July 9, 1946. N. P. LLOYD 2,403,868

CAMSHAFT ASSEMBLY

Filed Aug. 13, 1942 2 Sheets-Sheet 1

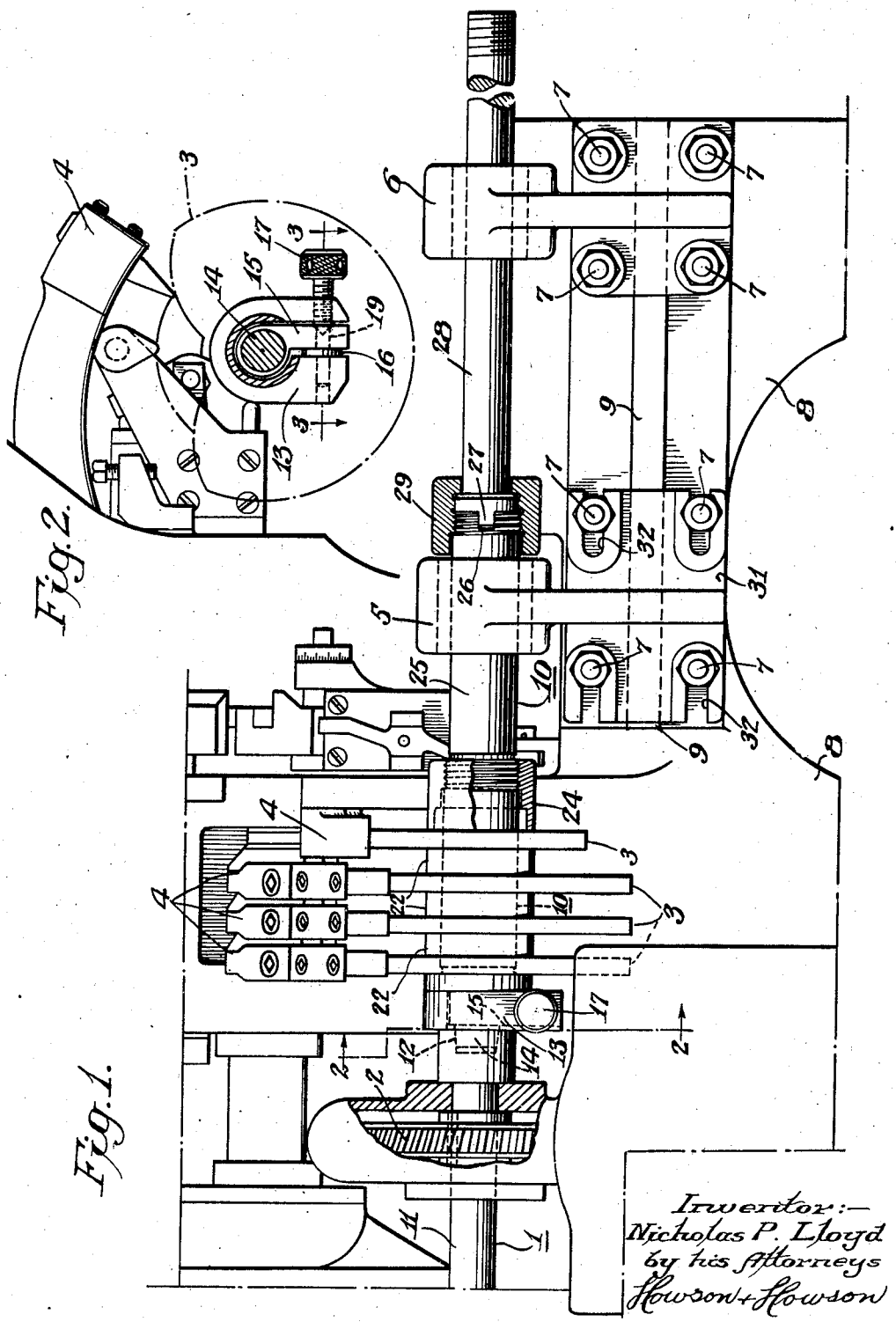

Fig. 2.

