Oct. 20, 1936. H. SMITH ET AL 2,058,267

BAILER FOR WELLS

Filed June 6, 1934 3 Sheets-Sheet 1

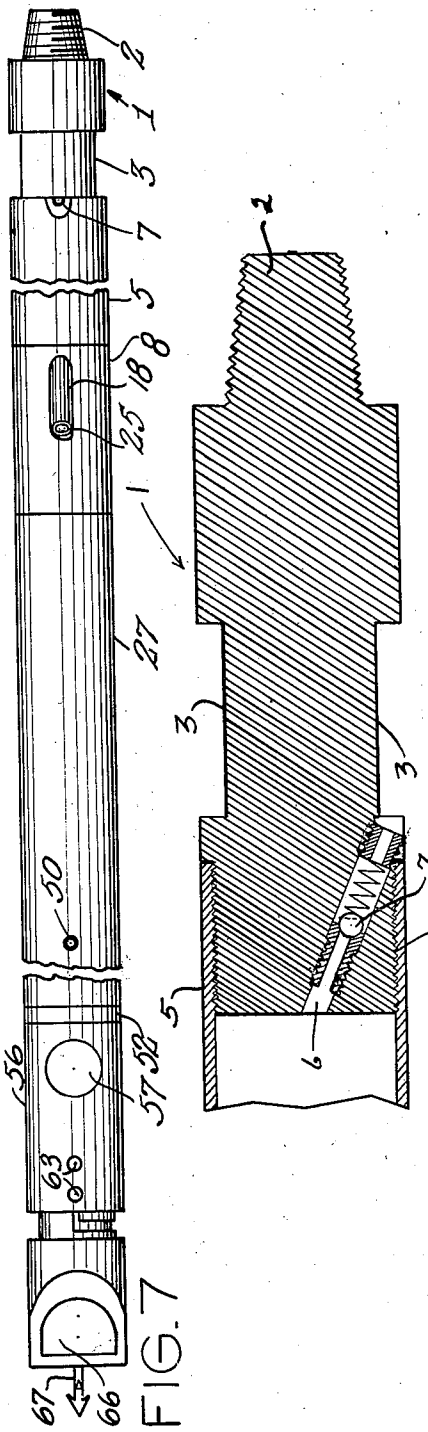


FIG. 1

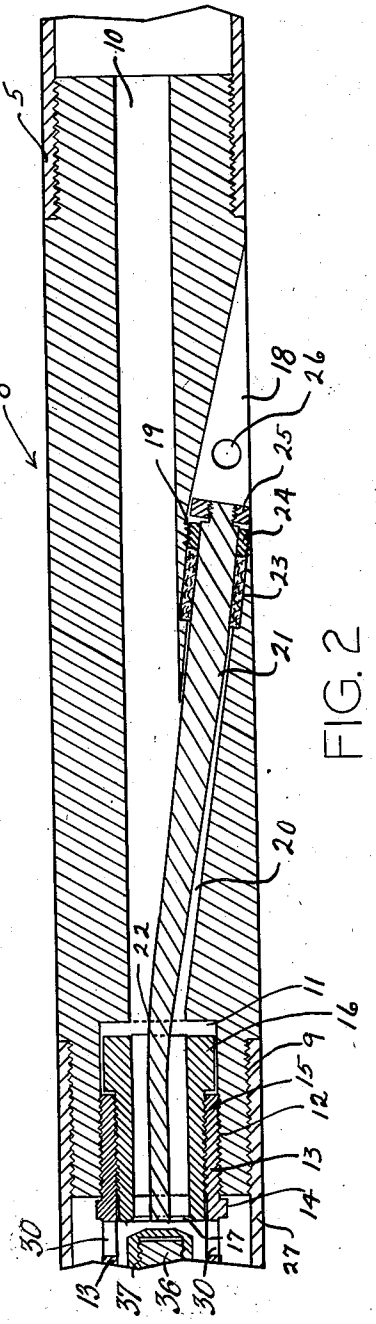


FIG. 2

FIG. 7

INVENTORS,
Herman Smith
William A. Larson
BY Loyal J. Miller
ATTORNEYS.

