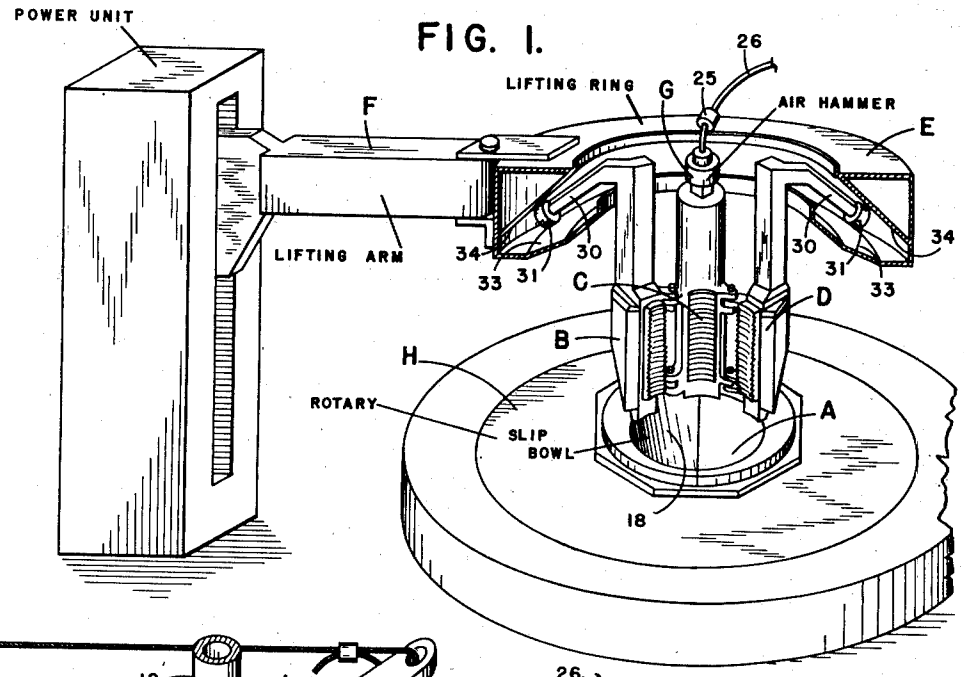
Oct. 2, 1951 A. L. STONE 2,570,039

IMPACT ROTARY SLIP LOCK.

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FIG. 1.



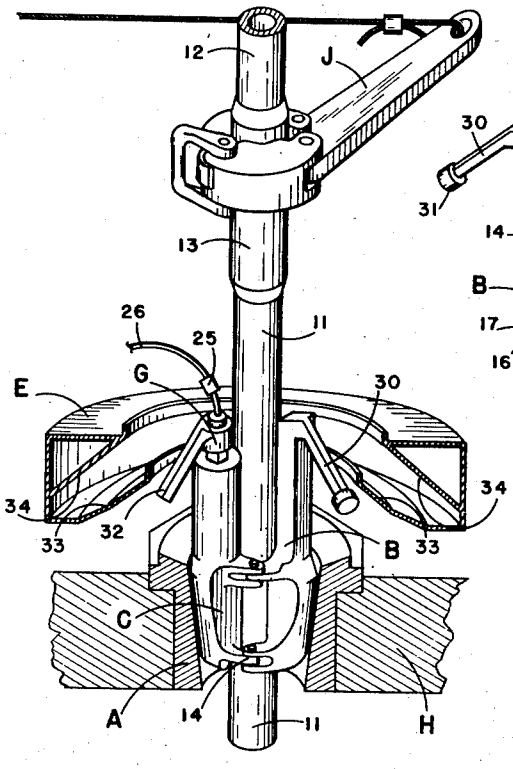


FIG. 2.

