Oct. 18, 1955 E. A. LYNCH 2,720,925

CONDUIT CLEANER

Filed May 4, 1950 5 Sheets-Sheet 1

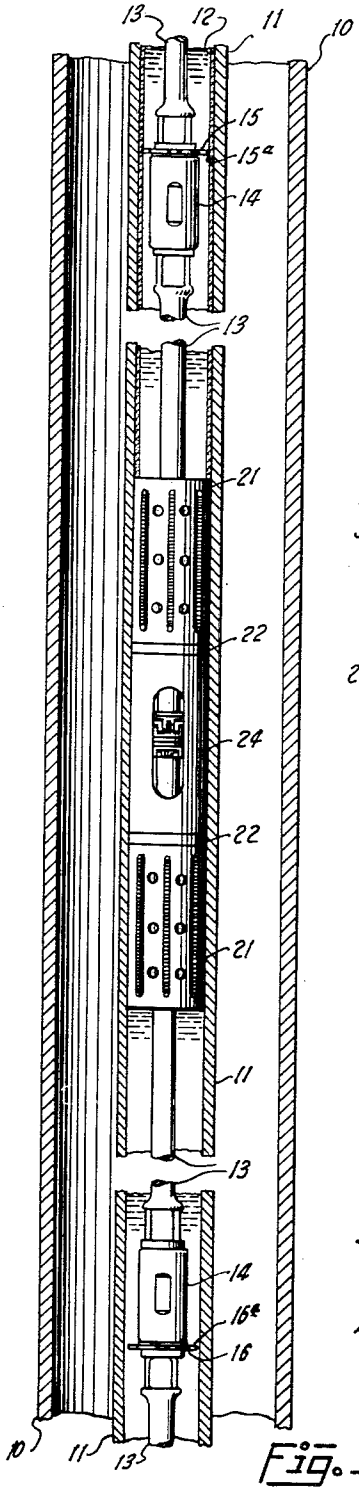


Fig. I

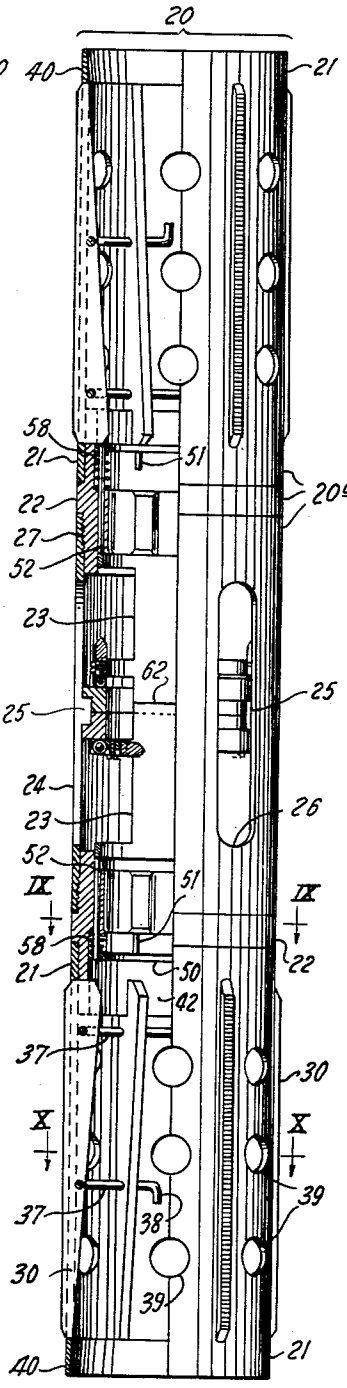


Fig. II

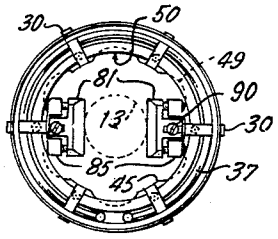


Fig. III

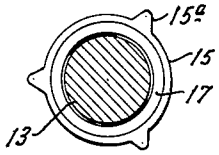


Fig. IV

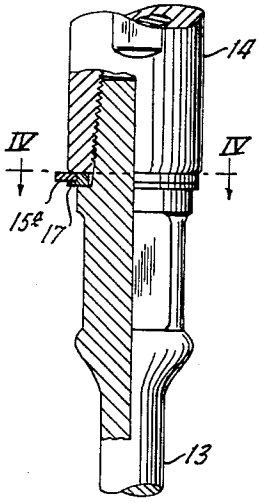


Fig. V

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Oct. 18, 1955 E. A. LYNCH 2,720,925

CONDUIT CLEANER

Filed May 4, 1950 5 Sheets-Sheet 2

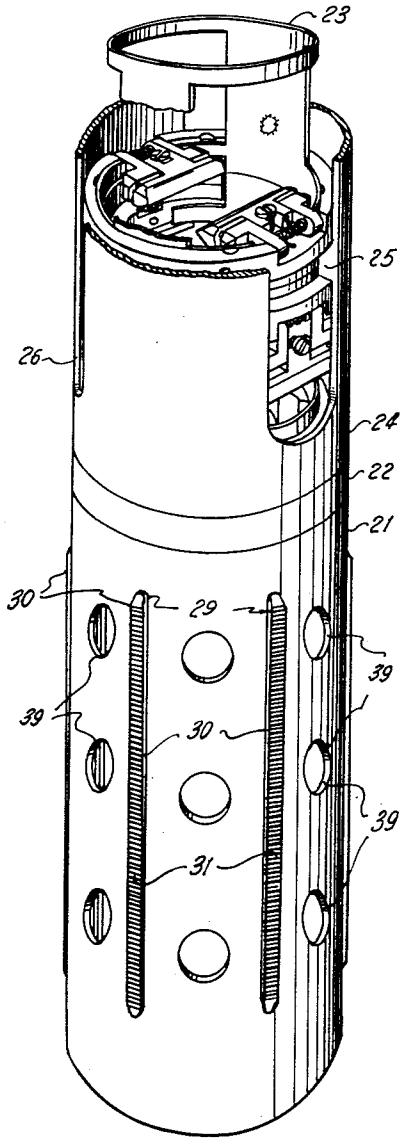


Fig. VI

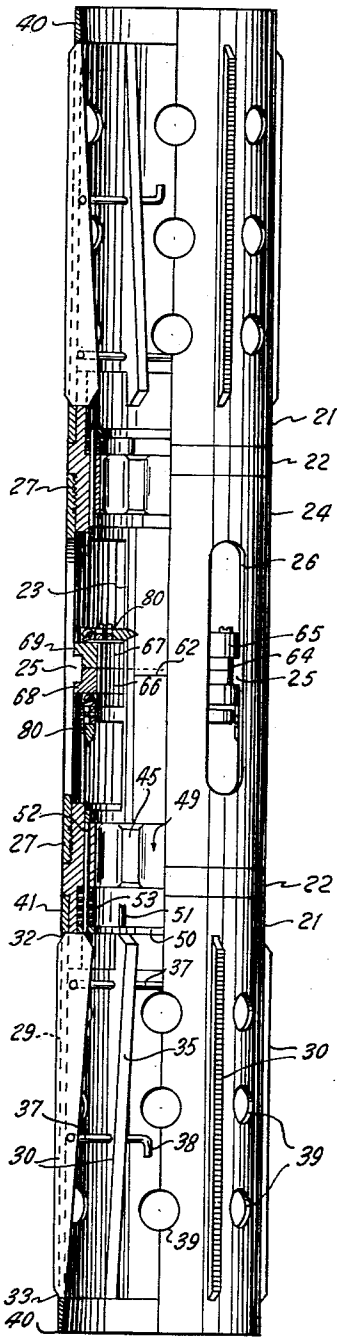


Fig. VII

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Oct. 18, 1955 E. A. LYNCH 2,720,925

