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# Repairing Antique Pendulum Clocks

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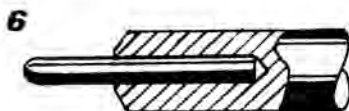
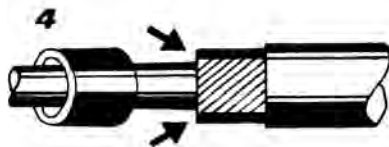
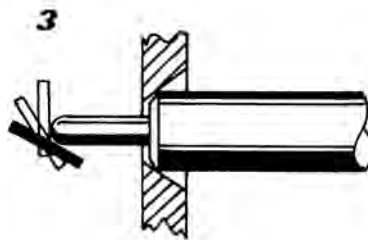
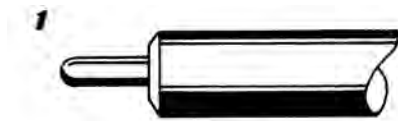
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Part 1  
Gear Trains  
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1) In old clocks we find exclusively square-shouldered pivots. These are re-polished as usual in a polishing lap on a lathe, or with modern devices that use rotating discs of hard metal and so produce a better finish than the traditional polishing file (Fig. 1).

2) Black Forest clocks with wooden frames have barrel-shaped pivots, to prevent jamming when through distortion of the wood the axles become skew. Here re-polishing can be performed only by the primitive method of using a wooden filing block and a polishing file. (Fig. 2).

3) Rounding of the pivot points is achieved while the shaft rotates in a funnel disc on a lathe, using a file for the final run. Previous turning marks, if any, are turned or ground off first. Although rounding is functionally superfluous for pivots without cover plates, no clockmaker is likely to omit this touch if the other parts of the clock are similarly finished. (Fig. 3).

4) Very often the front pivot of the centre wheel is worn. If the traces have been quite turned off and the pivot has been re-polished, it will be either as thin as the arbor of the hands itself, or at least the bearing will have to be bushed. A better solution is to mount on to the diminished pivot a steel ring; and the new pivot can now be worked to fit the bearing. However, in other cases this procedure is suitable only if the power to be transmitted does not endanger the weakened part. (Fig. 4).

5) The long arbor of the hands being a rather exposed pivot is often broken off. It can be replaced in two ways: either one drills in the arbor only, which preserves the original pivot; or, if the front pivot is defective or too thin, it is replaced as well, in which case the arbor must be given a thicker shaft which can be turned and polished to fit the existing bearing. (Fig. 5).

6) Pivots that are broken off are drilled in as usual. The stump of the arbor is clamped in a funnel disc on a lathe and the hole marked. The hole is bored slightly larger than the pivot to be fitted, and the depth must be at least three times the diameter. The fit must be airtight all along. If the arbor is too hard one may temper it. In French pendulum clocks, care is needed if the core of the wheel is near, because this is often welded on to the arbor with much tin and no fitting. (Fig. 6).

7) Another method is to cap the stump, although this may sometimes thicken the arbor which is not always technically sound if a large wheel is attached to it. However, if it is possible to turn the arbor down a little, it can be capped with a new section: since this involves shortening, the two operations should be performed together. As it is easier to turn an arbor to fit to a drilled hole rather than the other way round, one first prepares the capping piece of steel: drilling, hardening, tempering and preliminary turning. Such a cap will not always turn truly to centre: to achieve



this usually requires filing the turning marks, as might be indicated by testing the drive or the wheel. (Fig. 7).

8) If the pinion diameter is big enough it will be possible to drill a new section of arbor with its new pivot into the pinion, although here too care must be taken to ensure that the arbor and pinion rotate true to centre. (Fig. 8).

9) Setting back the pivot is simpler, but requires a bearing with protruding lining to compensate the shortened arbor. (Fig. 9).