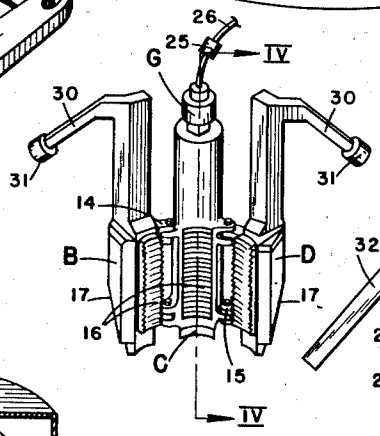


FIG. 3

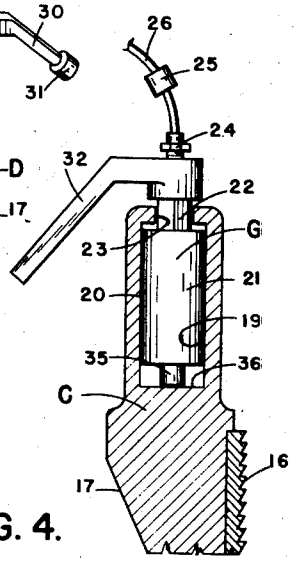


FIG. 4.

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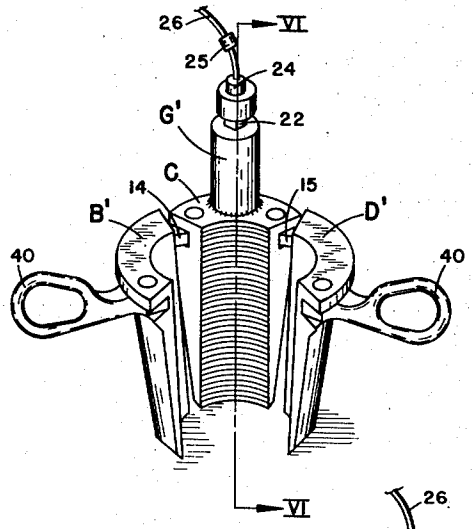


FIG. 5.

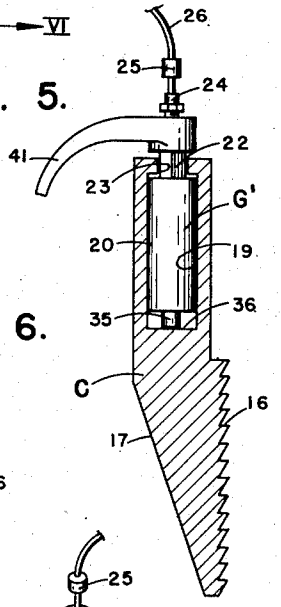


FIG. 6.

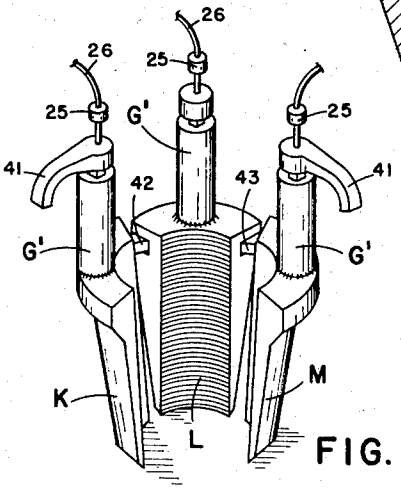


FIG. 8.

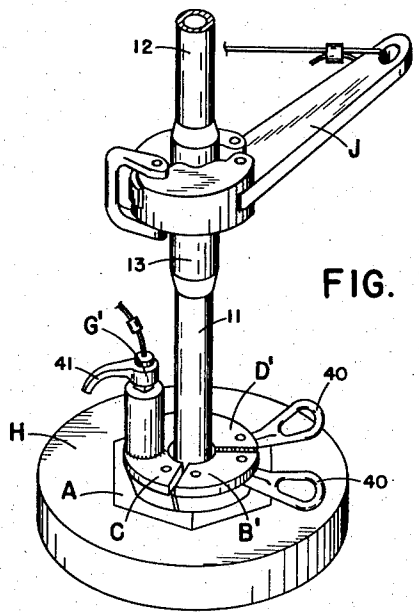


FIG. 7.

