March 17, 1959 C. B. CHASE ET AL 2,877,902

OIL FILTERS

Filed March 1, 1956 2 Sheets-Sheet 1

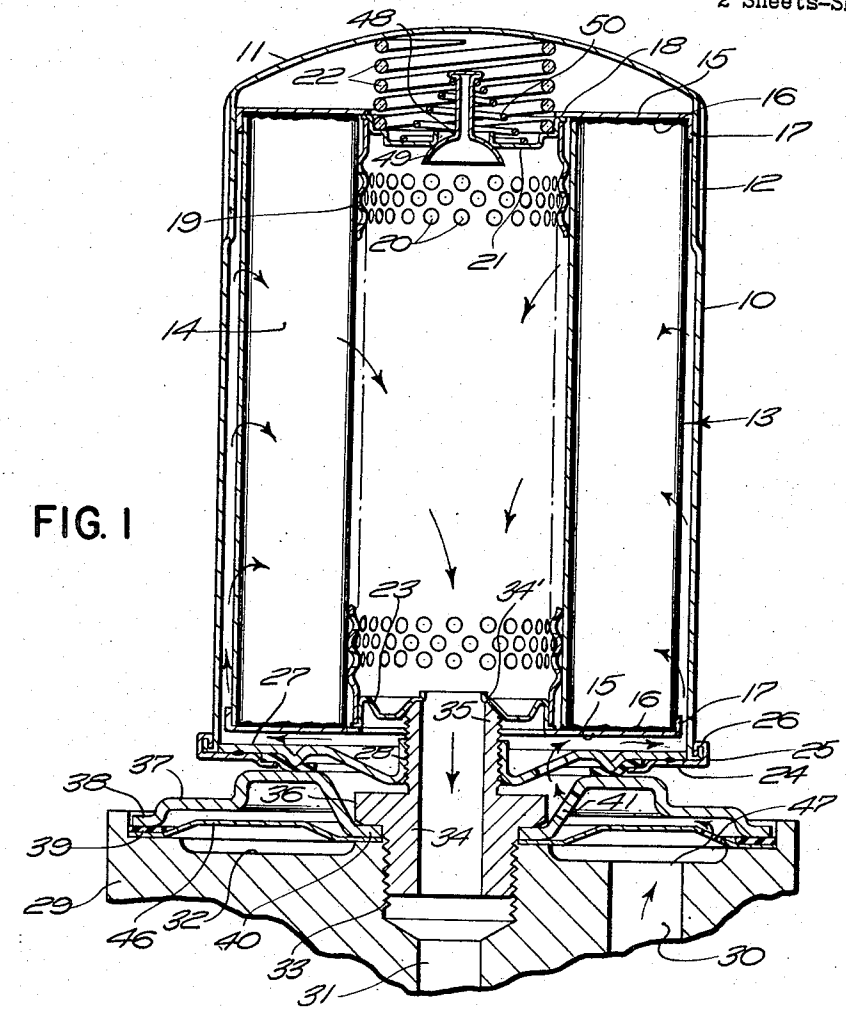

FIG. 1

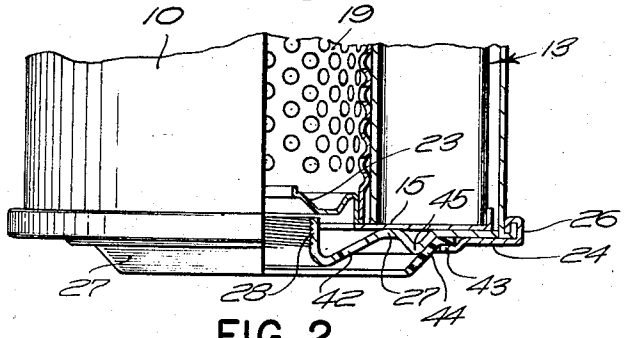

FIG. 2

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FIG. 3

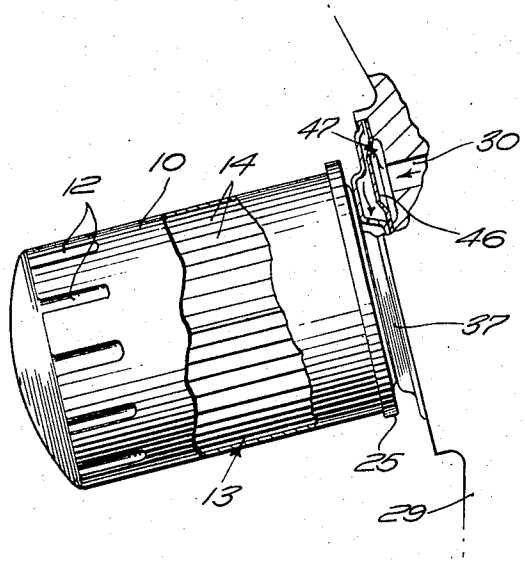


FIG. 4

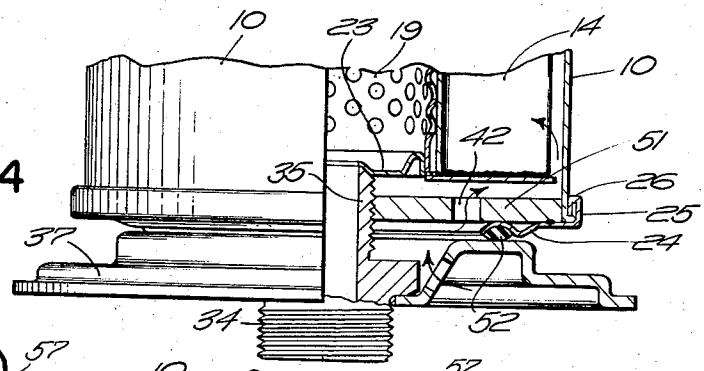


FIG. 6

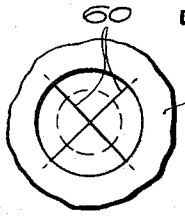
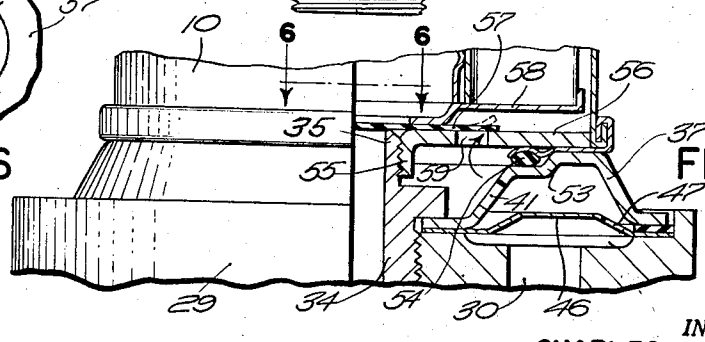


FIG. 5



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OIL FILTERS

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4 Claims. (Cl. 210—440)

This invention relates to oil filters of the throw-away type in which the filter cartridge is permanently secured inside the filter shell, and more particularly to a full-flow filter of the throw-away type which can be easily and quickly screwed into its operating position.

In the throw-away type of oil filter, it is important that the outer shell that houses the filter cartridge be made of inexpensive material such as thin sheet metal so as to keep down the cost of this replaceable filter. Furthermore, if this filter is of the full-flow type, as herein contemplated, it is important to so construct the thin metal shell that it will withstand a high internal pressure, such as 100 pounds or more per square inch.

The primary object of the present invention is to provide a full-flow, screw-in, throw-away type of oil filter, the outer shell of which is made of thin metal drawn into the shape of a cup and has the open end thereof sealed so that it will withstand a high internal oil pressure. In this construction the center post that is relatively expensive, and is usually employed is omitted.

