166-138

No. 881,154. PATENTED MAR. 10, 1908.

L. E. ROBINSON.

WELL PACKER.

APPLICATION FILED MAR. 7, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

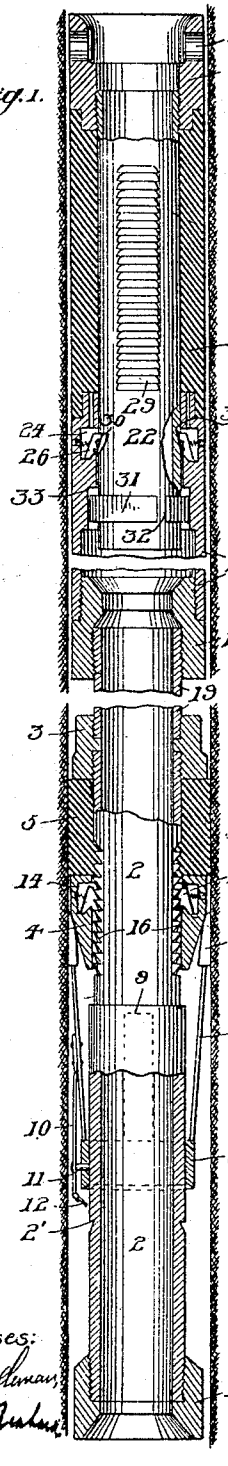


Fig. 2.

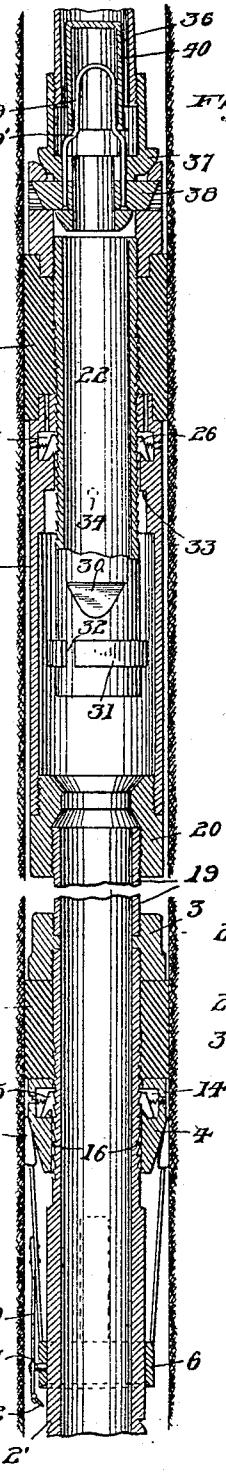


Fig. 3.

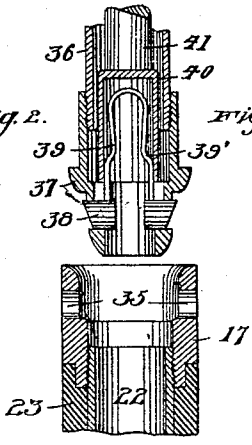


Fig. 4.

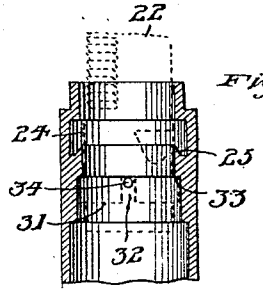


Fig. 5.

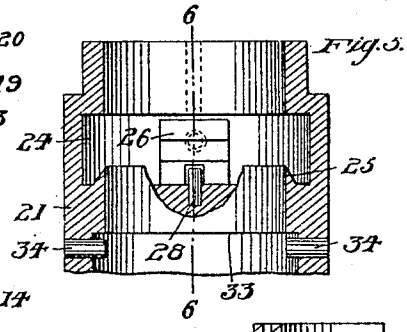
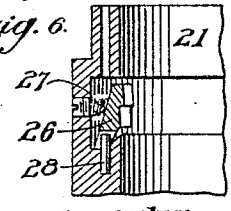


Fig. 6.



Witnesses:

J. R. Hoffman

Wm. Anderson

Inventor

L. E. Robinson,

By John Wallace

Atty.

THE NORRIS PETERS CO., WASHINGTON, D. C.

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2 SHEETS—SHEET 2.

Fig. 7.

