May 31, 1932. E. T. CAUSER 1,860,607

METHOD OF MAKING CRANK SHAFTS

Filed April 15, 1929

Fig. 2.

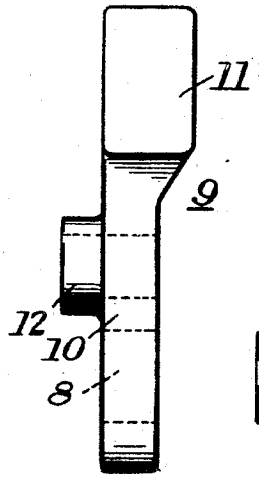


Fig. 1.

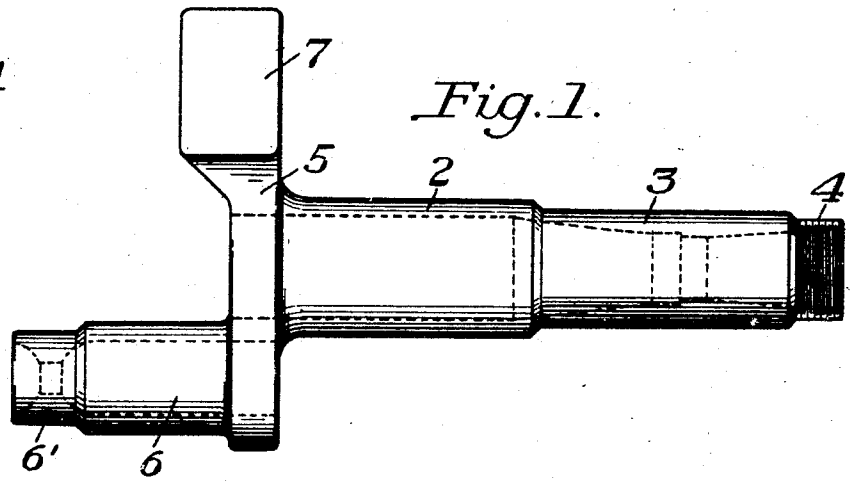
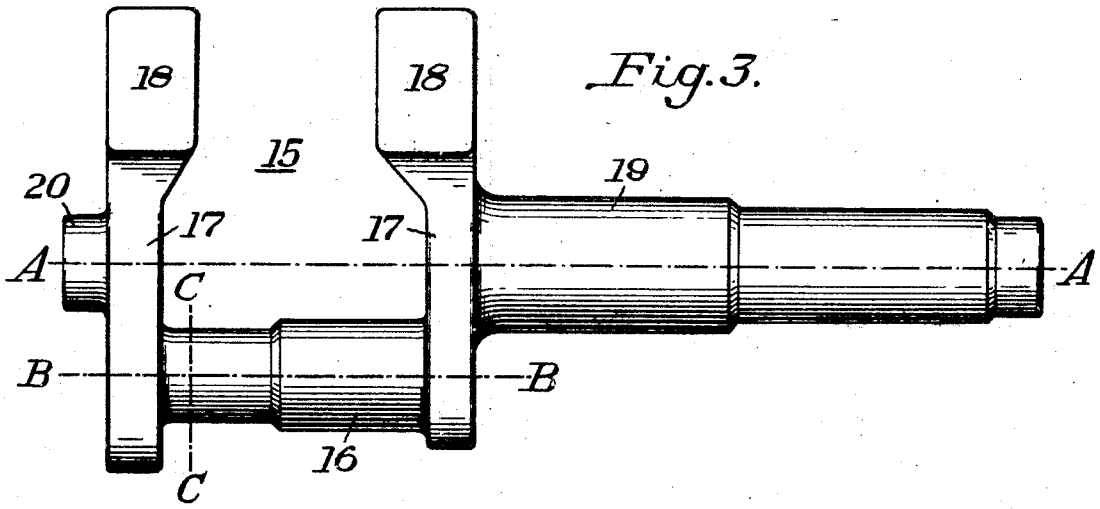


Fig. 3.



INVENTOR

Edward T. Causer

by his attorneys

Byron, Stebbins & Parmelee

Patented May 31, 1932 1,860,607

UNITED STATES PATENT OFFICE

EDWARD T. CAUSER, OF BEAVER FALLS, PENNSYLVANIA, ASSIGNOR TO UNION DRAWN STEEL COMPANY, OF BEAVER FALLS, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

METHOD OF MAKING CRANK SHAFTS

Application filed April 15, 1929. Serial No. 355,056.

This invention relates to a method of making crank shafts for internal combustion engines, and is particularly applicable to crank shafts for radial cylinder engines of the type commonly employed as airplane motors.

The design of many airplane motors necessitates the crank shaft being made in two separate pieces to facilitate the assembling of the engine. Heretofore, these parts have been made separately, as separate forgings, and machined separately. This requires two complete sets of forging dies, two distinct machining operations, one for each part, and finally the fitting together of the two parts.

According to the present invention, it is proposed to make the crank shaft as a one-piece forging, perform various machining operations thereon, and finally separate the forging at a predetermined point to provide the separate parts.

The invention may be readily understood by reference to the accompanying drawings which illustrate my invention and in which Figure 1 is a side elevation of the completed front end portion of the crank shaft assembly;

Figure 2 is a similar view of the rear end portion of the crank shaft assembly; and Figure 3 is a side elevation of the one-piece forging from which the two parts shown in Figures 1 and 2 are obtained.

