April 7, 1953 J. C. WEBBER **2,633,808**

WELL SWAB

Filed Sept. 25, 1948 2 SHEETS—SHEET 1

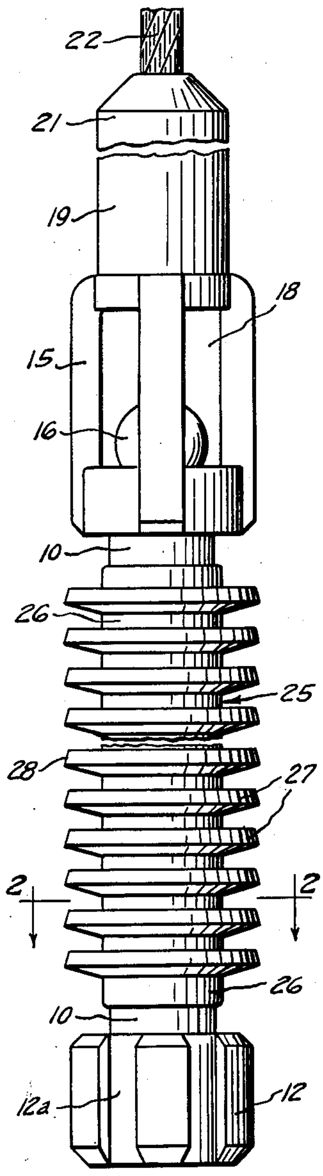

Fig. 1

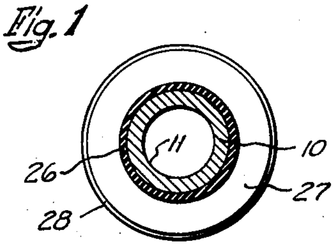

Fig. 2

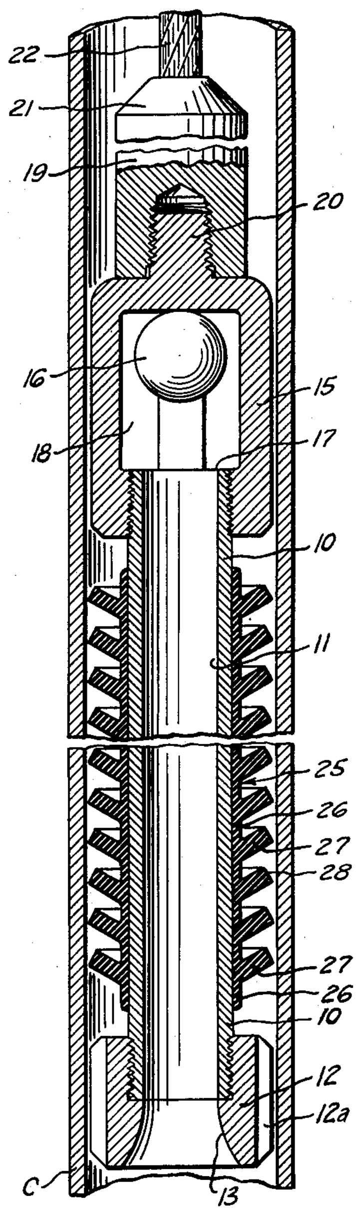

Fig. 3

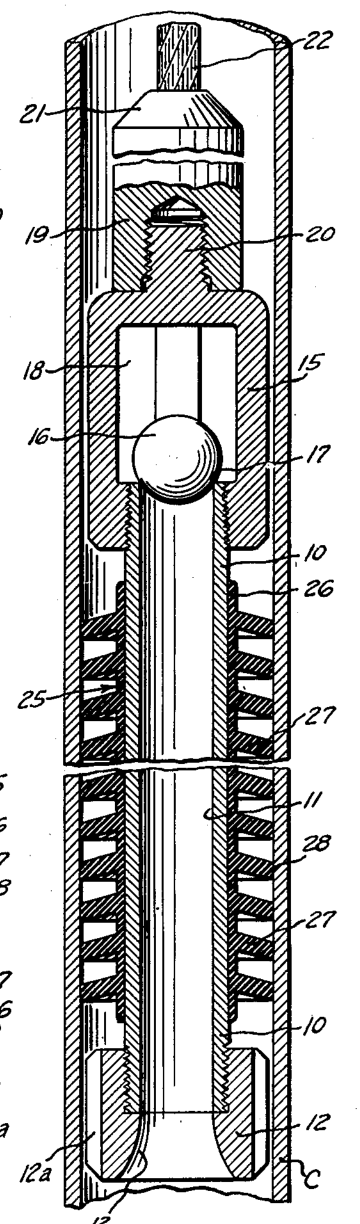

Fig. 4

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April 7, 1953 J. C. WEBBER 2,633,808

