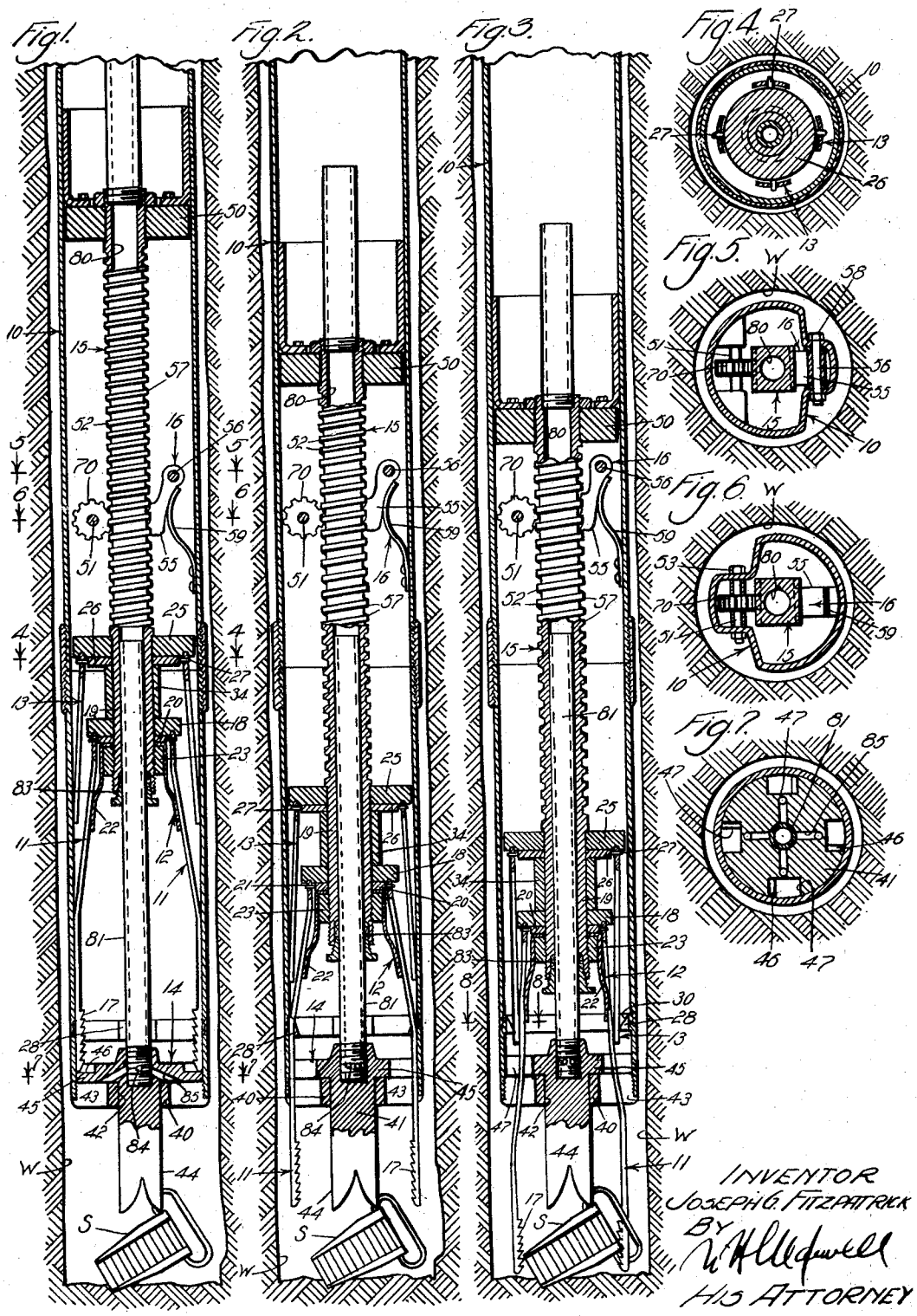
Sept. 9, 1930. J. G. FITZPATRICK 1,775,340

GRAB

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INVENTOR
JOSEPH G. FITZPATRICK
BY
HIS ATTORNEY

Sept. 9, 1930. J. G. FITZPATRICK 1,775,340

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Fig. 8.

