A CRANKSHAFT TURNING FIXTURE

by M.A.C.

Much has been written at various times concerning methods of producing the overhung crankshafts usually associated with miniature I.C. engines, and although with care efficient shafts can be fabricated, their strength and parallelism are always open to conjecture, and it is therefore generally conceded that crankshafts machined from the solid are to be preferred.

The usual methods of turning, either between offset centres or on a vee-block attached to the lathe face-plate, have many disadvantages, and it was to circumvent these that this fixture was made. It should be added, however, that, although the method is novel so far as the writer is aware, it would appear such an obvious solution to the crankshaft turning problem that he hesitates to claim it as original.

The dimensions given in the following notes refer only to the fixture under review and need not be adhered to, as these sizes will, of course, be modified to suit particular requirements.

To commence operations, a piece of mild-steel 1-3/4 in. diameter and 5-3/4 in. long was held in the three-jaw chuck, faced off and centred, and whilst supported by the tailstock centre the No. 2 Morse shank, to suit the spindle of the lathe, was turned. To avoid the chucking and re-chucking which would have been necessary had the taper been fitted directly to the spindle, a new 2-3 Morse taper socket was borrowed and the shank turned to fit this. At the same setting a 1/4 in. B.S.F. hole was tapped, the hole counter-bored and the end of the shank relieved as shown, these lines intersecting those already mentioned were scribed at 1/4 in., 5/16 in., 3/8 in. and 7/16 in. radii and the points of intersection very lightly dotted. The fixture, still secured to the fixture was next mounted on the saddle and carefully lined up to the axis of the lathe by means of a home-made indicator held in the chuck and the parallel diameter previously turned. The centre of the first hole to be bored was located by means of a time-honoured dodge, much used by millers and
horizontal borers, which is mentioned here for the benefit of readers who do not know it.

A centre drill is held in the chuck and a blob of plasticine or some similar substance stuck on the end. A pin or gramophone needle is set in this and, with the lathe revolving, the point is set to run true, this point then representing the centre of the lathe spindle. The pin point and the dot on the job are made to coincide (which can be ascertained by using a glass), the job tightened in position and boring may proceed. The first hole on the 1/4 in. radius was bored and reamed 7/32 in. diameter, the holes running the full depth of the fixture body. The opposite hole, on 3/8 in. radius, the location of which was found by the cross-slide index was reamed 9/32 in. and, repeating the process, the holes on 5/16 in. and 7/16 in. radii were reamed 1/4 in. and 5/16 in. respectively.

All four holes were finally provided with a liberal chamfer to clear the radius which should be present at the junction of journal and web of any self-respecting crankshaft.

The next step was to drill and tap four holes for the 2-B.A. Allen grub-screws which serve to lock the component in the fixture. Referring to Fig. 4, it will be seen that these were modified by drilling the ends and inserting small copper pads. This was done to prevent damage to the crankshaft journal whilst held in the fixture.

The last component is the silver-steel pin, Fig. 5, the end of which is screwed 6 B.A. to suit the hole in the fixture, whilst the head is flattened as shown and drilled with a small centre drill.

“Princess Royal”
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There were no undue snags in building, but, occasionally things went wrong, and the loco nearly went out of the window, accompanied by Railroad Esperanto! Which of us does not know these trying moments? But in usual model engineers’ style, the difficulties were overcome, of course.

When I asked Norman how long he had been model-building, he replied: “As long as I can remember.” His first urge to build a loco was in 1919, when, a schoolboy, he bought a copy of Models, Railways and Locomotives, a periodical now defunct. He “played about” for a time, as many of us did in our youth, making the models which, because of lack of tools and experience, and perhaps because of an excess of youthful over-optimism, didn’t work out as they should have done.

Then, in 1926, he started taking the Model Engineer, and set to work in 1927 to build “Helen Long.” There were very long periods when the workshop and “Helen” had to be neglected, but she was eventually completed early in 1938. She too is a lovely loco. and has won various “firsts.”

The building of the “Princess” was begun in 1938, but she was packed away on the outbreak of war, until 1942, when the grease was cleaned off and a fresh start made. It will be seen, therefore, that the spare time of five to six years was spent in building her.

As a matter of encouragement to the “tyro,”

Having now particularly described and ascertained the nature of our fixture (if one may be permitted an excursion into Patent Office jargon), the machining of a crankshaft can now be considered, and one having a journal diameter of 1/4 in. and 5/16 in. throw, i.e. for an engine of 5/8 in. stroke, will serve as an example.

The journal is turned in the normal way by chucking one end and centring the other, the crank-disc diameter being turned at the same setting. The whole is then parted off from the bar, which produces a component similar to Fig. 6.

Having inserted the journal in the appropriate hole in the fixture the crankshaft is locked by means of the grub-screw, Fig. 4, and machining of the crankpin is commenced by drilling a 6-B.A. clearance hole and inserting the pin, Fig. 5. The component is then positively located and using the back centre as a steady, the crankpin turning becomes a straightforward job.

No out of balance will be noticed at normal turning speeds, but at higher polishing speeds any tendency to vibration can be damped out by using a plug of material in the opposite hole.

It should be mentioned that one is not confined to any particular combination of journal diameter and crankshaft throw as provided by the fixture. If the longitudinal holes are reamed to the largest size ever likely to be required for any specific engine stroke, the journal can be semi-finish turned between centres to suit the fixture bore and finished to the required diameter after completing the crankpin.