Dec. 4, 1962 P. GRANDSTAFF 3,066,614

WELL SWAB

Original Filed May 2, 1955 3 Sheets-Sheet 1

Fig. 1

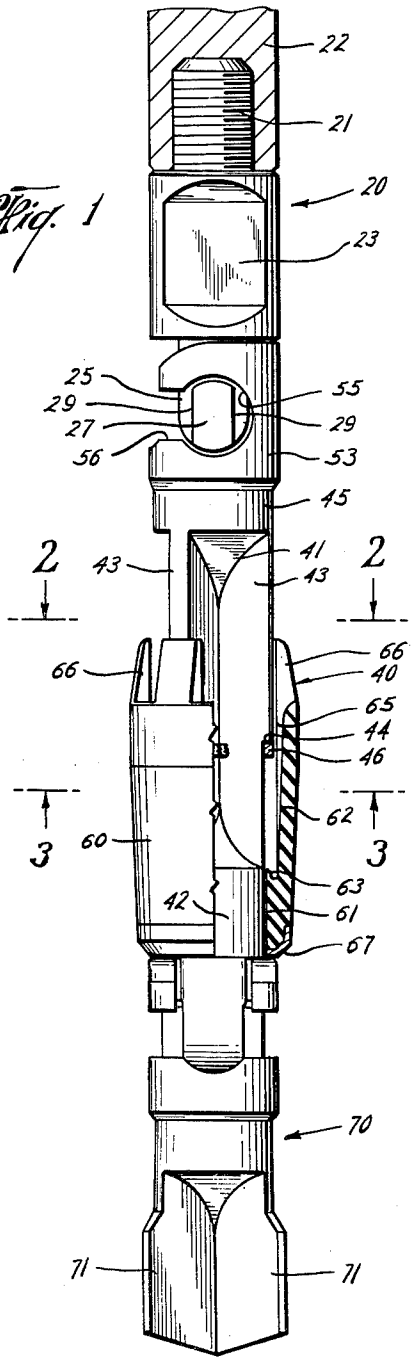


Fig. 2

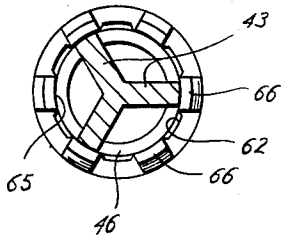
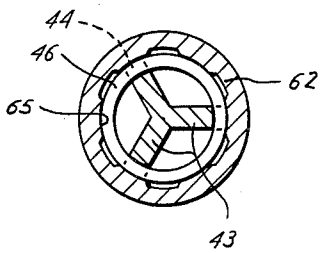


Fig. 3



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Fig. 4

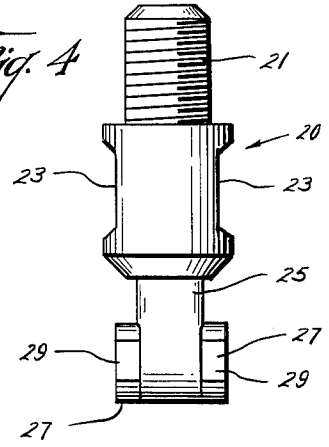


Fig. 5

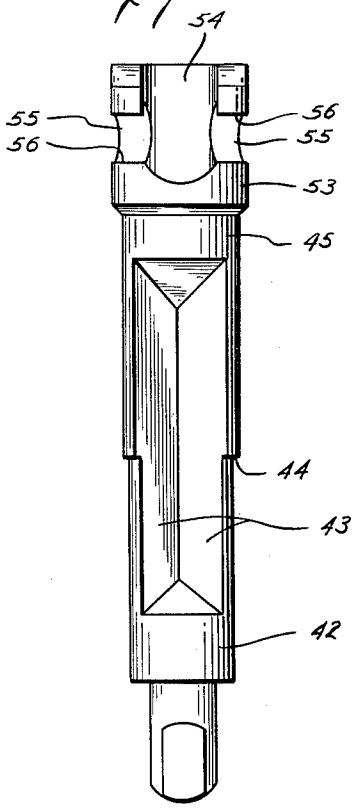


Fig. 6

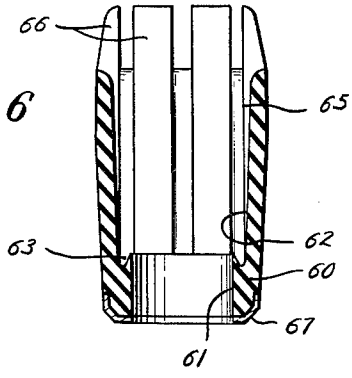
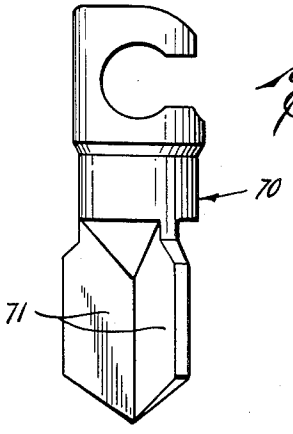