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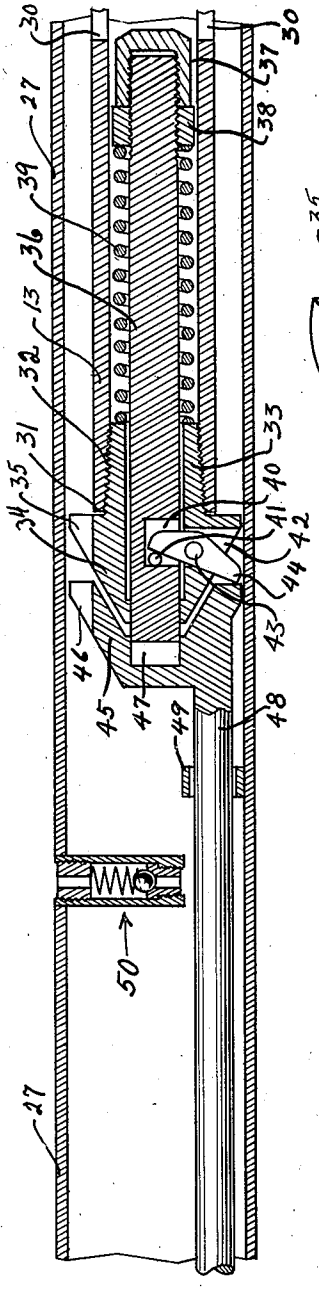


FIG. 3

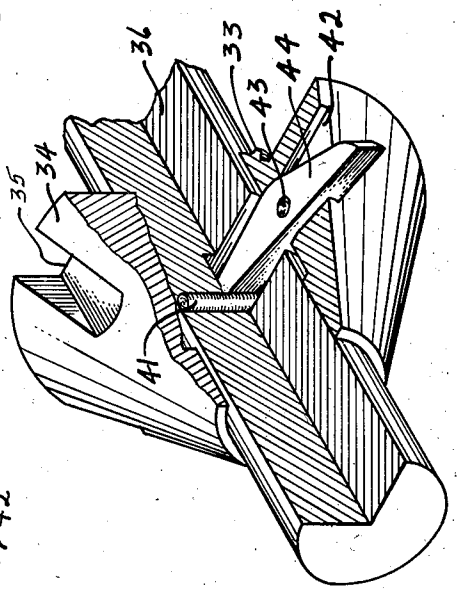


FIG. 4

INVENTORS,
Herman Smith
William A. Larson
BY Loyal A. Miller.
ATTORNEY

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BAILER FOR WELLS

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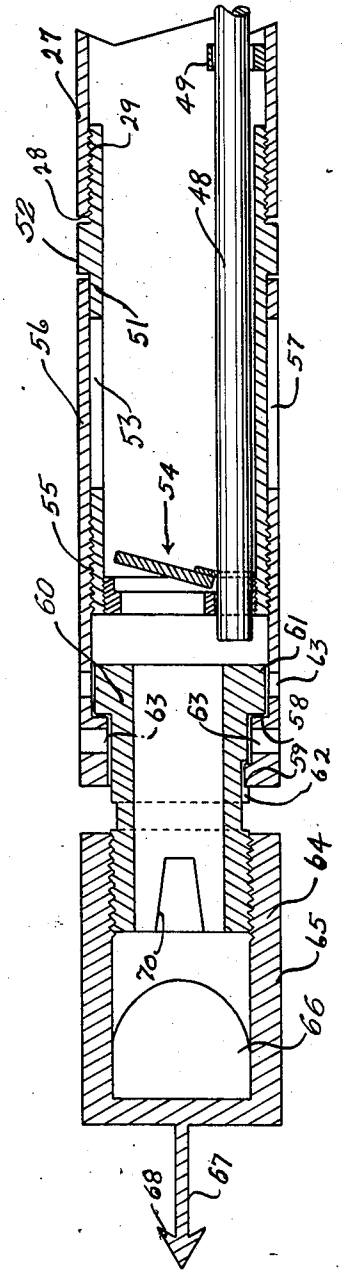


