a handle connected with the cam disk and movable substantially vertically at one side of the body.

10. In a pipe elevator or the like, a body with a vertical slip receiving bore there-through, horizontal pivot trunnions extending oppositely from the body, a supporting bail pivotally mounted on said pivot trunnions, a pair of slip raising and lowering cams mounted for rotation one on each of the pivot trunnions, and means interconnecting each slip with one of said cams.

11. In a pipe elevator or the like, a body with a vertical slip receiving bore there-

through, horizontal pivot trunnions extending oppositely from the body a supporting bail pivotally mounted on said pivot trunnions, a pair of slip raising and lowering cams mounted for rotation one on each of the pivot trunnions, means interconnecting each slip with one of said cams, a handle lever extending from each cam, and a cross-connecting handle between said handle levers.

12. In a pipe elevator or the like, a body with a vertical slip receiving bore there-through, a pair of wedge slips mounted for vertical movement in the bore, a pair of pivot trunnions extending outwardly from opposite sides of the body, a supporting bail pivotally mounted on said pivot trunnions, a substantially U-shaped handle assembly extending around one side of the body and pivotally rotatable about both pivot trunnions, and means operated by said handle assembly to cause vertical movements of the slips by virtue of swinging movement of the handle assembly.

13. In a pipe elevator or the like, a body with a vertical slip receiving bore there-through, a pair of wedge slips mounted for vertical movement in the bore, a pair of pivot trunnions extending outwardly from opposite sides of the body, a supporting bail pivotally mounted on said pivot trunnions, a substantially U-shaped handle assembly extending around one side of the body and pivotally rotatable about both pivot trunnions, and two separate means located one at each trunnion and each connecting the handle assembly to one slip for causing vertical slip movement by virtue of swinging movement of the handle assembly.

14. In a device of the class described, a body provided with a vertical bore, horizontal opposed trunnions to said body, slips movable vertically in said bore, a bail connected to said trunnions, and slip operating means including levers pivoted to said body on said trunnions.

15. In a device of the class described, a body provided with a vertical pipe receiving bore, an annular assembly of pipe engaging slips in said bore, radial projections to said assembly of slips projecting through the body, external horizontal trunnions radial to the body and bore, and members oscillatable on said trunnions and presenting raising and lowering surfaces to said projections.

16. In a device of the character described, a body having a vertical conical slip receiving bore, a wedge slip movable in said bore in contact with the bore wall, a horizontally revoluble cam having a radial cam face adapted to move the slip vertically and having an end cam face adapted to move the slip horizontally as it is moved vertically.

17. In a device of the character described,

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a body with a vertical conical slip receiving bore, a wedge slip movable in said bore in contact with the bore wall, a rotatable cam member mounted exterior of the body on a horizontal axis of rotation, said cam member having an eccentric cam slot, a lug on the slip projecting through said cam slot and having a head exterior of the cam, and the cam having an exterior cam face coacting with the head to positively cause horizontal movement of the slip simultaneously with its vertical movement caused by the action of said eccentric cam slot.

In witness that I claim the foregoing I have hereunto subscribed my name this 6th day of January, 1928.

STEWART L. CAMPBELL.

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