May 12, 1936. G. R. PENNINGTON 2,040,152

METHOD OF FABRICATING CASING STRUCTURES FOR SHOCK ABSORBERS AND THE LIKE

Original Filed Nov. 20, 1930

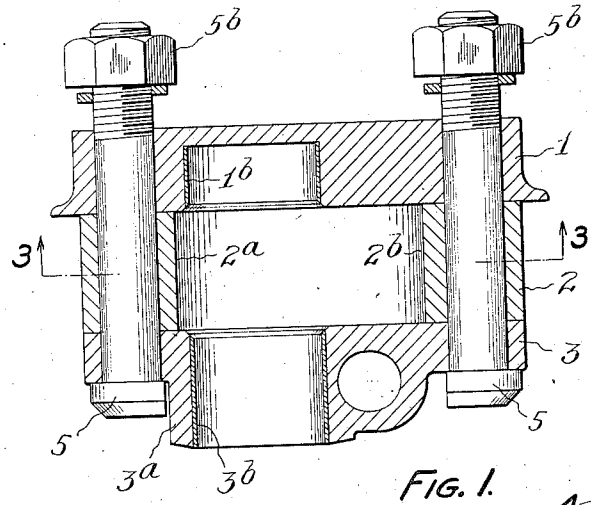


FIG. 1.

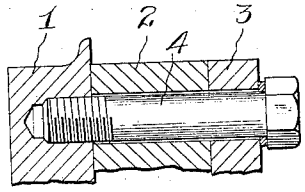


FIG. 4.

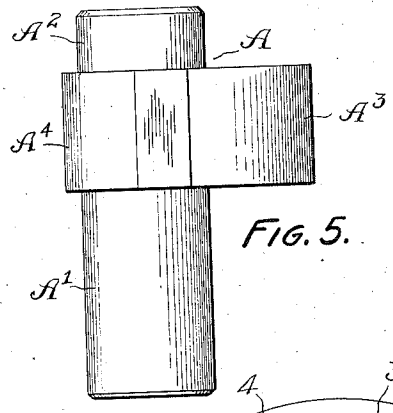


FIG. 5.

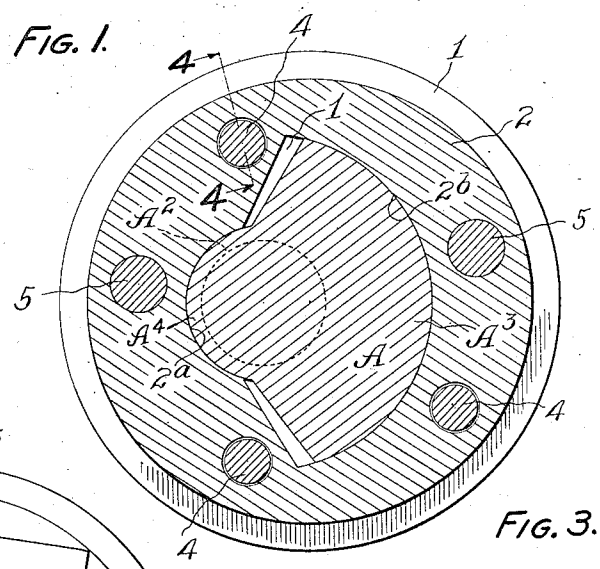


FIG. 3.

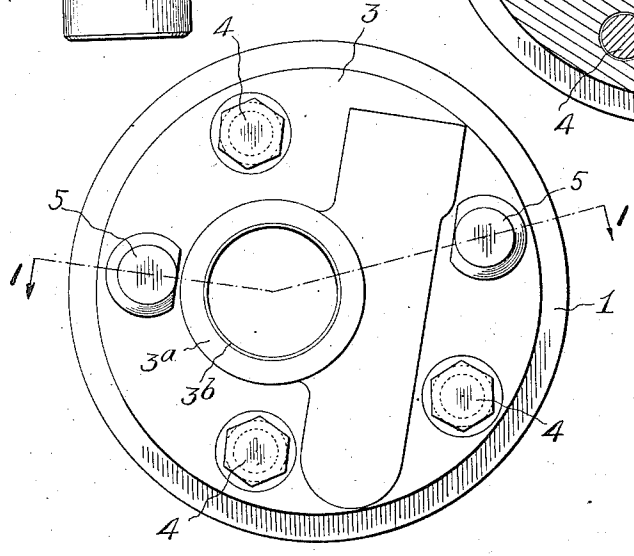


FIG. 2.

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METHOD OF FABRICATING CASING STRUCTURES FOR SHOCK ABSORBERS AND THE LIKE

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Original application November 20, 1930, Serial No. 496,909, now Patent No. 2,009,677, dated July 30, 1935. Divided and this application July 1, 1935, Serial No. 29,185

3 Claims. (Cl. 29—152)

The invention relates to methods of fabricating casing structures of hydraulic shock absorbers, pumps, motors and the like and particularly such casing structures in which a piston of the vane or swinging type is employed. The present application is a division of my earlier application Serial No. 496,909, filed November 20, 1930 issued as Patent No. 2,009,677 on July 30, 1935.