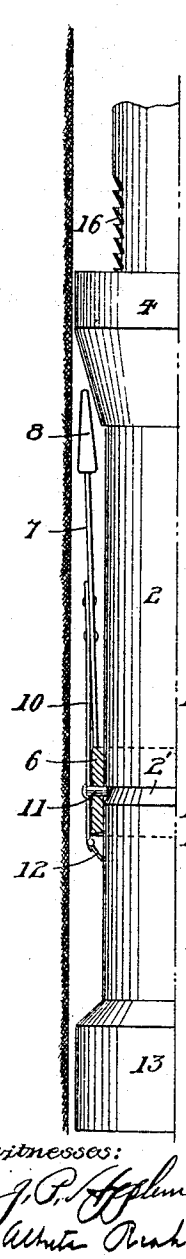


Fig. 8.

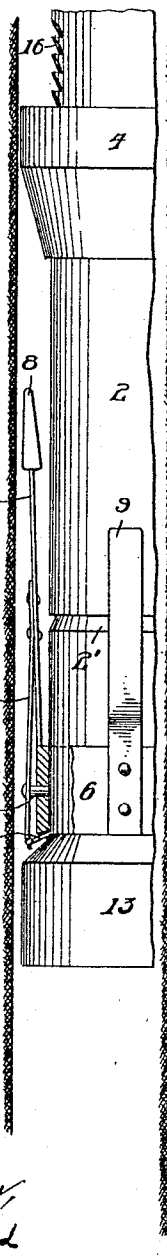


Fig. 9.

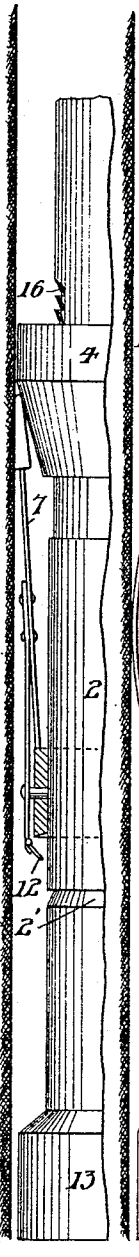


Fig. 10.

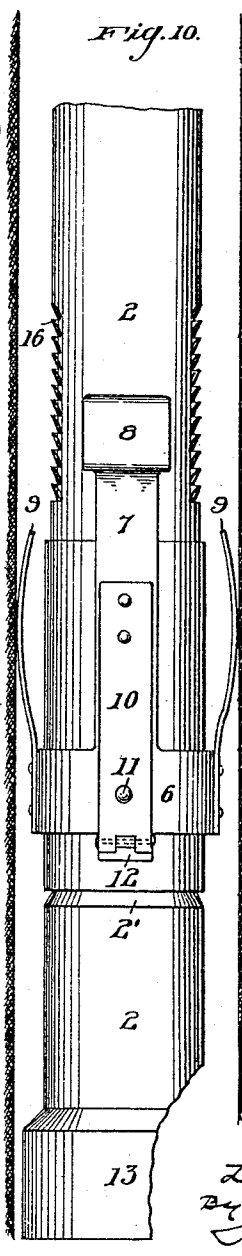


Fig. 11.

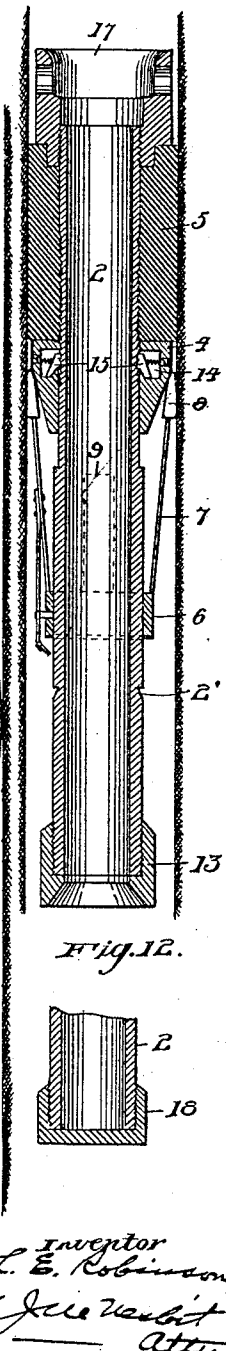


Fig. 12.