The parts shown in Figures 1 and 2 are the conventional parts of the crank shaft fully machined and ready for assembly. The front end member comprises a shaft portion 2 which must be machined and having an extension 3 of reduced diameter which must also be accurately machined and in which key slots are cut to retain a propeller. Beyond the reduced portion 3 is a threaded portion 4.

At the other end of the shaft 2 is a cross portion or cheek 5 on which is an eccentric crank pin 6. Opposite the crank pin 6 is a counterweight 7. The crank pin 6 has a reduced portion 6′ adapted to be received in an opening 8 in the rear end member 9 shown in Figure 2, this rear end member 9 having a cheek portion 10 corresponding in shape to the cheek portion 5 of the front end member, and the hole 8 is eccentrically positioned in the cheek portion 10. The member 9 is counterweighted at 11. It has a hub portion 12 which is machined externally. Both the front end member and the rear end member have an internal bore, as indicated in dotted lines in the drawings.

As heretofore made, the front end member and the rear end member have been forged separately and machined separately, necessitating separate forging dies for each member and necessitating a series of separate machining operations for each of the two members.

According to the present invention, a crank shaft is forged in one piece, as shown in Figure 3, the front end portion and the rear end portion being connected by the crank pin, which is originally made longer than is necessary for the crank pin in the finished assembly. In Figure 3, the one-piece forging 15 has a crank pin portion 16, cheeks 17 with counterweights 18. One of the cheeks has a forwardly extending shaft portion 19, and on the other cheek portion is a hub portion 20.

In carrying out the present invention, the crank shaft forging is machined. Upon setting the forging up in a lathe, or other machine tool to turn about its main longitudinal axis A—A, the necessary machining of the extension 19 can be effected to provide the portion 2 of Figure 1, the portion 3 and the threaded portion 4 and at the same time the hub portion 20 can be turned down to correspond to the portion 12 of Figure 2. Both the rear end portion and front end portion can be internally machined or bored at the same setting.

The one-piece unit may then be turned about the axis B—B of the crank pin to machine and bore the crank pin. During the machining operation, the perpheries and faces of the two cheeks 17 may also be finished and shaped, as can also the two counterweight portions 18.

After all of the machining operations which are common to the two pieces, or which can be carried out on the single unit, have been completed, the unit is separated by cut-

ting through the crank pin substantially in the plane of line C—C, the crank pin having originally been forged long enough to permit of it being severed in this manner. After the forging has been severed, the hole 8 can be formed in that piece that forms the rear end section and the two parts are complete.

The process possesses many advantages in that it eliminates the separate handling of the different pieces, the separate setting up of the pieces for the various machining operations, provides for multiple tooling operations, and reduces the chance of spoilage because the two parts, being made as one, will fit accurately together after they have been separated. Being made in one piece and being machined at one time, the parts will fit together with greater accuracy than can be obtained in the manufacture of the parts separately.

The process also considerably reduced the labor cost through the elimination of the handling of the separate parts and the time lost in the setting up of the separate parts in the machine tools.

Furthermore, the crank shaft itself is a superior product because, being forged as a single piece, it has a uniform metal content and the grain structure is developed, particularly in the crank pin, under more favorable conditions than where the two parts are forged separately. The assembly is also superior for the reason that the two parts, being made as a unit and machined as a unit, fit together with greater accuracy than where the parts are made separately.

It will be understood that in the drawings the crank shaft has been shown in a more or less conventional fashion and that the invention is not confined to the particular construction and shape therein illustrated, the drawings being merely for the purpose of illustration. It will also be understood that various parts may be differently machined according to the design and construction of the particular crank shaft and that the invention is not to be considered as restricted to the manufacture of the particular construction herein shown and described, but may be utilized in the manufacture of crank shafts of various types.

I claim:

1. The method of manufacturing a two-piece crank shaft assembly which comprises forming the two parts of the crank shaft having a crank pin disposed between the two parts as a rigid integral forging, machining both parts of the forging as a unit, and then severing the crank pin to provide the separate parts.

2. In the manufacture of a two-piece crank shaft assembly in which both pieces have a cheek portion and a hub portion and in which one piece has a crank pin adapted to engage a socket in the cheek portion of the other, the steps which comprise forging both parts and a connecting pin between the parts as a single unit, machining both parts as a single unit, severing the connecting pin to provide two parts and then further machining one part for cooperation with the other.

3. In the method of forming a two-piece crank shaft assembly wherein each part has a cheek portion and a hub portion, the steps which comprise forming the two parts as a single unit connected by a crank pin portion of a dimension longer than the crank pin of the finished assembly, machining the one-piece unit, and then separating the unit by cutting across the crank pin portion thereof closely adjacent the cheek of one part whereby substantially the full length of the crank pin remains attached to the other part, and thereafter forming a socket in the cheek portion of the part from which the pin has been severed and in line with the former axis of the pin.

4. The process of manufacturing a crank shaft assembly having a front end portion and a rear end portion which comprises initially forming both portions in a single unit connected by a crank pin portion whose dimension is longer than the crank pin of the finished assembly, and then separating the two portions by severing the crank pin adjacent one end thereof so that the greater portion of the crank pin is on one portion, and thereafter removing the remnant of the crank pin portion from the other member and providing a socket therein in line with the former axis of the crank pin, said socket being adapted to receive the end of the crank pin of the other member.

In testimony whereof I have hereunto set my hand.

EDWARD T. CAUSER.