Another feature of the present invention resides in an oil filter of this type which has an oil inlet and oil outlet at the same end of the shell, and more particularly a filter wherein the shell has the form of a cup and has a closure plate which is secured to the shell by a rolled seam that interlocks the end of the shell with the outer periphery of the closure wall. In such a construction the problem arises as to how to form this rolled seam so as to secure an oil-tight joint that is strong enough to withstand an internal pressure of 100 pounds or more.

This is accomplished in accordance with the present invention by providing inside the shell in contact with the end wall which is to close the open end of the shell, a relatively thick metal plate that contacts and reinforces such end wall. The outer periphery of this plate forms a back-up surface which serves to back up the rolled seam as it is formed to secure the end wall to the cup-shaped shell. This reinforcing plate is provided with a central hole and a concentric threaded portion that forms the screw-in part of the filter shell.

Still another feature of the present invention resides in an adaptor plate that forms a seat upon which the filter rests when it is in its operating position, and in a gasket which is secured in place between this plate and the end of the filter shell to provide a seal between them.

The above and other features of the present invention will be further understood from the following description when read in connection with the accompanying drawings; wherein:

Fig. 1 is a vertical sectional view through one embodiment of the oil filter of the present invention.

Fig. 2 is a side view with parts in section of part of the oil filter of Fig. 1 before it is secured in its operating position.

Fig. 3 is a side elevation of the filter of Fig. 1 shown in the inclined position in which it may be mounted upon an engine block.

Fig. 4 is a side view with parts in section of a modification of the filter shown in Fig. 1.

Fig. 5 is a view similar to Fig. 4 showing another modification; and

Fig. 6 is a plan view taken on the line 66 of Fig. 5 and shows a no-drip oil valve.

Referring to the embodiment of the invention shown in Figs. 1, 2 and 3, the oil filter has a cup-shaped outer shell 10 preferably formed of thin sheet metal drawn to the shape shown in the drawings. This shell has a rounded integral end portion 11, and the cylindrical portion of the shell 10 near this end 11 is preferably provided with the inwardly deflected ribs 12 which serve a purpose to be described.

Within the oil filter shell 10 is housed a filter cartridge 13 which may be variously constructed, but is shown as a pleated type of oil filter formed of a pervious sheet material such as paper that is provided with pleats 14 which extend lengthwise of the cylindrical-shaped cartridge. This pleated cartridge may be of well-known construction and is provided at each end with a closure plate 15 which is firmly bonded to the ends of the pleats 14 by any suitable adhesive or bonding agent 16. Each plate 15 has an outer peripheral flange 17 which embraces the outer folded edges of the pleats 14 as shown, and each plate is provided with a central opening which is smaller in diameter than the inner diameter of the cartridge 13, so as to provide the inwardly extending annular lip 18.

Within the cartridge 13 is provided a center tube 19 which is preferably made of thin metal having its wall apertured as indicated by 20 for the passage of oil therethrough, and the walls of this tube are preferably corrugated as shown throughout most of its length to impart added stiffness to the tube. Each end of this center tube is disposed adjacent an annular lip 18 as shown. This construction serves to retain the center tube in place within the pleats so that the center tube will internally reinforce the cartridge against the pressure exerted upon the pleats when the oil flows in an outside-in direction as indicated by the arrows.

The cartridge 13 is shown as provided at the end thereof that lies near the wall 11 with a closure disc 21 which has an outwardly extending annular flange that rests on an end of the center tube 19 below the lip 18. This closure disc preferably has the offset construction shown which is adapted to snugly embrace one or more coils of a heavy spring 22 that is confined between this disc and the end 11 of the filter shell, and serves continuously to urge the cartridge away from the end wall 11. The opposite end of the cartridge is provided with a somewhat similar disc 23 which has an outwardly extending annular flange that seats on the adjacent end of the center tube, and this end disc which is slightly cup-shaped fits snugly in the bore of the center tube and has a central opening through which oil is discharged. When the filter so far described is not secured in its operating position, the end walls 15 of the cartridge will rest against the adjacent end wall of the filter shell under the pressure of the coil spring 22 as shown in Fig. 2.