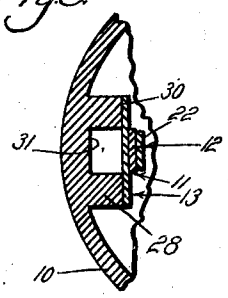


Fig. 11.

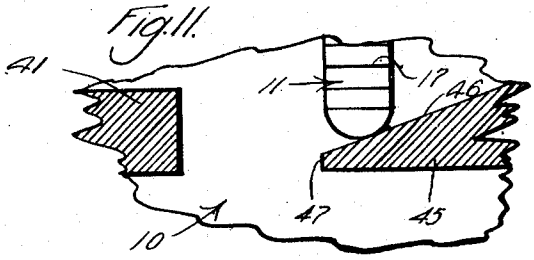


Fig. 9.

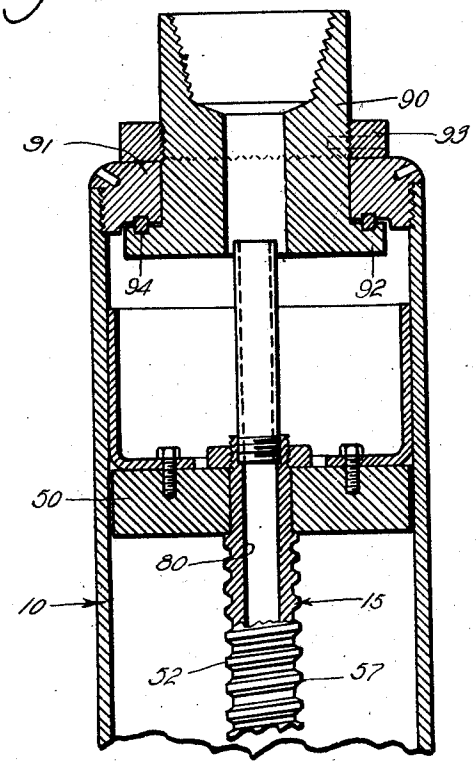
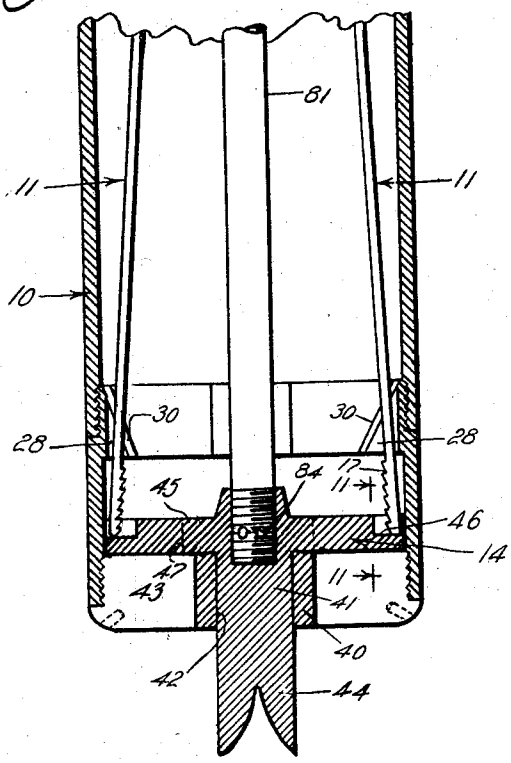


Fig. 10.