Fig. 1.

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Fig. 4.

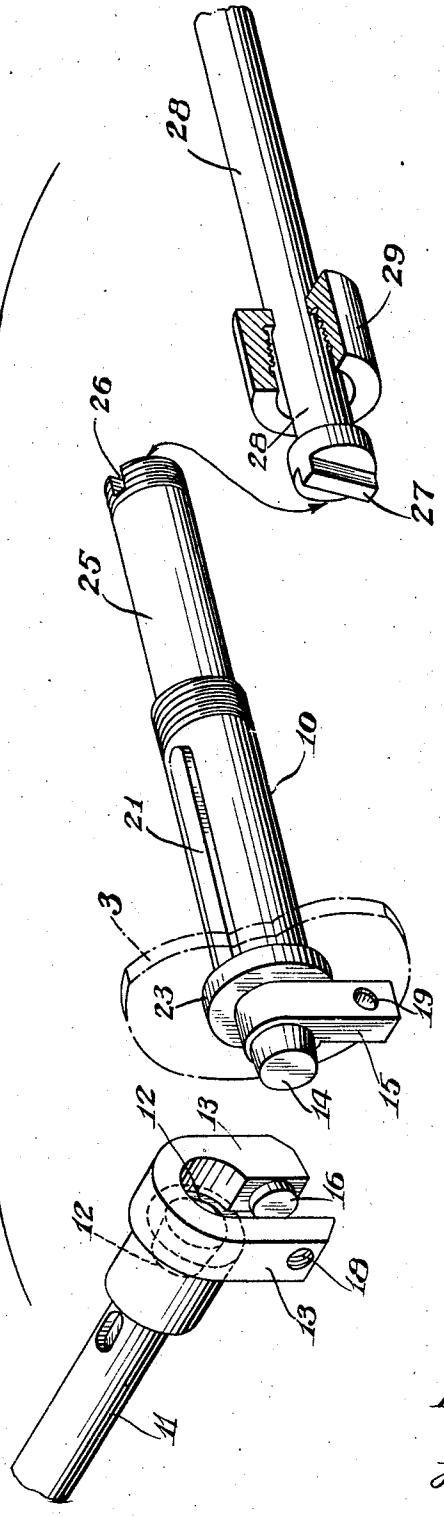
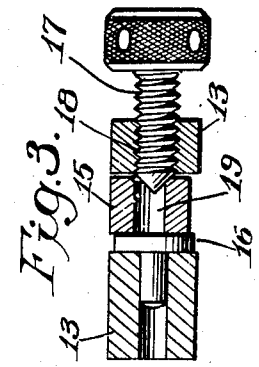


Fig. 3.



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CAMSHAFT ASSEMBLY

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5 Claims. (Cl. 287—1)

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A principal object of this invention is to provide a cam shaft assembly for machine tools and the like which shall be of a character to facilitate the operation of changeover from one set of operating cams to another. In machines of certain types such, for example, as the automatic lathe disclosed in my copending application Serial Number 383,634, several correlated operations of one or more of the machine elements are controlled, regulated and timed by means of a plurality of cams carried on a common shaft. Provision is customarily made for substitution of cams of different forms so as to modify the several operations as required to produce a desired final result. With the conventional arrangements, this substitution of cams is a time-consuming one requiring relatively extended shutdown of the machine during the changeover period.

A principal object of the invention, as previously set forth, is to provide a device for effecting a changeover of this character with a minimum period of shutdown for the machine and in a manner to insure maintenance of a high degree of precision in the operation of the machine.

More specifically, an object of the invention is to provide a cam shaft assembly wherein the shaft consists in part of a detachable section which carries the cam elements and which may be removed bodily for replacement by a corresponding section carrying a different cam combination.

