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C. W. LANG
CAM SHAFT

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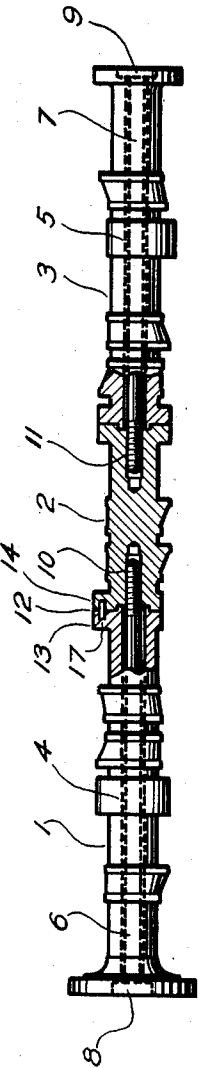


Fig. 1

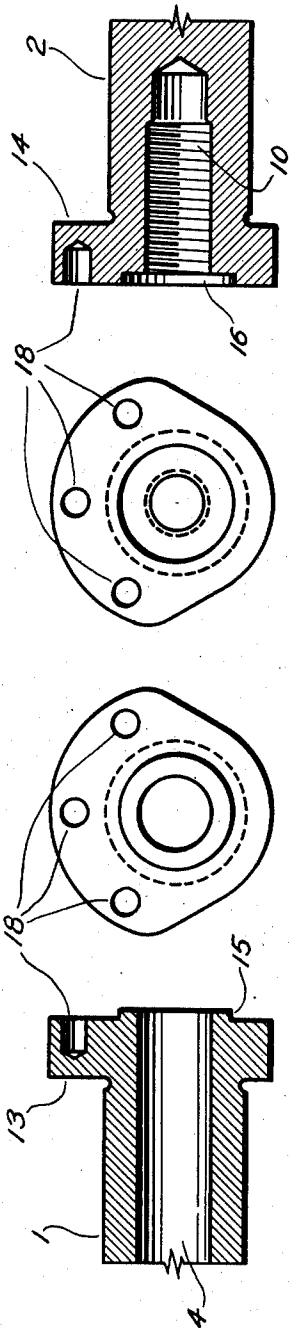


Fig. 2

Fig. 3

Fig. 4

Fig. 5

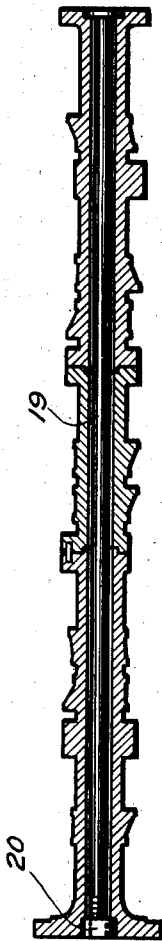


Fig. 6

INVENTOR.
Charles W. Lang
BY
Harry C. Schroeder

UNITED STATES PATENT OFFICE

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CAM SHAFT

Charles W. Lang, San Francisco, Calif.

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6 Claims. (Cl. 74—567)

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This invention relates to cam shafts for internal combustion engines and more specifically to the method of manufacture whereby a shaft can be machined in a plurality of sections, the sections being secured together in end to end relation.

Heretofore it has been the practise to manufacture the shafts in one piece with cams integral; in sections secured together by means of mating flanges and bolts, or by a one piece shaft with the various cams mounted thereon, and keyed in place.

Each one of these methods has its own inherent disadvantages which I have eliminated by my improved method of manufacture.

Due to the progressively increasing size of internal combustion engines of the Diesel type, the manufacture of a one piece shaft with cams integral has become an increasingly difficult and costly procedure. The spring inherent in a shaft of such proportions and the method of coping with this condition, combined with the physical size of machine tools capable of handling this type of work, has made the adoption of other methods of manufacture extremely desirable.

The method of mounting separate cams on a shaft and securing them with keys, while overcoming some of the undesirable features incidental to the manufacture of an integral shaft, presents its own peculiar problems in assembling the various component parts. Close tolerances have to be maintained, the cams have to be heated in order to assemble them, and not infrequently, a cam seizes upon the shaft before assuming its correct position, resulting in galling and abrasion which often causes the complete loss of the shaft. Also, the cams have to be made unduly large in order to have sufficient material surrounding the bore.

Neither of these methods of manufacture make the heat treatment of the finished product feasible, therefore the best physical characteristics of the material are never realized.

The third method described has the disadvantage of having flanges which occupy valuable space, cutting down the length of the shaft journals and otherwise complicating engine design.

The main object of my invention, is the provision of a shaft which has all the advantages of an integral shaft and does not have the disadvantages incidental to the other methods of manufacture as stated.

