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PROCESS FOR MANUFACTURING A LEVER ASSEMBLY

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Fig. 1

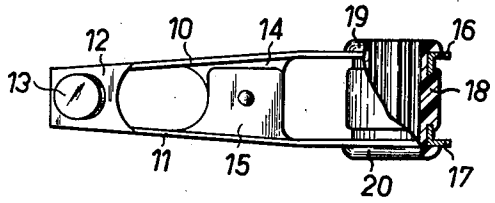
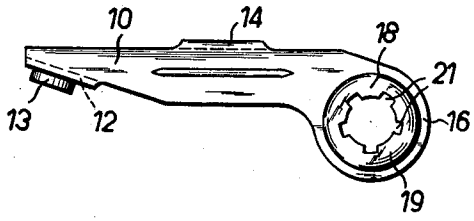


Fig. 2



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PROCESS FOR MANUFACTURING A LEVER ASSEMBLY

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Claims priority, application Germany Apr. 2, 1958
3 Claims. (Cl. 29—155.5)

The present invention relates to levers.

More particularly, the present invention relates to levers which are provided with tubular bearings sleeves such as, for example, the interrupter lever of the ignition system of an internal combustion engine.

This application is a division of application Serial No. 803,410, now Patent 3,011,360, filed April 1, 1959, and entitled "Lever Assembly."

Bearing sleeves of this type are generally made of a suitable resin. The resin, which may be synthetic, is in the form of an elongated tube from which short lengths are cut so that the individual bearing sleeves may be formed from these short tubular lengths. Each of these short tubular lengths are pressed at their ends into eyes of the lever and then the interior of the plastic tube is finished so as to be provided with the desired diameter.

With the lever assemblies of the above type, there are disadvantages both from the standpoint of the material from which the bearing sleeves are made as well as from the standpoint of the several different steps required in the manufacture of the assembly, such as the cutting of a short length from the tube of plastic, the pressing of the short length of tube into the eyes of the lever, and then the finishing of the interior diameter of the tube, all of which renders the assembly relatively expensive and requires a considerable amount of time to manufacture.

One of the objects of the present invention is to overcome the above drawbacks by providing a lever assembly of the above type which can be manufactured in a fraction of the time required for conventional lever assemblies of the above type and which is far less expensive than conventional lever assemblies of the above type.

Another object of the present invention is to provide a lever assembly of the above type which is exceedingly strong.

Also, it is an object of the present invention to provide a lever assembly of the above type which will effectively resist any tendency of the bearing sleeve to become undesirably distorted as a result of relatively large changes in temperature.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a view partly in section of a lever assembly according to the present invention, as seen from the underside of FIG. 2; and

FIG. 2 is a side elevational view of a lever assembly constructed according to the present invention.

Referring now to the drawing, an interrupter lever of an ignition system of an internal combustion engine is illustrated therein incorporating the structure of the invention and manufactured according to the process of the present invention. The lever illustrated in FIGS. 1 and 2 includes a pair of side walls **10** and **11** which are integrally connected at their left end, as viewed in FIGS.

1 and 2, by a bridge portion **12** which extends between the side walls **10** and **11**, the lever being made of any suitable sheet metal or the like. The bridge portion **12** carries the interrupter contact **13**. Furthermore, the side walls **10** and **11** have a pair of tongues **14** and **15** integrally extending therefrom, and these tongues also extend between the side walls **10** and **11**, as shown in the drawing. The tongues **14** and **15** overlap and engage each other and they are interconnected in any suitable way as by a rivet so that these interconnected tongues **14** and **15** serve to increase the stiffness of the lever assembly.

At the end of the lever distant from the bridge portion **12** thereof, the side walls **10** and **11** are provided with eyes **16** and **17**, respectively, these eyes being formed by stamping the sheet metal in such a way as to provide the walls **10** and **11** with the tubular portions which form the eyes **16** and **17** as shown most clearly in FIG. 1. It will be noted that the tubular portions at the right end of the walls **10** and **11** extend from these walls toward each other.

In accordance with the present invention a plastic sleeve **18** made of thermoplastic material is injection molded in the space between as well as around the eyes **16** and **17** so as to form the bearing sleeve **18** which has the construction shown in the drawing. The plastic material used for this purpose may be a polyamide such as nylon or polycaprylactam and these plastic materials have the property of becoming plastic only at temperatures above 100° C. These temperatures are only important, because ignition distributors with the described lever assemblies may heat up in service up to 100° C., and therefore the sleeves **18** must also endure these temperatures. When the plastic material hardens in the mold so as to form the sleeve **18**, this plastic material shrinks onto the eyes **16** and **17**, and furthermore the sleeve **18** forms flanges **19** and **20** at the exterior surfaces of the walls **10** and **11**, respectively, so that the sleeve **18** is similar to a hollow rivet which interconnects the side walls **10** and **11**. In this way the bearing sleeve provides the lever assembly with an increased stiffness, as compared to bearing sleeves which are pressed into the eyes after being cut from a length of tubing.