Still another object of the invention is to provide a means whereby the substituted shaft sections may be secured in place in precise predetermined position with respect to the companion shaft section or sections.

The invention further resides in certain structural details and arrangements hereinafter described and illustrated in the attached drawings, wherein:

Figures 1 is an elevational and partial sectional view showing a shaft assembly constructed in accordance with the invention;

Fig. 2 is a section on the line 2—2, Fig. 1;

Fig. 3 is a section on the line 3—3, Fig. 2, and

Fig. 4 is an exploded view in perspective showing the several elements of the shaft.

With reference to the drawings, the cam shaft, which is indicated generally by the reference numeral 1 and which in the present instance is driven through the medium of a gear 2, carries a plurality of cams 3 which are operatively associated in conventional manner with a corresponding number of levers 4 controlling certain of the

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operations of the machine of which the cams are a functional part. The shaft is supported in part in bearings 5 and 6, these bearings in the present instance being detachably connected by means of bolts or studs 7 to the frame 8 of the machine. The opposed faces of the bearing brackets and the frame 8 are slotted for reception of a key 9 which functions to position the bearings and to maintain them in accurate alignment.

In accordance with the present invention, the cam shaft 1 comprises at least one separable cam-carrying section 10, one end of which is fitted to and is supported by the relatively fixed portion 11 of the shaft, and the other end of which is supported in the bearing 5, as shown in Fig. 1; and the shaft section 10 is separable and is adapted to be removed bodily from the machine for replacement by a similar shaft section carrying a different set of cams calculated to afford a desired machine operation. To this end, the terminal end of the relatively fixed shaft portion 11 is formed, as illustrated in Figs. 1 and 4, with an axial socket 12, tapering inwardly in the present instance, and with a U-shaped yoke 13, said socket and yoke being formed for reception respectively of an axial extremity 14 and an adjoining transversely extending arm 15 both on the separable shaft section 10. The extremity 14 is tapered in the present instance and, as shown in Figs. 1 and 2, wedges tightly within the tapered recess 12 and is of lesser axial length than the recess so as to insure an accurate aligning of the terminal end of the shaft section 10 with the relatively fixed section 11. As shown in Fig. 2, the yoke 13 loosely embraces the arm 15, and one side of the yoke carries a hardened steel or other suitable button 16 which forms a solid abutment for one side of the arm 15 to establish the shaft section 10 accurately in a predetermined angular position with respect to the relatively fixed shaft 11.

Means is also provided for clamping the arm 15 solidly against the button 16, and also to force and maintain the shaft section 10 in an axial direction toward the section 11 so as to bind the tapered extremity 14 solidly in the recess 12. This means consists of a screw 17 which is threaded into a tapped hole 18 in the other arm of the yoke 13, the inner end of the screw 17 engaging an aperture 19 in the arm 15, as shown in Figs. 2 and 3. It will be noted that in the normal assembly of these parts, the tapered inner end of the screw 17 will engage one lateral edge of the aperture 19, see Fig. 3, so that the tightening of the screw not only forces the arm 15 solidly

against the button 16, but also exerts a pressure on the arm 15 in the axial direction tending to force the shaft section 10 towards the shaft section 11 and to thereby solidly engage the tapered extremity 14 in the socket 12, as previously described.

The aforedescribed construction insures accurate axial alignment of the separable shaft section 10 with the relatively fixed shaft section 11, and insures also that the shaft section 10 shall have and be maintained in a predetermined angular position with respect to the section 11.