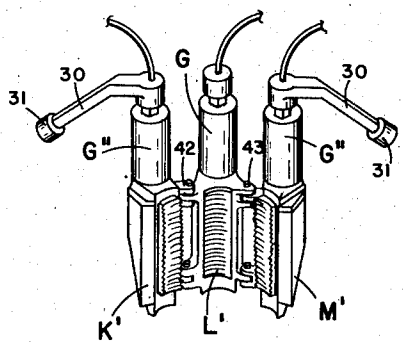


FIG. 9.

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IMPACT ROTARY SLIP LOCK

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Application August 6, 1949, Serial No. 109,045

8 Claims. (Cl. 24—263)

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The present invention is directed to a device for tightening slips used for holding a section of pipe.

In the handling of sections of pipe in drilling operations it is often desirable or necessary to hold the sections against downward and rotative movement. At the present time most wells for producing petroleum and gas are drilled by the rotary drilling method which involves the use of a rotary table for producing rotative motion of the drill stem. The drill stem is constructed by fastening sections of pipe together by means of screw threads. Incidental to the actual drilling operation it is necessary to add sections of pipe to and remove sections of pipe from the drill stem and in this operation it is common to support the drill stem by using a slip assembly mounted on a master bushing which in turn is carried by the rotary table.

It is necessary to support the drill stem below the joint to be made up or broken out when adding or removing sections of pipe. The operation of attaching or removing a section of pipe by screwing or unscrewing a joint requires that the pipe on one side of the joint be held against rotative movement while the pipe on the other side of the joint is rotated.

It is common to use a slip assembly for holding the drill pipe against vertical movement in such operations. The slip assembly usually consists of a member called a slip bowl which defines a cavity having sides tapering upwardly and outwardly. Cooperating and fitting within the slip bowl are wedge shaped slip members having outer surfaces tapering downwardly and inwardly with the several members cooperating to define a central passage. The slip members are provided with die members adjacent the central passage for gripping a section of pipe.

When a section of pipe is supported from the slip members the weight of the pipe exerts a force having components directed radially outwardly as well as downwardly.

When a conventional slip assembly is supporting a section of pipe, the application of a rotative force between the section of pipe and the slip bowl will produce a horizontal component directed radially outwardly and a vertical component directed upwardly. Usually a conventional slip assembly cannot be used to prevent rotative movement between the suspended pipe and the slip bowl unless the weight of the pipe is such that the rotative downward component exerted by the pipe on the wedge surface of the slip members is great enough to overcome the upward component produced by the rotative force. That is to say, they cannot be used to hold a back up or to transmit rotative movement to a supended section of pipe when breaking out or making up a joint unless the section of pipe suspended from the slips has a weight greater than a certain minimum. However, attempts have been made to use slip assemblies to hold a back up or to transmit rotative motion when carrying light loads normally insufficient to overcome the upward component produced by the rotative force, by hammering the slips down by hand at the time the load is being gripped. In general, however, such a procedure has been unsatisfactory. Most slips are not equipped with a place on which they may be hammered by hand and it is difficult to strike a proper blow. More important than this, an operator using a hammer cannot strike the blows rapidly enough and at the time the torque is being applied.

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It is an object of the present invention to provide a means whereby a series of impacts are continually imposed upon a slip member holding a pipe whereby the slips are enabled to resist a torque. More particularly, it is an object of the present invention to provide an assembly including slips for holding pipe with an impact-producing means for hammering at least one of the slips in the assembly so that the slips will resist rotative movement when supporting a weight insufficient to resist the upward component resulting from the rotative force.