CONDUIT CLEANER

Filed May 4, 1950 5 Sheets-Sheet 3

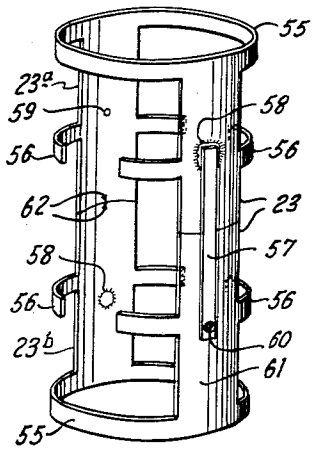


Fig. VIII

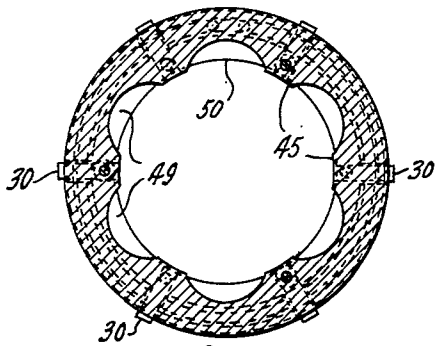


Fig. IX

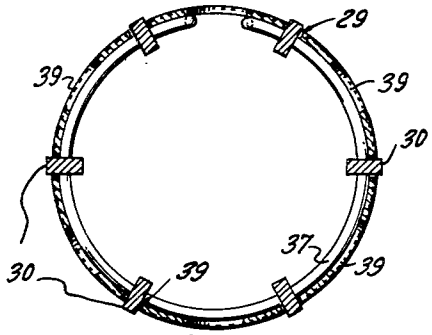


Fig. X

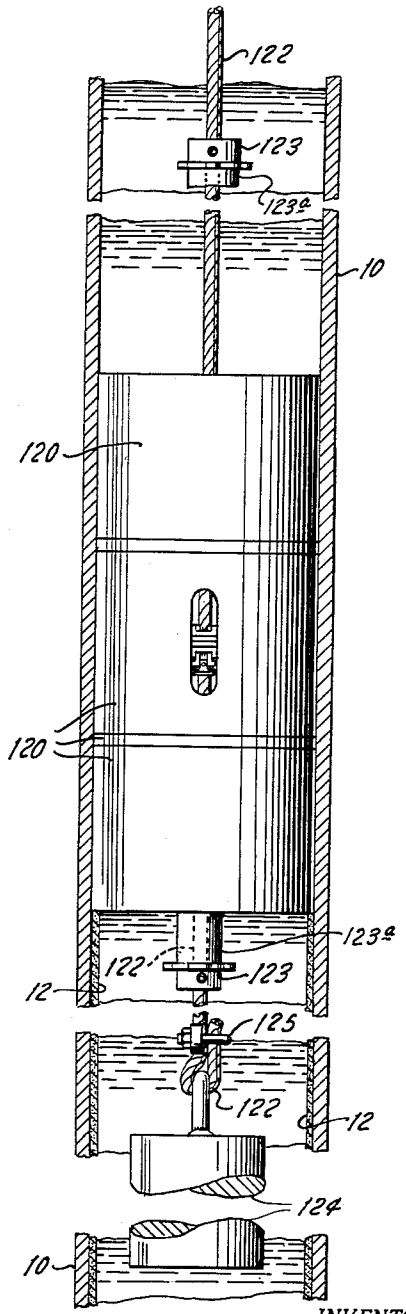


Fig. XI

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Oct. 18, 1955 E. A. LYNCH 2,720,925

CONDUIT CLEANER

Filed May 4, 1950 5 Sheets-Sheet 4

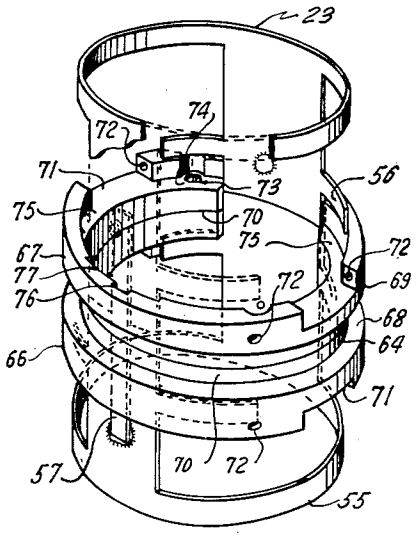


Fig. XII

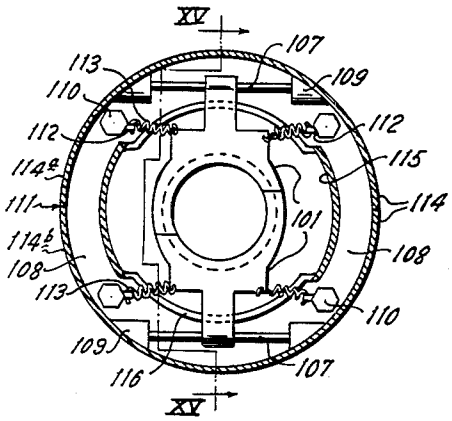


Fig. XIV

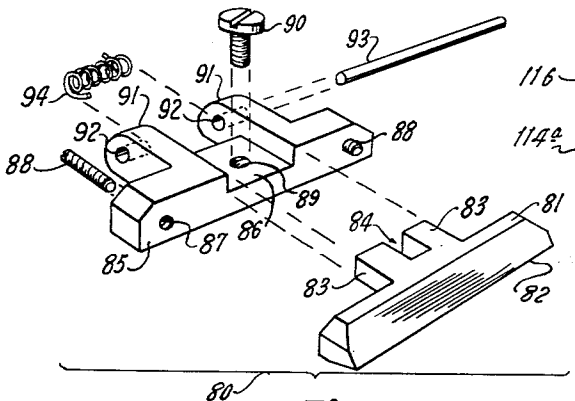


Fig. XIII

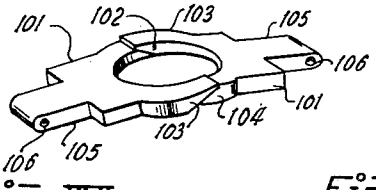


Fig. XVI

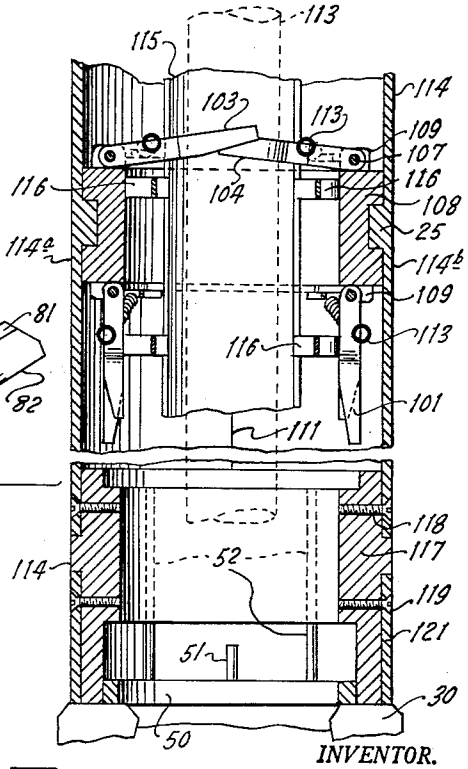


Fig. XV

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Oct. 18, 1955 E. A. LYNCH 2,720,925