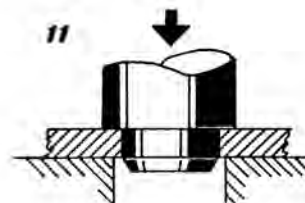
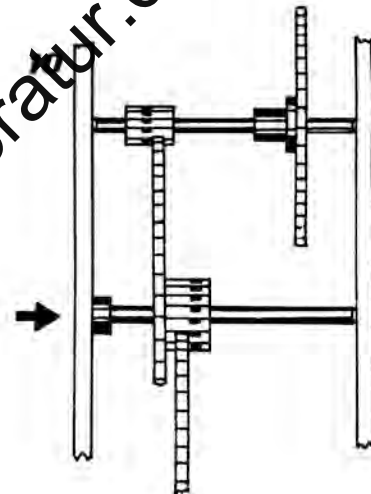
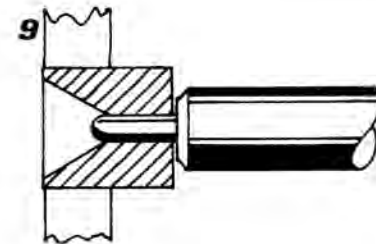
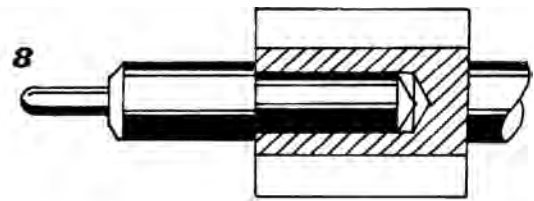
10) If the pinions of an old clock are damaged, this procedure enables us to displace two gear wheel engagements in such a way that the wheels work together with perfect fit: the arbor is indeed set back where the pivot is broken off or defective, but the protruding lining is fixed to the other pivot. Alternatively, one might lengthen the arbor at that end as in Fig. 7. In more complicated striking work one must consider whether in cases where a protruding lining is necessary it might not be used as an adjusting cock. (Fig. 10).

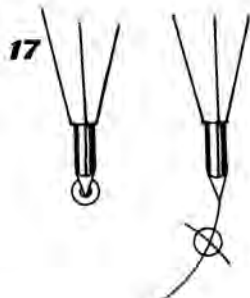
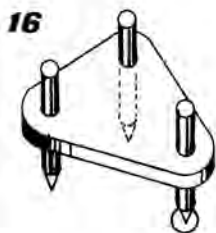
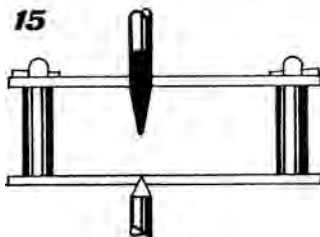
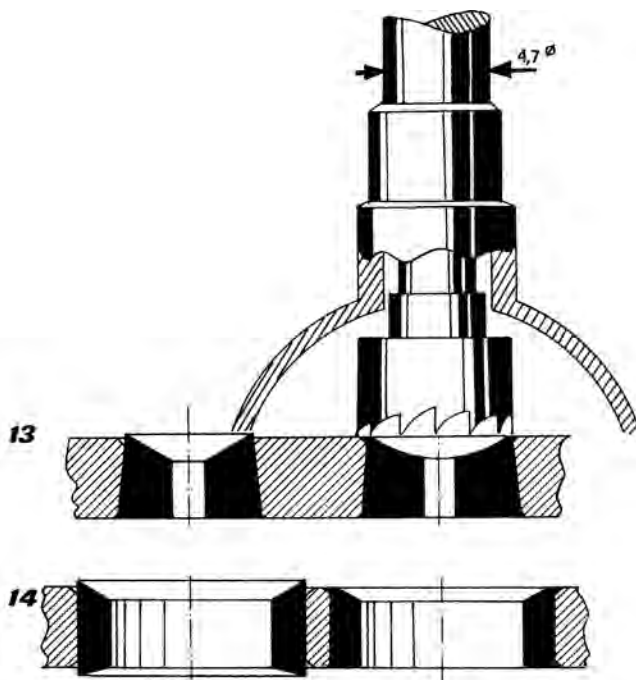
11) If the pivot bearings are worn too loose they must be fitted with bushes. In most cases it will be best to press in bearing linings of which an ample range is available today. They are pressed in from the inside, after the old, and enlarged pivot hole has been widened with a bull's foot file appropriate for the diameter of the bush, the plate being clamped into the pressing device. Whether externally protruding skew faces on the new bearings are removed (by filing, milling or grinding) depends on the clock's appearance as a whole, whether the new bushes fit in or look antique. Where many linings have to be pressed in it is advisable first to make a table stating for each the pivot diameter and external diameter. Next, the bushes are selected and the corresponding bull's foot files. A single file may then often be used to bore several holes in a single operation. (Figs. 11 and 12).

