

Sept. 8, 1942.

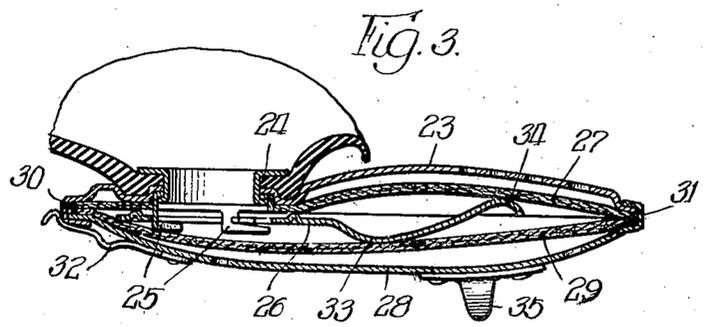
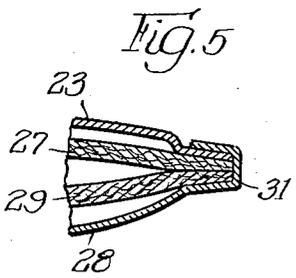
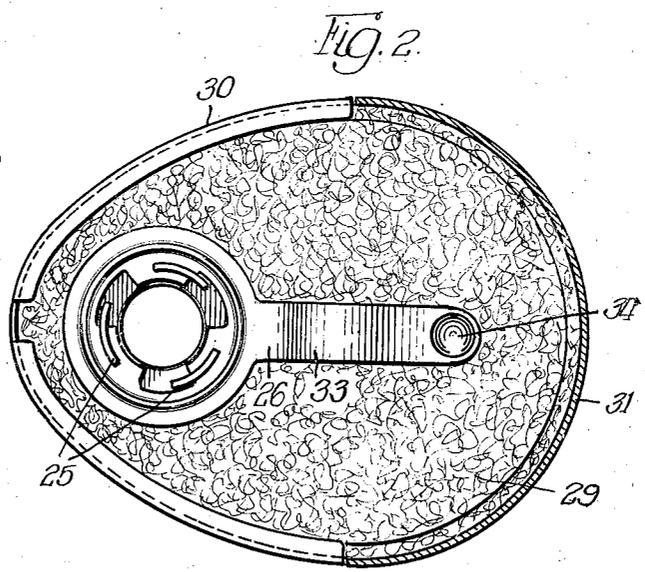
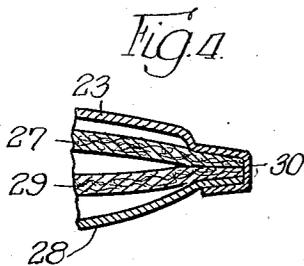
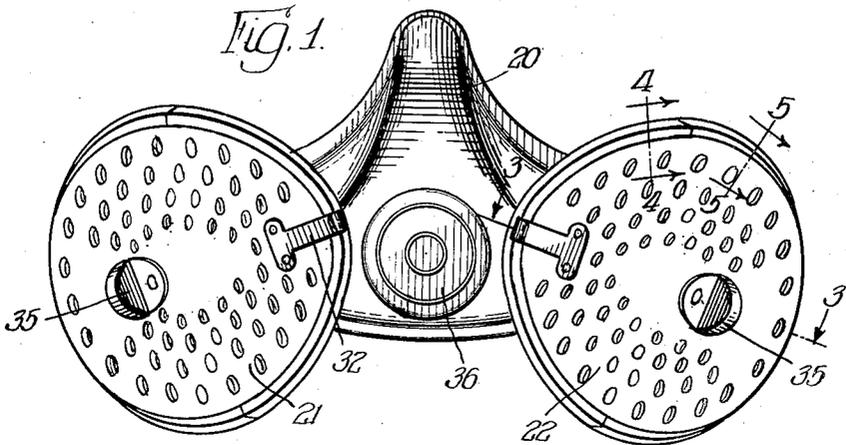
R. MALCOM ET AL