CONDUIT CLEANER

Filed May 4, 1950 5 Sheets-Sheet 5

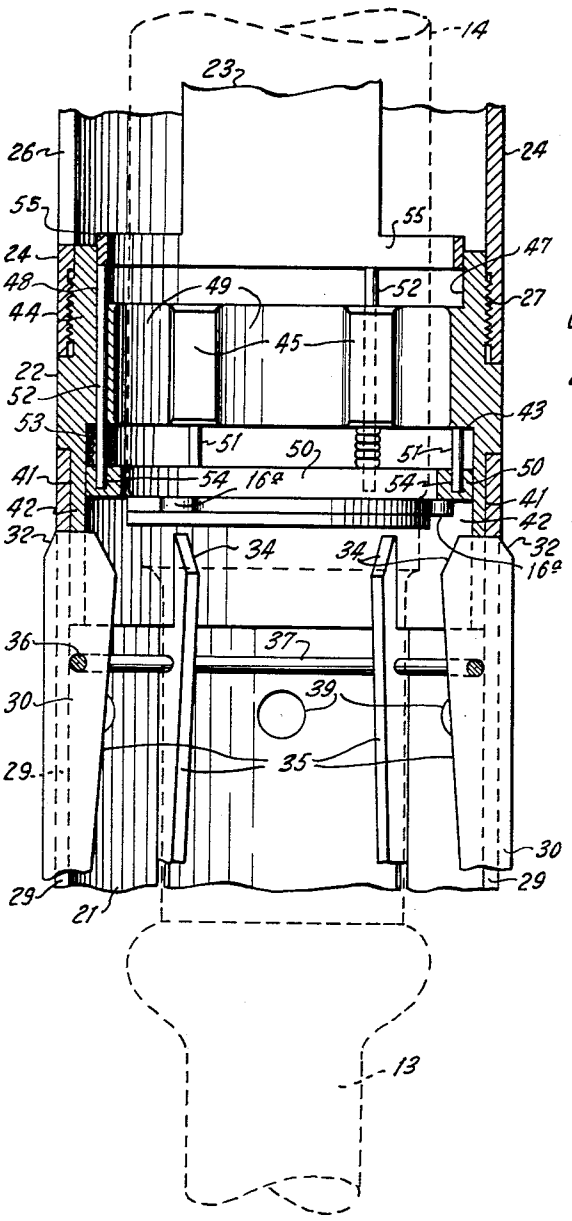


Fig. XVII

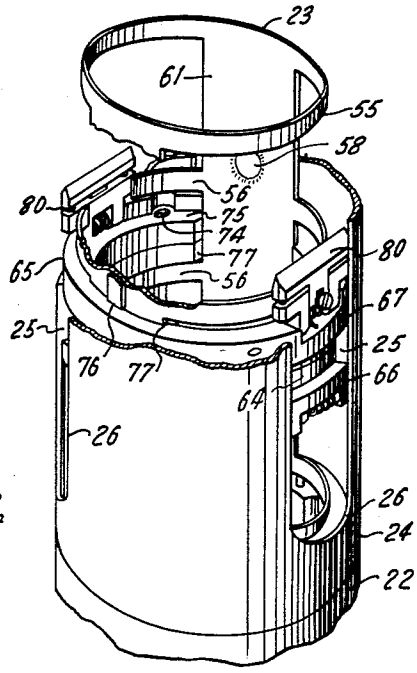


Fig. XVIII

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Patented Oct. 18, 1955

2,720,925

CONDUIT CLEANER

Edward A. Lynch, Duncan, Okla., assignor of one-fourth to Don F. Pierce, Wichita Falls, Tex.

Application May 4, 1950, Serial No. 159,973

7 Claims. (Cl. 166—176)

This invention has to do with conduit cleaners. It presents apparatus for cleaning well pipe and keeping such pipe clean. It is particularly useful in the cleaning of oil well tubing, casing and other well pipe and also in the cleaning of pipe lines and other conduits.

While this apparatus may be very appropriately employed to periodically clean out conduits, it is primarily a device for keeping conduits clean and eliminating the necessity of periodic cleaning.

This invention may be used in wells in which there are operated sucker rods or pump rods or other reciprocating members of such general character, including cables; and it may be continually operated without any increase in cost for labor or power whatsoever. Its use does not require the shutting down of a well, or the pulling of the rods or the removal of the tubing or of any other pipes. Its use does not involve the loss of any operating time in the production of the well.

This invention cleans conduits of all manner of accumulations, including well solids, paraffin, asphaltum, mud and cement, whether the last named be in unset slurry form or as a cement sheath clinging on the walls of the pipe. It also cleans sucker rods of all such accumulations, and it keeps them clean. The device is a travelling cleaner; and it passes freely over all rod joints. It also cleans cables by travelling therealong; and it passes over clamps and connections on such cables. It also removes burs and rough spots and abrasive surfaces in tubing and/or casing.

The device aligns and centers sucker rods, minimizes their frictional wear against the walls of the pipe, and prevents the corresponding frictional wear on the pipe itself.

This apparatus is adjustable to any desired length of travel within a conduit, however extended; and it is automatically self-reversing in its travel, and may be made to go back and forth automatically.

This invention may be provided with self-attaching friction means by which it may be held to the walls of conduit until moved therein to a new location by the reciprocation of pump rods; and the tool cannot fall into the well.

This invention consists essentially of an elongated tubular shell which may be made to fit snugly within the conduit to be cleaned. A pair of opposed and hinged engaging members are carried within the shell and supported thereby so that they normally extend inwardly thereof. These members engage the opposite faces of a reciprocating rod or cable in such manner that the shell itself is caused to move along within the conduit in response to the reciprocating movement of the rod or cable so engaged.

At the end of the stroke of the moving rod, the shell is caused to remain briefly stationary within the conduit. This may be accomplished by its snug fit therein. Preferably it is done through the use of spring-urged friction guides which are arranged to extend very slightly beyond the outer face of the shell and frictionally engage the

inner face of the conduit so as to hold the shell in a position of rest for a brief space of time. From such position it is further moved along the conduit by the next succeeding movement of the rod in the direction fixed by the engaging members which are set to cause the propulsion of the shell by stages until the desired travel distance has been covered.

As the shell moves along the conduit it cleans and scrapes the walls thereof, and keeps them clean. The cutting edges on the extreme ends of the shell may be sharpened and hardened so that continued use will keep them sharp.

At any desired location within the conduit and along the rod or cable may be located means for stopping the progress of the shell in one direction and causing it to reverse itself and travel in the other direction.

The progress of this cleaning tool along a conduit is predetermined in direction by the set of the engagers; and the length of travel is predetermined by the location of reversing stops, upon contacting which the tool is automatically reversed in its travel direction. It always moves by stages or steps, a short movement being succeeded by a brief period of rest, which is in turn followed by a short movement and a brief rest; and this operation is repeated endlessly. Thus the tool moves as long as the well is being pumped or as long as a cable or rod is being reciprocated therein.