INVENTOR
JOSEPH G. FITZPATRICK
BY
A. H. Maxwell
HIS ATTORNEY

Patented Sept. 9, 1930

1,775,340

UNITED STATES PATENT OFFICE

JOSEPH G. FITZPATRICK, OF ANAHEIM, CALIFORNIA

GRAB

Application filed May 6, 1929. Serial No. 360,671.

This invention has to do with a well tool and relates more particularly to a fishing tool, it being a general object of the invention to provide a simple, practical, and effective tool for fishing or removing objects from a well.

Occasionally, in the course of drilling a well, an object, say, for instance, a part of the equipment used in drilling, is lost or allowed to drop into the well bore, making it necessary to employ a fishing tool to remove such object before drilling can continue. The art of drilling tools is rather well developed in that different types of fishing tools have been developed for different classes of work. When small objects are lost it is customary to employ tools known as grabs. The usual grab includes a plurality of fingers which project downwardly to grip the fish or objects to be removed from the hole and to engage the bottom of the well bore, and includes means whereby the fingers are actuated to grip the object, such means being operable by the rotation of the drill pipe carrying the grab. In practice considerable trouble is experienced with this ordinary type of grab as the rotational strain which comes upon the fingers when the grab is being actuated often distorts the fingers and renders them useless or inefficient.

It is a general object of this invention to provide a tool in the nature of a grab in which the fingers or object engaging members are operable to engage and grip an object without being subject to rotational strain such as ordinarily falls upon the gripping members of a grab.

Another object of this invention is to provide a grab in which the circulation of fluid is controlled so that the operator knows when the tool is released ready for gripping the object and in which the circulation is distributed in a manner to aid the action of the tool.

A further object of this invention is to provide a grab in which the various parts are arranged and related so that the tool is simple and inexpensive of construction, practical, and dependable in operation.

The various objects and features of my invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description I refer to the accompanying drawings, in which:

Fig. 1 is a longitudinal detailed sectional view of the tool provided by this invention showing it in the unactuated position in a well bore ready to be operated to engage an object at the bottom of the well bore. Fig. 2 is a view similar to Fig. 1 showing the tool partially operated. Fig. 3 is a view similar to Figs. 1 and 2 showing the tool operated to have a hold of the object in the well. Figs. 4, 5, 6 and 7 are detailed transverse sectional views taken on line 4—4, 5—5, 6—6 and 7—7, respectively, on Fig. 1. Fig. 8 is an enlarged sectional view taken on line 8—8 on Fig. 3. Fig. 9 is an enlarged detailed sectional view of the upper end portion of the tool. Fig. 10 is an enlarged sectional view of the lower portion of the tool, and Fig. 11 is a sectional view taken on line 11—11 on Fig. 10.

The tool provided by this invention being in the nature of a grab, is adapted to be used for various fishing operations, particularly for fishing various small objects from a well bore. For purpose of illustration and without limiting the invention in any way, I have disclosed it operating to engage a slip lost in a well bore. The slip S is shown located at the bottom of the well bore W. Figs. 1, 2 and 3 of the drawings illustrate the action of the grab in fishing the slip from the well.

The tool provided by this invention includes, generally, a body 10, a plurality of arms 11 mounted within the body so that they are operable to project from the body and grip an object such as a slip S, spring means 12 normally yieldingly holding the arms 11 out or apart, levers 13 for operating the arms inwardly so that they grip the object to be fished from the well, control means 14 for the arms 11, a stem 15 supporting the arms 11, and certain of the other parts in the body, ratchet means 16 controlling the action of the stem, and various other parts the details and functions of which are hereinafter described.

The body 10 is an elongate tubular member adapted to be operated in the well bore W on the end of a string of drill pipe, or the like.

In practice the body 10 may be formed or built up in various manners, it being preferred to make it a sectional structure to facilitate manufacture and handling of the tools. In the drawings I have illustrated a body construction employing a plurality of sections connected together so that they can be conveniently taken apart when desired or necessary.