Witnesses:
J. P. Hoffleman,
Alberta Rinehard

Inventor
L. E. Robinson,
By Jno. Wesbit
Atty.

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

LAWRENCE E. ROBINSON, OF BUTLER, PENNSYLVANIA.

WELL-PACKER.

No. 881,154. Specification of Letters Patent. Patented March 10, 1908.

Application filed March 7, 1907. Serial No. 361,105.

To all whom it may concern:

Be it known that I, LAWRENCE E. ROBINSON, a resident of Butler, in the county of Butler and State of Pennsylvania, have invented certain new and useful Improvements in Well-Packers, of which the following is a specification.

One object of this invention is to provide improved means for holding compressed or packed in set position the rubber annulus of a deep well packer, whereby it cannot be dislodged by the expansive force of the rubber, or by any means other than that under the control of the operator.

A further object is to provide a double packer, that is—two packers which may be separated any desired distance, being connected by an intervening tubing, whereby a well may be packed in two places at one and the same time. An instance of this use would be that of shutting in a water bearing stratum entering either an oil or gas well, one packer being located above the water and the other below it.

A further purpose is to so arrange the packers that when setting the lower packer the upper packer operates as a rigid part or section of the tubing by means of which the packer is manipulated, means being provided for manipulating the upper packer so as to set it in an effective manner after the lower packer has been set. Conversely, in removing the packers, the mechanism operates to first release the upper packer, and then the lower packer so that both can be removed from the well.

Still a further purpose of the invention is to provide improved means for inserting the packer in a well, which means may be connected and disconnected at the pleasure of the operator. Thus, after setting the double packer in an instance like that above recited for shutting in water, or after setting a single packer, the letting-in mechanism may be removed from the well, so that, so far as manipulating the packer is concerned, it is unnecessary to leave a line of tubing in the well.

In the accompanying drawings, Figure 1 is a vertical sectional view of the double packer, partly broken away, showing the lower packer set and the upper packer expanded or unset. Fig. 2 is a similar view, showing both packers set. Fig. 3 is a sectional view of the letting-in device together with the upper extremity of the packer to which it connects. Fig. 4 is a sectional view of a portion of the upper packer, illustrating the internal construction thereof, and the relative positions of the internal parts of the fixed and movable portions of the packer. Fig. 5 is a vertical sectional view, enlarged, of the portion of the mechanism shown in Fig. 4, illustrating the position of one of the ratchet dogs, and Fig. 6 is a vertical sectional view taken on line 6—6 of Fig. 5. Fig. 7 is an elevation of the anchor mechanism carried by the lower packer, showing the adjustment of the parts when lowering the packer in a well. Fig. 8 is a similar view, illustrating the first operation in setting the anchor, and Fig. 9 is a like view of the same when set. Fig. 10 is a view taken at right angles to Fig. 9. Fig. 11 is a vertical sectional view of a single wall packer constructed in accordance with the invention, and Fig. 12 is a sectional view of the lower extremity of the packer shown in Fig. 11 when the same is utilized as a plug packer.

Referring to the drawings, 2 designates the tubular body of the lower packer, having collar 3 secured to its upper end.

4 designates the lower head or sleeve through which body 2 moves, and 5 is the rubber annulus which is compressed between sleeves 3 and 4.

The lower portion of body 2 carries the anchor mechanism which consists of ring 6 slidable on body 2 and provided with the upwardly projecting spring arms or reins 7 having the slips or wedges 8 at their upper ends which secure sleeve 4 to the well wall, as in Figs. 1, 2 and 9. Also secured to rings 6 are the outwardly bowed springs 9 which engage the sides of the hole and offer resistance to the downward movement of the packer. It is therefore necessary to provide means for holding ring 6 depressed on body 2, with slips 8 out of holding or wedging position, as in Fig. 7, while the packer is being lowered. This holding means consists of a spring arm 10 secured at its upper end to one of reins 7 and carrying a pin 11 which is movable through an aperture in ring 6 and enters groove 2′ in body 2, as in Fig. 7, thereby preventing the body from moving downward in said ring. The top face of groove 2′ forms a right angle shoulder, while the lower portion thereof tapers downwardly and outwardly, as shown. Hence, while body 2 cannot lower past the groove so long as the pin is lodged therein, the beveled lower face of the groove will permit the body to freely rise.