It is considered that the primary objects of the invention may be easily understood from the foregoing general statement. However, other and further objects will become apparent as this specification is developed. They will become more clear upon an examination of the accompanying drawings. These drawings set forth preferred embodiments of the tool and of its parts, together with some satisfactorily operating modifications thereof. However, the principle and objects of this invention may be practiced in still other forms than those disclosed without departing from the spirit of this invention.

The drawings are described as follows:

Fig. I is an elevational view of a typical cleaning tool employed in removing well solids from the walls of tubing surrounded by well casing.

Fig. II is a partially sectionalized elevation of a typical cleaning tool, showing engaging means so set as to cause the tool to progress upwardly.

Fig. III is a plan view of a typical tool seen from above, and in which the uppermost engaging means are in substantially horizontal position for engagement.

Fig. IV is a plan view of a typical travel limit ring surrounding a sucker rod, taken along line IV—IV of Fig. V.

Fig. V is a partially sectionalized elevation of the end of a sucker rod and rod joints showing the mounting therebetween of rotatable travel limit ring and bushing.

Fig. VI is a perspective view of the lower part of a typical cleaning tool, with certain members partially cut away.

Fig. VII is a partially sectionalized elevation of a typical tool having engaging means so disposed as to cause the tool to progress downwardly. Such position is the reverse of that shown in Fig. II.

Fig. VIII is a perspective view of a typical slideable reversing sleeve.

Fig. IX is a plan view taken along the line IX—IX of Fig. II.

Fig. X is a plan view taken along the line X—X of Fig. II.

Fig. XI is an elevational view of a modified form of the tool, moving in a large conduit along a weighted cable.

Fig. XII is a perspective view of a typical rotatable ring surrounding a reversing sleeve, the latter having some of its parts cut away.

Fig. XIII is an exploded perspective view of typical engaging means.

Fig. XIV is a plan view of a modified form of engaging means, surrounded by a modified form of center housing, and employing a modified form of sliding sleeve.

Fig. XV is an elevational view taken along the line XV—XV of Fig. XIV.

Fig. XVI is a perspective view of the modified engaging members shown in Fig. XIV and Fig. XV.

Fig. XVII is a sectionalized elevation of a typical fluid orifice body and adjacent mechanism.

Fig. XVIII is an assembly in perspective showing preferred forms of center housing, rotatable ring, engaging means, and reversing sleeve, some parts of the assembled members being cut away.

In the drawings various parts of the apparatus have been indicated by numerals, and like numerals are used to indicate like parts.

The numeral **10** indicates typical well casing or other pipe; and the numeral **11** indicates typical well tubing or other pipe to be cleaned or maintained in a clean condition.

Solids deposited on the walls of well pipe and other conduits include the solids of congealed paraffin, asphaltum, well mud and cement sheaths; and all of such deposits are indicated by the numeral **12**.

The complete assembly of the preferred form of the tool is shown as at **20**. It has the appearance of an elongated tubular body or shell **20***a*. This elongated shell may be made up of a single tubular structure, if desired. Or for convenience in manufacture and assembly, the shell may be made in sections or segments. Thus, the shell may be comprised of the two cutting tubes **21** (one at each end of the tool), the single central housing **24**, and the two thickened segments or body members **22**. These five members may be considered as constituting the entire shell **20***a* of the tool **20**.

Slideably mounted within the housing **24** will be found the reversing sleeve **23**. This sleeve is disposed between the two bodies **22** with which it coacts.

Typical of reciprocating members which pass through the tool will be found sucker rod **13**, along which the tool **20** travels. The sucker rod joints are shown as at **14**, and the tool travels over these joints with all facility until it comes to a joint having a travel limit ring, such as the upper travel limit ring **15**, which is provided with projections **15***a*. These projections stop the movement of the tool in the direction in which it is initially travelling, and cause the reversal of its travel direction, as will hereinafter be made plain.

A lower travel limit ring **16**, having projections **16***a* thereon, is so placed on the sucker rod as to fix and limit the lowermost extent of travel of the tool.

Travel limit rings **15** and **16** are allowed to rotate freely and at will on the sucker rod at selected rod joints. To allow such rotation, and at the same time to provide a bearing on which the joint may be made up in firm frictional contact, the fixed bearing **17** is provided. The shoulders on the male and female ends of the threaded joint and of the rods (when made up into the joint) come into compressive contact with the bearing **17**, holding it firmly, but they do not compress or in any way frictionally retard the free movement of the ring **15**, which may be rotated about the bearing.

Within the center housing **24**, and preferably near the middle thereof, is provided a circular rail **25**, arranged to extend as a lateral projection from the inside wall of the housing. This rail may be made of one piece with the housing or it may be made separately and affixed thereto. The rotatable ring assembly **65** is made to ride upon this rail.

Engaging units **80** are hingedly mounted on and carried by the rotatable ring **65**. These engagers are preferably provided with relatively sharp edges so that they may very firmly grip and engage the pump rod or cable while it is

making a stroke in one direction, and they will be carried along by it. However, they so engage the rod or cable that they are instantly released therefrom when it makes a stroke in the other direction. While the engagers are in gripping contact with the rod the entire tool **20** is caused to move the distance of one stroke. During this movement the cutting edge **40** on the forward end of the shell **20***a* of the tool scrapes and removes solids and deposits **12** from the pipe or tubing **11**.

Windows **26** may be arranged through the wall of housing **24**. They are preferably made plural in number, and should be spaced equidistantly around the perimeter of the housing. These windows have the dual function of providing fluid by-pass openings and also allowing access to the internal parts of the rotatable engaging assembly arranged within the housing.

Cooperating threads **27** may be arranged on the overlapping ends of the housing **24** and the body **22**, so that these two members may be removably attached together. Obviously other means for attaching these two members may be provided, such as machine screws, J slots, or any other suitable connection.

Vertically arranged slots **29** are provided through the wall of tube **21** so as to carry friction guides **30**, which guides will engage the inner face of the conduit being cleaned and hold the momentarily inactive tool **20** in place in the conduit. These slots may be provided in such numbers as may be found most suitable. However, it is recommended that at least three be used. Six equally spaced slots are shown in the typical tool revealed in the drawings. See Figs. I, II and VI.

Friction guides **30**, arranged to operate in slots **29**, are spring-urged outwardly so as to effect frictional contact with the inner face of the tubing **11**. However, they may be forced inwardly by being placed in a tight fitting conduit (to be cleaned) until they are substantially flush with the outer face of the shell of the tool.

Knurling **31** may be provided on the outermost and exposed faces of guides **30**. Serrations or roughened surfaces on the outermost faces of the guides facilitate the frictional attachment of the tool to the conduit during its momentary pauses while travelling the sucker rods or cable. This allows the tool to be held against and suspended by the conduit **11** for the brief time required in the making of one stroke of the rod or cable.

A beveled surface **32** should be arranged on the uppermost and exposed outward end and edge of each guide **30**. A beveled surface **33** should be arranged on the lowermost and exposed outward edge and end of these guides. Such beveled surfaces will guide the tool in its travel, and allow it to pass by couplings on the tubing or collars on the conduit being cleaned. Such beveled surfaces will prevent the tool from hanging up on the ends of the pipe where they are slightly separated in these couplings or collars.

Inclined innermost faces **35** are provided on the guides **30**, which extend within the shell. These faces constitute true inner guides, gently urging rod joints and rods toward the longitudinal axis of the tool as it moves along, and therefore toward the center of tubing **11**.

Holes **36** are arranged laterally through the guides **30**; and they are so disposed as to provide a series of such holes on a common level or in a common plane to receive spring **37**, arcuately carried inside the shell.

