



## Staking the Balance Staff

**A**BOUT the simplest staking operation to be found in watch work is staking the balance staff; that is to say, it is fundamentally simple; the conditions being correct, the riveting operation is of the very simplest character. Imperfect conditions is the stumbling block to many; the staff does not properly fit the hole; there is not enough stock projecting through the arm, to make a secure rivet; or, there is far too much; the part to be riveted is not sufficiently undercut, etc., etc.

Let us first consider the replacing of a balance staff, where we do not make the staff. The cases are rare where the part of the staff that goes in the balance should not be changed in some way; generally the riveting portion is too long. But let us first get the broken staff out without spoiling the balance arm. Do not, under any circumstances, drive the broken staff out without turning away the riveting so completely that the staff can be pushed out

without distorting the balance arm or throwing the rim out of true in the slightest degree.

This is not for the reason that it would be difficult to true the balance, or anything of that sort, but because forcing the riveting through the hole tears away more or less of the comparatively soft metal of the arm, thus destroying the truth of the hole, and it also enlarges it by stretching the metal of the arm, making it oval or elliptic in form.

This makes it impossible for a new staff to fit properly, and is the beginning, generally, of a whole train of evils. Let us avoid all the trouble by turning away the riveting in the first place, as we should. There are several ways to do it, and whichever one we adopt, we must take due care *not* to turn away any of the balance arm.

Every watchmaker has discovered that American staffs are very hard to turn or cut with a graver. This is because they are made

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by a quite different process than the hand-made staffs. Factory-made staffs are turned out complete from the soft steel, then hardened and tempered; the requisite finish being given to the pivots, etc., afterward.

On the regular factory staff, absolutely no turning is done after the staff is hardened and tempered. This method of manufacture makes it possible, even desirable, to leave the temper of the staff harder than it is practical to make hand-made staffs. When we say "practical" we mean just that. A staff *can* be turned as hard as a factory staff, but it isn't practical—takes too much time.

A few lines back we said it was desirable to have the staffs harder than hand-made ones. The reasons are: the pivots wear better; they are less easily bent. On the other hand, if *bent*, they are not so easy to *straighten*; but this, we think, can hardly be considered a disadvantage. A pivot once bent can never be as good as before, although it may *serve*, and in many cases, well enough.

For our own part we would prefer to have

a pivot break square off before bending too much; it would be less likely to crack the jewel, and if bent very much, we wouldn't want to save it anyway, for the reason that it can never be restored to *perfect* form, without reducing it. The differences are not large enough to be shown on a foot rule, but they exist, and with proper instruments, can be clearly shown.

To our mind the balance staffs which are driven in without riveting are a great step in advance; the idea is by no means new, but the originator arrived too soon; it took the world a great many years to catch up with him. With these staffs, a thousand could be inserted and removed from a balance with no injury to the balance, and practically no wear, for the walls of the hole are of tempered steel, and much greater surface than the regular kind.

True, a thousand staffs may be put in a regular balance, without injury, but it requires a higher grade of skill, and *more time* to do it; there's the point. Not that a high grade of skill is undesirable—far from it; but every

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unit of nerve force saved on the details of a job leaves the workman in just that much better form to apply the finishing touches to the job; the touches which count so much in the performance of the watch.

To get down to the job of turning away the riveting; we will first do it by cutting out or enlarging the undercut, *a*, Fig. 1. This, on American staffs, is generally very shallow. A better way than attempting to go down with a narrow pointed graver without touching the collet hub, *b*, is to turn away as much of the collet hub as we need to, to allow us to get down with a stronger graver, and make a comparatively wide groove as shown by dotted lines in Fig. 1. This allows us to remove the whole of the rivet, so the balance may easily be removed from the staff with the fingers.

No smooth turning should be attempted; in fact, a graver sharpened on a rather coarse stone cuts these hard staffs more readily than one with a very smooth edge. It takes a good

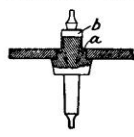


Fig. 1

graver to cut these American staffs, but good gravers can be had, or easily made; anyway, never give up with less than actually cutting the staff away as we have indicated.

Another method, preferred by some, is to grasp the staff by the collet hub in the chuck, and turn away the whole hub of the staff upon which the balance arm rests, removing the balance over the lower pivot.

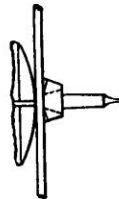


Fig. 2

This is shown in Fig. 2, where dotted lines show the part of the staff to be turned away. Properly done, either of the methods outlined give perfect results. In either case, if the old staff is to be utilized for measurements in choosing a new staff, the measurements should be made before the staff is removed; except of the part fitting the hole in the arm.