Hinged to the lower extremity of arm 10

is latch 12, which is normally in downwardly turned position, as in Fig. 7, with spring 10 pressing inward and holding pin 11 in groove 2′.

When the packer structure is lowered in the well into the position in which it is to be set, its movement is reversed, or in other words, it is raised slightly, and as ring 6 and the spring arms and slips carried thereby are held from raising by springs 9, packer body 2 moves upward through the ring, and causes foot piece 13 to turn latch 12 inward and upward against ring 6, as in Fig. 8, thus holding spring 10 deflected outward and preventing pin 11 from catching in groove 2′ when the packer body 2 is again lowered, as in Fig. 9. Thus, collar 4 lowers and expands slips 8, and the anchoring of the packer is made complete. When lowering body 2 from the position shown in Fig. 8 to that of Fig. 9, groove 2′ catches the upturned latch and turns it downward, so that when next the anchorage is released by raising body 2 and collar 4 (the latter from slips 8), pin 11 will again spring into groove 2′ when it comes in line therewith, and the mechanism will be in its original adjustment as when being lowered in the well, and cannot be again set without first raising, then lowering body 2, as above described. By this means the packer may be removed, or its position shifted as may be desired.

The inner wall of collar 4 is formed with channel 14, and confined in opposite portions thereof are the inwardly pressing toothed dogs 15 which engage the series of ratchet-teeth 16, formed on opposite portions of body 2. Thus, when the packer is entered in the well and collar 4 anchored, pressure from above depresses body 2, and compresses the rubber between collars 3 and 4. During this movement teeth 16 slip past dogs 15, and the latter prevent any upward movement of the body. The packer is thus permanently held in set position and the expansive force of the rubber cannot be exerted to dislodge it, nor can it be dislodged from below by anything short of a wrecking pressure.

To remove the bottom packer, it is only necessary to turn its body 2 at right angles to the position in which it is shown in Figs. 1, 2 and 11, thus disengaging teeth 16 from the dogs, and with the dogs then pressing against the intervening smooth surface of the body the latter may be drawn upward, releasing the rubber, when the packer may be removed.

While the foregoing description has been in connection with the lower packer of a double packer structure, its operation is the same as when used as a single wall packer as in Fig. 11, the only difference being that in the latter case a special form of letting-in collar 17 is substituted for collar 3, the construction and operation of which will be presently described. A cap 18, Fig. 12, may displace foot 13, Fig. 11, when the single packer is used as a plug packer for permanently closing a well.

Referring again to the double packer structure, collar 3 of the lower packer is connected by tubing 19 of any required length with bottom collar 20 of the upper packer, and extending from this collar is the tubular casing or body 21 through which the upper packer body 22 moves. The upper extremity of casing 21 forms the lower abutment for the rubber 23, while secured to the upper end of body 22 is one of the collars 17.

The upper portion of casing 21 has its inner face channeled at 24, the lower portion of the channel being inclosed by the inclined lip portion 25. Mounted in opposite sides of channel 24 are toothed dogs 26 which tilt inward over lip 25, being normally so held by springs 27. Lip 25 operates to confine the dogs within channel 24, while a pin 28, which the lower end of each dog embraces, prevents the dog from moving around in the channel. These spring-pressed dogs 26 engage the outer surface of body 22 and mesh with the vertical series of ratchet-teeth 29 formed in opposite portions of the latter when the body is so turned as to engage the same. At other times, the smooth surfaces of the body intermediate teeth-series 29 are alined with the dogs, and the body may be moved vertically as required.

Arranged at right angles to teeth-series 29 are opposite depressions or notches 30 in body 22, which when the upper packer is unset, are turned to be engaged by dogs 26, as shown in Fig. 1, thus preventing depression of body 22 in casing 21. Carried by the lower portion of body 22 is the annular ring or enlargement 31 formed with opposite vertical slots 32. Casing 21 is formed with the annular internal shoulder 33, and beneath this shoulder are the opposite inwardly projecting pins 34 which form stops for ring 32 when the packer is being drawn upward, but rotation of the packer body is not prevented until slots 32 of the ring register with pins 34, when the ring is raised into engagement with shoulder 33 and the packer body held against independent rotation.