A pair of springs **37** are carried by the entire collection of guides **30**, in any given cutting tube **21**; and they are so constructed, arranged and operated as to urge such guides outwardly, and at the same time limit their outward movement. Such movement is not required to do more than extend the guides slightly beyond the outer face of tube **21**.

Deformed ends **38** may be made on the springs **37**, and they are provided to maintain the springs in place without danger of loss. Any deformity, cap or nut or

other fixtures could be used to keep springs and guides in place.

Ports **39** should be arranged through the walls of tubes **21**. They should be made and placed in such numbers as may be most suitable to provide for the flow of fluid therethrough. Well fluid, oil, water or other liquids will pass through these ports and wash the walls which are being cleared of well solids and other undesirable deposits and accumulations. Such washing action makes more thorough and effective the cleansing effect of the tool.

A cutting edge **40** may be provided on the free end of the tube **21** to act as a circular knife or scraper. Edges **40** may be bevelled or sharpened, the better to remove from the inner face of the surrounding pipe the well solids and other accumulations thereon. Such edges may be so sharpened as to provide a true cutting edge, although the degree of such sharpness or bevel is optional, and should be made (if at all) in contempaltion of the particular materials being removed from the conduit. These edges may be so hardened that they will cut away pipe burs and slivers and other metallic and abrasive materials found along the path of travel of the tool.

After one complete travel of the tool **20** through any desired length of conduit, it will be found that the inner face of such conduit is unusually smooth; and after the travel has been repeated several times it will be found fairly well polished and cleaned, and entirely free from scale and rust and other undesirable accumulations.

It is to be noted that the entire tool **20** may rotate freely about the pump rod or cable on which it is travelling, so that eventually the entire inner surface of the conduit being cleaned will be scrubbed well. The knurled outer faces **31** of the friction guides **30** materially assist in doing a finished job of polishing, without any damage whatsoever to the conduit being cleaned.

Whenever the tool which is the subject of this invention has been employed to keep a pipe or casing or tubing or other conduit clean, then it will be found that swab cups, usually made of rubber compounds, which are operated in such conduits will have a much longer life than is ordinarily the case. There is far less abrasion and wear and deterioration in the swabs operated in a well after this tool has been used therein.

Packers and other well elements may be moved into place in a well conduit more safely and with less damage to their faces after such conduit has been cleaned with this tool.

Means **41** for effecting joinder between tubes **21** and bodies **22** may take any suitable form. However, the means shown in the drawings, Figs. II, VII and XVII, is a friction joint or a "sweated joint" in which there is initially provided a very close frictional engagement. The internal diameter of the fixed end of tube **21** is made less than the outer diameter of the engaging skirt on body **22**. When the joint is to be made by such means, then the end of the tube **21**, which is to overlap skirt **42**, is well heated and expanded and placed upon the cold skirt, so that when cooled a "shrink fit" may be effected. Any other means desired may be provided for holding these members together. Such alternate means may employ spot welding or seam welding, bolts, machine screws, companion threads, and other arrangements.

The upper part **44** of body **22** is made of a thickened wall, with the thickness extending inwardly, for strength and other functions, as will be made plain elsewhre herein, including the provision of an overhanging or projecting face **43**, extending inwardly near the top of skirt **42**.

The projecting face **43** will allow an annular space therebelow for the accommodation of transfer ring **50**, stubs **51**, push rods **52** and springs **53**, as will be further explained hereinafter.

Bosses **45** are arranged as spaced and inwardly extending blocks or thickened sections of upper part of body **22**. Several of these bosses are arranged in spaced relation around the inner face of the wall of body **22**. They provide for the fluid passages or orifices **49**, which are arranged between the bosses. Some of these bosses carry and guide the push rods **52**, in vertical holes **48** arranged through the bosses. Alternate bosses also provide stops for the abutment thereagainst of the stubs **51**.

An annular recess **47**, providing a ledge immediately therebelow, is arranged internally of the upper end of the body **22**, by making the wall at such end thinner.

The holes or guide channels **48** arranged through bosses **45** to accommodate push rods **52** are made parallel to the longitudinal axis of the tool **20**.

The transfer ring **50** operates to reverse the direction of the travel of the tool, when this ring is struck by the limit rings **15** or **16**, and particularly by the projections **15***a* or **16***a* on the latter rings, as the case may be. The operation of reversing the direction of the travel of the tool comes about when the tool has reached the limit of its predetermined travel range. This limit may be changed and fixed by the operator at his pleasure. He simply has to reset the stops (limit rings) **15** and **16** at the desired locations on the pump rod or cable.

When the transfer ring **50** is struck by the limit ring (**15** or **16**), then the transfer ring **50** itself moves and in turn moves the push rods **52**, which are carried firmly by the transfer ring in the securing holes **54**. The push rods, in turn, move the slidable reversing sleeve **23**, which holds one pair of the engagers out of action after they have been lifted by the rod coupling **14**. One pair of engagers is thus disengaged, and the other pair is thrown into engagement with the pump rod (or cable), and the tool changes the direction of its travel.

The stubs **51**, carried by ring **50**, in holes **54**, limit the movement of ring **50**. The free ends of the stubs will come into contact with the overhang **43** on the bosses **45**, which will then carry the final thrust of ring **50** and terminate the travel.

Push rods may be used in such number as may be found suitable. Preferably there are three which are equally spaced around the inner wall of body **22** and carried in holes **48** in bosses **45**.

Compression or coil springs **53** cushion the movement of ring **50**, and also the movement and progress of push rods **52**. These springs may well be carried around push rods **52**, and they are placed below overhang **43** and above transfer ring **50**, resting on the latter. These springs normally keep ring **50** spaced the maximum distance from overhang **43**.

The holes **54** provided in ring **50** in which to carry push rods **52** and stubs **51** may be made slightly smaller than the external diameter of the rods and the stubs which may be driven into such holes until they are held in frictional engagement. Obviously, other forms of attachment between the rods and the stubs on the one hand, and ring **50** on the other, can be provided, including companion threads, keys, pins, screws and the like.

Reversing sleeve **23** may be made as a single unit, and all in one piece, if desired. Such construction could be employed if the central housing is made in two halves by dividing it vertically, as exemplified in Figs. XIV and XV. The rail may be made of two or more separate arcuate segments, to be fastened to the wall of the housing, with a unitary rotatable ring thereabout; and the sliding sleeve may be fitted within such ring before the split housing is fastened together.

However, with a unitary housing **24** and an integral rail **25** and a rotatable ring **65** divided into the two halves **66** and **67**, I would employ the sliding sleeve as shown in Fig. VIII, which is made of two like members **23***a* and **23***b*. These members are held together with a connecting strap **57** which may be kept in place with screws **60** at one or both ends; but one end thereof may be welded as at **58**.

The machine or cap screw **60**, arranged through the free end of the connecting strap **57** in a hole therein

provided for this purpose, continues into a tapped and drilled hole **59** within the supporting side wall **61** of sleeve **23**.

From the supporting side wall **61** of sleeve **23** there is extended the arcuate trip fingers **56**. This wall is divided at about its center part, as at **62**, such numeral representing the meeting faces on the abutting ends of the members **23***a* and **23***b*.