2,295,119

RESPIRATOR

Filed Jan. 2, 1941

2 Sheets-Sheet 1



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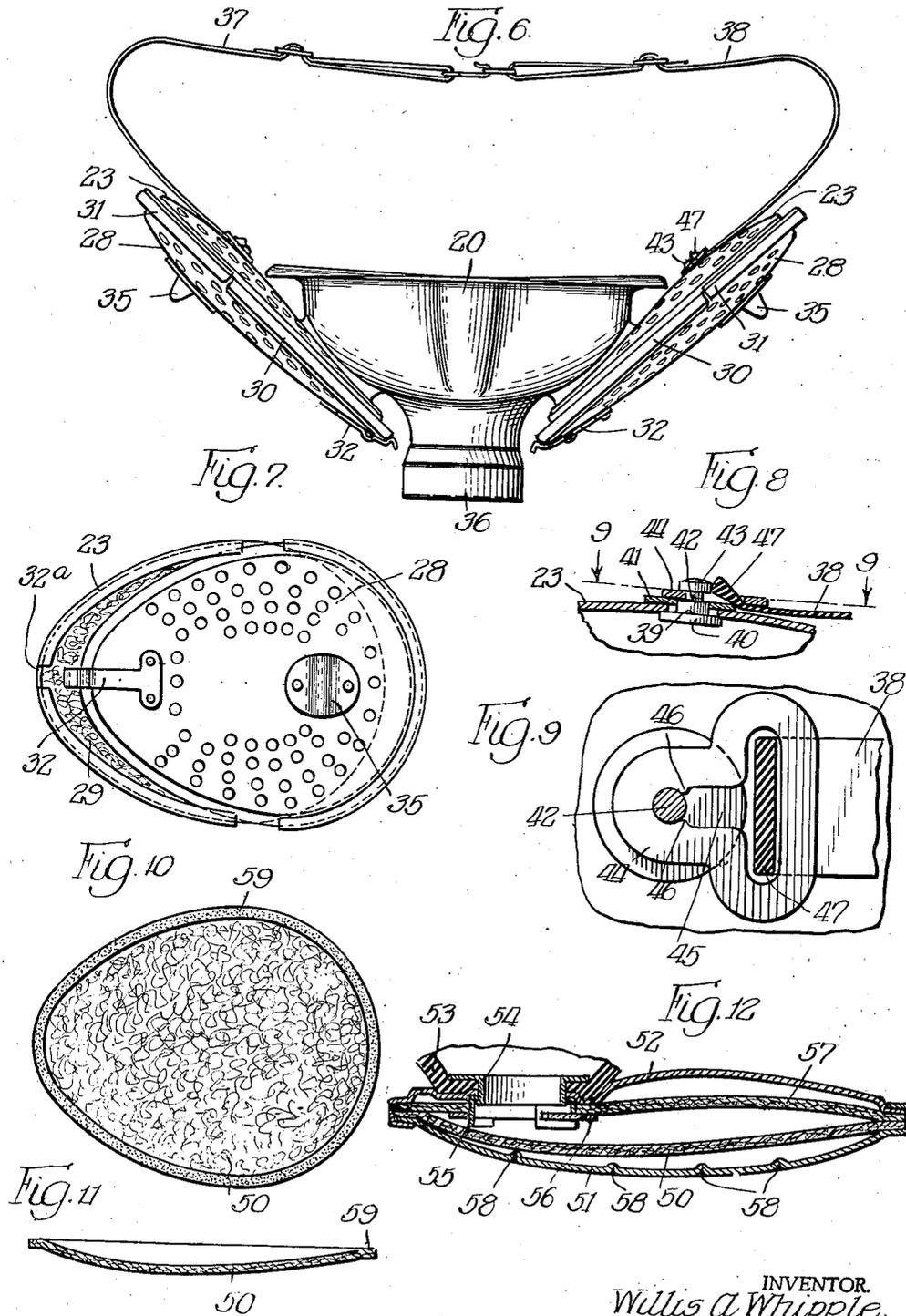
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RESPIRATOR

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UNITED STATES PATENT OFFICE

2,295,119

RESPIRATOR

Robert Malcom, Chicago, Ill., and Willis A. Whipple, Camp Lake, Wis.; said Whipple assignor to said Malcom

Application January 2, 1941, Serial No. 372,726

10 Claims. (Cl. 128—146)

The present invention relates to respirators.