12) In wooden frames (Black Forest clocks) long and thin brass bushes are not now readily replaceable, because bored lining wire (with or without seam and chamfered at the end) is no longer available. If some of these bushes have worn too loose one has to turn and drill them oneself. (It seems that in the past "skilled" specialists for such clocks simply knocked out these long linings and replaced them back to front, since the barrel-shaped pivots could only in part distend the bearings.)

13) For bushes of exceptional dimensions, bearings must be specially made, if linings are not available bored or turned down. With very long bearings one can solve the problem by pressing two bushes of equal length into the plate. However, the pivot must be longer than the bushes, otherwise the bearing does not carry all the way and tends to jam.

If a proper lathe is available, making new bearings from hard brass tubing is not as time consuming as might appear at first: marking the hole, drilling, fitting





of outside diameter, turning of countersink for rivet, cutting off flush at the back at the appropriate length and rivetting with a sufficiently large round stake. Since a rivetting machine does not project far enough to allow working in any way on a pivot bearing in the middle of a clock plate, one uses an adjustable punch guide, thus ensuring that a flat punch (or, more vitally still, a flat drill) is vertical. (Fig. 13).

14) Large bushes in relatively thin plates or barrels should be rivetted on both sides, especially since they may be subject to considerable stresses. Eccentrically worn bearings must of course be properly re-centred; usually one can file off the unworn parts by eye and then use a sufficiently large flat bull's foot file to rebore the hole. (Fig. 14).

15) Another method is to seal and re-centre the worn out bearing. This involves roughly centred widening followed by sealing with a round of brass. As in the "Burin-fix", a modern pressing device allows one to mark the centre in line with the opposite bearing centred from below. A straight drill is usually too small for this). (Figs. 15 and 16).

16) The old three-legged platform can be used for re-centering if the hole is to be completely sealed. One leg is placed in the original centre of the bearing and the other two will mark themselves on the plate by means of a light tap with a hammer (preferably on the inside). After sealing, these two are replaced into their markings and a light tap with a hammer then marks the centre of the pivot hole to be drilled.

17) If the position of the centre is uncertain because of defective engagement, one should use a depthing tool. The wheel in question is successively adjusted as well as possible with the two wheels and drives that it engages, and on the inside of the plate an arc is graved from each of the other two bearings: their intersection on the sealed lining is carefully marked and, if need be, corrected before drilling. If no depthing tool is to hand, the compass points of a good slide gauge may serve to transfer the distances from the opposite plate, though in this case one cannot accurately correct engagement if necessary. (Fig. 17).

18) In clocks where proper setting of the strike may be difficult, it is advisable to attach an adjusting cock instead of a simple bush, a precaution well worth the time spent. A simple solution is to press the new bush into a flat piece of material which is then fixed to the plate with one or two screws. The old pivot bearing is widened until the protruding bush can move freely in it. Where a lathe is ready to hand, the bridge can be turned in one piece from a thicker flat bar. Depending on the clock's construction, such cocks are fixed either on the pin wheel or on the warning wheel. (Fig. 18).

19) Bushing a bearing without dismantling the work is less advisable, but may be justified under certain circumstances; for example with a complicated clock that one prefers not to take apart although one or two of its bearings are so worn as to need repair.