

July 11, 1944.

R. M. HEINTZ ET AL

2,353,466

HOUSING AND METHOD OF MAKING SAME

Filed March 4, 1943

3 Sheets-Sheet 1

Fig. 1

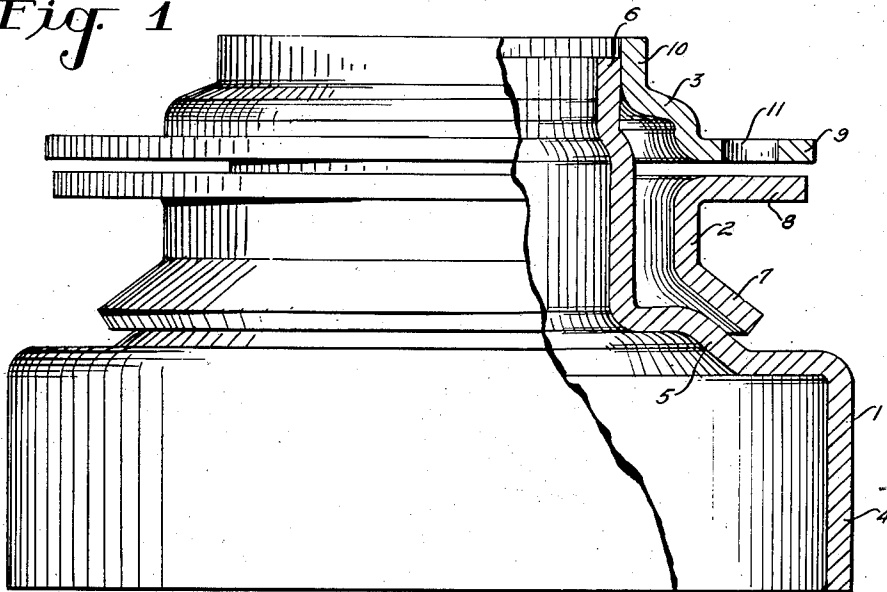
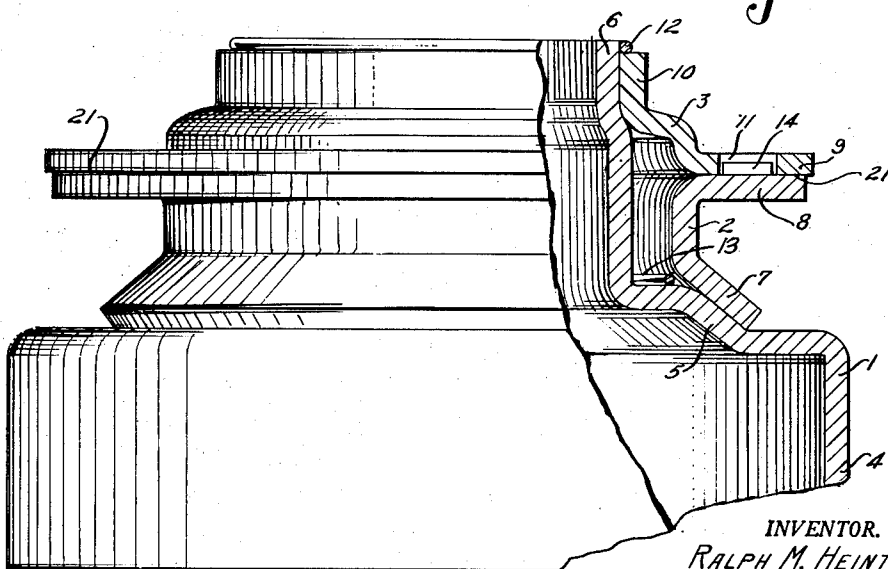