Fig. 7



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Fig. 8A

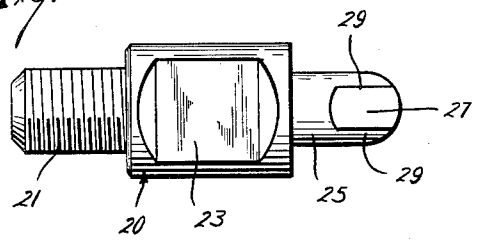


Fig. 8B

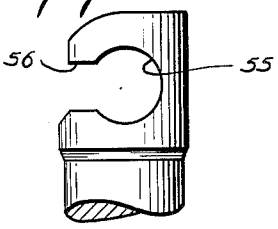


Fig. 9

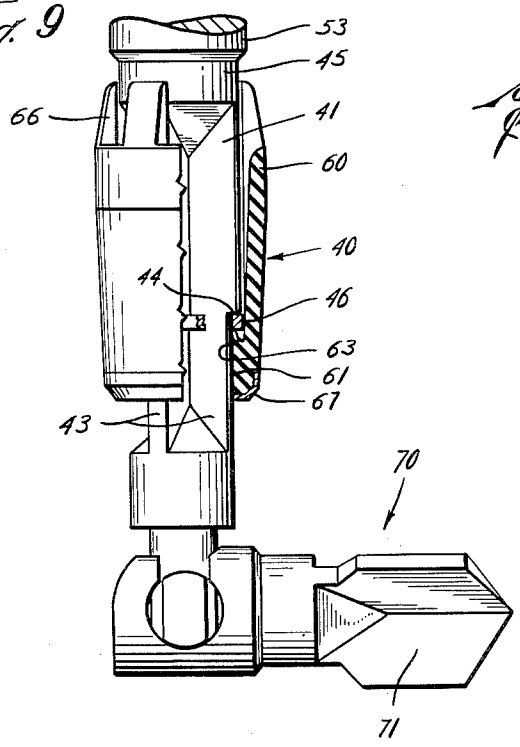
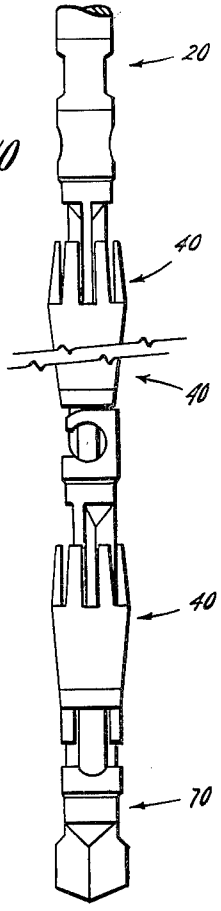


Fig. 10



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United States Patent Office

3,066,614

Patented Dec. 4, 1962

3,066,614
WELL SWAB

Perry Grandstaff, Oklahoma City, Okla., assignor to American Iron & Machine Works Company, Inc., Oklahoma City, Okla., a corporation of Delaware

Continuation of application Ser. No. 505,309, May 2, 1955. This application Sept. 26, 1960, Ser. No. 58,576.

16 Claims. (Cl. 103—225)

This invention pertains to well swabs.

This application is a continuation of my prior copending application entitled "Well Swab" Serial No. 505,309, filed May 2, 1955, now abandoned.

An object of the invention is to provide a well swab having packer units which can be readily connected in series to form a swab having as many packer units as desired.

Another object of the invention is to provide a multiple packer unit well swab in which the connections between the packer units are flexible.

Another object of the invention is to provide a multiple packer unit swab in which there are pivotal connections allowing pivoting of the units about horizontal axes having different azimuthal positions.

A further object of the invention is to provide a multiple packer unit swab in which the units cannot be disconnected while they are in the well.

Another object of the invention is to provide a multiple packer unit swab which can readily be broken at the connection between any adjacent units for the purpose of replacing a unit or any part thereof such as the packer cup.

Yet another object of the invention is to provide a swab having a combined guide and scraper unit below the packer unit or units.

Another object of the invention is to provide a swab having a separate adapter unit for connecting the uppermost swab unit to the rope socket whereby all the swab units can be identical.