WELL SWAB

Filed Sept. 25, 1948 2 SHEETS—SHEET 2

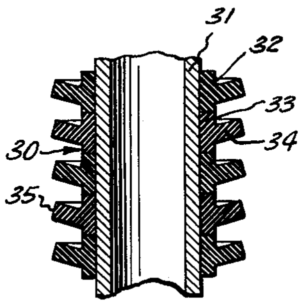

Fig. 5

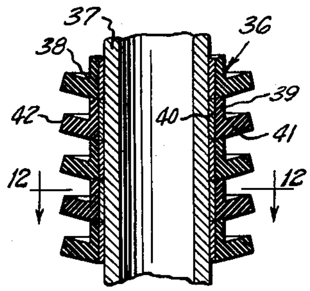

Fig. 6

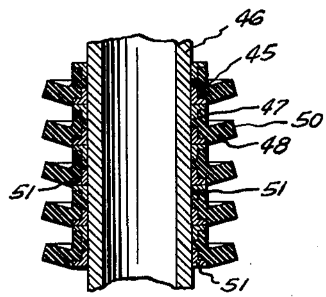

Fig. 7

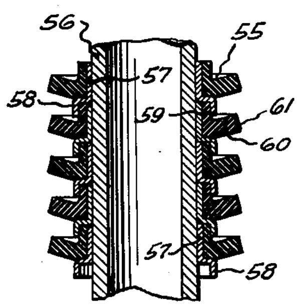

Fig. 8

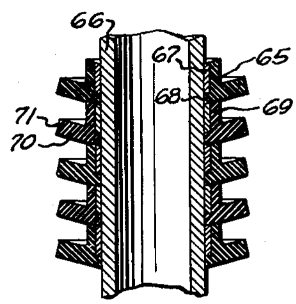

Fig. 9

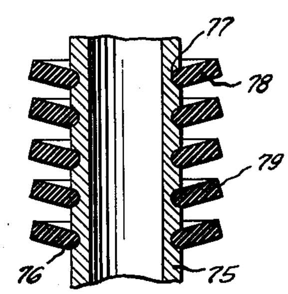

Fig. 10

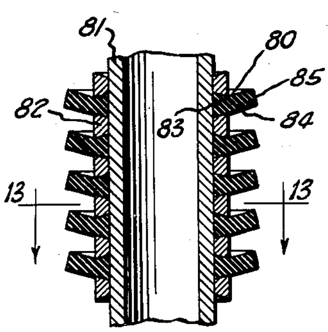

Fig. 11

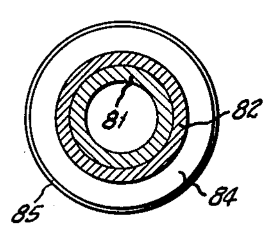

Fig. 13

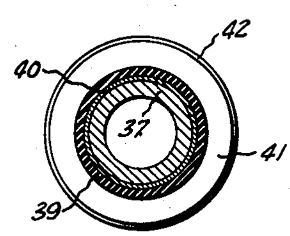

Fig. 12

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UNITED STATES PATENT OFFICE

2,633,808

WELL SWAB

Jack C. Webber, Dallas, Tex.

Application September 25, 1948, Serial No. 51,173

15 Claims. (Cl. 103—225)

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This invention relates to new and useful improvements in well tools and sealing means therefor.

It has been found in practice that, when well tools such as swabs or the like are positioned and used in a well flow conductor, only a single one of the cups or packing sleeves commonly used on such tools carries nearly all the load and hence wears rapidly. Swabs commonly in use at the present time are usually provided with two or more sealing elements, each of which is individually capable of carrying a very large fluid pressure load. Examination of the sealing elements of used swabs has disclosed by comparative wear that one of the two or more sealing elements does carry nearly all the fluid load, and hence when the first sealing element has become so worn that its sealing capacity is destroyed by such wear, or by damage otherwise caused, the fluid load is transferred to another intact sealing element. Thus, in effect, the customary swab may be regarded as a tool having only one effective sealing cup or sleeve. Furthermore, since the sealing elements of the customary swab are capable of carrying very large fluid loads, it is a common occurrence for such swabs to be lowered sufficiently deep below the surface of the liquid in the well bore to prevent the swab from being lifted. Or, such a great load applied to a single cup or packing sleeve of the swab may cause the cup or sleeve to be cut or stripped off when said cup or sleeve passes an irregularity or coupling recess in the flow conductor while carrying such heavy load. Also, when heavy loads are applied to a single cup or sleeve, it wears rapidly due to the heavy frictional engagement of the cup with the bore wall of the flow conductor, and such heavy loads also impose an increased frictional load resisting lifting of the swab.

It is, therefore, one object of this invention to provide improved sealing means for well tools such as swabs, such means including a plurality of uniformly spaced resilient substantially annular sealing rings carried by the well tool or swab which are arranged to move into sealing engagement with the bore wall of the flow conductor upon the application of fluid pressure thereagainst for maintaining a seal between the well tool or swab and the conductor.

It is a particular object of the invention to provide, in a well tool, sealing means including a plurality of spaced annular sealing rings which will each carry only a predetermined maximum pressure differential and which are arranged so that a pressure in excess of such fixed or prede-

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termined maximum differential will pass the individual sealing ring to act against the next adjacent sealing ring, whereby each sealing ring bears a proportionate share of the total load and cannot carry a load greater than the maximum predetermined load for which the sealing ring is designed, but a plurality of spaced rings will carry or absorb a desired total amount of fluid pressure.

Another object of the invention is to provide a swab of the character described wherein the sealing rings are so disposed that the swab will support only a predetermined pressure load, the sealing means being arranged to by-pass any fluid load in excess of such predetermined load to the well bore therebelow, whereby the possibility of overloading and sticking the swab is eliminated.