Fig. 2



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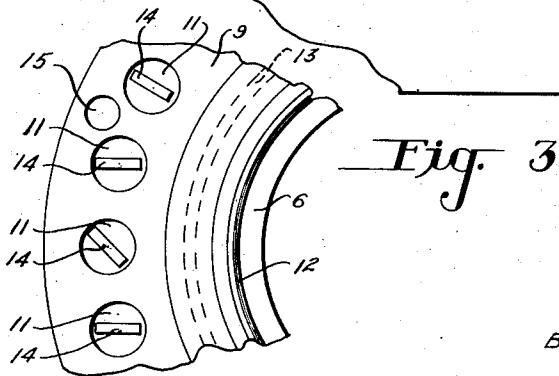
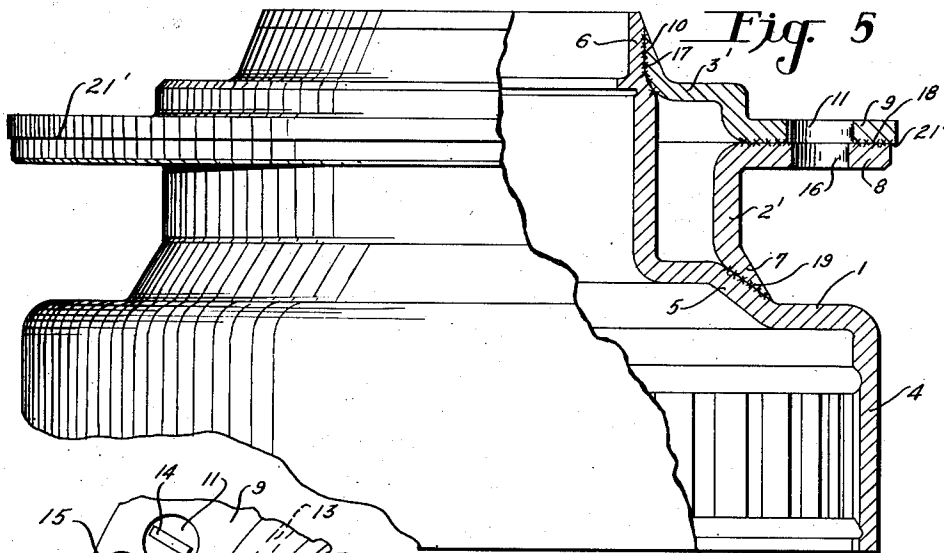
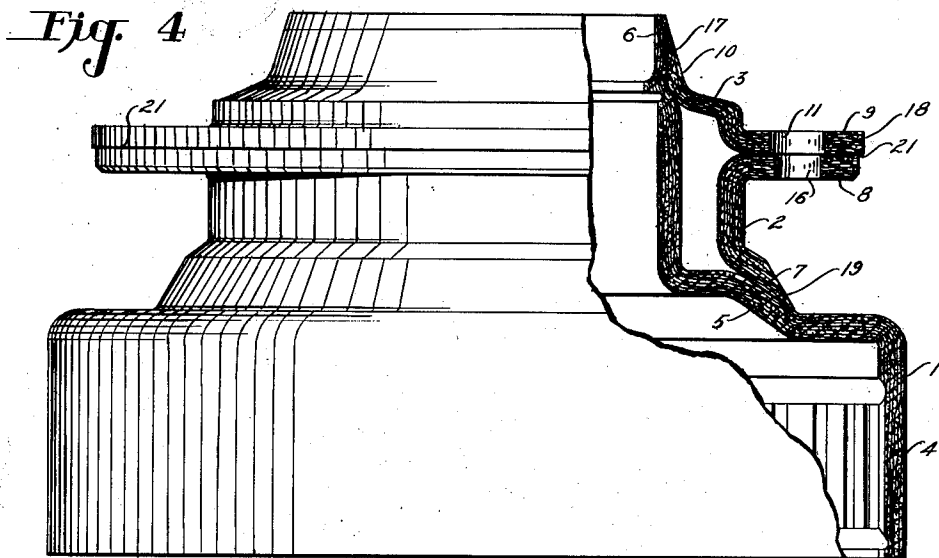
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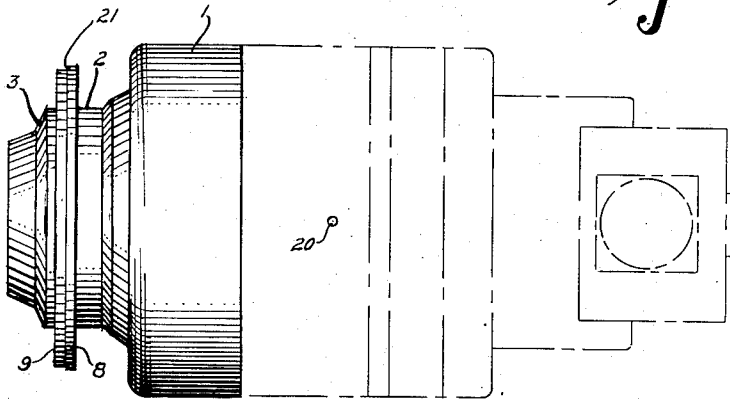
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Fig. 6.