Other objects and advantages of the present invention will be seen from the following description taken with the drawing, in which

Fig. 1 is an elevation partly in section of an embodiment of the present invention showing the relation of the open slip assembly with a slip bowl mounted on a rotary table;

Fig. 2 is a fragmentary view of the assembly of Fig. 1 engaged with a section of pipe and supported by a slip bowl in a rotary table, showing how the assembly may be used with a tong to break a joint of pipe;

Fig. 3 is a view showing by itself the slip assembly of Figs. 1 and 2;

Fig. 4 is a fragmentary view showing details of construction of the device of Figs. 1 to 3;

Fig. 5 is an elevation showing another embodiment of the slip assembly of the present invention;

Fig. 6 is a view taken along line VI—VI of Fig. 5;

Fig. 7 is a view of the assembly of Fig. 5 engaged with a section of pipe and supported by

a slip bowl in a rotary table, showing how the assembly may be used with a tong to break a joint of pipe;

Fig. 8 is a view showing another embodiment of the slip assembly of the present application; and

Fig. 9 is a view showing still another embodiment of the slip assembly of the present application.

Turning now specifically to the drawing and first to the embodiment of Figs. 1 to 4, a member A, such as a master bushing, is arranged to receive a slip assembly consisting of slip members B, C, and D. In Figs. 1 to 4 the embodiment shown is adapted for use with power operated slips and is provided with a lifting ring E arranged to be operated by power means F. The power means F moves ring E vertically and ring E in turn moves the slip assembly vertically for engaging and disengaging the slips with the section of pipe to be supported. As a specific example the lifting ring E and power means F may correspond to that of the power slips manufactured by the Mission Manufacturing Company as shown on pages 2728 and 2729 of the Composite Catalogue of Oil Field and Pipe Line Equipment, 1948, 16th edition, volume 2, published by Gulf Publishing Company, Houston, Texas.

An impact producing member G is mounted on slip C so that it can impose a series of impacts thereon.

Master bushing A is mounted in a rotary table H whereby the bushing may be given rotary motion. For illustrative purposes a portion of a string of pipe is shown supported by the slips in Fig. 2 with a lower section 11 and an upper section 12 connected together by screw joint 13. Lower section 11 is supported by the slip assembly and a tong J is shown in position for preventing rotation of upper section 12 when the lower section 11 is given angular movement by rotary H as when disconnecting the sections of pipe.

Slip members B, C, and D are connected together hingedly by hinge members 14 and 15 so that the slip assemblies are moved as a unit into position to seat in the slip bowl or out of position out of contact with the slip bowl. Slip members B, C, and D each have conventional dies 16 for gripping the pipe and wedge surfaces 17 for engaging with the inner tapered surface 18 of master bushing A.

The upper portion of slip C defines a cylindrically shaped cavity having walls 19. Impact producing member G has a body 20 with a lower wall portion 21 which is cylindrical and fits slidingly into the cavity defined by walls 19 of slip C. Above cylindrical surface 21 the body of member G defines a square portion 22 with which retaining members 23 of slip C fit loosely so that the body 20 of member G can move freely through a short vertical distance with respect to slip C. This mounting means may be described as one which allows impact producing member G to float freely in the cavity defined by slip C. Compressed air is supplied to impact producing member G to operate the same. This is done by a suitable means such as fitting 24 mounted on body 20 and connected through a slip tight coupling 25 to air hose 26 which in turn may be connected to any suitable source of compressed air, not shown in the drawing.

The assembly of slips B, C and D is provided with lifting means. Members B and D are each

provided with a lifting arm 30 terminating in rollers 31 while the center slip may be lifted by arm 32 secured to body 20 of impact producing device G. Lifting ring E has two parallel cone shaped surfaces 33 and 34. When lifting ring E is moved upwardly by power means F, surface 33 engages with rollers 31 and with arm 32 to lift the slip assembly upwardly. This upward movement releases the slips in that upon such movement arm 32 moves radially outward and arms 30 move through a sweeping arc. The slips may be set or engaged with a section of pipe by downward movement of lifting ring E which causes radial movement of arm 32 and sweeping arcuate movement of arms 30 to engage the slips with a section of pipe. Downward pressure may be exerted on the slip assembly from power means F through lifting ring E. This downward pressure is exerted on arm 32 which transmits it to center slip C and on arms 30 which transmit it to the slips B and D.