An important object of the invention is to provide sealing means of the character described wherein the bearing pressure between the sealing means and the bore wall of the pipe is maintained at a minimum under maximum conditions of load, whereby the wear of the sealing means is minimized under maximum load conditions.

Another object of the invention is to provide a sealing means for a swab which is so constructed and arranged that the sealing means can only wear and cannot be cut or torn into pieces by irregularities and projections in the bore wall of the flow conductor and deposited as trash or obstructions therein.

Still another object of the invention is to provide a sealing element which will be deflected upwardly and inwardly by the action of well fluids when lowered thereinto and thus provide by-pass area around the sealing element for the passage of well fluids in order that the swab may be lowered more rapidly and without wear on the sealing element.

It is a particularly important object of the invention to provide in a swab sealing means which is so constructed and arranged that the load carried by the swab is distributed substantially uniformly over a plurality of separate flexible sealing rings rather than applied solely against a single cup or sleeve, whereby wear and damage to the sealing elements are reduced and substantially eliminated and light loads may be lifted from great depths with minimum leakage or slippage, and heavy loads may be lifted with minimum wear.

A further object of the invention is to provide a sealing means which is simple to manufacture, has a minimum number of parts, and is designed for maximum life and minimum wear, and which is designed for maximum ease of replacement of worn parts when required.

Additional objects and advantages of the invention will readily be apparent from the reading of the following description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

Figure 1 is a side elevation of a swab having sealing means constructed in accordance with the invention provided thereon,

Figure 2 is a horizontal cross-sectional view taken on the line 2—2 of Figure 1,

Figure 3 is a transverse vertical sectional view through the swab of Figure 1, showing the swab being lowered into a well flow conductor,

Figure 4 is a view similar to Figure 2 showing the swab being lifted under conditions of load in the well conductor,

Figures 5 through 11 are transverse vertical sectional views of modified forms of sealing means, showing the same mounted on a tubular section of a well tool,

Figure 12 is a horizontal cross-sectional view taken on the line 12—12 of Figure 6, and

Figure 13 is a horizontal cross-sectional view taken on the line 13—13 of Figure 11.

In the drawings, the numeral 10 designates an elongate cylindrical mandrel of a well tool, such as a swab, and having an axial bore 11 therethrough. A guide shoe 12 having vertical external flow courses 12*a* is screwthreaded onto the lower end of the mandrel for guiding the same in its vertical movement in a well flow conductor C. The guide shoe has an axial flow passageway 13 therethrough which communicates with the bore 11 of the mandrel and is flared outwardly therebelow. A valve cage 15 is secured to the upper end of the mandrel by means of screw threads or any other suitable manner, and said valve cage provides means for retaining a ball check valve 16 in position to engage an upwardly facing valve seat 17 formed at the upper end of the bore of the mandrel 10, whereby the ball valve will engage the seat to close the bore of the mandrel against downward flow. Lateral flow openings 18 are provided in the valve cage for permitting fluids flowing through the bore of the mandrel to pass outwardly to the bore of the well conductor thereabove. A sinker bar 19 is screwthreaded to an upstanding pin 20 carried by the upper end of the valve cage, and a cable socket 21 at the upper end of the sinker bar provides means for connecting a flexible cable 22 to the mandrel. It is believed obvious that the valve may be positioned elsewhere than at the upper end of the mandrel, if desired.

Mounted on the exterior of the cylindrical mandrel 10, between the valve cage 15 and the guide shoe 12, is an elongate sealing member 25 for sealing between the mandrel and the bore wall of the well flow conductor C, as will be hereinafter explained. The sealing member includes an elongate cylindrical sleeve 26, formed of rubber, synthetic rubber, or the like resilient material, and preferably molded on the exterior cylindrical surface of the mandrel so as to be fixed against movement on said mandrel. A plurality of uniformly spaced inverted frusto-conical annular sealing rings 27 are carried by the sleeve 26, said sealing rings being preferably formed integral with the sleeve. The cross-sectional thickness of the rings projecting outwardly from the sleeve is preferably substantially uniform throughout, and each ring is molded in the form shown in Figure 1, wherein the ring extends outwardly and upwardly in substantially an inverted frusto-conical shape. The outer peripheral edges of the rings are beveled inwardly and upwardly, as clearly shown at 28 in Figure 1, for a purpose which will be hereinafter more fully explained.

The diameter of the sealing rings 27, in the normal undeformed position shown in Figure 1, is substantially equal to the diameter of the bore of the well conductor C. However, due to the fact that the sealing rings are formed in the inverted frusto-conical shape, it will be seen that when the swab mandrel is lowered into the bore of the well conductor the sealing rings will readily flex upwardly in the manner shown in Figure 3 to permit fluid to pass exteriorly of the mandrel between the sealing rings and the bore wall of the conductor. Also, the ball valve 16 will lift off the upwardly facing seat 17 at the upper end of the mandrel and permit fluids to flow upwardly through the bore of the mandrel as the swab is lowered through the liquid in the well conductor.