A further object of the invention is to provide a swab in which the connections between the packer unit or units and the guide and adapter units, like the connections between packer units, are flexible, inseparable in the well, and easily unmade out of the well, and pivot about axes having different azimuthal positions.

Still another object of the invention is to provide an improved packer unit in which the cup or packer is free to rotate to prevent binding and is axially slidable between a lower position sealing with the body of the unit and an upper position in which there is a passage between the body and packer to allow well fluid to flow freely through the swab when the swab is being run into the well.

Another object of the invention is to provide an improved packer or cup whose upper lip is free to flex into sealing engagement with the well pipe yet will not become caught in the space between pipe ends where they are coupled together.

Other objects and advantages of the invention will appear from the following description of a preferred embodiment thereof wherein:

FIGURE 1 is an elevation, partly in section, through a single packer unit swab embodying the invention;

FIGURE 2 is a horizontal section on line 2—2 of FIGURE 1;

FIGURE 3 is a horizontal section on line 3—3 of FIGURE 1;

FIGURE 4 is an elevation of the adapter unit taken at right angles to FIGURE 1;

FIGURE 5 is an elevation of the body of the packer unit taken at 90 degrees to FIGURE 1;

FIGURE 6 is a vertical section through the packer cup of the packer unit;

FIGURE 7 is an elevation of the guide unit taken at right angles to FIGURE 1;

FIGURES 8A–8B are an elevation showing the relative positions of the adapter unit and the upper end of the packer unit preparatory to connecting them or immediately after disconnecting them;

FIGURE 9 is an elevation of the lower end of the packer unit and the guide unit showing the relative positions thereof midway in the connecting or disconnecting thereof; and

FIGURE 10 is an elevation showing a multiple packer unit swab embodying the invention.

Referring now to FIGURE 1, there is shown a single packer unit well swab. At the upper end of the swab is an adapter unit 20 having a threaded pin 21 at its upper end adapted to engage a socket in a member 22 connected to a wire line or other suspension means. As shown also in FIGURES 4 and 8A there are flat portions 23 on the sides of the adapter unit for engagement with a wrench in making up the pin 21 in socket member 22. At the lower end of the adapter is a pin 25 of smaller diameter than the midportion of the adapter. Pin 25 carries a pair of coaxial pivots 27. The pivots are generally cylindrical but have two diametrically opposite flat sides 29.

Below the adapter 20 there is shown, in FIGURE 1, a packer unit 40 comprising a body 41 in the form of an elongated member having a lower cylindrical portion 42 and a fluted portion of reduced cross-sectional area formed by ribs 43. The lower portions of the ribs have the same radius as cylindrical portion 42 but the upper portions above shoulders 44 are of larger radius, preferably equal to that of the upper cylindrical portion 45 of body 41. There is a ring 46, preferably of the same radius as the ribs 43, secured to the body below shoulder 44 to provide a stop of larger area than shoulders 44. At the upper end of the body 41 is a member 53 forming part of means to connect the packer unit to another unit of the swab, member 53 being preferably of larger diameter than cylindrical portion 45 of the body of the unit.

Connection member 53 comprises a cylindrical socket 54, as shown best in FIGURE 5, adapted to receive pin 25 of the correlative connection member on the lower end of the adapter 20 or another packer unit. At diametrically opposite sides of the socket are formed two bearings 55 adapted to receive pivots 27 of the correlative connection member of the adapter unit or another packer unit. The bearings 55 and socket 54 are open at one side to allow entry of pin 25 and pivots 27. However, the side openings 56 in the bearings are only wide enough to receive the narrow dimension of pivots 27 so that the connection can only be made up or separated when the adjoining units at right angles as shown in FIGURES 8A–8B and 9. This type of connection is termed a knuckle joint.

At the lower end of the body 41 there is formed a connection member comprising a pin and two pivots, the same as at the lower end of the adapter unit. 20. The pin functions as a neck connecting the body 41 to the pivots, and the socket 54 thus forms a neck receiving recess. The axis of the pivots is at right angle to the axis of the pivot receiving socket provided by bearings 55.

A packer 60 of oil resistant rubber-like material such as synthetic rubber has a cylindrical opening 61 formed in the base thereof adapted to fit closely around against cylindrical body portion 42, but is slidable thereon. Extending up from the outer periphery of the base of the packer is an annular wall, the opening 62 therethrough being larger than opening 61 and thus spaced from the

lower smaller flutes 43 and adapted to slide over ring 46 and the upper larger portion of flutes 43. Extending up from the inner periphery of the base of the packer at the annular shoulder formed between openings 61 and 62 is an annular wall inclined inwardly upward to provide a lip 63 for sealing on body portion 42 when packer 60 is in its lowermost position. Opening 62 flares upwardly except for portions 65 forming stiffening ribs which merge with inwardly tapering fingers 66 on the upper end of the packer which serve as guides. Ring 46 provides a means to bridge between the ribs forming an azimuthally continous bearing so that the ribs 65 cannot enter between the ribs 43. A metal cup ring 67 molded to the bottom of the packer serves to support it when it rests on the knuckle joint therebelow in the lowermost position of the packer.