The primary object of the invention is the provision of a respirator having a non-circular filter box in which may be conveniently mounted readily removable filter elements.

Another object of the invention is the provision of a means for adjusting the head strap in relation to the face piece so as to insure a more comfortable and perfect fit of face piece.

Other objects and advantages of the invention will be apparent to those skilled in the art upon understanding preferred embodiments thereof shown in the accompanying drawings and hereinafter described. It is to be understood that the drawings are for purposes of illustration only and are not to be construed as unnecessarily limiting the scope of the appended claims.

In the drawings.

Fig. 1 is a front elevation of the respirator;

Fig. 2 is a view of a filter box with the outer cover removed;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a top plan view of the respirator;

Fig. 7 is a detailed view showing the manner in which the outer and inner sections of the filter box fit together;

Fig. 8 is a detailed sectional view showing the connection of the head band and the means for attaching it to a filter box;

Fig. 9 is an enlarged sectional view taken on the line 9—9 of Fig. 8;

Fig. 10 is a view of a modified form of filter element;

Fig. 11 is a sectional view of a modified form of filter element; and

Fig. 12 is a sectional view showing a modified form of filter element in a modified form of the filter box.

Referring to Fig. 1 of the drawings, it will be seen that the respirator comprises a face piece 20 to which is attached on either side filter boxes 21 and 22 respectively. It will be noted that the filter boxes are non-circular in shape, being substantially egg-shaped and are so mounted on the face piece that the mounting is near the smaller end of the filter box and the major portion of the filter boxes is in back of the front of the face piece.

Due to such mounting arrangement and the shape of the filter boxes the range of vision of

the wearer is not particularly interfered with. As compared to circular filter boxes the range of vision is very much greater. In addition, the filter boxes being non-circular the major portion of the weight of the filter boxes is disposed in back of the front of the face piece so as to provide the most desirable balance from the standpoint of the comfort of the wearer.

The filter boxes comprise an inner portion 23, as is clearly shown in Fig. 3, which is perforated to permit the entry of air and which is attached to the face piece by means of a grommet or flanged member 24. Attached inside the filter box around the grommet 24 is a locking ring 25 which is adapted to cooperate with a locking member 26 to securely clamp a filter member 27 around the grommet 24 at the air entrance opening to the face piece.

An outer or cover member 28 for the filter box is provided to cooperate with the member 23 to form a filter chamber. Positioned between the outer member 28 and the inner member 23 is a second filter member 29. The filter elements 27 and 29, respectively, have peripheral portions that are substantially coextensive with the filter box and their edges are sealed between the outer and inner members of the filter box. The filter element 27 has an opening so positioned as to slip over the locking ring 25 when in juxtaposition with the inner filter box 23. Both the outer and the inner filter box members 28 and 23, respectively, are perforated. It will be apparent that a large filtering area is obtained in the filter box as contrasted with the ordinary filter boxes in which the filter area is only equal to the area of the box, because in the construction herein disclosed the filter area is substantially twice the area of the filter box. This large filter area is obviously of importance in reducing the breathing resistance of the respirator and for other reasons which those skilled in the art will fully appreciate.

It is important that the outer filter box member be connected to the inner filter box member in such manner as to compress and seal the filter elements 27 and 29, respectively, at their edges so that there will be no leakage at this point. This may be accomplished by providing the inner portion of the filter box 23 with a reversely bent peripheral flanged portion 30 around the smaller end of the filter box which flange portion is adapted to receive the substantially flat edge portion of the smaller end of the outer member of the filter box 28.

In order to seal the enlarged end of the filter

box the outer member 28 of the filter box is provided with a reversely bent flanged portion 31 which is adapted to pass over and engage the substantially flat edge portion of the large end of the inner member 23 of the filter box.