The cartridge so far described, for the most part, is of well-known construction. The purpose of the ribs 12 above mentioned is to engage the outer flange 17 of the cartridge and center this end of this cartridge within the shell 10. As above stated, an important feature of the present invention is to so construct the shell that it can be inexpensively manufactured and the open

end of the cup-shaped shell can be closed so as to withstand high internal pressures.

This is accomplished in the construction shown in Figs. 1 and 2 by providing a closure wall 24 formed of thin sheet metal and which has a large central opening as shown. This closure wall is somewhat larger in diameter than the cylindrical shell 10 so as to provide sufficient metal at the outer periphery of this wall 24 to enable it to be bent laterally over the shell, as indicated at 25; then in a reverse direction toward the shell, as indicated by 26, and inwardly, so as to cause this portion of the wall to interlock with an outwardly bent portion at the end of the cup-shaped shell to form the locked seam shown in Figs. 1 and 2. It is practically impossible, however, to make this seam tight and strong enough to withstand a high internal pressure unless some means is provided for internally supporting the seam while it is being rolled to effect a tight gripping action between the interlocking portions of the shell 10 and the wall 24. If desired, a film of a suitable bonding agent may be provided between the parts forming this rolled seam 25, 26.

This difficulty of backing up the seam is overcome in accordance with the present invention by providing at the inner face of the closure wall 24 a relatively heavy reinforcing plate 27, the outer periphery of which abuts against the seam just mentioned, and serves to back up this seam while it is being formed. This plate 27 is preferably spot-welded or otherwise strongly secured to the wall 24, and it is provided with a central opening and with a concentric threaded portion adapted to be screwed upon threaded supporting means, to thereby support the oil filter in its operating position. In the embodiment shown in Figs. 1 and 2 the heavy plate 27 has its central portion thereof bent laterally into the shell to form the internally threaded sleeve 28. However, this threaded portion of the plate 27 can be variously formed as hereinafter pointed out.

Having described the principal features of the oil filter shell and the means for tightly closing an end of the cup-shaped shell after the cartridge 13 is mounted therein, one form of means for supporting this shell adjacent an engine block or other casting in operating relation therewith will now be described.

In Figs. 1 and 3 of the drawing the numeral 29 designates portion of a casting, such as part of an engine block, which is bored to provide an oil passage 30 that is supplied with oil from the usual oil pump, and an oil passage 31 through which oil is returned to the engine block. In the present case the passage 31 leads directly to the engine bearings, as is customary when the oil filter is of the full-flow type as herein contemplated. This block 29 as shown is provided with the annular recess 32 which allows the oil from the passage 30 to encircle the internally threaded bore 33 of the block, and which bore serves to receive an adaptor bushing 34. This bushing as shown has an externally threaded portion adapted to engage the threads 33 and a second externally threaded portion 35 that extends into the filter shell to engage the threads within the sleeve portion 28. This bushing 34 has the central oil passage shown and an outwardly extending shoulder 36 which may be of hexagon shape to receive a wrench so that this bushing can be screwed tightly into the engine block.

In the construction shown an annular adaptor plate 37 formed of relatively thick metal is provided to fit within an annular recess portion of the block 29, and this adaptor plate has an outer offset flange portion 38 adapted to seat upon the gasket 39 as shown. This plate also has an inner flange portion 40 which is preferably clamped in its operating position by the shoulder 36 of the adaptor bushing. The adaptor plate serves to confine the oil that enters the annular passage 32 from the oil pump and serves also to form a seat upon which the oil filter may rest. This adaptor plate is provided with a plurality of holes 41 through which oil may flow from the passage 32 in the direction indicated by the arrows to enter a space between the plates 27 and 37, and then passes through holes 42 formed in the plate 27 to enter the oil filter shell and flow around the cartridge as indicated by the arrows.

