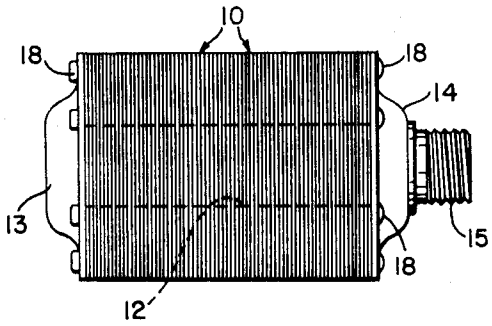
Oct. 4, 1960 S. J. GIBEL 2,954,839

MUFFLER

Filed Nov. 6, 1958

FIG. 1



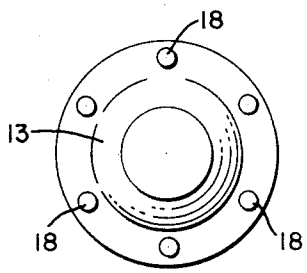


FIG. 2

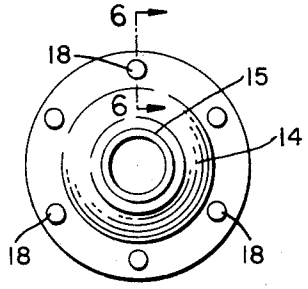


FIG. 3

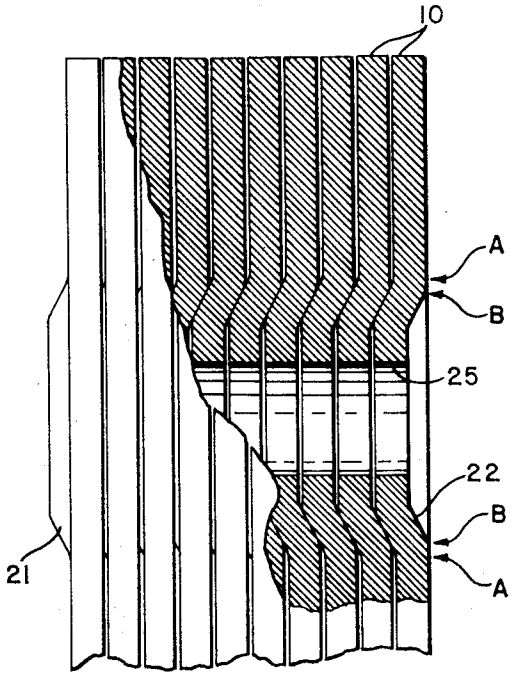


FIG. 6

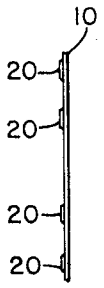


FIG. 5

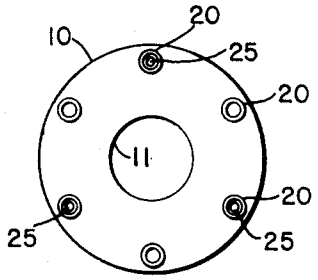


FIG. 4

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3 Claims. (Cl. 181—56)

This invention relates to mufflers and particularly to that type of muffler comprising a plurality of spaced plates between which gases are exhausted radially outwardly.

I have discovered that surprisingly effective muffling can be achieved with mufflers of fairly small dimensions without unduly increasing back pressures by using large numbers of flat discs which are spaced from each other minute distances by means of integrally formed bosses located near the peripheries of the discs. The combination of the features of having discs that are flat and spacing washers that are integral with the discs so minimizes the effect of warping and distortion that mufflers formed of inexpensive sheet metal stampings and the like will function effectively in the field and under a variety of conditions even though the spacing between the discs must be very small, say about .003 inch.

The invention particularly contemplates a modular assembly in which a plurality of flat stamplings or plates are provided with bosses which are nested together but which hold their associated discs in minutely spaced relationship due to the interference of the nested bosses with each other, as more fully set forth below. The provision of bosses which are nested together but which interfere with each other in a limited manner appears to be particularly effective in minimizing the adverse effects of warping and distortion, so that mufflers formed according to the invention from inexpensive sheet metal stampings and the like will function effectively under a variety of field conditions. For example, a muffler made according to the invention may be used advantageously as a law mower muffler subjected to exhaust temperatures in the order of 900–1000° F. In this respect it is pertinent to note that the above mentioned nested relationship not only defines the desired close spacing but interlocks the closely spaced plates against relative sliding movement.

In the accompanying drawings:

Figure 1 is an elevation of a muffler made according to the invention.

Figure 2 is a view of the left end of the muffler seen in Figure 1.

Figure 3 is a view of the right end of the muffler seen in Figure 1.

Figure 4 is a view of one of the plates or discs employed in the illustrated muffler.

Figure 5 is a side elevation of the disc shown in Figure 4.

Figure 6 is an enlarged fragmentary view taken from the plane of line **6—6** in Figure 3 and showing several adjacent plates forming part of the large number of plates which make up the muffler assembly. This view is partly broken away to show a portion of some of the spaced plates in cross section.