Beneath packer unit 40 is a guide and scraper unit 70 having on its upper end a socket member like that on the upper end of packer unit 40 connected to the pin and pivot member on the lower end of packer unit 40. The maximum radius of these socket members is greater than the radius of opening 61 in the packer 60 so as to provide a stop limiting downward motion thereof.

The lower end of unit 70 comprises three flutes 71 having a larger radial extent than the connection member at the upper end of the unit 71 and of the same radial extent as packer 60. The ribs 71 guide the swab down the well pipe and scrape any paraffin or other obstruction out of the way.

Instead of using just one packer unit 40, a number of them can be serially connected as shown in FIGURE 10. It will be noted that each unit is rotated ninety degrees relative to the adjacent units. By making the rotation always in the same direction as shown, the string of units will be able to flex in four different azimuthal directions relative to the axis of the swab.

In using the swab, units will be connected by placing them at right angles as shown in FIGURES 8A–8B and then engaged as shown in FIGURE 9 and then turned into alignment as shown in FIGURES 1 and 10. The knuckle joints permit flexure of the string of units forming the swab so it can pass through crooked pipe. Going down the well the packer 60 will be in its uppermost position, shown in 9, in which fluid can pass through opening 61 between flutes 43. The large area of stop 46 prevents damage to lip 63 abutting thereagainst. On the upstroke the packers will be down as shown in FIGURE 1, metal cup ring 67 resting on the upper end of the guide and scraper unit 70 and bridging across the open side of the knuckle joint. At the same time lip 63 will be sealing against cylindrical body portion 42 and the outer portion of the packer will be sealing against the well pipe, so that oil or other fluid in the well above the packer will be lifted. In going through couplings there will be no likelihood of the packer catching on the end of a pipe since the fingers 66 following large knuckle joint 53 will guide the cups into the pipe. The units are disassembled by turning them to the FIGURE 9 position and thus moving them apart as shown in FIGURES 8A–8B. When a packer is worn, its unit can be separated from the unit below without disturbing the other connections of the string and the worn out packer stripped off and replaced.

While a preferred embodiment of the invention has been illustrated and described, many modifications thereof can be made by one skilled in the art without departing from the spirit of the invention and it is desired to cover by Letters Patent all forms of the invention covered by the following claims.

I claim:

1. A well swab packer unit comprising a body having a cylindrical portion and a portion thereabove of reduced cross-sectional area, a packer of rubbery material having a portion forming a base with a cylindrical opening therethrough surrounding and axially slidable on said body and adapted to fit closely around said cylindrical body portion when in a lower position adjacent thereto but leaving a passage through said cylindrical opening around said reduced area body portion when said packer is in an elevated position relative to said body, said packer having an outer annular wall integral with said base extending up from the outer periphery of said base and an inner annular wall integral with said base extending up from the inner periphery of said base, the inner diameter of said outer annular wall being greater than that of said cylindrical opening, said inner annular wall having an inner cylindrical surface equal in diameter to that of said cylindrical opening and an outermost surface tapering inwardly upwardly to form a lip adapted to seal with said cylindrical portion of said body when said packer is in said lower position.

2. A well swab packer unit comprising a body having a cylindrical portion and a portion thereabove of reduced cross-sectional area, a packer of rubbery material having a portion forming a base with a cylindrical opening therethrough surrounding and axially slidable on said body and adapted to fit closely around said cylindrical body portion when in a lower position adjacent thereto but leaving a passage through said cylindrical opening around said reduced area body portion when said packer is in an elevated position relative to said body, said packer having an outer annular wall integral with said base extending up from the outer periphery of said base and an inner annular wall integral with said base extending up from the inner periphery of said base, the inner diameter of said outer annular wall being greater than that of said cylindrical opening, said inner annular wall having an inner cylindrical surface equal in diameter to that of said cylindrical opening and an outermost surface tapering inwardly upwardly to form a lip adapted to seal with said cylindrical portion of said body when said packer is in said lower position, said body portion of reduced area being fluted, the radius of the lower part of the fluted portion being equal to that of said cylindrical portion of the body and the radius of the upper part of the fluted portion being equal ot the minimum internal radial dimension of said outer wall of the packer whereby said outer wall fits slidingly on the upper part of said fluted portion.