As illustrated in Fig. 7, the manner in which the members of the filter box fit together is by sliding the outer member 28 in relation to the inner member 23 so that the respective flanged portions interlock with the respective flat portions of each portion of the filter box. Such an arrangement is exceedingly simple in construction, convenient to handle and permits the employment of filter boxes of non-circular shape which, as has been pointed out, have many advantages.

In order to insure a tight seal at the edge of the filters, as is shown in detail in Figs. 4 and 5, the reversely bent flanged portions of the outer and inner filter box members may be slightly tapered so that as these members are slid into engagement they compress the filter material to secure a tight seal at the edge portions. A further advantage of tapering the flanged portions is that it permits of easier assembly and disassembly of the filter boxes. In addition, this arrangement compensates for different thicknesses of filtering material. As is well known, filter materials even when carefully made do not always run uniform in thickness.

A locking clip 32 is provided on the outer filter box member and a receiving slot 32a for the clip is provided on the inner filter box member. The locking clip and slot not only serve the function of preventing accidental displacement of the filter box member while in use but also serve as a guide in assembling the members. The filter box members being non-circular they will jamb unless they are slid into position with their major axes in substantially parallel alignment. The clip and slot serve to guide the user in maintaining such relationship when assembling the filter boxes.

In the form of the invention shown in detail in Fig. 3 the locking member 25 which clamps the filter material around the air entrance opening of the face piece is preferably constructed with a handle portion 26 that is in the shape of a reverse curve, as indicated in the drawings, so that it will have a raised portion 33 which will engage the outer filter element 29 and space it from the inner filter element 27 which is engaged by the end 34 of the locking member 26.

In order that the filter box may be conveniently separated into its component parts and slid together again, a thumb rest 35 is provided which enables the user to grasp the outer member of the filter box and to conveniently slide it in relation to the inner member.

In assembling the filter box as shown in Figs. 1 to 7, inclusive, of the drawings, the inner filter element 27 is first put in place and the locking element 26 is secured to seal the inner filter element about the periphery of the grommet 24. The outer filter element 21 is then put in position with its edges superimposed over the edges of the inner filter element. Then the outer filter box member 28 is slid beneath the reversely bent flanged portion 30 of the inner filter box member 23 to interlock the outer and inner filter box members and seal the peripheral edges of the filter element. The outer filter box member will clear the spacing member 33 because the outer and inner filter box members do not interlock and require movement in substantially the plane

of the periphery of the inner filter box member 23 until the leading edge of the outer filter box member is past the spacing member 33.

As shown in the drawings, the respirator may be provided with a valve mounted in a housing that is indicated by the reference character 36.

In order to retain the face piece in place a head band comprising members 37 and 38 is provided. The head band is attached to the filter boxes, as shown in Figs. 6, 8 and 9. It is desirable to attach the head band to the filter boxes so that its point of attachment may be regulated or adjusted to suit the convenience of the wearer. In order to accomplish this result the head band is secured to the filter boxes by means of a pin 39 which is provided with an enlarged base portion 40, the pin 39 being so shaped as to pass through the air entrance openings in the inner member 23 of the filter boxes.

The head of the pin which projects beyond the filter box is provided with an annular groove 42 and a head portion 43, as clearly appears in Fig. 8. Adapted to engage the pin is a clip member 44 which is provided with a T-shaped slot 45, the slot being adapted to receive one end of the head band and also having a projecting portion which is adapted to pass over the head 43 of the pin 39. A washer 41 may be interposed between the clip and the filter box to permit the head band to swing freely at the point of attachment.

The portion of the slot in the clip 44 which passes over the head 43 of the pin 39 is of reduced area so as to snugly fit in the annular groove 42. The clip member may be provided with slight projections 46 which partially encompass the central portion of the pin at the annular groove 42 and which spring slightly to cause the clip to firmly engage the pin 39. The extreme end 47 of the head band is of enlarged cross section so that it will not pull out from the clip and, furthermore, as tension is applied to the head band the enlarged end portion 47 tends to assume a flat position in relation to the clip and to prevent the clip from being released from the pin 39, as shown in Fig. 8.