When the swab is raised by lifting the cable 22, the ball check valve 16 engages the upwardly facing seat 17 to close the bore of the mandrel and trap liquid in the bore of the flow conductor above the mandrel. The liquid trapped above the mandrel will act downwardly upon the uppermost sealing ring 27 and will deform the ring downwardly to substantially the position shown in Fig. 4, wherein the ring extends downwardly and outwardly in substantially a frusto-conical shape. The beveled edge 28 of the ring then engages substantially throughout the thickness of the ring against the bore wall of the conductor to form a seal therewith, though it may contact the conductor in other manners under different conditions.

Since the uppermost sealing ring 27 is made of rubber or other similar flexible material and is relatively thin, it will be seen that such sealing ring will support or lift only a predetermined column of fluids; for example, a column which weighs approximately 8 to 12 pounds per square inch, and any pressure in excess of that amount will deflect such uppermost sealing ring downwardly out of sealing engagement with the bore wall of the conductor to permit liquid to flow past such uppermost cup to the sealing ring next below it. The second sealing ring will then likewise be deformed downwardly in the same manner as was the uppermost sealing ring, whereby the peripheral beveled edge 28 of the second sealing ring engages and seals against the bore wall of the conductor and supports a column of liquid thereabove.

Since all of the sealing rings are of substantially the same dimensions, it will be seen that each sealing ring will support substantially the same fluid pressure differential thereacross, and any differential in excess of such predetermined value will cause the sealing ring to be deflected downwardly to permit the liquid to pass said ring to the ring next below it. Therefore, the total load of liquid to be supported by the swab will be borne in predetermined increments by each of the sealing rings 27, each sealing ring bearing its proportionate share of the load; and no one sealing ring will carry a greater load than the pressure differential which will deform or deflect said ring downwardly to permit liquids to pass downwardly below it.

It is to be clearly understood that it is not necessary that a sufficient space be provided between the sealing rings to permit the accumulation of a column of liquid above each sealing ring equal to the differential which said sealing ring will support. Instead, only enough space must be provided to permit each sealing ring to move independently of the other rings. The major portion of the column of liquid may be supported above the uppermost sealing ring, but each sealing ring will support and carry a predetermined pressure differential portion of the total load. Thus, if each sealing ring is so constructed that it will support, without leaking, a differential pressure of ten pounds per square inch, then ten rings would support a column of fluid exerting a downward force due to its weight equal to substantially 100 pounds per square inch. The uppermost ring would absorb or support 10 pounds per square inch of the total load, thus passing a 90 pounds per square inch pressure to the second ring, which would in turn support 10 pounds per square inch differential of the total load and pass to the third ring 80 pounds, and so on until the total load of 100 pounds per square inch had been absorbed by or distributed over the 10 sealing rings, each of which carries a 10 pounds per square inch share of the total load.

Since each sealing ring will support only a predetermined pressure differential without leakage, and any pressure in excess of such predetermined value acts to deform or force the sealing rings downwardly out of contact with the bore wall of the conductor; then, if the swab is lowered too deeply into the liquid in the well conductor, so that a column of fluid in excess of the capacity of the sealing rings is trapped above the swab, the sealing rings will simply leak until the load above the swab has been reduced to a column which the sealing rings will support. This provides for automatically controlling the column of liquid which can be carried by the swab and eliminates the possibility of lowering the swab so deep in the liquid that the swab is caused to stick. It will be seen that it is impossible to trap a liquid load above the swab which would prevent the swab from being lifted or pulled upwardly through the bore of the conductor. Therefore, the swab cannot be overloaded and stuck in the well.

Since the pressure load on each sealing ring tends to reduce the force of contact or bearing pressure between the sealing ring and the bore wall of the conductor by deflecting the sealing ring downwardly, it will be seen that the bearing pressure between the sealing rings and the bore wall of the conductor will be a minimum under maximum load conditions; hence the wear of the sealing rings will be a minimum when lifting the maximum load for which the swab is designed. Conversely, when the load is light the sealing rings will have a maximum bearing pressure against the pipe and thus reduce fluid slippage to a minimum.

It will be seen, therefore, that the life of the sealing element of the swab should be increasingly long for increasingly heavier loads up to the maximum for the swab. Therefore, since the bearing pressure between the sealing rings and the bore wall of the conductor will be low under heavy loads, and since the rate of wear is a function of bearing pressure, the rate of wear of the sealing rings under heavy fluid loads will be a minimum and the wear life of the seal rings correspondingly long. Furthermore, so long as bearing pressures

are low, it is almost impossible to cut rubber or like resilient material, and the sealing rings will thus pass irregularities and projections without material damage. As a result, the damage which occurs when conventional swabs pass coupling recesses under a heavy load is eliminated by the sealing element described herein, since the bearing pressure of the individual sealing rings against the bore wall of the conductor is relatively low and the edge portions of the sealing rings may pass coupling recesses with practically no damage or wear.

Furthermore, since only the outer peripheral edges of the sealing rings engage the bore wall of the conductor, it will be seen that only the outer edges of the rings can wear, and hence there is no way in which sizable chunks of the material of which the sealing rings are made can be torn off or stripped from the swab to remain in the bore of the conductor to foul chokes and the like therein, and obstruct flow therethrough.

It is believed manifest that the sealing member **25** may be constructed and assembled in manners differing from that previously described. Several modifications of the construction of the sealing member are illustrated in Figures 5 through 13.