3. A well swab packer unit comprising a body having a cylindrical portion and a portion thereabove of reduced cross-sectional area, a packer of rubbery material having a portion forming a base with a cylindrical opening therethrough surrounding and axially slidable on said body and adapted to fit closely around said cylindrical body portion when in a lower position adjacent thereto but leaving a passage through said cylindrical opening around said reduced area body portion when said packer is in an elevated position relative to said body, said packer having an outer annular wall integral with said base extending up from the outer periphery of said base and an inner annular wall integral with said base extending up from the inner periphery of said base, the inner diameter of said outer annular wall being greater than that of said cylindrical opening, said inner annular wall having an inner cylindrical surface equal in diameter to that of said cylindrical opening and an outermost surface tapering inwardly upwardly to form a lip adapted to seal with said cylindrical portion of said body when said packer is in said lower position, said body portion of reduced area being fluted, the radius of the lower part of the fluted portion being equal to that of said cylindrical portion of the body and the radius of the upper part of the fluted portion being equal to the minimum internal radial dimension of said outer wall of the packer whereby said outer wall fits slidingly on the upper part of said fluted portion, and means on said body bridging the flutes and forming a peripherally continuous annular bearing to support the inner surface of said outer annular wall of the packer, said outer wall of said packer having an inner surface flaring upwardly and provided with in-

tegral interior stiffening ribs whose inner surfaces extend parallel to the axis of the packer over said bridging means.

4. A well swab packer comprising a rubbery sleeve having a base with cylindrical opening therethrough and having inner and outer annular lips concentric with said opening extending upwardly therefrom, the inner lip having an inner cylindrical surface of the same diameter as said opening, the outer lip having an inner surface that flares upwardly, there being a metal ring beneath the lower end of said base concentric with said opening and extending therearound, said outer lip having vertical reinforcing ribs integral therewith on the inner periphery thereof extending radially therewithin and extending vertically thereabove providing guide fingers, said guide fingers being free at their upper ends to move outwardly with the outer lip to allow the outer lip to seal with a well wall when the packer is loaded with fluid and to move inwardly with the outer lip when the packer is unloaded, the innermost surfaces of said ribs forming portions of a vertical-axis cylindrical surface when the packer is unloaded whereby they are adapted to slide up and down on a circular bearing therewithin.

5. A well swab comprising

a plurality of elongated units disposed end to end in a line and adapted to be lowered into a well, at least one of said units including

packer means to seal with the well wall during lifting of the swab but providing fluid by-pass passage means during the lowering of the swab, each pair of adjacent ends of said units being connected together by

a quickly attachable and detachable pivot joint allowing angular misalignment of the axes of the units, each pivot joint comprising

a pin extending down from the lower end of the upper unit of the pair,

a bearing member extending up from the upper end of the lower unit of the pair, and

means on said pin and bearing member forming a knuckle joint therebetween including

a pivot on the lower end of said pin having a greater longitudinal extent in the direction of the length of its respective unit than its transverse extent in a direction transverse to the length of said unit, said pin having

a lateral extent smaller than the lateral extent of said pivot in a direction perpendicular to said length of the unit and at right angles to said transverse extent of said pivot, said bearing member having

a lateral hole therethrough adapted to receive said pivot and having

an opening in a side thereof below the uppermost part of said hole extending from said hole radially outward from the axis of the length of the unit,

the height of said opening being smaller than said longitudinal extent of the pivot but larger than said transverse extent thereof sufficient to receive said pivot when inserted with its longitudinal extent at right angles to the length of the unit of the said bearing member, said bearing member having

an opening in the top thereof extending longitudinally of the unit from the upper extremity of the bearing member to said hole therein and extending transversely to the length of the unit from the outer periphery of the bearing member on the same side as the first said opening toward the opposite side of the bearing member past the longitudinal axis thereof a distance greater than the corresponding transverse extent of said pin sufficient to receive said pin, said top opening merging with the first said opening in the side of the bearing member,

the lateral extent of said top opening being larger than that of said pin but smaller than that of said pivot so that after said pivot has been inserted in said hole in said bearing member through the first said opening the pin can be moved through said top opening into a position in said bearing member with the axis of the upper unit aligned with that of the lower unit,

the axes of the pivot on each pin being azimuthally displaced ninety degrees from the axes of the lateral holes of the bearing members of the pivot joints immediately above and below, said one unit comprising

a body having

a cylindrical portion at its lower end just above said pin extending down therefrom,