The movement for releasing and setting the slips of the embodiment shown in Figs. 1, 2, 3, and 4 as heretofore described is no different from the like operation of the Mission power slips described on pages 2728 and 2729 of the Composite Catalogue, supra. However, in the embodiment of the present invention the upward component resulting from a rotative force exerted on the pipe being held by the slip assembly may be restricted by the impact producing means G so that the slip assembly of the present invention is capable of holding pipe which is being subjected to a torque great enough to produce an upward component larger than the downward component resulting from the weight of pipe supported. This torque may be exerted by the rotary table H through master bushing A while tong J is used as a backup preventing angular movement of upper pipe section 12, or may be exerted by moving the handle of tong J angularly while master bushing A and the slip assembly are used as a backup to prevent angular movement of lower pipe section 11.

Impact producing member G may be a conventional reciprocating motor operated by compressed air such as is commonly used to operate hammers, pavement breakers, riveters and the like. In order to simplify the description the details of construction of this device are not shown. Impact producing member G has a mandrel 35 for transmitting the blow from the power means of G (such as a piston not shown in the drawing) to surface 36 defined by slip C. When compressed air is supplied through air hose 26 the impact producing means of G reciprocates to produce a series of impacts which are transmitted through hammer mandrel 35 to slip C. When the impact producing member of G is reciprocating, down pressure may be exerted thereon by means of lifting ring E. This is an efficient way of operating the device. However, it is not essential to exert a downward force against body 20 of member G in order to cause it to apply impacts to slip C. The compressed air supplied to mandrel G expands within the body 20 so that the device delivers a series of impacts to slip element C even though the body 20 is merely balanced and is free to move vertically.

Another embodiment of the present invention is shown in Figs. 5, 6 and 7. This embodiment is a hand operated slip assembly provided with an impact producing means.

In the embodiment of Figs. 5, 6 and 7 master bushing A, rotary table H and tong J are identi-

cal with like parts of the embodiment of Figs. 1 to 4. The slip assembly consists of members B', C and D' which are connected together by hinges 14 and 15. Slip members B and D are provided with handles 40. Impact producing means G' is provided with a handle 41 and is loosely mounted on slip member C. The elements B', D', and G' differ from elements B, D, and G of the embodiment of Figs. 1, 2, and 3, inclusive, in that they are provided with handles for hand operation rather than arms for power operation.

In the embodiment of Figs. 5, 6 and 7, the slips may be set and released by hand operation in the customary manner. However, when the slips are used to resist a torque, the impact producing means G' is set into operation to impose a series of impacts on slip member C' whereby the slip assembly can resist a torque which produces an upward component on the slips greater than the downward component resulting from the load carried by the slips. When the impact producing means G' is set into operation, an operator may, if desired, impose a downward force thereon through handle 41 but satisfactory operation may be obtained without the imposition of such a downward force.

Another embodiment of the present invention is shown in Fig. 8. This embodiment is a hand operated slip assembly, and may be employed with a slip bowl and rotary similar to the assembly of Figs. 5, 6, and 7 but in order to simplify the drawing the slip bowl has not been shown.

In Fig. 8 the slip assembly consists of slips K, L, and M which are connected together by hinges 42 and 43. Each of these slip members is somewhat similar to the slip member C of the embodiment of Figs. 5, 6, and 7 previously described in that an impact producing member G' is mounted on each of said slips. The arrangement for mounting the impact producing member on the slip may be identical with that shown in detail in Fig. 6 and in order to simplify the drawing the details of construction of the impact producing means of the embodiment of Fig. 8 are not shown. The impact producing member G' mounted on each of the slip members of the assembly of Fig. 8 is provided with lifting arm 41 identical with arm 41 of the embodiment of Figs. 5, 6, and 7.

In using the embodiment of Fig. 8 the slip assembly may be set and released by hand operation in the customary manner. However, when the slips are used to resist torque the impact producing means G' on each of said slip members K, L, and M may be set into operation to impose a series of impacts on each of said slip members whereby the slip assembly can resist a torque which produces an upward component on the slips greater than the downward component resulting from the load carried by the slips. When the impact producing means G' is set into operation, operators may, if desired, impose a downward force on one, two or all of said handles 41, but satisfactory operation may be obtained without the imposition of such downward force or forces.