In carrying out my invention I may connect the body 10 to a drill pipe, or the like, in various ways. In the drawings I show a swivel connection which allows the body 10, and therefore the entire tool, to turn or rotate relative to the drill pipe. The connection includes what I will term a head 90 to be applied to the lower end of a drill pipe, or the like, a sleeve 91 attached to the upper end of the body and rotatably carried on the head, a flange 92 and a collar 93 on the head 90 holding the sleeve in position on the head, and packing 94 between the flange and sleeve. The head is shown provided with a socket to receive the pin of a tool joint section. The construction just described allows the entire tool to turn relative to the drill pipe, if necessary.

The tool includes a plurality of arms 11. It is a feature of the invention to arrange and mount the arms so that they are entirely within the body when the tool is being lowered into the well bore and are operated to project from the body only when it is desired to grip the object to be fished from the well. In the particular form of invention illustrated I have provided four arms 11 arranged symmetrically within the body. The arms are elongate members held or pivotally supported at their upper ends and provided at their lower ends with toothed jaws 17 adapted to grip the object to be fished from the well.

In the drawings I have illustrated the upper ends of the arms 11 attached to a flange member 18 carried on the lower end portion 19 of the stem 15. The flange member 18 projects a suitable distance from the stem and has a downwardly facing groove to receive the upper ends of the arms 11. A ring 20 is carried on the reduced portion of the stem below the flange 18 and has projecting pins 21 which extend outwardly through openings in the arms and thus hold the arms up or in the proper seated engagement in the flange 18. The fit of the parts just described is such as to allow the arms 11 to work or swing in the desired manner as a tool is operated.

The spring means 12, provided for normally holding the arms 11 out or apart, may include any suitable arrangement of springs. In the form of the invention illustrated I provide a plurality of springs 22 immediately below the ring 20 to engage the inner sides of the arms 11. The springs normally bear outwardly against the arms to hold them out against the interior of the body 10, as clearly shown in Fig. 1 of the drawings. The springs 22 are held between the ring 20 and a nut 23 screw threaded on the lower end of the stem portion 19.

The levers 13 provided for operating the arms 11 are arranged within the body 10 and have their upper ends pivotally held in the body and their lower ends arranged to engage the outer sides of the arms 11 at points somewhat below the pivotal mountings of the arms 11. In practice I may provide a lever 13 for actuating each arm 11, as clearly shown throughout the drawings. The upper ends of the levers 13 are carried by a flange 25 projecting radially from the portion 19 of the stem 15. The flange 25 has a downwardly facing groove receiving the upper ends of the levers 13. A ring 26 is carried on the stem portion 19 immediately below the flange 25 and has outwardly projecting pins 27 which extend through openings in the levers to hold the levers in the groove of the flange 25. The fit of the various parts just described is preferably such as to allow the arms 11 to have the desired pivotal movement.

The invention provides means for operating the levers 13 inwardly so that they engage the arms 11 to move the arms 11 inwardly or together. In the form of the invention illustrated I provide a plurality of projections 28 on the interior of the body in position to be in register with the levers 13 as the tool is being operated to extend the arms 11. Each lug or projection 28 has a beveled face 30 operable to receive the lower end portion of a lever 13 and cause the lever to move or swing inwardly. In the form of the invention illustrated a notch or opening 31 is provided in each projection 28 to receive an arm 11 and the levers are made sufficiently wide to span the opening 31.

In the construction illustrated in the drawings the flange 25 bears upwardly against a shoulder on the stem 15 and the various other parts above referred to as being carried on the stem portion 19 on the flange 18 are held in assembled position by means of the nut 23. In practice a suitable spacer 34 may be arranged on the portion 19 between the ring 26 and the flange 18. From inspection of the drawings it will be obvious how the single nut 23 operates to effectively hold the entire construction assembled and in condition for operation. With this construction, removal of a single member, that is, removal of the nut 23, allows the arms 11 and also the levers 13 to be detached from their mountings. When the nut 23 is removed or loosened sufficiently, the rings 20 and 26 can be lowered away from the flanges 18 and 25, respectively, allowing the arms and levers to be removed from the pins projecting from the rings.