The sliding sleeve **23** is provided with a band **55** at each end thereof. This is known as the push band, and it is engaged by the push rods **52**, which will cause sleeve **23** to slide, and thereby reverse the direction of the engagers **80**. For instance, if the lowermost push band **55** is thrust upwardly by the lower push rods **52** (as in Fig. II), then the uppermost push band **55** will be elevated to a position where it may thereafter be struck by upper push rods **52** in the upper body **22**, at the end of limit of travel of the tool **20** when upper transfer ring **50** engages stop **15**. The engagers will be then reversed in position and the tool changes its direction and is made to return in its travel. The trip fingers **56** on the body of the reversing sleeve **23** slide against the lower engagers **80** and hold them out of engagement, as shown in Fig. VII, and the upper engagers will be freed of the upper trip fingers and fall into engagement, being spring-urged.

The rotatable ring assembly **65** is preferably made up of two members, a lower half **66** and an upper half **67**. These are so arranged as to provide between them the rail-riding annular recess **64** which fits around the rail **25** and is rotatable thereon. Such construction provides an upwardly looking shelf **68** on the lower ring **66** and a downwardly looking shelf **69** on the upper ring **67**. These faces are polished and made to ride freely upon rail **25**. The line of joinder between these two halves of assembled ring **65** is shown as at **70**.

A pair of oppositely disposed lateral cuts **71** is provided through the side wall of each of the members **66** and **67**. Such cuts are on the lowermost and uppermost walls, respectively, of these ring members. The engagers **80** are mounted in these cuts.

Laterally disposed holes **72** pass segmentally through the side walls of ring elements **66** and **67**, adjacent to and on each side of cuts **71**; and these holes are arranged to accommodate hinge pins **93** on which the engager **80** is mounted.

Holes **73** are provided vertically through the unbroken and uncut walls of ring members **66** and **67**, such holes being arranged parallel to the axis of such members. Companion holes are aligned in the members **66** and **67** to receive machine screws **74** by which the members **66** and **67** are removably secured together, so that they may operate as one unit, to wit: assembled ring **65**.

The uppermost and lowermost faces of rotatable ring **65** have been cut away on their inner wall to provide an annular recess terminating in the shoulder **75**, and this recess and shoulder receive and accommodate the tripping fingers **56**. When finger **56** rests on shoulder **75** then the immediately adjacent engagers **80** are in a position of engagement. But when these fingers are lifted from the shoulder **75** the engagers **80** are disengaged. See Fig. XVIII.

Strap slots **76**, to accommodate the strap **57** and allow it to slide therealong, are provided vertically in the assembled unit **65** and on the inner face thereof. These slots, accommodating the straps, make an excellent guide for the movement of the slideable sleeve **23**. A further guide is provided by the side wall slots **77**, cut into the inner face of assembled ring unit **65**, to accommodate and permit the slideable movement therealong of the supporting side wall **61** of reversing sleeve **23**.

Slots **76** and **77**, and the members slideably carried therein, work together to prevent relative rotation between the sliding sleeve **23** and the ring assembly **65**. Such construction and arrangement always keep the trip fingers **56** in their proper relation to the engagers **80**. See Figs. XII and XVIII.

It is to be noted that pump rods have the capacity to develop some torque when under stress, by pull or compression, and likewise they may twist and turn somewhat due to changes in temperature. Therefore, if the engagers **80** are firmly attached to the rod or cable, for the time being, and moving up or down with it, then the ring assembly **65** may turn and rotate within the shell **20***a* especially when the sharpened edges **40** of such shell are buried in thick deposits which are being removed from the conduit in the process of cleaning it, so that the shell is temporarily prevented from rotation.

On the other hand, there are conditions in which the engagers travel almost a straight line along the rod or cable, without any appreciable rotation thereabout.

Under such conditions, then the preferred construction will allow the shell **20***a* to freely rotate about the ring **65**, the rail **25** of such shell riding within the rail recess in such ring. Thus the shell **20***a* can rotate freely to accommodate itself to variations in the obstructions being removed by it, whether they be variations in the character, density, location or obliqueness of the deposits encountered. This arrangement always permits free relative rotation between the ring assembly **65** carrying the engagers on the one hand, and the shell **20***a* of the tool on the other, and it prevents any undue stress, or damaging torque or deflection between the various members and elements of the tool.

The engaging units **80** are presented as a preferred form of engaging members. However, such members may take various forms. They may be made as knives, spring-urged and reversible in the direction of their engagement, such as shown in Figure XVIII. They may take the form of the semi-circular fingers indicated in Fig. XVI. They may take many other forms. However, their general function will remain the same. They operate in pairs. They engage, for a brief term, the side walls of the sucker rods (or cable) along which they travel, or they may engage the external side wall of a tube carried centrally of two engaging assemblies and axially of the tool shell.

Some further explanation of a typical engaging unit **80** may be in order. The engaging knife is shown as at **81**, provided with a bevelled face **82** allowing for the creation of a relatively sharp edge. A pair of lugs **83** are provided on the backside of the knife, these lugs being spaced apart to provide a slot or space, as at **84**.

A base **85** is provided as a bladeholder, carrying and supporting the adjustable blade or knife **81**.

A recess **86** is arranged transversely of one side wall of the base **85**, to receive and accommodate the spaced lugs **83**.

Threaded holes **87** are provided through the base member **85** to receive the threaded and adjustable set screws **88**, which are inserted and adjusted from that end of the hole **87** which is nearest the hinge rod in the base.

Cap screw **90** is carried in hole **89**, and made up tightly to engage the lugs **83**, by reason of its overhanging cap. This will hold firmly together the members **85** and **81**; and they are held together at whatever predetermined spacing therebetween as may be found desirable. This spacing is determined and fixed by the adjustment of the set screws **88**; and after the spacing has been thus fixed as desired, then the cap screw **90** is made up firmly and tight to retain such spacing.

The capacity for adjustment between opposed blades to accommodate the passage therebetween of tubes, rods or cables of different diameters is of considerable importance. The opposed blades in a pair of oppositely arranged engaging units should be so adjusted, each with respect to its base, that the distance between the opposed edges of a pair of blades should be less than the diameter of the rod or tube or cable passing therethrough. When such adjustment is maintained, then it follows that the

opposed blades, engaging the rod therebetween, will not lie in a horizontal position. On the other hand they will be somewhat inclined. A slight inclination is usually sufficient for the purposes desired. However, an increase in such inclination will work satisfactorily.

When the blades are in engagement and in an inclined position, then they are readily releasable from the rod between them whenever that rod reverses the direction of its stroke and moves oppositely to the direction of its initial thrust which momentarily carried the blades and the tool along with it.

Construction and adjustment which provide blades engaged at an inclined angle will also allow the blades to be easily and freely removed from engagement by the coupling **14** or stop shank **123***a*, and held by fingers **56** of reversing sleeve **23** (at the end of the total travel distance of the tool) in response to the push rods **52**, activated by the transfer ring **50** when the latter strikes the stops **15** or **16**, as the case may be.

The engagers **80** are hingedly attached and spring-urged from their mounting on ring **65**. This may be arranged by providing a pair of hinged butts **91** on the base of the bladeholder **85**. Laterally provided holes **92** through these butts will receive hinge pin **93**; and around this pin and between the butts there is carried the torsion spring **94**. One end of the spring engages shoulder **75** on ring **65**, and the other end of the spring engages the blade carrier base **85**, and the relation between the blade carrier and the spring is such as to cause the spring to continually urge the blade carrier and its blade to be extended toward the horizontal position, such position allowing for the engagement by the blade of a member passing between it and an opposed blade.