Another embodiment of the present invention is shown in Fig. 9. This embodiment is a slip assembly adapted to be used with power operated slips and, accordingly, it is generally similar to the embodiment of Figs. 1 to 4. This embodiment is to be used with power means for operating the slip assembly and it is to be raised and lowered in a slip bowl but in order to simplify the drawing this additional equipment is not shown in Fig. 9.

In Fig. 9, slip members K', L', and M' are secured together by hinges 42 and 43. Slip member L' has impact producing member G mounted thereon. Slip members K' and M' each have an impact producing member G'' mounted thereon. Impact producing member G'' may be identical in construction with impact producing member G of the embodiment of Figs. 1 to 4 with the details of construction shown in Fig. 4. In order to simplify the drawing no showing is made of the construction of impact producing member G in Fig. 9. The impact producing members G'' mounted on each of members K' and M' are similar to impact producing member G but differ in being provided with a lifting arm 30 terminating in roller 31 whereas the lifting arm 32 of impact producing member G, as shown in Fig. 4, has no roller. The embodiment of Fig. 9 is adapted to be lowered into a slip bowl for engagement with a section of pipe and to be lifted from the slip bowl for disengagement from the section of pipe by means of a lifting ring and power means not shown in Fig. 9 but similar, for example, to lifting ring E and power means F shown in Figs. 1 and 2. When the assembly of Fig. 9 is lifted by such means the arm of impact means G will move radially backward while arms 30 will move through a sweeping arc. The movement of arms 30 of impact producing means G'' and arm 32 of impact producing means G will be reversed when the slip assembly is lowered into the slip bowl for engagement with a section of pipe.

The embodiment of Fig. 9 may be employed to hold a section of pipe against vertical movement and at the same time resist a torque in the same manner as the precedingly described embodiments and particularly the power operated embodiment of Figs. 1 to 4. However, the embodiment of Fig. 9 has an impact producing means mounted on each of the slip members so that the impact is delivered directly to one, two or all of the slip members while the assembly is resisting torque.

The slip assembly of the present invention is particularly adapted to be used for resisting a torque as when making up or breaking out a pipe joint. As is customary in the use of slips, the pipe joint joining an upper section of pipe with a lower section which is to be made up or broken out is positioned above the slip assembly with a lower section of pipe held by the slip assembly. In the use of the present invention, a torque may be applied by means of rotary table H through drive bushing A to the lower section of pipe while the upper section is held against angular movement as by backup tong J as shown in Figs. 2 and 7. As the torque is being applied to the pipe joint the impact producing member or members (G, G', or G'') is started so that the series of impacts is rapidly imposed on one or more of the slip elements of the slip assembly simultaneously with the application of torque to the pipe joint. In the embodiment of Figs. 1 to 4 and that of 5 to 7, the impact imposed in the center of the slip assembly necessarily tightens this segment against the other two segments so that the slip assembly resists the upward component resulting from the torque exerted on the pipe.

In the embodiment of Fig. 8 and that of Fig. 9, impacts may be imposed on each of the slips of the slip assembly to tighten the segments with-

in the master bushing so that the assembly resists the upward component resulting from the torque being exerted.

In breaking a joint of pipe there is very little angular movement during the high torque period. Hence, compressed air may be supplied through hose or hoses during this interval. As the rotary starts to spin, the coupling **25** is pulled away from the slips, shutting off the power supply to the impact producing means. However, this will occur when the torque being exerted on the pipe has diminished so that the load carried by the slips is in itself sufficient to resist the torque necessary to complete the operation of disconnecting the joint. In the reverse operation when making up a joint, the rotary may be spun until the high torque period is reached at which time the air hose may be connected to impact producing member or members (G, G', or G'') which then impose a series of impacts on the slip assembly, which impacts resist the upward component resulting from the torque being exerted on the joint as it is tightened.