The control means includes, generally, a guide plate 40 fixed to the lower end of the body 10 and a head 41 carried by the guide plate 40. The guide plate is fixed, for in-

stance, screw threaded to the lower end portion of the body 10, and is provided with a plurality of spaced openings 43 in register with the arms 11 and adapted to pass the arms as the tool is operated. The head 41 is rotatably carried in an opening 42 formed centrally in the guide plate 40 and has downwardly projecting parts 44 below the guide plate 40 adapted to engage the fish or object to be removed from the well. The parts 44 are designed so that they tend to cause rotation of the head as the tool is lowered against an object such as is ordinarily to be fished from a well bore. The head 41 has a flange part 45 slidably fitting the upper side of the guide plate 40. This flange 45 has beveled faces 46 on which the lower ends of the arms 11 rest when the tool is in the position shown in Fig. 1, and has openings 47 adjacent the beveled faces 46 to pass the arms 11 when the tool is operated.

With the construction just described, rotation of the head 41, caused by the parts 44 engaging the fish, causes the flange 45 to rotate so that the arms 11 move off of the beveled faces 46 and enter the openings 47 so that they can then continue to move downwardly and pass through the openings 43 in the guide plate 40.

In practice the adjoining surfaces of the collar 93 and the sleeve 91 are roughened, for instance, provided with small teeth or irregularities, to prevent turning of the body relative to the drill stem when the tool is being operated so that the parts 44 engage a fish, or the like. Through this arrangement the body 10 will not rotate relative to the drill pipe when the tool is lowered into engagement with the fish and it is necessary for the head 41 to rotate to release the arms 11.

The stem 15, to which the arms 11 and levers 13 are connected through the flanges 20 and 25, respectively, extends longitudinally through the body 10 and projects a substantial distance above the other parts just mentioned. A piston 50 is carried on the upper end portion of the stem and slidably fits the interior of the body 10 so that the stem can be operated downwardly in the body by fluid pressure applied from above. It will be obvious from the drawings how fluid pressure applied above the piston 50 operates to force the stem 15 downwardly, thus forcing the arms 11 and the levers 13 downwardly. This downward movement of the parts cannot occur until the control means has been operated to bring the openings 47 into register with the openings 43.

The ratchet device 16 engages the stem 15 to prevent it from moving upwardly in the body after it has been actuated by pressure applied to the piston 50. In the form of the invention illustrated the ratchet means includes a pawl 55 carried on a shaft 56 to cooperate with teeth 57 formed on the exterior of the stem. The shaft 56 has a projecting end portion 58 at the exterior of the body adapted to be engaged for the purpose of disengaging the pawl from the teeth 57. A spring 59 normally engages the pawl to hold it in cooperative engagement with the teeth 57. The arrangement of these parts is clearly illustrated in Figs. 1, 2 and 3 of the drawings.

For the purpose of operating the stem in or through the body, for instance, for preparing the tool for operation, a pinion 70 is mounted in the body on a shaft 51 so that it meshes with gear teeth 52 provided on the stem. The shaft 51 has a projecting end 53 at the exterior of the body so that it can be engaged and rotated in order to rotate the pinion. When the pinion is rotated it cooperates with the gear teeth or ratchet 52 to move the stem 15 longitudinally within the body.