FIG. 5

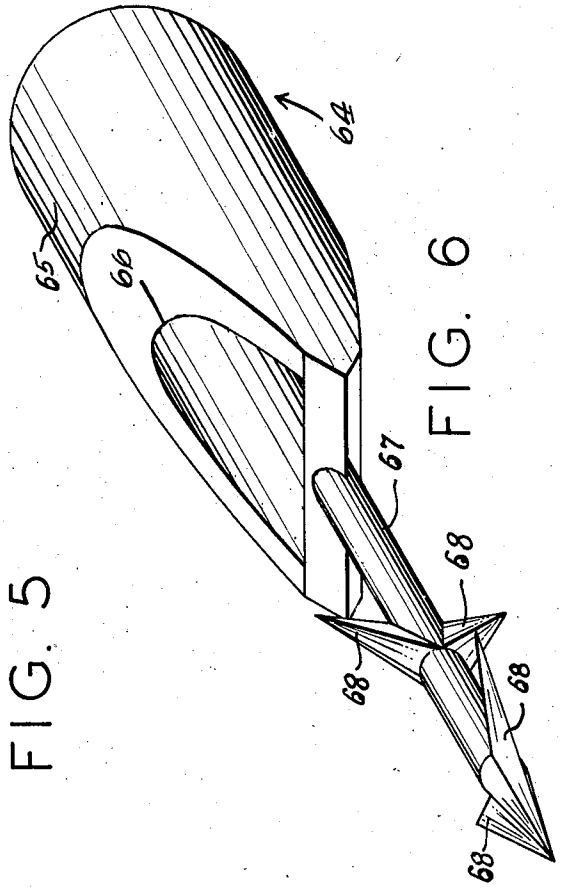


FIG. 6

Herman Smith
William A. Larson
INVENTORS,

BY Loyal J. Miller

ATTORNEY

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2,058,267

BAILER FOR WELLS

Herman Smith and William A. Larson,
Oklahoma City, Okla.

Application June 6, 1934, Serial No. 729,247

3 Claims. (Cl. 166—19)

Our invention relates to well bailers for removing detritus, substances and fluid from wells.

In oil wells it frequently or periodically becomes necessary, in order to keep them producing, to clean out debris or detrital materials which through the force of gravity accumulate at the bottom of the wells.

A bailer, usually consisting of a hollow tubular open topped bucket having a check valve in its lower end, is lowered into the well upon the end of a cable and each time it reaches the bottom of the well some of the debris, if it is loosely deposited, is forced into the bucket by the force with which it strikes the well bottom. It frequently occurs that the conglomerate is made up of pieces of material too great in size to enter the bailer, and when this is true the conglomerate must either be drilled up into smaller pieces, or specially designed tools must be used to grapple the larger fragments of the debris and bring them to the surface of the earth.

It is the prime object of the present invention to provide a bailer which may be lowered into a well in the usual manner, and so constructed that during the lowering operation it remains closed, but when it reaches the bottom of the well, the fluid will be drawn into the bucket with such force and velocity that a greater amount of the debris will enter the bucket than is possible with usual bailers. The force and velocity of the fluid is such that if the debris is packed it will be disintegrated by the flowing fluid and any particles or pieces small enough to enter the aperture in the bucket be forced to enter.

Another principal object of the invention is to provide a bailer which is so designed that its lower end may be connected to various tools for tearing up the larger pieces of the debris each time it reaches the bottom of the well.

Other objects of the invention are to provide a device of the class described which will be new, novel, practical and of utility; which will accomplish a given amount of work in less time than is now possible with usual bailers; the valve mechanisms of which will be positive in action; the moving parts of which are all removable and replaceable; the manufacturing cost of which will not be prohibitive; which is strong and durable; and, which will be efficient in accomplishing all the purposes for which it is intended.

With these and other objects in view as will more fully appear hereinbelow, our invention consists in the construction, novel features, and combination of parts hereinafter more fully described, pointed out in the claims hereto appended, and illustrated in the accompanying three-sheet drawings, of which,

Figure 1 is an elevational sectional view of the uppermost portion of the device;

Fig. 2 is a similar view of the portion lying next below that illustrated in Fig. 1;

Fig. 3 is a similar view of the portion lying next below that illustrated in Fig. 2;

Fig. 4 is an enlarged fragmentary perspective view, partially in section, detailing the valve operating mechanism illustrated in Fig. 3;

Fig. 5 is an elevational sectional view of the portion of the device lying next below the portion illustrated in Fig. 3;

Fig. 6 is a perspective view of the lowermost portion of the device and showing one type of tool which may be used for breaking up the debris in the bottom of the well; and,

Fig. 7 is an elevational view of the complete device.