the portion of said body above said cylindrical portion being fluted and of reduced cross-sectional area,

the radius of the lower part of the fluted portion being equal to that of said cylindrical portion of the body and

the radius of the upper part of the fluted portion being larger than that of said lower portion forming

shoulders at the juncture of said upper and lower fluted portions of the body,

means on said body below said shoulders and adjacent thereto bridging the flutes and forming

an annular bearing having

a continuous downwardly facing plane surface and

a peripherally continuous cylindrical surface of a radius equal to that of said upper part of the fluted portion of the body, said packer means comprising

a sleeve of rubbery material having at its lower end a portion forming

a base with

a cylindrical opening therethrough surrounding and axially slidable on said body and adapted to fit closely around said cylindrical body portion when in a lower position adjacent thereto but leaving a passage through said cylindrical opening around said reduced axis body portion when said packer is in an elevated position relative to said body, said packer means having

an outer annular wall integral with said base extending up from the outer periphery of said base and

an inner annular wall integral with said base extending up from the inner periphery of said base, said inner annular wall having

an inner cylindrical surface equal in diameter to that of said cylindrical opening in said base and

an outermost surface tapering inwardly upwardly to form

an inner lip adapted to seal with said cylindrical portion of said body when said packer means is in said lower position,

the upper edge of said inner lip being engageable with said downwardly facing plane surface of said annular bearing to limit the upward travel of said packer means relative to said body, said outer annular wall having

an inner surface that flares upwardly, forming

an outer lip, said outer lip having

vertical reinforcing ribs integral therewith on the inner periphery thereof extending radially therewithin and extending vertically thereabove providing

guide fingers, said guide fingers being free at their upper ends to move outwardly with said outer lip to allow the outer lip to seal with a well wall when the packer means is loaded with fluid and to move inwardly with the outer lip when the packer means is unloaded,

the innermost surfaces of said ribs forming when said packer means is unloaded

vertically extending portions of a vertical axis cylindrical surface of a diameter equal to that of said peripherally continuous surface of said bearing means whereby they are adapted to slide up and down thereon,

the diameter of said cylindrical portion of the body being larger than the maximum dimension of said

pin and pivot at right angles to the length of said unit whereby said sleeve can be assembled to said one unit by passing over the lower end thereof when said pivot joint is disconnected but being smaller than the maximum dimension of said pivot joint bearing member at right angles to the length of said unit whereby when said one unit is connected to the unit therebelow, said bearing member forms a stop limiting downward travel of the sleeve, said sleeve having a metal ring around said base portion at its lower end adapted to seat on the upper end of said bearing member and bridge across the gap formed by the opening in the side thereof so as to provide solid support for the rubbery sleeve continuously around its lower periphery.

6. A well swab comprising a plurality of elongated units disposed end to end in a line and adapted to be lowered into a well, at least one of said units including packer means to seal with the well wall during lifting of the swab but providing fluid by-pass passage means during the lowering of the swab, each pair of adjacent ends of said units being connected together by a knuckle joint, each knuckle joint comprising a pin extending down from the lower end of the upper unit of the pair having pivot means extending transversely to the pin at the lower end thereof and a bearing member extending up from the upper end of the lower unit of the pair having a vertical socket therein adapted to receive said pin and having a transverse hole therethrough adapted to receive said pivot means, said bearing member having an opening in its side communicating with said socket and hole to admit said pin and pivot means therethrough, said one unit comprising a body having a cylindrical portion at its lower end just above the said pin extending down therefrom, the portion of said body above said cylindrical portion being fluted, said packer means comprising a sleeve of rubbery material having at its lower end an internal diameter adapted to fit slidably on said cylindrical portion of the body, the diameter of said cylindrical portion of the body being larger than the maximum transverse dimension of said pin and pivot means whereby said sleeve can be assembled to said one unit by passing over the lower end thereof but being smaller than the maximum transverse dimension of said bearing member whereby when said one unit is connected to the unit therebelow the bearing member forms a stop limiting downward travel of the sleeve, said sleeve having a metal ring around its lower end adapted to seat on the upper end of said bearing member and bridge across the gap formed by the opening in the side thereof so as to provide solid support for the rubbery sleeve continuously around its lower periphery, said lower end of said sleeve having projecting upwardly therefrom concentric inner and outer lips adapted to seal with said cylindrical body portion and the well wall respectively when said swab is being raised and said sleeve is in its lowermost position on said one unit, said inner lip and lower end of the sleeve sliding up above said cylindrical body portion onto said fluted portion of the body during downward travel of the swab to allow fluid to by-pass said packer means.