The bearing sleeve **18** is formed with the desired inner diameter directly as a part of the injection molding thereof. In order to compensate for tendency of the sleeve to change its shape as a result of temperature changes, which might occur when the temperature changes are relatively large, the sleeve is formed in its interior in the example illustrated with five axial grooves **21** distributed about the axis of the sleeve as shown, the grooves being formed by the mold.

When exposed to heat thermoplastic materials expand more than thermosetting materials. Nevertheless the arrangement of the grooves **21** in the sleeve **18** allows closer tolerances for the bore of the sleeves, because the material may expand into the grooves **21** when the heat increases.

With regard to the manufacture of the sleeves the present invention is not limited to the group of the polyamides, the melting temperature of which lies between 200° C. and 260° C. Other materials may also be used such as polyurethanes with melting temperatures of 150° C. to 190° C. (Duretan BK), polypropylenes with melting temperatures of 160° C. to 180° C. (Hostalen PPH) or polycarbamates with melting temperatures of 220° C. to 260° C. (Makrolen).

Other materials, such as polyacrylates (Plexigum 8–N), polyethylenes (Hostalen CG–6 400), especially perfluorinated polyethylene (Teflon), and trifluoro-monochloropolyethylene (Kel–F), and isotactic and syndiotactic polystyrenes (Polystyren 51) are also suitable for the purposes of the present invention.

In all cases the exact quantity of the material, for instance granulated polycaprylactam, is introduced into a press cylinder with a press ram, heated preferably by electricity to 253° C. Attention must be paid to the fact that a temperature higher than the melting temperature may lower the quality of the materials, and a lower one however may make it hard to inject the material.

With a pressure of 400 kg./cm.^{2} the liquified material is then injected through a nozzle into a multiple injection mold containing the interrupter levers and perfectly closed on all sides until the mold is filled completely.

The press ram stays at its lower dead center for about 2 seconds in order to avoid back flowing of the polycaprylactam from the mold. Only at the end of this time the press ram is moved back in the press cylinder, the injection cylinder is lifted off, refilled and prepared for the following cycle.

The mold itself, consisting of several parts, stays closed for 6 to 10 seconds after the injection cycle. When using several molds the still closed mold may cool off outside of the injection press, at the same time the next mold, which has already been prepared for the injection cycle is inserted into the press.

With this working method a new injection cycle may be started every 7 to 10 seconds. This quick sequence of working cycles is possible on account of the use of thermoplastic materials, which cool fast and do not need a long setting time as thermosetting materials.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of lever assemblies differing from the types described above.

While the invention has been illustrated and described as embodied in interrupter levers for ignition systems, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of the prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A process for manufacturing a lever assembly having an insulating bushing at one of its ends comprising the steps of bending the legs of a flat substantially U-shaped sheet metal member substantially normal to the base portion of the U-shaped member so that said legs extend respectively in planes substantially normal to the plane of said base portion and so as to form a lever having a pair of side walls united at one end by a bridging portion; forming at the other end of each side wall an eye having a tubular portion coaxial with and spaced from the tubular portion of the other side wall, said first two steps being carried out in any sequence; and afterwards injection molding into the space between and around said pair of tubular portions a thermoplastic sleeve substantially coaxial and in direct contact with said tubular portions so that the latter become embedded in and each engaged on opposite ends by said thermoplastic sleeve and so that said sleeve shrinks onto the tubular portions, so as to form an insulating bushing about said tubular portions while permanently uniting the same.

2. A process for manufacturing a lever assembly having a pair of spaced metal wall portions each formed with a tubular metal portion coaxial with and spaced from the tubular metal portion of the other metal wall portion comprising the steps of injection molding into the space between and around said pair of coaxial tubular metal portions a bushing of thermoplastic material substantially coaxial and in direct contact with said tubular metal portions so that the latter become imbedded in and each engaged on opposite end faces by the bushing of thermoplastic material and so that said bushing shrinks onto the tubular portions and forms an insulating bushing about said tubular metal portions while permanently uniting the same; and forming during the injection molding of the bushing a plurality of grooves in the inner surface thereof angularly displaced from each other and each extending longitudinally through the whole length of the bushing.

3. A process for manufacturing a lever assembly having a pair of spaced metal wall portions each formed with a tubular metal portion coaxial with and spaced from the tubular metal portion of the other metal wall portion, comprising the step of injection molding into the space between and around said pair of coaxial tubular metal portions a bushing of thermoplastic material substantially coaxial and in direct contact with said tubular metal portions so that the latter become imbedded in the bushing of thermoplastic material and so that the bushing shrinks onto the tubular portions and forms an insulating bushing about said tubular metal portions while permanently uniting the same.

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