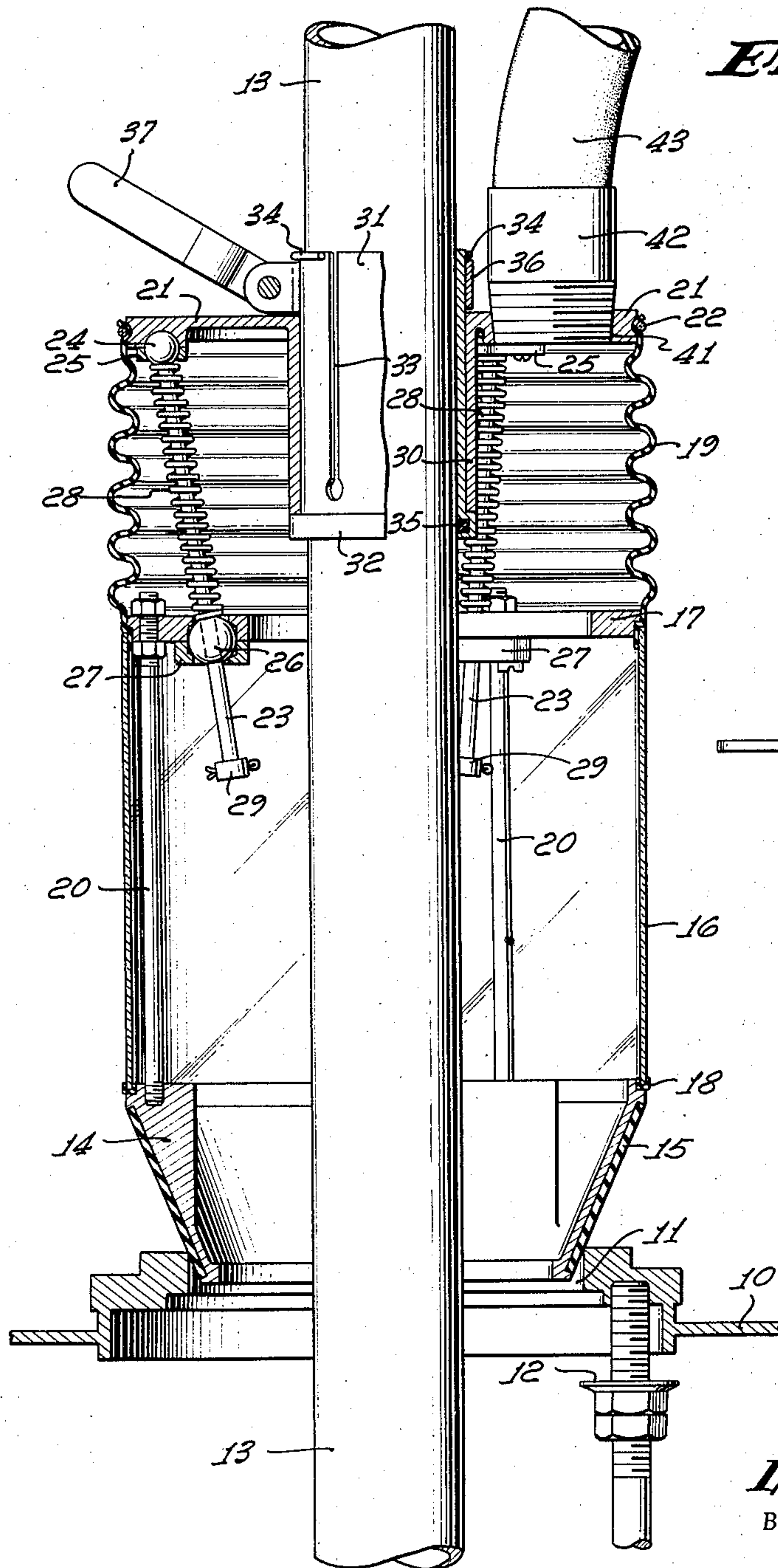


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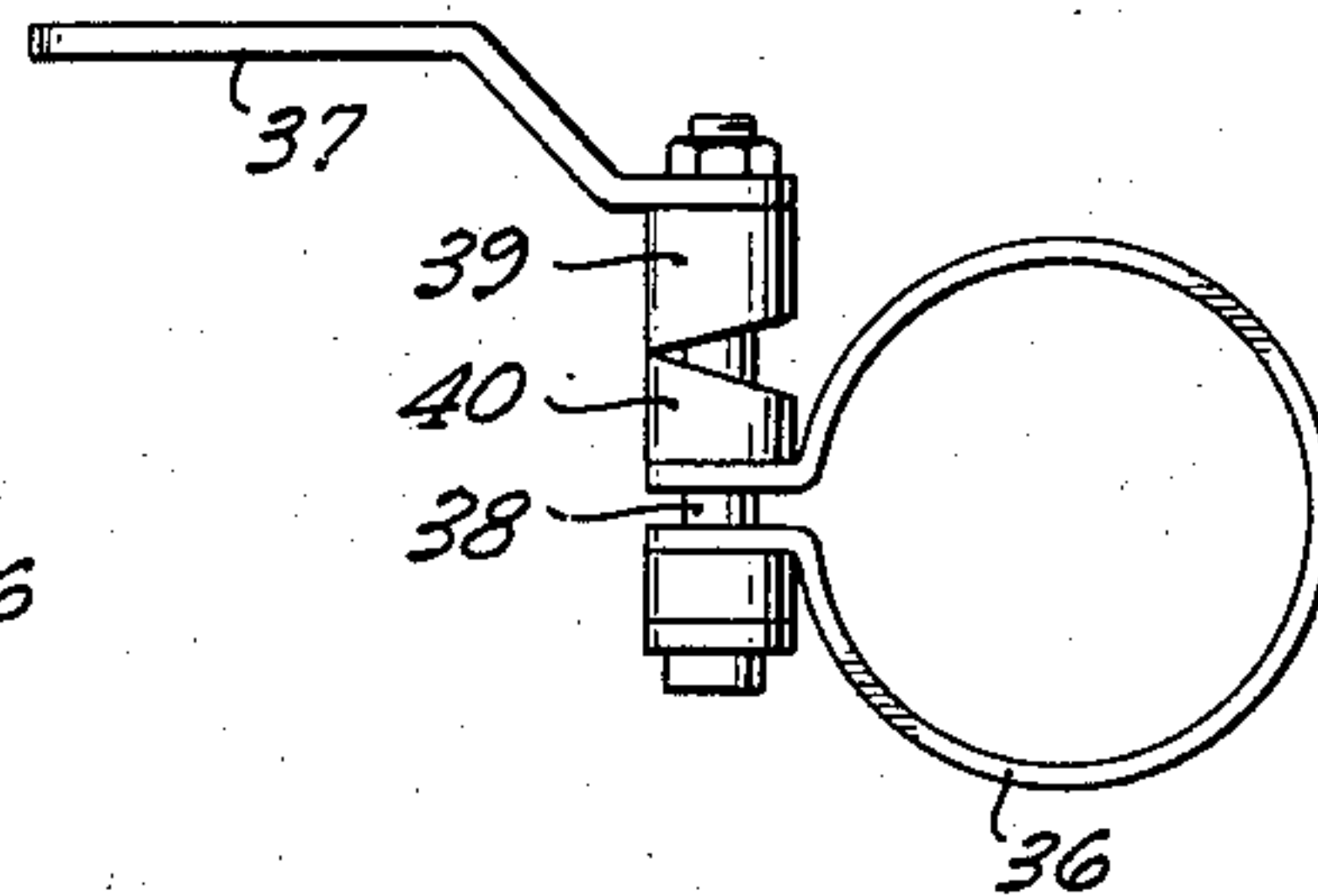
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VAPOR-RECOVERY HOOD  
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*Fig. 1.*

*Fig. 2.*



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## VAPOR-RECOVERY HOOD

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2 Claims. (Cl. 141—95)

This invention relates to recovery of vapors during the loading of volatile liquids into containers and it more particularly relates to recovery of hydrocarbon vapors while gasoline is being loaded into a tank truck.