In Figure 5, a sealing member **30** is shown assembled on a portion of a tubular cylindrical mandrel **31**, said sealing member being formed of a plurality of separate rings of resilient material, such as rubber, synthetic rubber, or like flexible material. Each ring **32** is provided with a cylindrical body section **33** which closely surrounds the mandrel **31** and abuts against the ends of the body portions of adjacent rings. Located centrally of each body section **33** of the sealing rings is an inverted frusto-conical annular sealing lip **34** which is formed integral with the body section and projects outwardly and upwardly therefrom. The outer peripheral edge portion of the sealing lip is beveled inwardly and upwardly as illustrated at **35**, similarly to the sealing rings **27** of the form first described. Manifestly, any number of the separate sealing rings **32** may be mounted on the mandrel **31** to provide a sealing element **30** having the desired load carrying capacity. Other than the difference in structure just pointed out, the functioning and operation of the sealing element **30** is the same as that of the form first described, and such sealing element may be used in place of such previously described form of sealing element.

In Figures 6 and 12 a sealing member **36** is illustrated as being mounted upon a cylindrical mandrel section **37**, said sealing member being formed of a plurality of separate sealing rings **38**. Each sealing ring includes a cylindrical resilient body section **39** which is molded or otherwise secured to a metallic cylindrical sleeve or core **40** which is arranged to slidably fit on the mandrel **37**. The ends of the supporting sleeve **40** abut the ends of adjacent rings to prevent vertical collapsing of the sealing assembly. Each sealing ring body portion **38** is provided with an inverted frusto-conical sealing lip **41** preferably formed integral with said body portion and of a flexible material such as rubber, synthetic rubber or the like, and projecting outwardly and upwardly from the lower portion of said body portion. The outer edge **42** of the annular sealing lip is beveled inwardly and upwardly for the same reason as the bevel **28** formed on the form first described. The sealing lips **41** function in the same manner as the sealing rings **27** of the form first described.

A further modification of the sealing element is illustrated in Figure 7, wherein a plurality of sealing rings 45 are mounted on a mandrel section 46. Each sealing ring is formed with a cylindrical body portion 47 and an inverted frusto-conical sealing lip 48, which projects outwardly and upwardly from the lower portion of said body section and is provided with an inwardly and upwardly beveled outer edge 50. Substantially L-shaped reinforcing rings 51 of metal or the like are molded or otherwise secured to the opposite ends of the body portion 47 of the sealing ring, one arm of said reinforcing rings extending outwardly from the bore of the body portion and the other arm of each reinforcing ring extending longitudinally inwardly of the bore from the end of the body portion on which it is secured. The reinforcing rings of adjacent sealing rings abut each other, and will serve to prevent stretching or stripping of the body of the sealing rings from the mandrel. The structure and functioning of the sealing lips 48 of this modification of the sealing rings are the same as that of the sealing rings 27 of the form first described. The reinforcing rings will facilitate installation and removal of the sealing rings on the mandrel, as well as strengthen the end portions of the body sections of such sealing rings.

A still further modification of the sealing element is illustrated in Figure 8, wherein a plurality of sealing rings 55 are illustrated as mounted on a mandrel section 56. The sealing rings of this form are similar to the sealing rings of the form illustrated in Figure 6, except that the sealing rings are provided with a reinforcing sleeve or core 57 of metal which is formed at its lower end with a central outwardly directed flange and a depending annular skirt 58. The horizontal portion of the flange overlies and the skirt surrounds the adjacent upper resilient portion of the body 59 of the sealing ring next below and confines such portion of the sealing ring against displacement from sealing position on the mandrel. Each sealing ring is also formed with an inverted frusto-conical annular sealing lip 60, which projects outwardly and upwardly from the lower portion of the body section 59 of the sealing ring and is provided with an inwardly and upwardly directed bevel 61 at its outer peripheral edge. The function and operation of this form of sealing ring are the same as that of the rings previously described.

Another modification of the sealing member is illustrated in Figure 9, wherein a plurality of separate sealing rings 65 are shown as mounted on a mandrel section 66. Each sealing ring is substantially the same as the sealing ring of the form illustrated in Figure 6, except that the reinforcing sleeve 67 which is provided in the bore of the sealing ring terminates short of the lower end of said body portion of the sealing ring, whereby a resilient inwardly directed annular flange 68 is formed at the lower end of the body portion 69 of the sealing ring for sealing against the mandrel and the upper end of the reinforcing sleeve 67 of the sealing ring next below. Each sealing ring is also provided with an annular inverted frusto-conical sealing lip 70, which projects outwardly and upwardly from the lower portion of the body 69 of the sealing ring and is provided with an inwardly and upwardly directed bevel 71 at its outer peripheral edge. These sealing rings likewise function in the same manner as the rings first described.

In Figure 10 is illustrated still another form of

sealing ring. In this modification, the mandrel 75 is provided with a plurality of spaced annular concave grooves 76 which are substantially hemispherical in cross-section configuration and which receive the convex substantially hemispherical inner peripheral edge 77 of annular inverted frusto-conical sealing rings 78. The inner convex peripheral edge portion of the sealing ring tightly engages in the concave annular groove 76 in the mandrel for sealing against said mandrel. The sealing rings extend outwardly and upwardly from the mandrel and are provided with an inwardly and upwardly directed bevel 79 at their outer edge for the same purpose as the bevel 28 of the sealing rings first described. The sealing rings 78 will function in substantially the same manner as the sealing rings 27 of the form first described. However, the sealing rings may pivot in the concave annular recesses or grooves 76 in the mandrel when said rings are deformed downwardly by fluid trapped thereabove. Likewise, the sealing rings will flex or pivot upwardly in the groove to return to their normal initial shape when the pressure is relieved and the mandrel 75 is lowered through liquid, whereby the liquid may pass between the mandrel and the bore wall of the conductor past the sealing rings.