This means of attachment of the head band to the filter boxes is both secure and simple and also permits ready adjustment of the position of the head band on the filter boxes. Such adjustment is desirable because it permits of securing more comfortable and better fit of the face piece to different facial contours. If the point of application of the head band is near the top of the filter box the face piece tends to fulcrum at the nose portion and to secure a tighter fit around the nose, whereas, if the head band is attached near the bottom of the face piece the face piece tends to fulcrum at the chin and to put greater tension on the portion adjacent the wearer's chin. By adjusting the location of the head band in relation to the filter box it is possible to secure the best fit of the face piece both from the standpoint of securing a seal between the face piece and the face and also from the standpoint of comfort to the wearer.

In Figs. 10, 11 and 12 there is shown a modified form of the structure. In these figures a structure is illustrated in which no spacing means is employed between the filter elements. In such an arrangement the outer filter element, indicated by the reference character 50, is preferably preformed so as to approach the contour of the outer or top member of the filter box designated at 51. In these figures, the inner member of the filter

box is designated by the reference character 52, the face piece by the reference character 53 and the grommet for fastening the face piece to the filter box by the reference character 54.

In such construction the fastening means may consist of a slotted member 55 with a slotted locking ring 56 for securing the inner filter element 57 to the face piece. Obviously various types of fastening means may be employed without departing from the spirit of the invention. It is not necessary to preform the inner filter element 57 as upon application of pressure by the locking member 56 the inner filter element will tend to bow slightly so as to form a hollow portion at the center of the filter box. However, to insure adequate space between the filter elements it is desirable to preform the outer member 50 as shown in detail in Fig. 11. It is also desirable to provide spacing lugs 58 on the inner side of the top or outer portion 51 of the filter box. The purpose of such spacing lugs is to prevent the outer filter element 50 from directly engaging the filter box and thus preventing free circulation of air. Of course, both the inner and outer members of the filter box are properly perforated.

In order to assemble the device shown in Figs. 10, 11 and 12 it is necessary that the filter element 50 be placed in the outer portion of the filter box 51 before the outer portion of the filter box is slid into engagement with the inner portion of the filter box, otherwise, since there is no spacing means employed between the filter elements the sliding movement of the outer filter box member might flatten the filter element 50 and cause it to approach too closely the filter element 57. In view of the fact that there might be a high coefficient of friction between the filter elements and they would not easily slide relative to each other if they were made of some materials, it may be desirable to provide a smooth surface at the periphery of one of the filter members. Such a smooth surface not only facilitates assembly of the filter boxes but also prevents the filter elements from being abraded during assembly of the filter box.

As shown in Fig. 10 this smooth peripheral portion may be obtained by the application of a foil coating, indicated by the reference character 59, around the periphery of one of the filter elements. The edge portion may have applied thereto any well known lacquer or similar material which will provide a substantially smooth peripheral band around the filter element or, if desired, a separate metallic ring may be employed.

The expedient of providing a smooth peripheral surface on one of the filter elements is only desirable when the outer filter element is to be placed in the outer filter box member before the parts are assembled and is not necessary when the outer filter element can be placed in juxtaposition to the inner filter element before the filter box is assembled.

Respirators constructed in accordance with the invention have been found to be highly useful and satisfactory. They are light in weight, convenient to assemble and disassemble, economical to manufacture and comfortable for the user. A further advantage is that both the front and the back of the filter box admit air, therefore the maximum amount of filtering area is obtained. In addition, it is convenient to employ filter elements which can be used and discarded and replaced. Relatively cheap but efficient cellulose material may be employed for the filter elements and in view of the fact that the filter ele-

ments are protected by the filter boxes such material need not have any substantial strength or wearing qualities.

We claim:

1. In a respirator, a filter box having inner and outer members which are connected together about their peripheries to form a filter chamber, said connecting means comprising a reversely bend flange for interlocking engagement with the other of said members, said flange being tapered to provide for free access of the edge of the other of said members, one of said members being shiftable in the plane of the other of said members for interlocking engagement therewith and a filter element mounted in said chamber and compressed at its edge between said filter box members when the latter are in assembled relationship.