Shown in Figure 1 is a muffler comprising a stacked array of flat discs or plates **10** stamped from sheet metal such as sheet steel or the like. For an application in which the stacked array is approximately 2¼ inches

long and 1¾ inches in diameter, the array may comprise about 80 discs or plates **10**, each having a thickness of about .024 inch, the adjacent discs being spaced apart approximately .003 inch. Each of the discs **10** is provided with an open center **11**, the open centers together forming a central passage **12** extending through the stacked array. Provided at each end of the stacked array of discs **10** is a capping member. The capping member **13** comprises merely a closure for one end of the array. The other capping member **14** also comprises a closure and furthermore is provided with a port means, such as a threaded connection **15**, which communicates with the pipe, manifold or other line (not shown) through which the gas to be muffled is received. Bolts, rivets or other similar means extend through the array of discs **10** between the capping members **13** and **14** and are tensioned to clamp the array together. In the particular apparatus illustrated, these tensioning members comprise rivets **18**, only the heads of which are visible in the drawings, the stem of the rivet which would ordinarily be visible in Figure 6 having been eliminated for purposes of clarity. In the particular apparatus illustrated, there are only three rivets **18** provided, the remaining three intervening similar shapes on the flanges of the end members **13** and **14** comprising merely dummy rivet heads to provide a more balanced appearance for the assembled structure.

Each of the discs or plates **10** has integral bosses **20** formed therein and holding the plates in their closely spaced relationship. The bosses **20** comprise indents which are integrally formed in their associated plates **10** as by lateral displacement of the walls of the plates **10**, which displacement may be accomplished by a stamping operation. These indents have a convex face **21** and a concave face **22** (Figure 6), the indents of adjacent plates being nested with each other as most clearly seen in Figure 6. In the illustrated apparatus, six rows of nested indents are angularly spaced around the extent of the muffler assembly. The indents are nested with the convex faces **21** of the indents received against the concave faces **22** of adjacent indents. The convex faces are wider than the concave faces, as most clearly illustrated in Figure 6, where it may be seen that in the specific cross section illustrated, the convex faces extend between the points A while the concave faces extend only between the points B. It presently appears preferable that the indents be circular in which case the width of the faces would be the same in any cross section. The greater width of the convex faces as compared to the concave faces results in a degree of interference between the nested indents that causes their associated plates **10** to be held apart in their closely spaced relationship, as illustrated in Figure 6. Also, the nested indents anchor their associated plates or discs **10** against relative sliding motion which may tend to occur because of warping, distortion and the like due to heat or other field conditions.

Alternate rows of the nested indents are provided with central openings **25** to accommodate the stems of the rivets **18**.

The structural relationship contemplated by the invention and disclosed above provides a muffler which may be very inexpensively manufactured and which compares favorably in operating characteristics and capacities with mufflers of the prior art. The particular structural features contemplated by the invention make possible the provision of large numbers of minutely spaced discs which will maintain the desired spaced relationship under field conditions and which at the same time can be very inexpensively assembled as a modular structure.

The above description of the invention should make it apparent that many details of the apparatus embodying the invention may be varied without departing from the

teaching of the invention. For example, the openings **11** need not be circular and they may be replaced by two or more openings, so long as the openings are located radially inwardly from the sides of the discs or plates **10**, and so long as the openings in neighboring plates register with each other to form passage means equivalent to the passage **12**. Accordingly, the scope of the invention is not to be limited to precise details of the specifically described embodiments but is to be defined by the following claims.

What is claimed is:

1. A muffler comprising a plurality of flat plates in stacked array, said plates each having at least one radially inwardly located opening, said openings registering to form passage means extending through the stacked array, a capping member at each end of the stacked array, tensioned means extending through the array between the capping members to clamp the array together, port means on at least one of said capping members for communication with a line through which the gas to be muffled is received, the flat plates having integral bosses formed therein and holding the plates in closely spaced relationship, the bosses comprising indents integrally formed in the plates, the indents having a concave face and a convex face, the indents of adjacent plates being nested with each other in angularly spaced rows with the convex faces of the indents received against the concave faces of adjacent indents, the convex faces being wider than the concave faces to establish a degree of interference between the nested indents whereby the bosses hold their associated plates in said closely spaced relationship and anchor their associated plates against relative sliding motion due to warping, distortion and the like.

2. A muffler comprising a plurality of flat plates in stacked array, said plates each having at least one radially inwardly located opening, said openings registering to form passage means extending through the stacked array, a capping member at each end of the stacked array, tensioned means extending through the array between the capping members to clamp the array together, port means on at least one of said capping members for communication with a line through which the gas to be muffled is received, the flat plates having integral bosses

formed therein and holding the plates in closely spaced relationship, the bosses comprising indents integrally formed in the plates, the indents having a concave face and a convex face, the indents of adjacent plates being nested with each other in angularly spaced rows with the convex faces of the indents received against the concave faces of adjacent indents, the convex faces being wider than the concave faces to establish a degree of interference between the nested indents, said tensioned means comprising fastener stems extending through the centers of at least some of said angularly spaced rows.

3. A muffler comprising a plurality of flat plates in stacked array, said plates each having at least one radially inwardly located opening, said openings registering to form passage means extending through the stacked array, a capping member at each end of the stacked array, said array of flat plates and said capping members being fixed together in assembled relationship, port means on at least one of said capping members for communication with a line through which the gas to be muffled is received, the flat plates having integral bosses formed therein and holding the plates in closely spaced relationship, the bosses comprising indents integrally formed in the plates, the indents having a concave face and a convex face, the indents of adjacent plates being nested with each other in angularly spaced rows with the convex faces of the indents received against the concave faces of adjacent indents, the convex faces being wider than the concave faces to establish a degree of interference between the nested indents whereby the bosses hold their associated plates in said closely spaced relationship and anchor their associated plates against relative sliding motion due to warping, distortion and the like.

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