7. A well swab comprising a plurality of elongated units disposed end to end in a line and adapted to be lowered into a well, at least one of said units including packer means to seal with the well wall during lifting of the swab but providing fluid by-pass passage means during the lowering of the swab, each pair of adjacent ends of said units being connected together by a knuckle joint, each knuckle joint comprising a pin extending down from the lower end of the upper unit of the pair having pivot means extending transversely to the pin at the lower end thereof and a bearing member extending up from the upper end of the lower unit of the pair having a vertical socket therein adapted to receive said pin and

having a transverse hole therethrough adapted to receive said pivot means, said bearing member having an opening in its side communicating with said socket and hole to admit said pin and pivot means therethrough, said one unit comprising a body having a cylindrical portion at its lower end just above the said pin extending down therefrom, the portion of said body above said cylindrical portion being fluted, said packer means comprising a sleeve of rubbery material having at its lower end an internal diameter adapted to fit slidably on said cylindrical portion of the body, the diameter of said cylindrical portion of the body being larger than the maximum transverse dimension of said pin and pivot means whereby said sleeve can be assembled to said one unit by passing over the lower end thereof but being smaller than the maximum transverse dimension of said bearing member whereby when said one unit is connected to the unit therebelow the bearing member forms a stop limiting downward travel of the sleeve, said sleeve having a metal ring around its lower end adapted to seat on the upper end of said bearing member and bridge across the gap formed by the opening in the side thereof so as to provide solid support for the rubbery sleeve continuously around its lower periphery, said lower end of said sleeve having projecting upwardly therefrom concentric inner and outer lips adapted to seal with said cylindrical body portion and the well wall respectively when said swab is being raised and said sleeve is in its lowermost position on said one unit, said inner lip and lower end of the sleeve sliding up above said cylindrical body portion onto said fluted portion of the body during downward travel of the swab to allow fluid to by-pass said packer means, said fluted portion of the body having a metal ring extending therearound spaced above said cylindrical portion providing a stop engageable by said inner lip to limit the upward travel of said sleeve during lowering of the swab into a well, said stop ring bridging said flutes to provide a continuous support for said inner lip all around its periphery, said outer lip having an inner surface flaring upwardly and provided with vertical reinforcing ribs extending inwardly and adapted to slide on the outer surface of said stop ring.

8. A well swab comprising a plurality of elongated units disposed end to end in a line and adapted to be lowered into a well, at least one unit including packer means to seal with the well wall during lifting of the swab and means to by-pass fluid during the lowering of the swab, each pair of adjacent ends of said units being connected together by a knuckle joint, each knuckle joint comprising a downwardly extending pin on the lower end of the upper member of the pair of units having pivot means extending transversely to the pin at its lowermost end, and an upwardly extending bearing member on the upper end of the lower member of the pair of units, said bearing member having a vertical socket adapted to receive said pin and a hole transverse to said socket adapted to receive said pivot means, said bearing member having an opening in the side thereof communicating with said socket and hole and large enough to pass said pin and also said pivot means when said pin is disposed with its axis transverse to the socket axis, the axis of the pivot means of each pin being azimuthally displaced ninety degrees from the axes of the knuckle joints immediately above and below.

9. A well swab comprising a plurality of elongated units disposed end to end in a line and adapted to be lowered into a well, at least one of said units including packer means to seal with the well wall during lifting of the swab and means to by-pass fluid during the lowering of the swab, each pair of adjacent ends of said units being connected together by a quickly attachable and detachable knuckle joint, each knuckle joint comprising hook shaped means forming a bearing on one unit and hook engaging means on the adjacent unit adapted to be engaged with the hook shaped bearing and to pivot about

an axis therein, the hook shape of said bearing providing an opening along one side of the bearing and said hook engaging means having an elongated cross-section transverse to said axis whose maximum lengthwise dimension is larger than said opening and whose maximum transverse dimension is smaller than said opening, the elongation of the cross-section of said hook engaging means being in the direction of the elongation of said units, the position of said opening in the side of said hook shaped bearing being such that a line joining the midpoint of the opening and said axis of said bearing is transverse to the length of said one unit, whereby it is necessary to place the adjacent unit with its length similarly transverse to the length of said one unit to separate the units by moving said hook engaging means through said opening, such relative placement of the units being impossible while the swab is in the well so that its units cannot become separated, and whereby when the units are in the well and said knuckle joints are in tension the hook engaging means is not trying to pull free through said side opening in the bearing but instead is fully supported from below by the hook shaped bearing.