When a tank truck returns empty to a loading rack for a new cargo, the space within its tanks is ordinarily saturated with gasoline vapor. In the past, when gasoline was pumped into a tank, the vapor displaced by the inflowing liquid was allowed to escape to the atmosphere. It is believed that the discharged hydrocarbon vapor has contributed to the unpleasant and perhaps harmful atmospheric pollution occurring in certain heavily populated areas, and it undoubtedly has aggravated the fire hazard existing in the vicinity of loading racks and has constituted a loss of substantial quantities of valuable hydrocarbons.

Equipment for recovery of the displaced vapor must include means for closing the annular space between the rim of the filling port or "manhole" of a tank and the gasoline-carrying pipe which is inserted into the tank through that port. It has been a difficult problem to provide reliable and convenient closure means, capable of functioning satisfactorily regardless of the exact position of a tank truck with respect to the loading rack. The problem has been further complicated by the necessity of providing for observation (direct or indirect) of the liquid level within the tank and of the gauge marker which indicates the minimum permissible outage.

An object of my invention is to provide closure means for tank trucks at loading racks which is capable of forming and maintaining a secure seal in spite of moderate variation in the position of trucks with respect to a loading rack.

Another object of my invention is to provide a closure means for tank trucks at loading racks, having a transparent portion to permit direct observation of the liquid level.

Further objects and advantages of my invention will be apparent from the following description and from the drawing, in which:

Fig. 1 is a sectional view of the device in operative position; and

Fig. 2 is a view of the strap clamp which forms a part of the device.

Referring to Fig. 1, 10 is a fragment of the upper part of the shell of a vehicular tank, provided with a filling port or so-called manhole 11 and a gauge marker 12 placed at the height of the maximum permissible liquid level.

A fragment of filling pipe 13 is shown in position for introducing gasoline into the tank. The filling pipe is customarily a rigid tube attached by a swivel joint to the end of an overhanging pipe which is attached to a supply pipe by another swivel joint, a structure which permits the filling pipe to be inserted into the manhole regardless of the exact position of the tank truck with respect to the loading rack, but which does not permit

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the pipe always to be precisely vertical or at any other predetermined angle.

A plug for the opening consists of a tapered casting 14 faced with a resilient layer 15 preferably made of an oil-resistant rubber such as neoprene. A cylinder 16 of of transparent material resistant to fogging by gasoline vapor is mounted above the tapered plug. The available flexible transparent materials have not proved to be satisfactory in this service, so I prefer to employ a synthetic methacrylate resin (Plexiglas, Lucite, etc.) for the cylindrical member.

The transparent cylinder is held in place by ring 17, the lower end of the cylinder being sealed by gasket 18, made of neoprene or the like, and the upper end being sealed by placing the cuff of flexible tube 19 between the cylinder and ring 17. Ring 17 is bolted to tapered casting 14 by three tie bars 20—20.

The wall of flexible tube 19 is sinusoidal in longitudinal section, and is made of or coated with gasoline-resistant material. Such tubes are commercially available (for example, under the trademark "Spiratube") with soft cuffs at both ends, and that is the form most conveniently incorporated into the herein disclosed structure. The cuff at the upper end of tube 19 is affixed to the periphery of bonnet 21 by ring clamp 22.

Three rods 23—23 are provided with balls at their upper ends as at 24, these balls are fitted into sockets in the under surface of bonnet 21 near the periphery, and they are held in place by ball-joint covers 25—25. Three other balls, one of which appears at 26, have holes drilled through them to fit freely over rods 23—23. These balls are fitted into shouldered holes provided in ring 17 and are held in place by ball-joint covers 27—27. The distance between these latter balls and the center of ring 17 is considerably less than the distance between balls 24 and the center of bonnet 21; this improves the mobility of bonnet 21 with respect to the lower rigid portion of the assembly. The portions of rods 23—23 between the two balls on each rod are surrounded by helical springs 28—28, and stop collars 29—29 are affixed to the lower ends of the rods.

The inner portion of bonnet 21 consists of a downwardly extending cylinder 30 having an inside diameter somewhat greater than the outside diameter of pipe 13. Inside of cylindrical portion 30 fits collet 31 which has at its lower end a flange 32 fitting against the lower end of cylinder 30. Collet 31 is slotted in one or more places, as at 33, to permit the collet to be clamped to pipe 13. Bonnet 21 and collet 31 form an essentially rigid structure which is capable of transmitting downward force to springs 28—28 and thence through ring 17 and bars 20—20 to tapered plug 14, thus maintaining a secure closure. This structure having been assembled, short pieces of wire 34—34 are soldered to the outer surface of collet 31 at the upper end to prevent disassembly of the device while in service. The inner surface of collet 31 is provided with an annular groove to receive O-ring seal 35.