Still another modification of the sealing member is shown in Figures 11 and 13, wherein a plurality of separate resilient sealing rings 80 are confined on a tubular mandrel 81 between metallic retaining and spacing rings 82. The sealing rings have a short resilient body portion 83, the upper and lower ends of which are beveled to provide outwardly converging end surfaces; and an annular inverted frusto-conical flange or lip 84 is formed integral with and projects outwardly and upwardly from the central portion of the body portion of the sealing ring. An inwardly and upwardly inclined bevel 85 is formed on the outer peripheral edge of each flange or lip section, for the same purposes as the bevel 28 of the form first described. The retaining and spacing rings 82 have their ends converging inwardly to correspond with the inclined ends of the body portion of the sealing rings, whereby the sealing rings are retained in place on the mandrel in proper spaced relationship. The annular flange or lip portions of these sealing rings will flex or be deformed in the same manner and with the same results as the rings 27 first described. Furthermore, the sealing members function in the same manner as the previously illustrated and described sealing members.

In all forms of the sealing rings hereinbefore described, each sealing ring will support only a predetermined maximum pressure differential without leaking, and any pressure in excess of such predetermined value acts to force or deform the sealing ring downwardly out of contact with the bore wall of the conductor to permit liquid trapped thereabove to flow downwardly past said sealing ring. The sealing rings are all arranged to move into sealing engagement with the bore wall of the conductor upon the application of fluid pressure thereagainst for maintaining a seal between the mandrel and the bore wall of the conductor. Furthermore, each sealing ring is arranged to carry only a predetermined maximum pressure differential so that a pressure differential in excess of such predetermined maximum differential will pass the individual sealing ring to act against the next adjacent sealing ring, whereby each sealing ring bears a proportionate share of the total load, and will not carry a load greater than the maximum predetermined load for which the sealing ring is designed. However, it is believed manifest that a plurality of spaced rings will absorb the total amount of fluid pressure, each carrying its predetermined share or proportion of such total load. Furthermore, it is believed manifest that the sealing rings are so constructed that the bearing pressure between the outer peripheral lip portions of the ring and the bore wall of the conductor is maintained at a minimum under maximum conditions of load, whereby the wear of the rings is minimized under such maximum load conditions. It is also believed manifest that a light load applied to the sealing rings does not deflect the rings downwardly to so great an extent, whereby a greater bearing pressure is exerted against the wall of the well conductor and light loads may be lifted from great depths with minimum leakage or slippage.

Furthermore, due to their resiliency, the sealing rings will naturally return to the normal position illustrated in Figures 1 and 5 through 10 when the load is removed from the annular lip portion of the sealing rings and the sealing member is moved downwardly in the well conductor. The sealing ring lip portions will be deflected downwardly only under conditions of load sufficient to cause such deflection, and will move downwardly past sealing position upon the application of a load in excess of the pressure differential for which the sealing ring is designed and constructed.

It is believed manifest that improved sealing means has been disclosed which is simple to manufacture, has a minimum number of parts, and is designed for maximum life and minimum wear, and wherein the sealing means may only wear and cannot be cut or torn into pieces in the well bore to be deposited as trash or obstructions therein.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. A sealing member for a well tool and including, an elongate tubular body member of resilient material adapted to be mounted on the well tool and having a plurality of integral spaced resilient annular flange-like sealing rings of substantially uniform cross-sectional thickness projecting outwardly and upwardly from said body in an inverted frusto-conical shape, said sealing rings being each arranged to be flexed downwardly into sealing engagement with the bore wall of the well flow conductor below a horizontal plane for sealing between said conductor and the body member, each sealing ring being arranged to support not more than a predetermined maximum fluid pressure differential and being each further flexible downwardly out of sealing engagement with the conductor wall upon the application thereto of a fluid pressure differential in excess of said maximum pressure differential carriable by said sealing ring to permit excess fluid pressure to by-pass said ring, and being arranged to each return to its normal inverted frusto-conical shape when relieved of any pressure differential.

2. A well swab to be lowered and raised through a well tubing in situ in a well to elevate well liquid comprising: a hollow mandrel; a check valve to shut off down flow through the inside of said mandrel when the mandrel is raised through the well liquid, said valve lifting to pass liquid through the mandrel as the mandrel moves down through the tubing containing liquid; an annular sleeve member about said mandrel; a plurality of axially spaced inverted annular substantially frusto-conical sealing flange-like rings of substantially uniform cross-section projecting from said sleeve, each of said rings being upwardly and outwardly inclined and having a peripheral edge substantially normal to the thickness of the ring, each of said rings being constructed and arranged to flex under a predetermined load of liquid thereon to move from an outwardly and upwardly inclined position to a downwardly and outwardly inclined position such that said outer periphery first moves downwardly to seal with the well tubing interior surface and then further downwardly to a leakage position to eventually move out of sealing position and out of engaging contact with the well tubing interior surface if the load persists and so long as the load on the ring exceeds said predetermined load, whereby said swab will automatically unload by leakage, past the seal rings, any excess load of liquid through which the swab may have been lowered and whereby said swab will raise only a predetermined total load of liquid.