Unless restrained and retained by trip fingers **56**, a free blade and blade holder would therefore lie in a substantially horizontal position, ready for engagement. It would assume an inclined position when a rod is inserted between it and a companion blade.

An engager **80** is forced out of operating position by the movement against such engager of rod coupling **14** or the stop shank **123***a* and then held out of engagement by the trip fingers **56** which are carried on the slideable reversing sleeve **23**.

The engagers may be made to allow for the accommodation of some side sway or lateral movement of the pump rod and/or cable, which are notable for departures from a perfectly straight line, especially when in reciprocal motion. Such construction will allow the tool to operate without undue stress upon its parts.

This purpose is accomplished by making the engagers **80** to carry straight edged blades **82**, between the opposed edges of a pair of which a rod or cable could slide laterally without the blades losing their grip thereon.

Modified yoke engagers **101** are provided with a relatively narrow hinge butt **105** and a relatively long hinge rod **107**, so that these engagers may slide laterally along the hinge rod in response to lateral movement of the pump rod or cable held between the arcuate fingers of such engagers.

Certain modifications of parts of this tool are set forth in Figs. XIV, XV and XVI. Numeral **101** represents modified engaging means which include yoked or forked fingers, instead of the usual blades. The engaging edges are shown as at **102**. Overlapping fingers may be employed. Upper fingers **103** may overlap lower fingers **104**. The hinge butts **105** are provided with rod hole **106** to receive hinge rod **107**.

Modified rotatable ring **108** is arranged to carry the fingered engagers **101**. This ring is made in one piece, and it replaces split ring **65**. It is substantially like ring **65** in most other respects. The unitary ring **108** may be housed by dividing the housing **114** into two like halves, **114***a* and **114***b*. The line of joinder between these two parts of the housing is shown as at **111**.

Lugs **109** are arranged on the face of ring **108**; and cap screws **110** are carried by these lugs. Wire loops **112** may be carried as connectors between screws **110** and springs **113**, the latter being a modified form of spring for urging engagers **101** into engagement.

The modified form of split center housing **114** (comparable to unitary housing **24**) may be attached to body **22** or body **117** through the use of machine screws **118**. Screws **119** may be employed to fasten cutting tube **121** to the skirt of body **117**. The windows **26**, indicated in the preferred form, may be eliminated altogether.

Body **117** is substantially like body **22** except for the elimination of threads **27** and the provision of threaded holes for carrying flush screws **118** and **119**.

Modified form of sliding sleeve **115** is employed for reversing engagers **101**, and such sleeve employs special elevator bands **116** for elevating engagers **101**, and preventing their engagement.

As shown in Figs. XIV and XV, sleeve **115** is provided with two oppositely disposed arcuate long walls, and these walls extend the full length of the sleeve to provide the sleeve ends which may be contacted by one or more of the push rods **52** carried by slideable reversing ring **50**, the movement of which ring causes sleeve **115** to slide. Intermediate the ends of sleeve **115** there are the two oppositely disposed arcuate short walls of the sleeve, and such short walls contact gripping engagers **101** and force them outwardly from their normal inward inclination when the sleeve is caused to slide appropriately. See Figs. XIV, XV and XVI for details of such modified forms and structures.

A modified form of cleaning tool **120** is shown in Fig. XI; and it is substantially like the preferred form of tool **20**, except that the ports **39**, the slots **29** and friction guides **30** have been eliminated. Windows may be provided in the central housing if desired. The tool as a whole has been varied in its relative proportions; and its size and strength have been increased.

Tool **120** is primarily intended to clean out and keep clean very large pipes and conduits, such as long stretches of pipe line, either below or above ground, or well casing, or other large cylindrical vessels and conduits.

Suitable cable **122**, such as steel cable, may be arranged to have reciprocating motion imparted thereto, regardless of the length of the cable. Such cable may be placed in a long string of pipe line or in a deep well or in any other location. When in a well, the cable may be made to reciprocate by the use of a lever mechanism, comparable to a pump jack.

Where the conduit to be cleaned out is horizontal, then reciprocation may be imparted to the cable therein by the use of a pair of synchronized wheels, one at each end of the conduit, with the cable attached to the rim of each wheel. When these wheels are slowly turned, the cable will move back and forth in the conduit.

If desired, one end of the cable may be attached to a lug on the periphery of a slowly moving wheel, and the other end of the cable may be passed over a pulley and heavily weighted; or it may be attached to a stout spring. Weight **124**, sufficient to keep the cable taut may be used; and the cable may be attached to such weight by any cable clamp, such as that indicated at **125**.

The reciprocating cable should be provided with stop and trip means **123**, one being employed at each end of the travel distance and fixed on the cable. The operation and use of such stops is comparable to stops **15** and **16** on the preferred form of tool first herein presented.

The cable may be reciprocated by any kind of suitable mechanism. Any form of my tool, as presented herein, will travel the full length of a reciprocating cable, climb it, descend it or follow it at any angle, however disposed.

The operation of my invention should be apparent from the foregoing. However, it may be generally stated as follows:

The tool is placed around a pump rod or cable and inserted within the conduit to be cleaned. Assuming

that it is desired to have the tool first progress downwardly in the conduit, the uppermost engagers will be positioned substantially as they appear in Figs. VII and XV, so that they may engage the rod or cable at all times, but be carried thereby only on the downward stroke thereof, it being understood that the rod or cable is operating in reciprocable movement, as in the pumping of a well or in like movement.

The free ends or edges of the upper and spaced pair of engagers will grip the face of the rod or cable passing therebetween. The entire cleaning tool is thereupon carried downwardly the distance of one down stroke. The forward edge of the tool, shown as at **40**, will scrape away from the conduit wall the undesirable accumulations **12**.

At the end of the down stroke, the rod or cable will start upwardly to make the return stroke, during the entire length of which the rod or cable will pass freely between the upper inclined engagers, without moving the tool.

The friction guides **30**, pressing outwardly from the shell of the tool, being spring-urged, will momentarily maintain the tool in a fixed position within the conduit; and from such position it will be forced downward again upon the making of the next down stroke

This process continues by stages, each movement in the stage representing substantially the legth of a downstroke, and each period of rest for the tool being substantially the time required for the upstroke.

During the progress of the tool through the conduit, the tool shell may rotate about rather freely, relative rotation being provided between the shell and the ring which carries the engagers.

Also, the rod or cable may slide laterally between the opposed edges **82** of the knife of the engagers **86**; or the rod or cable may move laterally, carrying the engagers **101** along hinge rod **107**, if the modified and slideable form of engagers is employed.

During the cleaning operation, well fluids pass through the tool, which is a hollow body provided with a continuous passageway throughout its length; and some of such fluid will pass in and out of the windows **26** (if they are provided) or in and out of the ports **39** (if they are provided), washing away the cuttings and scrapings and all materials loosened by the tool in its progress.

Meanwhile the friction guides **30**, being spring-urged outwardly, will also scrape and polish the inner face of the conduit being cleaned.

Where the edges **40** of the open ends of the cutting tubes are hardened and sharpened for the purpose, burs, thread ribbons, slivers and other undesirable metallic obstructions found in the path of the tool will be cleanly and smoothly cut away, leaving a very clean wall, which will also be freed of rust and scale.