The operations of setting and removing the double packer are as follows: When being inserted in the well, the upper packer structure is in the adjustment shown in Fig. 1, with dogs 26 in engagement with notches 30, thus preventing the upper packer from collapsing. After the lower packer has been anchored in the manner heretofore described, the weight of the structure above, augmented if necessary by pressure, compresses the rubber of the lower packer and as body 2 moves downward through collar 4 it is engaged and held by dogs 15. After the lower packer has been set, the operating or letting-

in mechanism is given a half-rotation which operates to disengage the dogs 26 from notches 30, and alines teeth series 29 with said dogs. Thus by exerting downward pressure, the latter is collapsed and body 22 rigidly held in downward position by the dogs. For removing the double-packer structure from the well, upper packer body 22 is given a half turn which disengages teeth 29 from dogs 26, when body 22 may be turned upward, relaxing and releasing the upper rubber 23. Then, while exerting an upward pull on body 22 the latter is turned until ring-notches 32 interlock with pins 34, as in dotted lines in Fig. 4, preventing further independent rotation of said body. A further turning of body 22 therefore results in the turning also of casing 21 with which it is interlocked, this turning connecting tubing 19, and body 2 of the lower packer. This movement disengages teeth 16 thereof from dogs 15, whereupon the lower packer body is free to move upward, releasing the rubber, and permitting the whole structure to be removed from the well.

While spring dogs and ratchet mechanism of the upper and lower packers have been separately described and numbered, they are identical, as are also the teeth on the packer bodies which coöperate with them.

In order to manipulate the packer without providing a permanent operating tubing extending to the top of the well, it is necessary to provide an operating means which may be connected with and disconnected from the packer at will, and which when connected may be operated to turn the packer as required in the setting and releasing operations. Under many conditions it is absolutely necessary to provide a detachable operating means, and under other conditions it is highly desirable as a matter of economy, an instance of the latter being the setting of a plug packer in a shut-in well. To this end, I provide the special form of collar 17 at the upper end of the upper packer, this collar having its interior flared upwardly and outwardly as shown, and provided at opposite sides with pin-holes 35. 36 is the lower extremity of a string of letting-in tubing having secured thereto head 37, tapered to enter the flared upper end of collar 17. Movable through openings in opposite sides of heads 37 are pins or bolts 38 secured to the lower extremities of the upwardly bowed spring 39. The arms of this spring are formed with lateral bends or off-sets 39′, the upper portion of the spring being narrower or smaller than its lower portion. The springs operate to hold pins 38 normally projected and entered in holes 35 of collar 17, thus interlocking the letting-in mechanism and the packer, and enabling the latter to be turned as required. To connect the letting-in mechanism with a packer set in a well, said mechanism is simply lowered, pins 38 being held projected by the spring. When head 37 enters collar 17, pins 38 are pressed inward until the head has been turned sufficiently to cause them to register with holes 35, when the spring forces them outward and locks the parts together.

While the packer is being let into the well and while it is being set, the upper bowed end of spring is embraced by the inverted cup-shaped device 40, which rests on offsets 39′, as shown in Fig. 2. To disengage the letting-in device a weight 41 is dropped through casing 36 and drives device 40 down over and contracts the spring, as shown in Fig. 3, retracting pins 38 and releasing the hold on the packer.

I claim:

1. The combination with a well packer, of ratchet mechanism for holding the packer compressed.

2. The combination with a well packer, of ratchet mechanism embodied in the packer structure for holding the packer compressed.

3. A packer consisting of inner and outer telescoping parts, dogs on one of the parts, and holding points on the other part adapted to be engaged by the dogs for holding the inner part against withdrawal as it passes into the outer part.

4. A packer consisting of inner and outer telescoping parts, ratchet-teeth on the inner part, and spring pressed dogs seated in the outer part which the ratchet teeth freely pass when moving inward, but which so engage the teeth as to prevent outward movement of the inner part.

5. A packer consisting of inner and outer telescoping parts with the inner part turnable in the outer part, vertical series of teeth on one of the parts interrupted by untoothed surfaces, and spring-pressed dogs on the other part adapted to engage either the untoothed or the toothed surfaces according as the inner part is turned, and when in engagement with the teeth adapted to prevent withdrawal of the inner part.