Like characters of reference designate like parts in all the figures.

It is understood that various changes in the form, proportion, size, shape, weight and other details of construction, within the scope of our invention may be resorted to without departing from the spirit or broad principle of our invention and without sacrificing any of the advantages thereof; and it is also understood that the drawings are to be interpreted as being illustrative and not restrictive.

In the drawings:

The reference numeral 1 (Fig. 1) indicates as a whole the uppermost portion of the device, which consists substantially of a solid body having at its upper end a threaded pin 2 which is adapted to be connected to any desired means, not shown, for attaching it to the lower end of a cable, not shown. The member 1 intermediate its ends is provided with two flattened portions 3 for receiving a wrench or other tool for causing its rotation. The lower end portion of the member 1 is provided with exterior threads 4 which act as a means for connecting thereto a tubular oil chamber 5 which may be of any desired length but which in actual use is preferably about twenty feet long. The member 1 is provided at its lower end portion with a bore 6 which communicates between the interior of the chamber 5 and the exterior of the member 1, and the bore 6 is equipped with any usual or desired check valve mechanism 7 which is adapted to open upon upward pressure and close upon downward pressure thereupon. It is preferable that the mechanism 7, including its seat, spring, and spring detenture shall all be removable.

Threadedly connected to the lower end of the chamber 5 is a hollow cylindrical body 8 the lower end of which is provided with exterior threads 9 the office of which will be more fully described hereinbelow. As may best be seen in Fig. 2 the body 8 has a central bore 10 which communicates with the interior of the chamber 5 and which is surrounded by walls considerably

greater in thickness than the walls of the chamber 5. The lower end portion of the bore 10 is enlarged as shown at 11 and the lowermost portion thereof is equipped with interior threads 12. A tubular element 13 having an outwardly extending shoulder 14 and having interior threads 15 at its upper end is threadedly engaged by the threads 12 of the body 8 and acts to adjustably confine in the enlarged portion 11 of the bore 10 an adjustable valve seat member 16 the lower end of which is provided with a beveled valve seat 17.

A straight sided indenture or superficial notch 18 is machined into one of the walls of the body 8 and terminates in a flat shoulder 19 from whence a bore 20 extends downwardly at an angle through the wall and into the bore 10 of the body 8. A tapered rod 21 bent slightly at its lower end as illustrated at 22 is slidably disposed within the bore 20 and bore 10 and its lower end terminates adjacent the valve seat 17. Packing 23 adapted to be compressed by a packing nut 24 is provided around the rod 21 and the upper end of the rod is equipped with a square nut 25 which bears against the walls of the indenture 18 to prevent the rod from rotating. One of the walls of the indenture 18 is equipped with an outwardly projecting pin 26 which limits the upward movement of the rod 21. The office of the rod 21 will be more fully described hereinbelow.

To the lower end of the body 8 and engaged by the threads 9 is a tubular sleeve 27 which terminates at its lower end at a point illustrated by the reference numeral 28, and the lower end of which is equipped with interior threads 29 (Fig. 5).

The element 13 is provided with a plurality of through perforations 30 directly beneath the shoulder 14 and extends therebelow to a point of termination illustrated by the reference numeral 31 (Fig. 3) and is provided at its lower end portion with interior threads 32. The threads 32 of the element 13 engage an upwardly extending portion 33 of a conical casting 34 provided with radially spaced notches 35 for permitting the passage of a fluid therethrough. Slidably disposed within the element 13 is a valve stem 36 the upper end of which is equipped with a beveled valve head 37 and a lock nut 38. A compression spring 39 is provided between the upper end of the casting 34 and the lower face of the lock nut 38 for normally holding the stem 36 at the upper end of its throw at which position the head 37 is held seated within the valve seat 17 (Fig. 2). When the valve head 37 is moved out of its seating position the lower end of the stem 36 protrudes somewhat below the lower end of the casting 34. The lower end portion of the stem 36 is provided with a superficial indenture or cavity 40 within which is welded or otherwise rigidly attached a bearing pin 41. One wall of the casting 34 is provided with a through slot 42 within which is pivotally mounted upon a pin 43 a lever arm 44 which is adapted to bear against the pin 41 and cause the downward movement of the stem 36 when its free end is moved upwardly.