3. A well swab to be lowered and raised through a well tubing in situ in a well to elevate well liquid comprising: a hollow mandrel; a check valve to shut off down flow through the inside of said mandrel when the mandrel is raised through the well liquid, said valve lifting to pass liquid through the mandrel as the mandrel moves down through the tubing containing liquid; an annular sleeve member about said mandrel; a plurality of axially spaced inverted annular substantially frusto-conical sealing rings of substantially uniform cross-section projecting from said sleeve, each of said rings being upwardly and outwardly inclined and having a peripheral edge substantially normal to the thickness of the ring, each of said rings being constructed and arranged to flex under a predetermined load of liquid thereon to move from an outwardly and upwardly inclined position to a downwardly and outwardly inclined position such that said outer periphery first moves downwardly to seal with the well tubing interior surface and then further downwardly to a leakage position to eventually move out of sealing position and out of engaging contact with the well tubing interior surface if the load persists and so long as the load on the ring exceeds said predetermined load, whereby said swab will automatically unload by leakage past the sealing rings any excess load of liquid through which the swab may have been lowered and whereby said swab will raise only a predetermined total load of liquid, each of said rings being independent and self-sustaining for its individual load.

4. A well swab to be lowered and raised through a well tubing in situ in a well to elevate well liquid comprising: a mandrel having a longitudinal flow passage; a check valve to shut off down flow through said flow passage when the mandrel is raised through the well liquid, said valve opening to pass liquid through the mandrel flow passage as the mandrel moves down through the tubing containing liquid; an annular sleeve member about said mandrel; a plurality of axially spaced inverted annular substantially frusto-conical sealing rings of substan-

tially uniform cross section projecting from said sleeve, each of said rings being upwardly and outwardly inclined, each of said rings being constructed and arranged to flex under a predetermined load of liquid thereon to move from an outwardly and upwardly inclined position to a downwardly and outwardly inclined position such that the outer periphery of the ring first moves downwardly to seal with the well tubing interior surface and then further downwardly to a leakage position to eventually move out of engaging contact with the well tubing interior surface if the load persists and so long as the load on the ring exceeds said predetermined load, whereby said swab will automatically unload by leakage, past the sealing rings, any excess load of liquid through which the swab may have been lowered and whereby said swab will raise only a predetermined total load of liquid.

5. A well swab to be lowered and raised through a well tubing in situ in a well to elevate well liquid comprising: a mandrel having a longitudinal flow passage; a check valve to shut off down flow through said flow passage when the mandrel is raised through the well liquid, said valve opening to pass liquid through the flow passage as the mandrel moves down through the tubing containing liquid; an annular sleeve member about said mandrel; a plurality of axially spaced inverted annular substantially frusto-conical sealing rings of substantially uniform cross section projecting from said sleeve, each of said rings being upwardly and outwardly inclined, each of said rings being constructed and arranged to flex under a predetermined load of liquid thereon to move from an outwardly and upwardly inclined position to a downwardly and outwardly inclined position such that the outer periphery of the ring first moves downwardly to seal with the well tubing interior surface and then further downwardly to a leakage position to eventually move out of engaging contact with the well tubing interior surface if the load persists and so long as the load on the ring exceeds said predetermined load, whereby said swab will automatically unload by leakage past the sealing rings any excess load of liquid through which the swab may have been lowered and whereby said swab will raise only a predetermined total load of liquid, each of said rings being independent and self-sustaining for its individual load.

6. A well swab to be lowered and raised through a well tubing in situ in a well to elevate well liquid comprising: a mandrel; an annular sleeve member about said mandrel; a plurality of axially spaced inverted annular substantially frusto-conical sealing rings of substantially uniform cross-section projecting from said sleeve, each of said rings being upwardly and outwardly inclined, each of said rings being constructed and arranged to flex under a predetermined load of liquid thereon to move from an outwardly and upwardly inclined position to a downwardly and outwardly inclined position such that the outer periphery of the ring first moves downwardly to seal with the well tubing interior surface and then further downwardly to a leakage position to eventually move out of engaging contact with the well tubing interior surface if the load persists and so long as the load on the ring exceeds said predetermined load, whereby said swab will automatically unload by leakage past the sealing rings any excess load of liquid through which the swab may have been lowered and whereby said swab will raise only a predetermined total load of liquid.

7. A sealing member for a well tool for use in well tubing comprising: a sleeve member mountable on the well tool; and a plurality of axially spaced inverted substantially frusto-conical flange-like sealing rings projecting from said sleeve, each of said rings being upwardly and outwardly inclined, each of said rings being constructed and arranged to flex under a predetermined load of liquid thereon to a downwardly and outwardly inclined position such that the outer periphery of the ring first moves downwardly and outwardly to seal with the well tubing interior surface and then further downwardly and inwardly to a leakage position to eventually move out of engaging contact with the well tubing interior surface if the load persists and so long as the load on the ring exceeds said predetermined load, whereby said sealing member will automatically unload by leakage, past the sealing rings, any excess load of liquid through which the well tool and sealing member may have been lowered in a well tubing and whereby said sealing member will raise only a predetermined total load of liquid.