It is important that an oil-tight seal be provided between the plates 27 and 37. This is accomplished in the construction shown in Figs. 1 and 2 by providing the closure wall 24 with the inner annular lip 43 adapted to grip a portion of a rubber gasket 44 to secure this gasket in place so that a substantial portion of such annular gasket will lie between the adaptor plate 37 and a protruding annular rib 45 of the reinforcing plate 27 to grip firmly the gasket therebetween as shown in Fig. 1. Other means may be provided for holding the gasket in place, as hereinafter pointed out.

In employing the construction so far described, the adaptor bushing 34 is screwed tightly into the threaded portion 33 so as to firmly clamp the adaptor plate 37 in place. The oil filter of the present invention may then be easily and quickly secured in its operating position by simply grasping the filter shell in one hand and screwing it onto the threaded portion 35 of the adaptor bushing until the gasket 44 is tightly compressed between the plate 37 and annular rib 45 of the plate 27, so as to provide an oil-tight seal therebetween. In operation, oil will enter through the passage 30 and travel in the direction shown by the arrows to flow through the pores of the pleated filter element 13 to pass into the center tube 19, and then downwardly through the central tube to the adaptor bushing 34 as indicated by the arrows. When the filter is in the operating position in which it is shown in Fig. 1, the disc 23 within the center tube will seat upon the inwardly protruding end 34' of the adaptor bushing 34 as shown, so that this end of the bushing will hold the cartridge in spaced relation to the reinforcing plate 27 as shown so that the oil may flow freely between these surfaces as indicated by the arrows. The heavy coiled spring 22 will hold the cartridge firmly seated on the adaptor end 34'.

It is desirable to provide means whereby oil will not drain out of the oil filter when the oil pump is idle. This is prevented in the construction shown by providing a thin metal disc 46 which is clamped between portions of the casting 29 and the annular portions 38 and 40 of the adaptor plate 37 as shown. This anti-flow-back plate 46 is provided with a single oil hole 47 which is disposed so that when the filter is mounted in the inclined position in which it is shown in Fig. 3, this hole 47 will lie at an elevated position so that oil within the filter shell below this hole will not drain out by gravity back to the oil pump through the passage 30.

When a full-flow oil filter cartridge is used, it is important to provide a relief valve which will permit oil to by-pass the cartridge when such cartridge has become plugged with dirt. The present cartridge is provided with a simple and inexpensive type of relief valve which is associated with the closure disc 21 located at that end of the cartridge which lies near the end 11 of the shell. This disc 21 has a comparatively small central opening in which is seated a valve member 48 that is shaped somewhat like a collar button and has an annular end portion 49 which is normally held seated against the plate 21 so as to close the central passage through this plate. This valve 48 is held yieldingly in its closed position by a helical spring 50 which is confined between one face of the disc 21 and a head on the other end of the valve member 48. The arrangement is such that when a predetermined pressure has developed within the shell, the pressure of the oil against the rounded portion 49 of the valve will unseat this valve and allow the oil to by-pass the cartridge and enter the center tube 19.

Now turning to the modified embodiment of the invention shown in Fig. 4, the construction here illustrated

is very similar to that shown in Figs. 1, 2 and 3 except that the heavy reinforcing plate 27 of Fig. 1 has been replaced by a flat disc-like reinforcing plate 51. This plate 51 is provided with a central hole which is internally threaded to receive a correspondingly threaded portion 35 of the adaptor bushing, and the outer periphery of the plate 51 rests against and serves to back up the seam 25, 26 when pressure is exerted upon this seam to tightly close the seam. In other respects the construction shown in Fig. 4 is substantially the same as that shown in Fig. 1, except that in Fig. 4 the sealing gasket 52 is held in its proper position by forming the end wall 24 with the annular recessed portion shown that provides a seat for this gasket.