The desired length of travel of the tool will have been previously fixed by locating on the pump rod the stop rings **15** and **16**, or on the cable the stop bodies **123**, one at each end of the determined travel length. When the tool has reached the end of its downward travel it will strike stop body **16**, and the projections **16***a* thereon will come into contact with the transfer ring **50** and lift this ring up. The push rods **51**, carried by the transfer ring, will likewise be lifted up; and they will strike the sliding sleeve **23**, engaging the lower end **55** thereof, so that the sleeve also will be lifted.

During this operation the rod coupling **14**, being of greater diameter than the rod **13**, lifts upwardly and out of engagement the upper pair of engagers. At the same time the upper trip members **56**, which are a part of the sleeve, will move up and restrain the upper engagers and prevent their engagement, and the lower trip members will release the pair of engagers theretofore held out of engagement thereby (and in substantially parallel relation).

The lower engagers, being spring-urged (as are the upper engagers also) will then fall into inclined contact with the pump rod.

With this reversal of the angles of inclination of the engagers, in both top and bottom pairs, the direction of the travel of the tool is reversed. It is now ready to climb back up the pump rod, or cable, as the case may be.

With the first upward stroke of the rod, the lower engagers grip the walls of the rod and are lifted with it carrying the tool. On the succeeding down stroke of the rod, it passes freely between the opposed edges of the lower engagers, and the tool is held meanwhile against the wall of the conduit being cleaned, such momentary holding being effected by the friction guides.

In the progress of the tool upwardly, until the uppermost travel limit has been attained, the tool will repeat the patterns and stages of operation theretofore performed by it in its downward passage.

Thus the conduit cleaner travels up and down within a well pipe, or back and forth within any inclined or horizontal string of pipe, performing operations which include those of cleaning and then those of maintaining the conduit clean and free and preventing undesirable accumulations and obstructions.

The continual use of the tool, arranged to travel any desired length in any conduit, will keep and maintain the interior walls thereof perfectly clean, and reduce to a minimum the friction and abrasion on all tools, rods, tubes, swabs, packers, and the like, which are operated, placed or maintained in the conduit for any purpose.

Once my tool is installed in any conduit, it operates free of labor costs and free of power costs, no additional power being required and no labor being necessary. The cleaning operation simply becomes a costless incident to the pumping or swabbing of a well or to the reciprocable operation of any tube, rod or cable within any elongated hollow vessel.

The shell of the tool may be so shaped as to fit into any elongated hollow vessel to be cleaned. It may be so fashioned that a cross-section thereof would be round, elliptical, square or rectangular, depending on the shape of such vessel. The sleeve member could also be made of any desired shape. It should be so moveable as to allow it to function as a releasable keeper for restraining the engagers, when desired. In whatever shape it is made the tool functions as a traveling cleaner moving through the vessel by repeated and successive steps.

I claim:

1. In a conduit cleaner tool, an elongated shell; a pair of opposed gripping engagers hingedly carried by the shell and normally extending inwardly thereof, said engagers being normally spring urged inwardly into gripping engagement with an elongated member when such member is extended through the shell, and said engagers being arranged to be carried by the elongated member when such member is moved longitudinally in one direction in a conduit and to slide over the elongated member when such member is moved in the opposite direction in a conduit; a slideable sleeve mounted within the shell and adapted to move against the engagers and hold them from their normal inclination; a travel limit stop carried on an elongated member passing through the tool, the engagers being adapted to engage such member when they are in their normal position, and the sleeve being engageable by the stop and adapted to slide in response to the movement of the tool against such stop.

2. In a conduit cleaner, an elongated shell; a rotatable ring carried within the shell; a pair of opposed gripping engagers mounted on the ring the gripping engagers being hinged to the ring and being normally spring-urged inwardly into gripping engagement with an elongated member when such member is extended through the shell so as to move with elongated member in a conduit in one direction and to slide over the elongated member when such member is moved in the opposite direction in a conduit; a slideable member carried within the shell, such

member being provided with retainer parts whereby the engagers may be held in non-engaging position until the said member is moved; and a plurality of friction guides extending laterally from the side wall of the shell.

3. In a conduit cleaner, a tubular shell, including a pair of open ended cutting tubes, a central housing and a pair of orifice bodies, one such body being so arranged on each end of the housing as to communicate with the immediately adjacent cutting tube; a ring carried by and arranged to rotate within the housing; a pair of opposed gripping engagers mounted on each end of the ring said engagers being hinged to the ring and being normally spring-urged inwardly into gripping engagement with an elongated member when the elongated member is extended through the shell so as to move with the elongated member in a conduit in one direction and being adapted to slide over the elongated member when such member is moved in the opposite direction in a conduit; a slideable sleeve carried in the shell between the bodies; a pair of transfer rings slidably carried in the shell, one such ring being adjacent to that end of each body which is farthest from the housing; a plurality of push rods so carried by each transfer ring as to be engageable with the sleeve; and the sleeve being provided with trip means alternately engageable with each pair of engagers whereby each pair of engagers may be successively held out of engaging position whenever the other pair of engagers is in a position of engagement; and stop means carried by the elongated member alternately engageable with the transfer rings to move the sleeve to release for operation one pair of gripping engagers and to lock the other pair of gripping engagers in inoperative position.

4. In a cleaning device, an elongated hollow body, a pair of hinged and opposed gripping engagers mounted therein in spaced relation; spring means normally urging each engager toward the other and into gripping engagement with an elongated member when the elongated member is extended through the body so as to move with the elongated member when such member is moved in one direction in a conduit and being adapted to slide over the elongated member when such member is moved in the opposite direction in a conduit; a slidable keeper so carried within the body as to releasably hold the engagers apart; and moveable means carried within the body engageable with the keeper, whereby the keeper may be released from contact with the engagers; said moveable means being arranged to engage a stop member carried by the elongated member to thereby move the moveable means within the body.

5. In a cleaning device, an elongated hollow body; two pairs of opposed gripping engagers, each such pair being hingedly mounted in spaced relation within the body; resilient means co-acting with each engager to urge it toward its opposed engager to bring the engagers into gripping engagement with an elongated member when the elongated member is extended through the body so as to move with the elongated member when such member is moved in one direction in a conduit and to slide over the elongated member when such member is moved in the opposite direction in a conduit; a sliding keeper carried within the body normally holding one pair of engagers apart without restraining the other pair; and a moveable member carried in the body associated with each pair of engagers and with the keeper each moveable member being moveable within the body by contact with separated stop members carried on the elongated member, whereby the keeper may be released from contact with one pair of engagers and caused to restrain the other pair.

6. In a cleaning device, an elongated hollow body; a pair of opposed gripping engagers hingedly carried in spaced relation within the body; springs urging the engagers away from the body wall and into gripping engagement with an elongated member extending through the body so as to move with the elongated member when such member is moved in one direction in a conduit and to slide over the elongated member when such member is moved in the opposite direction in a conduit; a keeper slideably mounted within the body and arranged to releasably hold the engagers from moving in response to the springs; a transfer member slideably mounted within the body and arranged to release the keeper from the engagers upon sliding movement of the transfer member by contact with a stop member carried on the elongated member; a plurality of friction elements carried by the wall of the body; and springs urging the elements outwardly of the body.

7. As an article of manufacture, an elongated shell; an arcuate rail carried by the shell and extending laterally therein; a member rotatably mounted on said rail; a pair of gripping engagers hingedly attached to said member in opposed spaced relation; and spring means normally urging said engagers toward one another into gripping engagement with an elongated member when the elongated member is extended through the shell so as to move with the elongated member when moved in one direction in a conduit and to slide over the elongated member when such member is moved in the opposite direction in a conduit.

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