Another object of my invention, is the provision of a shaft that can be heat treated and

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machined to closer tolerances than can one of integral construction.

Other objects and advantages residing in the novel features of my method of manufacture will become apparent during the course of the following description and claims, taken in connection with the accompanying drawing forming a part thereof.

In the drawing:

Figure 1 is an elevation of a cam shaft, partly in section, showing an embodiment of my improved method of manufacture.

Figure 2 is an enlarged detail illustrating a sectional elevation of one of the connecting ends.

Figure 3 is an end elevation of the detail shown on Figure 2.

Figure 4 is an enlarged detail illustrating a sectional elevation of the mating end to the detail shown on Figure 2.

Figure 5 is an end elevation of the detail shown on Figure 4.

Figure 6 is a sectional elevation of a modified method of locking the various sections together.

Referring to the drawing in detail, cam shaft sections 1, 2, and 3 completely machined, are shown locked together to form one unit. Sections 1 and 3 are constructed with hollow shafts as indicated by the numerals 4 and 5, for the reception of bolts 6 and 7, the heads of which, are seated in counterbores 8 and 9. The center section 2, of the completed shaft is of solid construction, but is drilled and tapped at each end as indicated by numerals 10 and 11. Bolts 6 and 7, are passed through sections 1 and 3, screwed into the tapped holes 10 and 11, respectively and the entire assembly drawn tightly together as shown on Figure 1.

It will be noted from the drawing, that my method of attaching the adjoining sections of the complete shaft contemplates a novel method of utilizing a cam as a pair of mating flanges. Fuel cam 12, is composed of one half 13, integrally formed with section 1, and the other half 14, integrally formed with section 2. This construction is shown in detail on Figures 2 to 5, inclusive.

Axial alignment is maintained between the adjoining sections by male projection 15, and the female counterbore 16. Angular alignment is maintained by means of dowels 17, fitted into holes 18, which are drilled and reamed to jig.

This method of utilizing the cams to connect the adjoining sections, offers all the advantages of the flanged construction without the disad-

vantage of encroachment upon valuable space.

The modification shown in Figure 6, discloses all sections of hollow construction and being locked together by bolt 19, which passes through the entire shaft and engages nut 20.

Other modifications may be made within the spirit and scope of the appended claims, therefore, I do not wish to be limited to this particular disclosure.

I claim:

1. A cam shaft consisting of a plurality of sections fitting into the cam shaft bearings of an internal combustion engine, each section having at least one end thereof formed with a half of a fuel cam, the main plane of which is substantially at right angles to the main axis of the shaft; means carried by the adjoining complementary half fuel cams for axial and angular alignment of the same; and means for securing said sections together.

2. A cam shaft consisting of a plurality of sections fitting into the cam shaft bearings of an internal combustion engine each section comprising a substantially cylindrical body and having at least on one end thereof a half of a fuel cam integral with said body; the abutting halves of a fuel cam of the two adjoining sections forming a full fuel cam; means carried within the cams for axially and angularly aligning the same; and means within the cam shaft for securing all sections together.

3. A cam shaft comprising a plurality of longitudinal sections, each section comprising a portion of the shaft proper and one half of a fuel cam at least on one end thereof, which half being integral with the shaft; means in said half cams for mutual axial and angular alignment; the aligned abutting halves being adapted to complement one another into a full cam; and means for securing the sections together.

4. A cam shaft comprising a plurality of longitudinal sections; each of the end sections forming a portion of the cam shaft, a half of a cam formed on an end of each of said sections; the intermediate forming a portion of said shaft and a half of a cam on each end thereof; means entirely within said halves of said cams for mutual axial and angular alignment of said half cams; the aligned adjoining halves of each cam

being adapted to form a full cam; and means within said shaft for securing the sections together.

5. A cam shaft comprising a plurality of longitudinal sections; each of the end sections forming a portion of the cam shaft, a half of a cam formed on an end of each of said sections; the intermediate forming a portion of said shaft and a half of a cam on each end thereof; means entirely within said halves of said cams for mutual axial and angular alignment of said half cams; the aligned adjoining halves of each cam being adapted to form a full cam; said sections being formed with a central bore; and fastening elements passing through said bore for securing said sections together.

6. A cam shaft comprising a plurality of longitudinal sections, each of the end sections consisting of a portion of the cam shaft and terminating with a portion of a cam; an intermediate section forming a portion of said cam shaft and a portion of a cam on each end thereof; the portions of a cam on abutting ends of each two adjacent sections complementing one another into a full cam; means entirely within each of said cams for mutual axial and angular alignment of said complementary portions; the intermediate section being formed with a threaded bore in each end; the rest of said sections being tubular; and threaded fastening elements passing through said bores and secured in said threaded bores for securing said sections together.

CHARLES W. LANG.

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