6. A packer consisting of inner and outer telescoping parts, spring-pressed dogs on the outer part, and vertical series of ratchet teeth on the inner part adapted to be engaged by the teeth, the inner part having smooth surfaces between the teeth series, whereby when the teeth are turned out of the path of the dogs the outward movement of the inner part is unrestricted.

7. A packer consisting of inner and outer telescoping parts, the inner face of the outer part having a depression, dogs in the depression and springs for pressing the dogs toward the axial line of the outer part, stop means for holding the dogs from moving circumferentially in the depression, and ratchet-teeth formed on the inner packer-part for engaging the dogs.

8. The combination of two connected packers, each packer consisting of telescoping sections, and means for anchoring the lower packer.

9. The combination of two connected packers, each packer consisting of telescoping sections, means for anchoring the lower packer, and means for preventing the sections of the upper packer from collapsing while setting the lower packer.

10. The combination of two connected packers, each packer consisting of telescoping sections, means for anchoring the lower packer, means for preventing the sections of the upper packer from telescoping while setting the lower packer, and means for locking the sections of the upper packer in telescoping relation after said packer has been set.

11. The combination of two connected packers, each packer consisting of telescoping sections—one turnable within the other, spring-pressed dogs carried by one section of each of the packers, and the other section of each packer having vertical series of ratchet-teeth interrupted by vertical smooth surfaces.

12. The combination of two connected packers, means for anchoring the lower packer, each packer consisting of telescoping sections, opposite spring-pressed dogs on one section of the upper packer with the other section of said packer formed with notches adapted to be engaged by the dogs for preventing collapsing of the upper packer when setting the lower packer.

13. The combination of two connected packers, means for anchoring the lower packer, each packer consisting of telescoping sections, spring-pressed dogs mounted on the outer section of the upper packer, the inner section thereof having vertical series of teeth on opposite sides with vertical smooth surfaces intervening between the teeth-series, the smooth surfaces each having a notch in its lower portion.

14. The combination of two connected packers, means for anchoring the lower packer, each packer consisting of telescoping sections, mechanism for each packer operating when the sections are turned into certain relation to each other to prevent withdrawal of the inner section, and means for preventing the sections of the upper packer from turning one on the other when turning the inner section of the lower packer.

15. The combination of two packers each consisting of telescoping inner and outer sections, tubing connecting the outer section of the upper packer with the inner section of the lower packer, mechanism for each packer operating when the sections are turned into certain relation to each other to prevent withdrawal of the inner section, and means for preventing the inner section of the upper packer from turning in its outer section when releasing the lower packer.

16. The combination of two packers each consisting of inner and outer telescoping sections, tubing connecting the outer section of the upper packer and the inner section of the lower packer, the inner sections being turnable in the outer sections, ratchet mechanism for each packer operating to prevent longitudinal movement of the outer part when the sections are turned in certain relation, the outer section of the upper packer having internal inward projections, and an enlargement at the lower end of the inner section of the upper packer adapted to bear upward against said projections with recesses in the enlargement for embracing the projections and holding the inner section from turning.

17. In anchor mechanism for a packer, the combination of a packer body, a slip carrier movable vertically thereon, wall-engaging springs secured to the carrier, laterally springing slips extending upwardly from the carrier, a collar on the body above the slips for spreading the latter, a vertical spring movable with the carrier, the spring being secured at its upper end and free at its lower end, a pin adapted to be held by the spring in engagement with the packer body when the packer is moving downward, a latch pivoted to the lower end of the spring, and a latch turning device at the lower end of the packer body operating when the packer body is raised to turn the latch inward and move the spring and pin outward.

18. The combination of a grooved packer body, a slip-expanding collar thereon, a carrier slidable on the body, slip bearing spring arms extending upwardly from the carrier, a spring movable with the carrier and free at its lower end, a pin secured to the spring and movable through an aperture in the carrier and adapted to enter the body-groove, a latch pivoted to the lower end of the spring, and a shoe at the lower end of the body adapted to turn the latch inward and deflect the spring outward, the parts operating as herein described.

In testimony whereof I affix my signature in presence of two witnesses.

LAWRENCE E. ROBINSON.

Witnesses:

J. M. NESBIT,

JNO. J. FITZGERALD.