10. A well swab comprising a plurality of elongated units disposed end to end in a line and adapted to be lowered into a well, at least one of said units including packer means to seal with the well wall during lifting of the swab and means to by-pass fluid during the lowering of the swab, each pair of adjacent ends of said units being connected together by a quickly attachable and detachable pivot joint allowing angular misalignment of the axes of the units, each pivot joint comprising socket means forming a bearing on one unit and socket engaging means including a pivot connected to the adjacent unit, said pivot having a greater length in the direction of the length of the unit than transverse thereto, said pivot being connected to said adjacent unit by a neck of smaller dimension transverse to the length of said units than the transverse dimensions of said pivot, said socket means having an opening in a side thereof above the bottom of the socket and facing radially outward from the axis of length of the unit, said opening being smaller than said length of the pivot but larger than the transverse dimensions thereof and adapted to receive said pivot when inserted with its length at right angles to the length of the unit, said socket means having an opening in the bottom thereof extending laterally from the center of the socket means all the way to the outer periphery thereof to merge with said opening in the side of the socket means, said opening in the bottom of the socket means being of larger transverse dimension than said neck but smaller than said pivot, whereby after said pivot has been inserted in said socket means through the small opening the neck can be moved laterally through said bottom opening into said socket.

11. A well swab packer support body comprising an elongated metal member adapted to carry a packer thereon, one end of said body having a pin extending longitudinally therefrom with a pivot means extending transverse to the pin at the extremity thereof, the other end of said body having a bearing member extending longitudinally therefrom with a longitudinal socket therein and having a hole extending transversely therethrough, the side of said bearing member having an opening therein communicating with said socket and hole and large enough to admit the pin and pivot means of a like body, the axis of said hole in the bearing member being displaced azimuthally from the axis of said pivot means by ninety degrees.

12. A well swab packer support body comprising
an elongated member including
a central portion adapted to carry a packer thereabout,
a neck extending longitudinally from one end of the central portion,
a pivot at the end of the neck,
said neck connecting the pivot to said central portion,
a bearing member extending longitudinally from the other end of said central portion, said bearing member having
a pivot receiving socket and
a neck receiving recess in the side of the bearing member, said recess having
a height in the direction of the length of said elongated member extending from the end of said bearing member to said socket and having
a depth in a direction transverse to the length of the elongated member extending from the side of the bearing member toward the opposite side thereof past the axis of said elongated member at least as far as said neck, and having
a width in a direction transverse to the length of the elongated member and to said depth at least as great as said neck, said socket having
a width greater than the width of said recess, said bearing member having
an opening in the side thereof communicating with said socket and with said recess, said opening having
a width greater than said recess, and
a height smaller than the height of said pivot but larger than a dimension of said pivot transverse to the length of said elongated member.

13. Combination according to claim 12 wherein said socket has a circular cross-section and the cross-section of said pivot is generally circular including two parallel straight line chords and two circular arcs, said chords extending in the direction of the length of said elongated member, and said dimension of said pivot transverse to the length of said member being the distance between said chords.

14. Combination according to claim 12 wherein the thickness of said central portion measured transverse to the length of said member is smaller than that of said bearing member and greater than that of said neck, and said pivot has a greater extent transverse to the length of said member than said width of said recess.

15. Combination according to claim 14 wherein said central portion is fluted over a part of its length, said flutes terminating short of one end of said central portion, the last said end being the lowest end of said central portion and being cylindrical providing a sealing surface, and including a swab packer having a cylindrical bore slidably disposed on said central portion adapted to seal with said sealing surface in a lower position on said central portion and to bypass fluid through said flutes in an upper position thereon, the bore of said packer being larger than said transverse extent of the pivot but smaller than said thickness of the bearing member.

16. In a well swab,
a packer support body comprising
an elongated member including
a central portion adapted to carry a packer thereabout;
another member disposed with one of its ends adjacent to an end of said elongated member; and
means pivotally connecting said members; the last said means including
a neck extending longitudinally at the end of one of said members,
a pivot at the end of said neck,
said neck connecting the pivot to the remainder of said one member,
a bearing member extending longitudinally from the end of the other member adjacent said end of said one member, said bearing member having
a pivot receiving socket and
a neck receiving recess in the side of the bearing member, said recess having
a height in the direction of the length of said elon-

gated member extending from the end of said bearing member to said socket and having

a depth in a direction transverse to the length of the elongated member extending from the side of the bearing member toward the opposite side thereof past the axis of said elongated member at least as far as said neck, and having

a width in a direction transverse to the length of the elongated member and to said depth at least as great as said neck, said socket having

a width greater than the width of said recess, said bearing member having

an opening in the side thereof communicating with said socket and with said recess, said opening having

a width greater than said recess and

a height smaller than the height of said pivot but larger than the depth of said pivot.

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