While specific embodiments of the present invention have been described, it will be apparent to a workman skilled in the art that various changes in the sizes, shapes, proportions and arrangements of the parts may be made without departing from the scope of the present invention.

Having fully described and illustrated preferred embodiments of the present invention, what I desire to claim as new and useful and to secure by Letters Patent is:

1. A slip assembly adapted to fit in a slip bowl for holding a section of pipe against movement comprising, in combination, a plurality of slip members adapted to fit into the slip bowl and cooperating therewith when engaged with a section of pipe to support said pipe and at least one impact producing means mounted on at least one of said slip members, said impact producing means comprising a compressed air operated reciprocating motor with a hammer member arranged so that the reciprocating motor transmits a series of blows through the hammer member to said slip member in substantially the same direction as the downward component resulting from the load of pipe carried by the slip members and an air hose having a readily disconnectable coupling, said air hose being operatively connected to said compressed air motor and adapted to connect said motor with a source of compressed air.

2. A slip assembly adapted to fit into a slip bowl for engaging with a section of pipe to support said pipe comprising, in combination, a plurality of slip members hingedly connected together, an impact producing means mounted on one of said members, said impact producing means comprising a compressed air operated reciprocating motor with a hammer member arranged so that the reciprocating motor transmits a series of blows through the hammer member to said slip member in substantially the same direction as the downward component resulting from the load of pipe carried by the slip members and an air hose having a readily disconnectable coupling, said air hose being operatively connected to said compressed air motor and adapted to connect said motor with a source of compressed air.

3. A slip assembly adapted to fit into a slip bowl and cooperating therewith to support a section of pipe, said slip assembly consisting of a central slip member and side slip members

hingedly connected to said central slip member, said central slip member defining a cavity at its upper end having an axis substantially parallel to the longitudinal axis of said slip member and an impact producing means mounted in said cavity, said impact producing means comprising a compressed air operated reciprocating motor with a hammer member arranged so that the reciprocating motor transmits a series of blows through the hammer member to said slip member in substantially the same direction as the downward component resulting from the load of pipe carried by the slip members and an air hose having a readily disconnectable coupling, said air hose being operatively connected to said compressed air motor and adapted to connect said motor with a source of compressed air.

4. A device in accordance with claim 3 in which the impact producing means carried by the central slip member has a body with a projecting arm and in which each side slip has a projecting arm, said arms being adapted to cooperate with a power means for moving said slip assembly vertically into and away from the slip bowl.

5. A device in accordance with claim 3 in which the impact producing means carried by the central slip member has a body with a projecting handle and in which each side slip has a handle secured thereto whereby said slip assembly may be moved vertically by operators into and away from the slip bowl.

6. A slip assembly adapted to fit into and cooperate with a slip bowl for supporting a section of pipe comprising, in combination, a plurality of slip members hingedly connected together, each of said slip members defining a cavity and a separate impact producing means mounted in the cavity of each of said slip members, each of said impact producing means comprising a compressed air operated reciprocating motor with a hammer member arranged so that the reciprocating motor transmits a series of blows through the hammer member to the slip member in which it is mounted in substantially the same direction as the downward component resulting from the load of pipe carried by the slip members and air hoses each having a readily disconnectable coupling, a separate air hose being operatively connected to each of said compressed air motors and adapted to connect said motors with a source of compressed air.

7. A device in accordance with claim 6 in which each of said impact producing members has a body with an arm projecting therefrom for cooperating with a power means for raising and lowering the slip assembly vertically into and away from the slip bowl.

8. A device in accordance with claim 6 in which each of said impact producing means has a body and a handle is secured whereby said slip assembly may be moved vertically by operators into and away from the slip bowl.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,455,731	Kelly	May 15, 1923
1,763,872	Uhrig	June 17, 1930
1,817,467	Thompson	Aug. 4, 1931
2,076,042	Penick et al.	Aug. 6, 1937
2,349,520	Ripley	May 23, 1944