As a means for moving the lever 44 to actuate the stem 36 we provide an annular member 45 having a plurality of peripheral notches 46 for permitting the flow of a fluid therethrough and having a central bore 47 for permitting movement therein of the lower end of the stem 36. To one side of the annular member 45 is welded or otherwise rigidly connected a depending rod 48 which is slidably mounted within a plurality of guide rings 49 welded or otherwise rigidly attached to the interior surface of the tubular sleeve 27 (Fig. 2).

At any desired point beneath the member 45 the tubular sleeve 27 is provided with a suitable check valve mechanism 50 which is adapted to open upon pressure from within the sleeve 27 and to close when a greater pressure is exerted upon the exterior of the sleeve.

As may best be seen in Fig. 5, the threads 29 carried by the lower end of the sleeve 27 connect the upper end of a tubular element 51 which is equipped with an exterior angular portion 52 adapted to receive thereon a wrench or other tool for causing its rotation. The element 51 has a port 53 through one of its walls and its lower end is interiorly threaded to receive a suitable flapper-valve 54 which is adapted to open upon upward and close upon downward pressure thereon. The rod 48 extends through the side portion of the valve 54 to a point somewhat below the lower end of the element 51. The lower end of the element 51 is also provided with exterior threads 55 which threadedly engage interior threads carried by a sleeve 56 one wall of which is provided with a port or opening 57. The upper end of the sleeve 56 terminates slightly below the portion 52 of the element 51. Adjacent its lower end the bore of the sleeve 56 is reduced to form an inwardly projecting annular shoulder 58 and its extreme lower end below the shoulder 58 is provided with an inwardly projecting lug 59. Slidably disposed within the sleeve 56 is a hollow tubular casting 60 the upper portion of which terminates in an enlarged head 61 which is adapted to seat upon the shoulder 58 when the casting 60 is at the lower end of its throw. The exterior of the casting 60 is provided with a superficial guide groove 62 which is open at its lower end and within which the lug 59 slides when the casting is at the lower end of its throw. When the casting 60 is at the upper end of its throw the rod 48 will be moved upwardly and the lug 59 will be located below the groove 62 and consequently rotation of the sleeve 56 is permitted around the element 51 in such a manner that the ports 53 and 57 may be brought into registration. The lower end portion of the sleeve 56 is provided with a plurality of through perforations 63 which act as a means for preventing any sediment or extraneous materials from lodging between the sleeve 56 and the casting 60 and retarding the sliding movement of the casting. The lower end 70 of the bore of the casting 60 is angular in form for a purpose later described hereinbelow.

The lower end of the casting 60 is exteriorly threaded to receive a tool 64 which may best be seen in Figs. 5 and 6. The tool 64 consists substantially of a hollow body 65 the lower end of which is wedge shaped and is provided with side openings 66 for permitting ingress of a fluid. To the extreme lower end of the body 65 is removably or rigidly connected a rod 67 having outwardly projecting barbs 68 which are for the purpose of breaking up any debris encountered at the bottom of the well.

The tool 64 may be exchanged for any desired type of tool for disrupting or destroying various types of debris. The particular tool shown herein is designed specifically for the purpose of engaging and recovering any sheet metal objects which might be at the bottom of the well. It may be found desirable in some instances to re-

move the rod 67 and in this case the lower wedge shaped end of the body 65 would act to destroy large pieces of stone. The lower aperture of the casting 60 is made angular in form for a purpose which will later be described herein.

Operation

When the device is started to be lowered into the well both chambers are empty, and the valve head 37 is held seated in the valve seat 17 by action of the spring 39. The valve mechanisms 7 and 50 are then in a closed position, and the flapper-valve 54 is also closed. The weight of the ring 45 and rod 48 at this time has forced them to the lower end of their throws, and consequently the casting 60 is seated upon the shoulder 58 and the lug 59 is within the groove 62.

In practically all oil wells the natural pressure within the oil bearing stratum holds a column of oil in the well for a considerable height above such stratum. In many deep wells this column of oil stands in the well casing at a height as great as fifteen hundred to twenty-five hundred feet and is consequently causing a bottom hole pressure of some seven hundred and fifty to twelve hundred and fifty pounds per square inch.