Prior to the invention covered by my application Serial No. 496,909, the casing structures of vane-type shock absorbers were commonly made with two main wall parts, one part forming the wall to engage one side and the wall to engage the outer periphery of the piston vane, while the other part formed the wall to engage the other side of the vane. The fabrication of such casing structures, and particularly of the integral part forming one side wall and the peripheral wall, presented serious difficulties which I overcome by forming the side walls and the peripheral wall in three separate parts.

The object of my present invention is the provision of a method by which the parts of a casing structure of the three-part type referred to can rapidly and at low cost be machined to accurate dimensions for proper cooperation with the piston and shaft structure of the device.

To facilitate explanation of my improved method I have shown in the accompanying drawing one of the several forms of casing construction illustrated in my said application Serial No. 496,909 together with an "assembly plug" which is employed in carrying out the method.

In the drawing, Fig. 1 is a sectional view of the casing of a shock absorber of the vane type to which my improved method is applicable.

Fig. 2 is a front elevation of the casing.

Fig. 3 is a section on the line 3—3 of Fig. 1 showing in the chamber of the casing an "assembly plug" suitable for use in carrying out my method.

Fig. 4 is a fragmentary section on the line 4—4 of Fig. 2.

Fig. 5 is a side elevation of the "assembly plug" shown in Fig. 3.

To facilitate an understanding of the method I shall first describe the casing structure illustrated in the drawing.

The structure comprises a rear plate-like part 1 which is circular in form, an intermediate part 2, and a front plate-like part 3. These casing parts may be made of any suitable metal. I prefer to make them in the form of steel forgings but they may also be made in the form of malleable iron castings. Still other metals may be found satisfactory. The parallel side surfaces of the intermediate part 2 are made to nicely fit the adjacent plane surfaces of the rear and front parts and the three parts are tightly and rigidly secured together by cap screws 4, 4 and dowel bolts 5, 5, said bolts being of suitable length to project through a vehicle frame part (not shown) so that when the nuts 5^b of the bolts are tightened up they clamp the casing to the vehicle frame as well as help secure the casing parts together. The cap screws pass loosely through apertures in the front part 3 and the intermediate part 2 and engage threaded closed bottom holes in the rear part 1 (Fig. 4). The dowel bolts 5 engage apertures in the front casing part 3 and the intermediate casing part 2 with suitable fits for dowel members and engage apertures in the rear casing part 1 with relatively heavy forced fits, the object of the very close fits in the rear part 1 being to obviate leakage. The dowel bolts 5 approach from the rear face of the shock absorber casing and thus serve as a means for securing the casing to a frame of the vehicle, as well as helping to secure the three parts of the casing together and serving, as dowels, to accurately position the three casing parts in relation to each other.

Casing structures of this character comprise an additional reservoir member which has not been shown as it is not involved in the practice of the present invention.

The casing part 2 forms the peripheral wall of an approximately sector shape chamber which is designed to receive a piston of the swinging or vane type, the vane being mounted on or integral with a shaft. The front casing part 3 is provided with a bearing boss 3^a through which the piston shaft extends and which is provided with a suitable anti-friction bushing 3^b. The rear member 1 of the casing is bored out and fitted with a bushing 1^b to provide a bearing for the rear end of the shaft. The intermediate part 2 of the casing is formed with concentric circular surfaces 2^a and 2^b designed to engage the hub and outer peripheral surfaces, respectively, of the piston or vane, the surfaces 2^a and 2^b being concentric with the bearings in the members 1 and 3.

I turn now to the method of machining and fabricating the casing structure. By making the main casing in three parts, 1, 2, and 3, it is possible to have the two joints between these three parts formed by plane surfaces which can be accurately machined with great ease and rapidity. This machining I preferably carry out by grind-

ing operations on the three casing parts. The peripheral surfaces 2^a and 2^b of the casing part 2 I machine or finish by a simple broaching operation, it being possible to form both of the concentric surfaces simultaneously by a single broaching tool. This operation is, of course, made possible by the fact that the casing part 2 is separate from both of the parts 1 and 3.

To insure proper alignment and relative positioning of the two shaft bearings when finished with the finished surfaces 2^a and 2^b of the casing I have devised a special procedure. First, the plane surfaces of the three casing parts 1, 2, and 3 are machined and the internal surfaces of the intermediate part 2 are broached, as above described. The holes for the cap screws and the dowel bolts are then drilled in the back plate and the front plate, the bolt holes being drilled about $\frac{1}{32}$'' under size and the screw holes in the front plates about $\frac{1}{32}$'' over size, and the screw holes in the back plate are tapped. The back plate is then placed in a fixture which locates the plate in relation to the bolt holes therein and the rear bearing recess is bored out, the bushing thereof inserted and finish bored. Then, in the same manner, the shaft bearing of the front plate is machined. The middle casing part 2 is placed in a fixture which locates the part with respect to the broached surfaces thereof and the holes for the cap screws and the dowel bolts are drilled. The bolt holes are drilled about $\frac{1}{32}$'' under size and the screw holes about $\frac{1}{32}$'' over size, as in the case of the front plate of the casing.