The invention provides means within the tool for handling circulating fluid so that it is introduced at the gripping or jaw portions 17 of the arms 11 as the tool operates. Further, it is desirable to provide a means whereby the circulation may be employed as an indicator of the operating position of the tool. In the form of the invention illustrated the stem 15 is provided with a central longitudinal circulation opening 80 and the head 41 has a tubular extension or wash pipe 81 projecting upwardly through the plate 40 and into the lower end of the opening 80 of the stem 15. A suitable packing gland 83 may be provided around the wash pipe 81 at the lower end of the stem 15 as shown in Figs. 1, 2 and 3 of the drawings. The wash pipe 81 is provided with lateral openings 84 at a point within the head 41 communicating with openings 85 adapted to cooperate with the openings 43 in the guide plate 40. The ports are arranged and related so that the openings 85 are closed, or do not register with the openings 43 when the parts are in position to hold the arms 11 within the body, as shown in Fig. 1, and only register with the openings 43 when the parts are positioned to allow the arms to project downwardly from the body as shown in Figs. 2 and 3. In the case illustrated the openings 85 are shaped to discharge downwardly through the openings 43 in the guide. By providing an opening 85 to discharge downwardly through each opening 43, the arms 11 are effectively flushed as the tool operates, and in this way the circulation fluid materially aids the action of the tool. It will be obvious, of course, that the opening of the ports to allow circulation through the openings 43 relieves the pressure of the circulation fluid so that the operator knows the tool is in operative position.

In operation the parts are positioned as shown in Fig. 1 so that the arms 11 are entirely within the body 10 and the guide member 40 and the plate 41 are related so that

the arms 11 are held in the body. The tool is lowered in the well and, upon reaching the right location, for instance, the bottom of the well, the parts 44 of the head engage the bottom of the well, or the object to be fished from the well, as shown in Fig. 1. The head 41 then rotates causing the openings 43 and 47 to register and the circulation openings 84 to register with the ports 85. When the arms 11 are released ready for projection from the body, circulation is established at the arms. The registering of the openings 84 and 85 to establish circulation indicates to the driller that the tool is ready for operation. The fluid pressure applied through the drill pipe forces the piston 50 downwardly in the body causing the arms 11 to be projected from the lower end of the body while they are held out by the springs 22. When the arms are well beyond the end of the body and are in position to engage around the object to be fished from the well, the levers 13 engage the projections 28 and, as they move downwardly with relation to the projections 28, they are moved inwardly and engage the arms 11 to move the arms inwardly. The engagement of the arms by the levers causes the lower end portions, or the jaw portions of the arms, to move inwardly and grip the object lost in the well. As this action progresses, the ratchet operates to hold the stem 15 so that the parts will not retract. When the tool has been operated as shown in Fig. 3, it is removed from the well and the object caught between the jaw portions of the arms is removed by releasing the pawl 55 and allowing the stem to move upwardly with relation to the body.

Having described only a typical, preferred form of my invention, I do not wish to limit myself to the specific details hereinabove set forth, but wish to reserve to myself any changes or variations that may occur to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A tool of the character described including, a tubular body, a stem shiftably carried in the body, spaced arms pivotally connected with the stem to be shiftable therewith and to have free ends normally within the body, means for operating the stem to project the arms from the body, and means for operating the free ends of the arms toward each other when projected from the body.

2. A tool of the character described including, a tubular body, a stem in the body, spaced arms pivotally attached to the stem so that they are normally within the body, fluid pressure means for operating the stem through the body to project the arms from the body and means to cause the free ends of the arms to approach one another when projected from the body by the fluid pressure means.

3. A tool of the character described including, a tubular body, a stem in the body, means for operating the stem through the body, arms on the stem having spaced free ends normally within the body, means normally holding the free ends of the arms apart, fluid pressure means for operating the stem through the body to project the arms from the body, and means for causing the free ends of the arms to approach each other when projected from the body.

4. A tool of the character described including, a tubular body, a stem operable longitudinally in the body, spaced gripping arms pivotally attached to the stem to be operable therewith and so that they are normally within the body, means for moving the stem through the body in one direction to project the arms from the body, means for preventing movement of the stem in the opposite direction, and means for moving the free ends of the arms toward one another.