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HOUSING AND METHOD OF MAKING SAME

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Application March 4, 1943, Serial No. 477,930

11 Claims. (Cl. 74—606)

This invention relates to an improved construction for a housing, having particular reference to that portion of a housing carrying a base flange for supporting the housing on an engine mounting pad or the like.

It has become an established practice to machine the base portions of housings for airplane starters and the like from steel forgings, such housings being subject to considerable stress in starting operations besides being subjected to severe vibratory stresses for considerable durations of time on long flights. In case the starter clutch fails to operate smoothly, or in the event of unusual engine vibration, the normal stresses may be still further increased by an amount which is difficult to determine, resulting in failures of the housing base portions. The present invention is concerned both with the prevention of such failures without increasing the weight of the housing, and with an improved type of construction providing a saving in the required raw material.

In the conventional method of forging out a billet and then machining down the forging to make a typical starter housing, the finished weight of the housing is less than twenty-two per cent of the weight of the original billet, and approximately only twenty-five per cent of the weight of the forging. This means that three-quarters of the material in the forging is removed by machining, involving a relatively high investment in labor and plant for a given output, and, in times of raw material shortage, entailing an undesirable amount of waste; also, if the machining shop is remote from the forging shop there is involved the handling and transportation of seventy-five per cent waste.

The primary objects of the present invention are therefore to provide an improved housing construction effecting a marked saving of raw material and improved strength characteristics. A particular object is to provide a housing construction wherein the directions of grain flow of the metal follows the contours of the sections. A further object is to provide a novel and improved box form of housing construction having component parts cold drawn from sheet steel stock.

A preferred embodiment of housing constructed in accordance with the principles of the invention is illustrated in the accompanying drawings in which:

Figure 1 is an exploded view in partial section showing the component parts of an airplane starter base housing portion embodying the principles of the invention,

Figure 2 is a partial sectional view of the component parts of the housing arranged for brazing,

Figure 3 is a fragmentary plan view of the housing shown in Figure 2,

Figure 4 is a view of the completed housing showing the directions of the flow lines in the grain structure of the metal,

Figure 5 shows the manner in which the same housing body may be provided with a different size base flange, and

Figure 6 shows the position of the center of gravity of a starter with respect to its supporting base flange.

The starter housing illustrated comprises three component parts, as best shown in Figure 1, showing the parts in a partially exploded view before they are bonded together. The inner part 1 forms the housing body to which are to be bonded a spacer flange 2 and a base flange 3. Each part is preferably cold drawn from sheet steel stock, the body 1 being set and ironed to produce the proper contours. After drawing, the spacer flange 2 is also set, to obtain the flaring contour shown.

The housing body 1 comprises a cylindrical portion 4, a conical surfaced portion 5, and a slightly reduced neck portion 6. The spacer flange 2 has a portion 7 flared to a conical shape to fit the conical portion 5, and a flange portion 8 adapted to flatly meet a flange portion 9 on base flange 3. The base flange 3 has a neck portion 10 capable of making a press fit on the neck portion 6, and has punched holes 11 to correspond with the arrangement of studs on the mounting pad of the engine on which the starter is to be installed.