A strap clamp, more clearly illustrated in Fig. 2, surrounds the portion of collet 31 which extends above bonnet 21. This clamp comprises a circular strap 36 having outwardly turned ends, a handle 37 affixed to stem 38, a cam 39 permanently affixed to handle 37 as by soldering, and a cam 40 similarly affixed to one of the outwardly turned ends of strap 36.

Bonnet 21 is provided with a second opening 41 which has pipe threads to receive the end fitting 42 of hose 43. The hose communicates with a storage space for recovered vapor, such as the vapor space in the tank from which gasoline is supplied to the loading rack.

To put the device into use, it is screwed onto the end fitting 42 of hose 43 and then, with clamp 36 in the



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released position, pipe 13 is put through the device by way of the opening in collet 31. Then pipe 13 is inserted deeply into an empty tank truck standing at the loading rack, with the pipe sliding freely through collet 31. Pipe 13 being thus positioned, bonnet 21 is pushed downwardly until plug 14 is firmly seated on the rim of the manhole, the pressure being transmitted through springs 28—28 and bars 20—20. When this is accomplished, clamp 36 is tightened and gasoline is pumped into the tank truck through pipe 13, while displaced vapor flows through hose 43 to storage. At least in the later stages of the filling operation, the operator watches the liquid level and gauge marker 12 through transparent cylinder 16. If pipe 13 happens to be in a position which obstructs the operator's best view of the gauge marker, it can be pushed to one side without disturbing the closure; this is because bonnet 21 is freely movable within limits in any direction with respect to plug 14 without destroying the approximate balance of pressure against the plug. When the liquid level reaches marker 12, the operator shuts off the flow of gasoline into the tank or signals a co-worker to do so. Then the pipe is withdrawn from the tank, the manhole is closed by its cover, and the truck is moved away to make room for another.

When a truck is of considerably different size than that of its predecessor, or in a considerably different position, it may be necessary to change the position of the closure means on the filling pipe. This is easily accomplished by releasing clamp 36, moving the device to the required position on the pipe, and then tightening the clamp.

The dimensions of plug 14 are so chosen that the plug will fit the smallest manholes which are expected to be encountered, which at this time are eight inches in diameter, and also somewhat larger manholes. For using the device with tank trucks having manholes larger than the greatest diameter of plug 14, an adapter ring is placed between the plug and the rim of the manhole.

I claim as my invention:

1. A device for preventing the escape of vapor during the loading of gasoline through a movable pipe into a tank

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having a filling port at the top, comprising: a rigid structure adapted to fit around said pipe and to be attached thereto; a plug adapted to form a seal with the rim of said port, said plug having a central opening much larger than the cross section of said pipe; a transparent cylinder having one end affixed to the periphery of said plug; a flexible tubular wall connecting the other end of said cylinder with said rigid structure, said cylinder and said flexible tubular wall being arranged to establish a confined space between said plug and said rigid structure; means, elastic at least in part, for transmitting mechanical pressure from said rigid structure to said plug and for distributing said pressure around the periphery of said plug; and an outlet for said confined space adapted for connection with a conduit for vapor.

2. A device for preventing the escape of vapor during the loading of gasoline through a movable pipe into a tank having a filling port at the top, comprising: a rigid structure adapted to fit around said pipe and to be releasably attached thereto, said structure being provided with an opening adapted for connection with a conduit for vapor; a plug adapted to form a seal with the rim of said port, said plug having a central opening much larger than the cross section of said pipe; a transparent cylinder having one end placed against the periphery of said plug to form a seal therewith; a ring placed against the other end of said cylinder; means for attaching said plug, said cylinder, and said ring together into a rigid assembly; a flexible tubular wall connecting the latter end of said cylinder with the periphery of said rigid structure to establish a confined space therebetween; and springs arranged to transmit mechanical pressure from said rigid structure to a plurality of points distributed circumferentially around said ring.

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