8. A well swab adapted to be lowered and raised within a well conductor to elevate well liquid and including, a support, a plurality of annular sealing elements mounted on the support in axially spaced relationship, each sealing element being constructed of elastic material and being upwardly and outwardly inclined with its peripheral edge in non-sealing engagement with the wall of the well conductor when the element is in a normal undistorted position, each sealing element being capable of flexing in a downward direction under a predetermined load of liquid to effect a sealing engagement of the peripheral edge of the element with the wall of the conductor, whereby said element may be utilized to lift the predetermined load of liquid, increase of the liquid load beyond the predetermined load causing further flexing of said element in a downward direction to move the peripheral edge thereof out of sealing engagement with the wall of the conductor to permit escape of liquid downwardly past the element and reduce the liquid load thereabove to the predetermined load.

9. A well swab adapted to be lowered and raised within a well conductor to elevate well liquid and including, a support having a flow passage therethrough, means in the passage closing the passage when the support is raised through well liquid in the conductor and for opening the passage upon downward movement of the support through the tubing, a plurality of annular sealing elements mounted on the support in axially spaced relationship, each sealing element being constructed of elastic material and being upwardly and outwardly inclined with its peripheral edge in non-sealing engagement with the wall of the well conductor when the element is in a normal undistorted position, each sealing element being capable of flexing in a downward direction under a predetermined load of liquid to effect a sealing engagement of the peripheral edge of the element with the wall of the conductor, whereby said element may be utilized to lift the predetermined load of liquid, increase of the liquid load beyond the predetermined load causing further flexing of said element in a downward direction to move the peripheral edge thereof out of sealing engagement with the wall of the conductor to permit escape of liquid down-

wardly past the element and reduce the liquid load thereabove to the predetermined load.

10. A well swab including: an elongate support having a longitudinal flow passage therethrough, a valve cage carried by said support and having a flow passage communicating with the passage of the support, a movable valve member in said cage and seating against an upwardly facing seat in said cage, means at the upper end of the support for connecting the swab to a flexible line hoisting mechanism, and an elongate sealing member carried by the support and including an annular member deformable downwardly from a non-sealing position above a horizontal plane into sealing engagement with the interior wall of a well flow conductor, said sealing member being further deformable downwardly upon the application of a predetermined fluid pressure load thereacross to permit fluid pressure from above the sealing member to flow downwardly past the sealing member to the bore of the flow conductor therebelow.

11. A well swab having a tubular body with a flow passage therethrough and valve means controlling fluid flow through said flow passage in one direction, and a sealing member carried by the body for sealing between the body and the bore wall of a well flow conductor, said sealing member being initially deformable downward from a non-sealing position above a horizontal plane into sealing engagement with the bore wall of the flow conductor and being further downwardly deformable upon the application of a fluid pressure load thereacross in excess of a predetermined fluid pressure differential to move the sealing means out of sealing engagement with the bore wall of the flow conductor to permit fluid pressure to flow downwardly past the sealing member.

12. A well swab having a tubular body with a flow passage therethrough and valve means controlling fluid flow through said flow passage in one direction, and a sealing member carried by the body for sealing between the body and the bore wall of a well flow conductor, said sealing member being initially deformable downwardly from a non-sealing position above a horizontal plane into sealing engagement with the bore wall of the flow conductor and being further downwardly deformable upon the application of a fluid pressure load thereacross in excess of a predetermined fluid pressure differential to move the sealing means out of sealing engagement with the bore wall of the flow conductor to permit fluid pressure to flow downwardly past the sealing member, said sealing means returning to sealing engagement with the bore wall of the flow conductor after the excess pressure load had been relieved to support said predetermined fluid pressure load.

13. A well swab of the character set forth in claim 5, wherein the sleeve member is formed of a plurality of short tubular sections each having one of the annular sealing rings projecting therefrom.

14. A well swab of the character set forth in claim 6, wherein the sleeve member is formed of a plurality of separate sections each carrying one of the annular sealing rings.

15. A well swab adapted to be lowered and raised within a well conductor to elevate well liquid and including, a support, a plurality of annular sealing elements mounted on the support in axially spaced relationship, each sealing element being constructed of elastic material and being upwardly and outwardly inclined with its peripheral edge in non-sealing engagement with the wall of the well conductor when the element is in a normal undistorted position, the upward and outward dimension of each sealing element being greater than the radial distance between the support and the wall of the conductor, each sealing element being capable of flexing in a downward direction under a predetermined load of liquid to effect a sealing engagement of the peripheral edge of the element with the wall of the conductor, said dimension and resiliency of said sealing element coacting to provide firm sealing contact between the peripheral edge of said sealing element and the conductor wall, whereby said element may be utilized to lift the predetermined load of liquid, increase of the liquid load beyond the predetermined load causing further flexing of said element in a downward direction to move the peripheral edge thereof out of sealing engagement with the wall of the conductor to permit escape of liquid downwardly past the element and reduce the liquid load thereabove to the predetermined load.

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