2. A respirator comprising a face piece having air entrance openings on each side thereof, non-circular filter boxes mounted over said air entrance openings, the main body portion of said filter boxes projecting rearwardly from the front of said respirator, said filter boxes having openings in the walls thereof, a head band and means for connecting the ends of the head band at various points on said filter boxes, said means comprising a pin adapted to project through openings in said filter boxes and a clip engaging said pin and secured to said head band, said clip being removable from said pin.

3. A respirator comprising a face piece having air entrance openings on each side thereof, non-circular filter boxes mounted over said air entrance openings, the main body portion of said filter boxes projecting rearwardly from the front of said respirator, said filter boxes having openings in the walls thereof, a head band and means for connecting the ends of the head band at various points on said filter boxes, said means comprising a pin adapted to project through an opening in said filter boxes and a clip engaging said pin and secured to said head band, said clip being removable from said pin, the head band having an enlarged portion projecting through said clip in the proximity of said pin to prevent said clip from accidental displacement from said pin.

4. A respirator comprising a face piece having air entrance openings on each side thereof, filter boxes mounted over said air entrance openings, the main body portion of said filter boxes projecting rearwardly from the front of said respirator, said filter boxes having openings in the walls thereof, a head band and means for connecting the ends of the head band at various points on said filter boxes, said means comprising a pin adapted to project through an opening in said filter boxes and a clip engaging said pin and secured to said head band, said clip being removable from said pin and resilient locking means on said clip for engaging said pin.

5. A respirator comprising a face piece having an intake on each side, a perforated filter box attached to each intake, each filter box comprising a pair of complementary ovate casing members, each casing member having a channeled flange extending about a portion of its periphery and an outwardly directed flange engaging portion around the remainder of the periphery, the flange engaging portion and channeled flange of one of said members inter-engaging the channeled flange and flange engaging portion, respectively, of the other, and a filter element disposed within the casing and gripped peripherally

between the flange engaging portion and channeled flanges of the casing members.

6. A respirator comprising a face piece having an intake on each side, a filter box attached to each intake, each filter box comprising a pair of complementary, dished, ovate, perforated casing members, one of said casing members having a channeled flange extending partly along the sides adjacent the small end and a flat flange around the remainder of its periphery, the other member having a flat flange around the small end and a channeled flange around the large end cooperating with the said flanges of the first mentioned member and a filter element gripped peripherally between the cooperating flanges of said members.

7. The respirator of claim 6 in which the channeled flanges have inclined walls thereby forcing the casing members to approach each other and to compress the margin of the filter element as said filter box is assembled.

8. A filter box for respirators comprising a pair of complementary casing members which are adapted to form a filter chamber, flange members mounted on each of said casing members, said flange members being provided with spaced portions to receive a filter element, each of said flange members being provided with inturned portions for engaging the other casing member, said flange members being disposed in a single plane, each of said casing members being shiftable along said plane into interlocking engagement with the flange member of the other, a filter element mounted at its edge in the spaced portion of said flange members, the inturned portion of said flange members being so positioned as to cause said casing members to grip the

edge of said filter member when said casing members are shifted into interlocking engagement.

9. A filter box for respirators comprising a pair of complementary casing members which are adapted to form a filter chamber, flange members mounted on each of said casing members, said flange members being provided with spaced portions to receive a filter element, each of said flange members being provided with inturned portions for engaging the other casing member, said flange members being disposed in a single plane, ends of said casing members being shiftable along said plane for interlocking engagement with the flange member of the other, a filter element mounted at its edge in the spaced portion of said flange members, said filter element comprising a plurality of filter members having portions thereof spaced apart, and the inturned portion of said flange members being so inclined as to cause said casing members to seal the edge of said filter member as said casing members are shifted into interlocking engagement.

10. A filter box for respirators comprising a pair of complementary, dished, ovate, perforated casing members, each casing member having a channeled flange extending around a portion of its periphery and an outwardly directed flat flange around the remainder of the periphery, the flat flange and channeled flange of one member interengaging the channeled and flat flanges respectively of the other, and a filter element disposed within the casing and gripped peripherally between the flanges of the casing members.

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