Next the three casing parts 1, 2, and 3 are assembled upon a fixture A (Fig. 5) which I term an "assembly plug". This assembly plug comprises a main shaft section A^1 to engage the bearing of the front casing plate 3 and a rear shaft section A^2 to engage the bearing of the rear casing plate 1. It also comprises a vane part A^3 having a hub portion A^4. The assembly plug is similar to the combined piston and shaft of the shock absorber except that the vane or piston part A^3 has a circumferential extent great enough to substantially fill the working chamber of the shock absorber and that the fixture is made of such a size that its bearing surfaces which engage the peripheral surfaces 2^a and 2^b of the casing part 2 fit the latter with a smaller clearance than do the corresponding surfaces of the shock absorber piston. This assembly plug, being made very accurately, serves to very accurately position the surfaces 2^a and 2^b of the intermediate casing part in relation to the shaft bearings of the casing parts 1 and 3.

The three casing parts when assembled upon the plug A are brought into alignment with each other by inserting a pin through one of the sets of holes and then while the three casing parts are clamped rigidly together the dowel bolt holes are brought to their final finished size by reaming, the bolt holes in the back plate 1 being preferably finished to a somewhat smaller size than the bolt holes in the other two casing members so that the dowel bolts when they are inserted in the assembled casing will have a heavy pressed fit in the back plate that will insure a leak tight joint or engagement between the bolts and the said back plate. With the casing parts thus machined, it is obvious that when the shock absorber is assembled the insertion of the dowel bolts will position the three casing parts with a high degree of accuracy in their proper relation to each other.

It will be obvious to those familiar with modern machine tool practice that my improved casing structure can be machined in the manner described with very great ease and facility with a high degree of accuracy and uniformity so that a nice working fit between the bearing or working surfaces of the piston and shaft member and of the casing is insured.

The machining of the peripheral walls of the sector-shape chamber of the main casing of the shock absorber is highly advantageous because it combines low cost with a high degree of accuracy. This method is made possible by the three-part construction of the main casing and by the novel method of machining the dowel holes with reference to the broached surfaces.

While I prefer to proceed in the manner above described it will be obvious to those familiar with machine tool practice that the procedure can be varied in different ways without departing from the invention as defined in the appended claims.

What I claim is:

1. The method of machining the casing of a vane-type shock absorber or the like having front and rear wall parts with plane surfaces to engage the sides of the vane and with a shaft-bearing aperture in at least one of said parts, an intermediate part having concentric surfaces to engage the hub and outer periphery, respectively, of the vane and plane front and rear surfaces to engage the front and rear wall parts, and dowels engaging the three casing parts, the said method comprising forming the concentric surfaces of the intermediate part and the bearing aperture or apertures of the front and rear parts, securing the three parts together with the bearing aperture or apertures in axial alignment with the concentric surfaces of the intermediate part, and while the three parts are so secured accurately forming aligning dowel holes in all three parts.

2. The method of machining the casing of a vane-type shock absorber or the like having front and rear wall parts with plane surfaces to engage the sides of the vane and with a shaft-bearing aperture in at least one of said parts, an intermediate part having concentric surfaces to engage the hub and outer periphery, respectively, of the vane and plane front and rear surfaces to engage the front and rear wall parts, and dowels engaging the three casing parts, the said method comprising forming the concentric surfaces of the intermediate part, drilling dowel holes in the front and rear wall parts to undersize dimensions, forming a shaft bearing aperture in one or both of the front and rear wall parts in a position located from the dowel holes of such part, drilling corresponding undersize dowel holes in the intermediate part of the casing while said part is located with respect to the concentric surfaces thereof, securing the three parts together with the bearing aperture or apertures in accurate axial alignment with the concentric surfaces of the intermediate part and with the corresponding dowel holes of the three parts in alignment, and while the three parts are so secured accurately forming the aligning dowel holes of all three parts to their full finished dimensions.

3. The method of machining the casing of a vane-type shock absorber or the like having front and rear wall parts with plane surfaces to engage the sides of the vane and with a shaft bearing aperture in at least one of said parts, an intermediate part having concentric surfaces to engage the hub and outer periphery, respectively, of the vane and plane front and rear surfaces to engage the front and rear wall parts, dowels

engaging the three casing parts, and screws passing through the front and intermediate parts and having threaded engagement with the rear part, the said method comprising forming the concentric surfaces of the intermediate part, drilling in the front and rear wall parts dowel holes to undersize dimensions and screw holes, the screw holes in the front plate being drilled oversize, forming a shaft bearing aperture in one or both of the front and rear wall parts in position located from the dowel holes of such part, drilling undersize dowel holes in the intermediate part corresponding to the dowel holes of the front and rear parts and located with respect to the concentric surfaces of the intermediate part and simultaneously drilling oversize screw holes in the intermediate part corresponding to the screw holes of the front and rear parts, securing the three parts together with the bearing aperture or apertures in accurate axial alignment with the concentric surfaces of the intermediate part and with the corresponding dowel and screw holes of the three parts in alignment, and while the three parts are so secured accurately forming the aligning dowel holes of all three parts to their full finished dimensions.

GORDON R. PENNINGTON.