As the lower end of the device comes in contact with the column of oil the valve 54 opens and the interior of the lower chamber is filled with oil up to the valve seat 17. The upper chamber 5 maintains its original pressure during the lowering operation which pressure is equal to the atmospheric pressure at the top of the well and which consequently is considerably less than the bottom hole pressure of the well. When the tool 64 strikes the debris in the well bottom the element 60 is moved upwardly and forces the rod 48 upwardly which in turn causes the ring 45 to contact the free end of the lever arm 44, the other end of which acts upon the pin 41 to lower the stem 36 against the action of the spring 39 and opens the valve head 37 from its seated engagement with the valve seat 17. When this occurs the upper chamber 5 acts similarly to a vacuum chamber and the oil in the lower chamber is drawn with great force into the upper chamber at an extremely high velocity. The movement of this oil consequently causes a tremendous suction in the openings 66, in the tool 64 and any debris around the tool which is of a size sufficiently small to enter the openings 66 will be speedily washed into the lower chamber.

Instead of considering that the low pressure in the chamber 5 forms a suction to draw the oil and debris into the device it may instead be considered that the bottom hole pressure forces the oil into the upper chamber under a pressure of from seven hundred and fifty to twelve hundred and fifty pounds per square inch. In either event it may be seen that the speed and force of the oil entering the device will be sufficient to not only carry with it any loose particles of the debris, but that it will actually disintegrate most debris by hydraulic force.

When the oil enters the chamber 5 the valve mechanism 7 will remain closed because the exterior pressure thereon, caused by the column of oil, will be as great as the pressure within the chamber. The air in the chamber 5 will therefore be compressed into a small space in the upper portion of the chamber.

Due to the fact that the upper end of the rod 21 is exposed to the pressure of the column of oil, and this pressure is transmitted by the rod to the inner face of the valve head 37, it is not necessary in opening the valve to overcome the differential in pressures between the two chambers.

As the device is withdrawn from the well and approaches the earth's surface the valves 7 and 50 will open to equalize the pressure within the device with the atmospheric pressure at the earth's surface.

It will be obvious that a single chamber for receiving the fluid could be provided instead of two chambers, and suitable mechanism provided for carrying atmospheric pressure within the device to the bottom of the well, and for opening the chamber when it reaches the bottom of the well.

A particular advantage of the tool lies in the fact that the intake openings 66 are in a position at which any of the debris disrupted by the tool will be drawn therein. Also that the tool disrupts part of the debris each trip into the well, and various tools may be used.

After the loaded device has been raised from the well, the angular bore 70 of the casting 60 is engaged by a suitable tool to prevent rotation of the casting 60, or if the tool 64 is used it may be engaged by a suitable tool for a similar purpose. The sleeve 56 is then rotated to bring the ports 53 and 57 into registration and the fluid in the device is thus permitted to escape.

It may be seen that the ring 45 insures positive contact with the lever arm 44 regardless of the radial position at which the casting 34 is disposed after assembly.

Obviously, the invention is susceptible of embodiment in forms other than that which is illustrated in the accompanying drawings and described herein, and applicable for uses and purposes other than as detailed, and we therefore consider as our own all such modifications and adaptations and other uses of the form of the device herein described as fairly fall within the scope of our invention.

Having thus described our invention, what is claimed and desired to be secured by Letters Patent, is:

1. In a well bailer, a housing adapted to be lowered to the bottom of a well and forming two superimposed chambers, one of said chambers being closed and adapted to hold therein air at the atmospheric pressure present at the top of the well, the other chamber being free to fill with the fluid in the well during the lowering operation, communicating means between the two chambers, a valve for normally closing said communicating means, means for opening the valve when the housing reaches the bottom of the well, and means for equalizing the pressure on both sides of the valve, said means including a slidable rod extending through the wall of the housing, its outer end exposed to action of fluid pressure in the well and its inner end adapted to exert an opening pressure upon the valve.

2. Organization as described in claim 1, and means for packing around the rod.

3. Organization as described in claim 1, and means for relieving pressure in both chambers as the device is raised within a well.

HERMAN SMITH.
WILLIAM A. LARSON.