To all whom it may concern:

Be it known that I, THOMAS H. GALLAGHER, a citizen of the United States, residing at Crafton, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Double Packers for Liners, of which the following is a specification.

This invention relates to packing means specially adapted for use in connection with oil wells, and more particularly to what I term a double packer for liners.

One of the main objects of the invention is to provide simple and efficient means for forming a tight closure about a liner above and below the different strata from which the oil is obtained, or for forming a tight closure above and below a cave, so as to prevent the material from falling into the lower portion of the well and clogging the same. A further object is to provide simple and efficient means for coupling the various packers to the liner in such a manner as to permit lowering of the same into the well and insure that the packing members will be properly spread when the liner is in position so as to form a tight closure with the wall of the well. Another object is to provide simple and efficient means for lowering the liner and the packers into the well, which means can be readily detached from the liner and will eliminate possibility of any of the sections of the liner or the packers becoming loosened. Further objects will appear from the detailed description.

In the drawings:

Figure 1 is a sectional view through a liner and two of the packers and associated parts showing the means for lowering the liner and packers into the well;

Figure 2 is a horizontal section taken above one of the couplings, looking down;

Figure 3 is a vertical section through the outer coupling member and the end portion of the liner;

Figure 4 is an elevation of the inner coupling member;

Figure 5 is a section through one of the packers and associated parts showing the packer in spread or operative condition;

Figure 6 is a section through the upper portion of the upper packer, the tubing being shown in elevation;

Figure 7 is a vertical sectional view through a well showing the packers as applied.

The packers are adapted to be used in connection with a liner of a known type which may be formed in a plurality of sections which are connected by the packers.

Each packer includes a tubular member 3 which is secured at its upper end in a collar 4 into the upper end of which is threaded the lower end of the superjacent section 1 of the liner. Member 3 is slidable into the upper end of the subjacent section 1 of the liner and is provided, at its lower end, with a coupling member 5 threaded at 6 on member 3. Coupling member 5 fits beneath an inner annular flange 7 provided at the upper end of an outer coupling member 8 which is threaded at 9 on the upper end of liner section 1. Member 5 is provided with a plurality of upwardly projecting lugs 5 which are adapted to fit into corresponding recesses 7 formed by cutting away flange 7. The coupling thus produced permits tubular member 3 to slide into the subjacent section 1 of the liner while effectually preventing complete withdrawal of this member from the liner. When the tubular member is raised position lugs 5 engage into recesses 7, these members co-operating to lock the liner and tubular member 3 against independent rotation. A packing member 10 of rubber or other suitable elastic material fits snugly about member 3 and is positioned between the lower end of collar 4 and the upper end of member 8.

At the upper end of the packer at the top of the liner, collar 4 is replaced by a heavier collar 4 having its upper end ground to provide a downwardly tapersing seat. This collar is also bored and threaded to receive the threaded body 12 of a nipple 12 the neck 12 of which is threaded onto the lower end of a suitable length of tubing 13. The threaded connection between the body of nipple 12 and collar 4 is left handed, all of the other threaded connections being righthanded. In practice, the sections of the liner and the various packers are assembled in the manner illustrated in Figure 1 and are lowered into the well by means of tubing 13. The packers are placed so that, when the liner is in position, the packers will be positioned above and below the various oil bearing sands or strata S, the liner between the packers and at the bottom of the
well being perforated to permit the oil to flow into the well from which it may be removed by any suitable pumping mechanism through tubing 12° supported in the liner, or in any other suitable or preferred manner. When the liner and the packers associated therewith have been lowered into the well by means of tubing 13, the tubing is rotated so as to unscrew body 12° of nipple 12 from collar 4°. During this operation the tubular members 3 of the various packers are raised so that members or lugs 5° engage into recesses 7° thus locking the packers against rotation and permitting the nipple to be unscrewed from collar 4°. As the thread on body 12° of nipple 12 is lefthanded, and all the other threaded connections employed are righthanded, this effectually eliminates any possibility of loosening of any of the connections. When nipple 12 is disconnected from collar 4° the tubular members 3 of the packers 2 slide downwardly into the sections of the liner, this setting or expanding the packers, the elastic packing members 10 contacting with the upper ends of outer coupling members 8 also serve as cushion members to absorb shocks due to dropping of the packers and associated parts. After tubing 13 has been withdrawn the tubing 13° is lowered into the well and through the liner and packers. A frusto-conical plug 14 is secured about the tubing 15° beneath a collar 15° and is secured to a plate 16 by means of screws 16 and nuts 17 between which plate and the plug is confined a rubber packing ring 18 which fits tightly about tubing 13° so as to eliminate any possibility of leakage between the tubing and the plug. A packing gasket 19 in the form of a thick band of rubber or other suitable material is set into a channel extending about the lower portion of plug 14 and, when the plug is in position, is forced tightly against seat 11 and held securely in position by the weight of the tubing and associated parts which are supported upon plate 15 by means of collar 15°. As bolts 16 are slidable through plate 15 the weight of the tubing and associated parts also acts to spread packing ring 18 radially so as to insure a fluid tight closure about tubing 13°. The weight of the tubing and associated parts exerts downward pressure upon the packing members 10 of the respective packers and serves to cause radial expansion of members 10 thus forcing the same into tight contact with the surrounding wall of well W (Figs. 5 and 7). This also serves to force the packing members into tight contact with the respective tubular members 3 and to hold the packing members tightly against the upper ends of the coupling members 8. In this manner the well is effectually packed or closed above and below the various oil bearing strata or sands, and may also be packed in a similar manner above and below a cave C. This effectually eliminates all possibility of clogging or choking of the well due to materials from the softer strata falling into the well such as frequently occurs in wells employing the present type of liner not provided with packers such as that illustrated and described herein.