In the modified construction of Fig. 5 the adaptor plate 37 is formed with a shoulder portion 53 which helps retain the sealing gasket 54 in place, and in this view the heavy reinforcing plate above mentioned is mounted within the filter shell and has a threaded central sleeve 55 that is reversely bent from the sleeve 28 shown in Fig. 1. This brings the inner face of the reinforcing plate 56 of Fig. 5 into approximately the same plane as the protruding end 34' of the adaptor bushing 34 and forms a flat surface upon which a rubber sheet 57 may rest. This rubber sheet is held in place by the downward pressure of an end plate 58 of the cartridge. The purpose of this rubber sheet 57 is to overlie the oil inlet holes 59 so that this rubber sheet may move, as indicated by the dotted line position, to permit the entrance of oil, and will move into its full line position to prevent oil from leaving the filter shell through these holes 59. The purpose of this is to prevent the escape of oil from the filter while it is being removed from its operating position. The loss of oil at this time may be further prevented by providing the rubber sheet 57 which overlies the bore within the adaptor bushing 34 with crossing cuts 60 as shown in Fig. 6. These cuts will flex to permit oil to escape from the filter shell under normal filtering operations but will prevent the oil from flowing by gravity out of the filter shell when the same is unscrewed from its operating position.

It will be seen from the foregoing that the heavy reinforcing plate 27, 51 or 56 can be variously formed and that its outer periphery serves to back up the seam 25, 26 as this seam is formed into a tight joint. It will also be apparent that this plate is the main load-carrying member of the filter and provides the means for securing the filter to its support so that no oil leakage will occur therebetween. The adaptor bushing 34 forms one good practical means for supporting the oil filter, but it will be apparent that other means to this end may be provided.

Having thus described our invention, what we claim and desire to protect by Letters Patent is:

1. An oil filter of the screw-in throw-away type having at one end thereof an oil outlet and a surrounding oil inlet passage; comprising an oil-tight shell having an integral end that transmits to the shell walls the entire fluid pressure upon said end, a filter cartridge in the shell, a reinforcing plate thicker than the shell stock within the shell and having a threaded central portion for engagement with a support for the filter, a thin metal end closure abutting against said plate and secured to the shell by a rolled seam that is backed up by the outer periphery of said plate, and an annular oil passage surrounding said threaded central portion and from which oil enters the shell.

2. An oil filter of the screw-in throw-away type having at one end thereof an oil inlet and an oil outlet, comprising an oil-tight shell having an integral end that transmits to the shell walls the entire fluid pressure upon said end, a filter cartridge within the shell, a reinforcing plate secured to the oil-receiving end of the shell to impart rigidity thereto and having a central opening and concentric threads, an adaptor bushing having a central oil passage and threaded at one end to engage a supporting casting and threaded at the other end to engage the threads of said plate as the filter shell is screwed thereon by rotating the same, and means providing an oil passage surrounding the bushing whereby the oil to be filtered enters the shell from one of said passages and leaves through the other.

3. An oil filter of the screw-in throw-away type having at one end thereof an oil inlet and an oil outlet, comprising an oil-tight shell, a filter cartridge within the shell, an end closure wall secured at said one end of the shell, a reinforcing plate secured to the closure wall and having a central opening and concentric threads, an adaptor bushing having a central oil passage and threaded at one end to engage a supporting casting and threaded at the other end to engage the threads of said plate as the filter shell is screwed thereon by rotating the same, and means providing an oil passage surrounding the bushing whereby the oil to be filtered enters the shell from one of said passages and leaves through the other.

4. An oil filter of the screw-in throw-away type having at one end thereof an oil inlet and an oil outlet, comprising an oil-tight shell, a filter cartridge within the shell, an end closure wall secured at said one end of the shell, a reinforcing plate secured to the closure wall and having a central opening and concentric threads, an adaptor bushing having a central oil passage and threaded at one end to engage a supporting casting and threaded at the other end to engage the threads of said plate as the filter shell is screwed thereon by rotating the same, and an adaptor plate held in place by the bushing and having an oil passage surrounding the bushing whereby the oil to be filtered enters the shell from one passage and leaves through the other.

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