The parts may be assembled for brazing in various ways. If they are accurately formed, and considerable care is exercised in the process, they may be pressed together as shown in Figure 2, the press fit between the necks 6 and 10 holding the flanges 8 and 9 together and the flared portion 7 firmly fitting against the conical portion 5. It is preferred, however, to accurately mate the spacer flange 2 and base flange 3 in a jig and then fasten these parts together before fitting them on the housing body 1. The preliminary fastening means may comprise rivets or spot welds in the flanges 8 and 9 between the holes 11, spot welds such as shown at 15 in Figure 3 being preferred. The parts 2 and 3 spot welded together then form a sub assembly which may be pressed on the body 1, the press fit at 6, 10 holding the sub assembly in alignment and in firm surface engagement with the conical surface 5.

Figure 2, then, shows the parts assembled and ready for the brazing furnace. Copper wires 12 and 13 supply the brazing material for the bonds with the body 1, and short pieces of copper wire 14 placed in the holes 11 supply the brazing material to unit the flanges. Housing assemblies prepared in this manner are fed through a hydrogen atmosphere brazing furnace on a conveyor system, the housings resting upon their broad bases in the position shown. The copper wires are melted by the furnace heat and flow into the joints to be united, making strong bonds, as shown at 17, 18 and 19 in Figure 4, to form a box construction between the body and engine pad mounting flange.

Other methods of brazing, or welding, may be employed to produce the box construction shown, the above described hydrogen atmosphere furnace with conveyor being at present preferred for large scale production. An advantage of the preferred method, in addition to its adaptability to mass production, is the fact that the assemblies come out of the furnace bright and clean, without rust or scale. Also, the heating and cooling operations affect the structure slowly and uniformly so as not to produce strains or distortions in the housing.

After leaving the brazing furnace the flange 8 is drilled concentrically with the punch holes 11, the drill holes 16 being preferably slightly smaller to fit the mounting pad stud bolts; and the necessary machining and grinding operations are performed. Figure 4 illustrates the completed housing, showing how the directions of grain flow follow the contours of the sections. This feature, in conjunction with the box type section makes for great strength where strength is needed.

In Figure 6 a complete starting unit is shown in broken lines, showing the position of the center of gravity 20 with respect to the supporting base flange 21, comprising the bonded flanges 8 and 9; the housing parts previously described being shown in full lines. The box section incorporating the flange 21 may be said to form a cantilever support for the starter housing, which support must absorb all the torsional, shock and vibration stresses imposed upon the starter in its use on an aircraft engine.

Figure 5 illustrates how the housing body 1 may be fitted with an enlarged supporting flange 21' to fit a larger engine mounting pad, the only change being in the parts 2' and 3'. Corresponding reference numerals are used for parts identical with those in Figures 1, 2 and 4, and primed reference numerals are used to indicate similar parts having different dimensions for the purpose indicated. Similarly, either of the flange units 21 or 21' may be applied to housing body units 1 having different body lengths, for different types of starters. This interchangeability of parts enables a flexibility of manufacture not possible with conventional cast or forged housings where the size and type are determined in the initial operation.

In the cold drawing process of the present invention the sheet steel stock for a housing base weighs less than half as much as the billet from which a forged base is made, and only slightly more than half as much as the forging itself. It will be seen from a comparison of Figures 2 and 4 that the weight of material removed in applicants' machining step is very small, requiring less work, making less waste, and saving a great

deal on transportation from the mill to the machine shop.

The finished weight of applicants' housing is substantially the same as the weight of a conventional forged housing, the difference being within four per cent in the preferred embodiment illustrated. The present cold drawn, box construction, therefore, provides improved strength characteristics accompanied by a marked saving in material.

Various changes in variations will occur to those skilled in the art, and all such modifications are included in the invention. The invention is to be limited only by the scope of the appended claims.

We claim:

1. A cantilever supporting base for an engine accessory housing comprising a housing body member, said body member having a reduced cylindrical end portion and a conical surface adjacent said end portion, and a mounting flange member for supporting said housing, said flange member comprising an annular box construction having a cylindrical portion bonded to said cylindrical end portion, a conical portion bonded to said conical surface, and a radial supporting flange surrounding said body member intermediate said two portions.

2. A cantilever supporting base for an engine accessory housing comprising a housing body member having a conical portion and cylindrical portions of large and small diameters, an annular box construction embracing said conical and said small diameter portions, and a radial supporting flange for said housing carried by said box construction intermediate said conical and small diameter portions.