With the oil and gas bearing sands protected as above described the oil or gas may be obtained without hindrance from all of the producing sands in a well during the life of the sands. In some cases one packer placed on the upper end of the liner above the oil or gas bearing sand or sands would be sufficient to protect the sand below against water or scaling from the strata above. In other cases packers placed in the liner above and below a cave would be sufficient to protect the oil or gas sands below, but where the strata between the sands was of such nature as to cause the wall of the well to scale it would be necessary to place a packer both above and below the upper sands. Finally when the production has been reduced to a point where oil or gas can no longer be obtained in paying quantities, the tubing together with the packing members on the upper end of the upper packer can readily be withdrawn, leaving the liner in the bottom of the well with the packers in position above or below the sands and with the upper end of the liner open to receive cement or other materials from above in the process of plugging the well. When the liner has been suitably filled a wooden or other suitable plug is then set or driven into the upper end of the liner and after the well is cemented a suitable distance above the plug it will be tightly sealed so that it will be impossible for water to seep downward or for gas to escape upward from any of the sands below. It is important to consider this feature in connection with my invention as in many cases the cost of plugging a well by the present methods from the bottom of the well up to the point described above greatly exceeds by far the actual cost of the liner and the packers left in the well for plugging purposes.

What I claim is:

1. In packing means, a plurality of liner sections, packers connecting said sections and having threaded connection with the lower ends of the respective sections, collars threaded on the upper ends of the respective sections and each provided with an inner annular flange cut to provide recesses, each of the packers including a tubular member slidable through said flange, and a collar threaded on the tubular member beneath the flange and having projections adapted for engagement into said recesses, the connections between the packers and the lower ends of the liner sections and between the
collars and the upper ends of the liner sections and the tubular members being similarly threaded, the uppermost packer being adapted at its upper end for reception of a member threaded oppositely to said connections for lowering the liner and associated parts into a well and disconnecting said oppositely threaded member without loosening any of the threaded connections of the liner and packers.

2. In packing means, a plurality of liner sections, packers connecting said sections and having threaded connection therewith, the connections between the packers and the liner sections being similarly threaded, and a packer connected to the upper end of the top liner section and adapted for reception of a member threaded oppositely to said connections, the packers and the liner sections being provided with cooperating means for locking the same against independent rotation.

3. In packing means, a tubular member having a tapered seat, a frusto-conical plug provided with a packing member fitting in to said seat, a plate above the plug, tubing extending through the plate and plug and supported by said plate, and an elastic packing collar surrounding the tubing and positioned between the plate and plug, the weight of the tubing acting to expand the collar and produce a fluid tight closure between the collar and the plate and plug and the collar and the tubing.

In testimony whereof I affix my signature.

THOMAS H. GALLAGHER.