As illustrated, the shaft section 10 is provided in the present instance with a spline or key 21 for locating and retaining the cams 3 in predetermined angular position on the shaft. The cams are separated by spacer sleeves 22, one terminal cam bearing against a flange 23 on the shaft section and the other terminal cam being engaged by a sleeve 24 which is threaded on the shaft, see Fig. 1, so as to clamp the entire cam assembly in position on the shaft. In the present instance the reduced terminal end 25 of the shaft section 10 which is supported by the bearing 5 is provided at its extremity with a slot 26 which is adapted to receive a corresponding rib 27 on the end of a shaft section 28 whereby this section 28 may be coupled to the section 10. A sleeve 29 on the shaft section 28 is adapted to be threaded on the end of the shaft section 10, as shown in Fig. 1, whereby to secure the sections together in axial alignment, the shaft section 28 being supported in the bearing 6, which bearing as previously described is held in accurate axial alignment with the bearing 5. The shaft section 28 is adapted for detachable connection to operating parts of the machine not shown.

If it is desired to change over from one set of cams to another, it is only necessary to remove the shaft section 10 and to replace it with another section carrying the required cams. This permits the cams required for any particular machine operation to be made up on the replaceable shaft section while the machine is still in operation or the shaft section 10, with its cams, may be one of a number of permanent interchangeable units. In either case, the machine need be shut down only for the period required to remove the one section 10 and to install the other. This may be accomplished by releasing the screw 17 to permit axial withdrawal of the shaft section 10 from the socketed end of the relatively fixed section 11, release of the collar 29 from the end of the shaft section 10, and subsequent bodily removal of the bearing 5 from the frame by release of the studs 7. The shaft section 10 may then be withdrawn from the bearing 5, the new shaft section inserted, and the parts then reassembled in the machine in obvious manner to complete the changeover.

There may be modifications in various details of the device without departure from the invention.

I claim:

1. In a coupling for detachably uniting two shaft sections in predetermined axial and angular relation, a tapered axial recess in the end of one of said sections, a tapered axial extremity on the end of the other section adapted for wedging engagement in said recess, a laterally projecting arm on one of said sections, an abutment for the said arm on the other of said sections, said arm and abutment establishing a predetermined angular relationship between said sections about the shaft axis, and a tapered fastening element on the last-named section adapted to engage a shoulder on said arm so as to force the arm against said abutment and axially toward the other of said sections.

2. In a coupling for detachably uniting two shaft sections in predetermined axial and angular relation, a conical axial recess in an end of one of said sections, a conical axial extremity on an end of the other section adapted for wedging engagement in said recess, a pair of spaced laterally extending arms on one of said sections, a laterally extending arm on the other section arranged to lie between the arms first named when the said sections are in the said wedging engagement, a screw in one of the arms of said pair operative on the intermediate arm to clamp it laterally against the other arm of the pair, and interengaging means on the screw and the intermediate arm reactable when the screw is turned in toward the clamping position to draw the shafts together axially into said wedging engagement.

3. In a coupling for detachably uniting two shaft sections in predetermined axial and angular relation, an axial socket in the end of one of said sections, a correspondingly formed extremity on the end of the other section adapted to fit in said socket, circumferentially aligned laterally projecting arms on said sections coactive to establish a predetermined relative angular position of the said sections about the shaft axis, and clamping means operatively associated with said arms for securing the said sections together.

4. In a coupling for detachably uniting two shaft sections in predetermined axial and angular relation, an axially extending tapered recess in the end of one of said sections adapted for wedging engagement with a correspondingly tapered end of the other section, abutment means on one of said sections for establishing a predetermined relative angular position of said sections about the shaft axis, an element on the other of the sections for engagement with said abutment means, and a single securing element coacting with said abutment means and with said element to retain the sections in the said abutting relation and in said wedging engagement.

5. In a coupling for detachably uniting two shaft sections in predetermined axial and angular relation, an axially extending tapered recess in the end of one of said sections adapted for wedging engagement with a correspondingly tapered end of the other section, abutment means on one of said sections for establishing a predetermined relative angular position of said sections about the shaft axis, an element on the other of the sections for engagement with said abutment means, a screw for retaining the element in engagement with the abutment means, and means associated with said screw for exerting axial pressure on said element forcing the sections into said wedging engagement.

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