3. A cantilever supporting base for an engine accessory housing comprising a housing body member having a conical portion and cylindrical portions of large and small diameters, an annular box construction embracing said conical and said small diameter portions, and a radial supporting flange for said housing carried by said box construction intermediate said conical and small diameter portions, all of said parts having directions of grain flow following the contours of the respective sections.

4. A supporting base for an engine accessory housing comprising a housing body member, said body member having an enlarged portion and a reduced neck portion, and an annular box construction embracing both of said portions and carrying an intermediate radial base flange for supporting said housing.

5. A supporting base for an engine accessory housing comprising a housing body member, said body member having an enlarged portion and a reduced neck portion, an annular base flange embracing said reduced neck portion, and an annular spacer flange between said base flange and said enlarged portion of said body member, the flange portions of said base and spacer flanges being united to form a radial supporting flange for said housing surrounding said neck portion.

6. A supporting base for an engine accessory housing comprising a housing body of cold drawn sheet steel having an enlarged portion and a reduced neck portion, a cold drawn annular base flange embracing said reduced neck portion, and a cold drawn annular spacer flange between said base flange and said enlarged portion of said body member, the flange portions of said base and spacer flanges being united to form a radial supporting flange for said housing surrounding said

neck portion, all of said parts having a grain flow in directions following the contours of the respective sections.

7. A fabricated base for an aircraft starter and the like comprising a cold drawn sheet steel housing body having a reduced neck portion, a conical portion, and an enlarged cylindrical portion, a cold drawn sheet steel base flange engaging said neck portion in a press fit, a cold drawn spacer flange member fitting between said base flange member and said conical portion to form an annular box construction for supporting said housing body by means of said flanges, and bonding means integrally uniting said flanges with each other and with said neck and conical portions of said housing body to form a composite radial supporting flange around said neck portion.

8. The method of fabricating an engine accessory housing base comprising cold drawing a sheet steel housing body so as to have a reduced cylindrical neck portion, a conical portion, and an enlarged cylindrical portion, cold drawing a base flange element adapted for a press fit over said neck portion, cold drawing a spacer flange element adapted to fit said conical portion, the cold drawing of all of said parts being carried out so that the directions of the grain flow follow the contours of the respective sections throughout, pressing said flange elements on said housing body so as to fit said neck and conical portions in the manner described, and bonding said flange elements to each other and to said neck and conical portions of said housing body to form a composite unitary supporting flange for said housing.

9. The method of fabricating an engine accessory housing base from a housing body, a base flange, and a spacer flange, said housing body having a reduced neck portion and a conical portion, said base flange being adapted for a press fit over said reduced neck portion, and said spacer flange being adapted to fit said conical portion;

comprising attaching said flanges together in proper relation and alignment, pressing said attached flanges on said body so as to obtain said fits, and then brazing said flanges together and to said housing body at said neck and conical portions to form a composite unitary supporting flange for said housing.

10. The method of fabricating an engine accessory housing base from a housing body, a base flange element and a spacer flange element comprising punching holes in one of said flange elements, attaching said flange elements together, pressing said attached flange elements on said housing body, placing copper wire around said body adjacent marginal edges of said flange elements, placing pieces of copper in said holes, passing said assembly through a brazing furnace to braze said flange elements together and to said housing body to form a composite unitary supporting flange for said housing, and then drilling holes in the other of said flange elements smaller than and concentric with said punched holes and of a size to fit mounting studs for said housing.

11. The method of fabricating a base for an aircraft starter and the like comprising cold drawing a housing body having a reduced cylindrical neck portion, a conical portion, and an enlarged cylindrical portion, cold drawing a base flange adapted for a press fit over said neck portion, cold drawing a spacer flange adapted to fit said conical portion, said drawing being executed in such a manner as to produce grain flows in directions following the contours of the respective sections, pressing said flanges on said housing body so as to abut each other and establish said fits, and then bonding said flanges to each other and to said housing body to form an annular hollow box construction having an intermediate radial composite supporting flange for said starter.

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