5. A tool of the character described including a tubular body, a stem extending through the body, spaced gripping arms pivotally attached to the stem, ratchet means permitting movement of the stem in one direction through the body and preventing movement of the stem in the opposite direction, and means for causing the free ends of the arms to move toward one another.

6. A tool of the character described including, a tubular body, a stem extending through the body, gripping arms attached to the stem having spaced free ends, ratchet means permitting movement of the stem in one direction through the body and preventing movement of the stem in the opposite direction, means for disengaging the ratchet means, manual means for operating the stem in either direction upon disengagement of the ratchet means, and means for causing the free ends of the arms to move toward one another.

7. A tool of the character described including, a tubular body, a stem extending through the body, spaced gripping arms on the stem operable between a position where their free ends are spaced apart and a position where their free ends are adapted to grip an object, and means controlling operation of the arms, said means including a head rotatably mounted in the body having openings to pass the arms.

8. A tool of the character described including, an elongate tubular body, a stem extending through the body, spaced gripping arms on the stem operable between a position where their free ends are spaced apart and a position where their free ends are adapted to grip an object, and means controlling operation of the arms, said means including a plate fixed on the body and a

rotatable head cooperating with the plate, the plate and the head having openings adapted to pass the arms.

9. A tool of the character described including, an elongate tubular body, a stem extending through the body, spaced gripping arms on the stem operable between a position where their free ends are spaced apart and a position where their free ends are adapted to grip an object, and means controlling operation of the arms, said means including a plate closing one end of the body, there being openings in the plate, and a rotatable head cooperating with the plate normally supporting the gripping arms and having openings adapted to pass the arms, and a part on the head projecting from the body.

10. A tool of the character described including a tubular body, a stem extending into the body, a plurality of spaced gripping arms pivotally mounted on the stem and normally located completely within the body, fluid pressure means to operate the stem and arms through the body, and means to cause the free ends of the arms to move toward each other upon being operated to positions where they project from the body.

11. A tool of the character described including, a tubular body, a stem in the body, a plurality of spaced gripping arms pivotally attached to the stem, means for moving the ends of the arms together when the stem is operated through the body, and means for operating the stem through the body including a piston on the stem operating in the body.

12. A tool of the character described including, a tubular body, a stem in the body, arms on the stem having spaced free ends normally within the body, spring means normally holding the free ends of the arms apart, fluid pressure means for operating the stem through the body to project the arms from the body, and means for causing the free ends of the arms to approach each other when outside of the body.

13. A tool of the character described for use in connection with a string of drill pipe, including a body swivelly connected to the drill pipe, a stem extending through the body, spaced gripping arms pivotally connected to the stem, a rotatable head projecting from the body, means for operating the arms to grip an object, and means releasably holding the body against rotation relative to the drill pipe.

14. A tool of the character described for use in connection with a string of drill pipe, including a body swivelly connected to the drill pipe, a stem extending through the body, spaced gripping arms pivotally connected to the stem, a rotatable head projecting from the body, means for operating the arms to grip an object, the last mentioned means including means on the stem operable by fluid pressure, levers on the stem, and projections on the body to cooperate with the levers in forcing the end portions of the arms together upon movement of the stem.

15. A tool of the character described including a tubular body, a stem extending through the body, a plurality of gripping arms symmetrically arranged on the stem and having spaced end portions, a plurality of levers pivoted on the stem at points spaced from the arms there being a lever engaging each arm, means for operating the stem through the body, and beveled projections on the body to engage the levers and force them against the arms as the stem operates through the body.

16. A tool of the character described including, a tubular body, a stem in the body, a plurality of gripping arms on the stem having spaced free ends, fluid pressure means for operating the stem through the body, means for operating the free ends of the arms toward each other including pivoted levers, and means for controlling operation of the fluid pressure means and the arms.

In witness that I claim the foregoing I have hereunto subscribed my name this 23rd day of April, 1929.

JOSEPH G. FITZPATRICK.