Well, assuming that we have removed the old staff, we must select a new one. The only dimensions we will concern ourselves with here is the part entering the balance arm;



sometimes called the "waist", possibly because the arm encircles it. This part should fit the hole tightly enough to support the weight of the balance, when held up by the staff. It is a mistake to drive a staff very tightly into the arm; although it may go in somewhat more tightly than shown by the test we have mentioned; this is given to show what might be taken as a minimum. In any event the staff should not fit so tightly as to prevent it being inserted with the fingers, up to fully three-fourths the way to the shoulder. We should determine by measuring whether the bearing is of sufficient length to reach through the arm, and allow a sound riveting. This allowance for riveting will vary with different cases; depending somewhat on how much the hole in the balance arm is chamfered; but in no case should it exceed .1 mm., or about .004 inch; generally .002 inch is sufficient.

With a workman skilful with the graver, if the riveting allowance is too great, it may be cut down to the right length after the balance is pressed home on its seat. And in case we



Fig. 3

have to do this, it is well to cut the groove deeper than is usually done in factory staffs. Let the conditions resemble those shown in Fig. 3.

Now, to the riveting; we select a hollow round faced punch, which will just *freely* go over the collet hub; the nearer it fits the better, but it must be *free*. We now select a hole in the die, in which the lower part of the staff fits as closely as possible, and yet be free; center it carefully, and bind the die securely. Now with the balance and staff in position, and the round faced punch brought down upon the rivet, as shown in Fig. 3, we hold down firmly on the punch, which is held with the forefinger and thumb of the left hand, and tap the punch lightly with the brass hammer, turning the punch slightly—say one fourth turn—after each blow; continue until the rivet is well turned, which may take six or eight light blows. Then with a flat faced punch fitting freely like the round faced punch, and held in the same manner, a



few light blows completes the riveting; the rivet will be flush with the balance arm, or very nearly so, and will be almost polished; the balance will be perfectly firm on the staff, and very nearly true, often quite so.

In the riveting operation, some prefer to turn the balance and staff slightly after each blow, rather than the punch, as we have directed; still others turn both; this is a matter of personal preference, and equally good results may be had either way. It is better to change the relative angular position of the punch and staff, after each blow, however, no mistake about this, but just *how* it shall be done, each workman may decide for himself.

There is a class of cases, unfortunately too common, where the hole in the arm has been stretched, or at any rate, is slightly too large for the regular staffs; by "too large" we mean that the staffs would not be tight enough to meet the requirements we have given as correct. Now, if the workman has to use such a staff, it is well to know how to rivet it with the least chance of the balance being found eccentric

after the riveting is done. Mr. Bernard C. Husband, a skilful watchmaker, of Boston, informs the writer that most satisfactory results are secured in such cases by using the flat-faced punch first, in fact to do the entire riveting with the flat-faced punch.

In fine staffs, after riveting, we always like to touch up the undercut and riveting slightly, with very fine diamond powder, used on a piece of ivory, boxwood, or even pegwood; it gives it that crisp "better than ordinary" appearance, which we all like to give our work.

#### THE WALTHAM TAPER SHOULDER DETACHABLE BALANCE STAFFS.

These staffs are illustrated on page 68 of the catalog section. In driving out the old staff, care should be taken to see that the hub in the balance arm has a secure seating in the taper mouth of the stump—the balance arm must *not* touch the stump; the hub should never be loosened in the arm.

Notwithstanding the accuracy with which the staffs are made, it will be found sometimes

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that the part marked "staff" in Fig. 1, page 68, is too tight a fit for the hole in the hub. In such cases, the staff should be reduced with oilstone powder and a strip of soft steel, used by hand, while the staff is revolved in the lathe; or a pivot polisher lap may be used. The hand method is generally satisfactory, for the reduction required is but slight.

In driving in the staffs, care should be taken to seat the taper shoulder firmly; this requires a special punch, with outer diameter slightly less than the taper shoulder of the staff; see Fig. 3, page 68. These cuts are self-explanatory, and if the young watchmaker will bear in mind the points we have mentioned, he should have no difficulty.

#### STAKING THE ROLLER.

In all the higher priced and more complete K. & D. staking tool sets, are stumps, designed especially to support rollers while driving the



Fig. 4

staff into them. In our own practice we have preferred a small special stump for all kinds of rollers, both single and double. This stump is shown in section in Fig. 4. As will be noticed, it supports the roller closely around the hole; the edge coming in contact with the roller is rounded, making it suitable for double rollers, with polished concave in the lower face; in such cases, we prefer to lay a piece of tissue paper over the stump, although there is no danger of scratching the work if the stump is kept properly polished.

With INVERTO, a suitable round faced hollow punch may be used for this purpose. We would advise every workman to have such a stump—if he hasn't INVERTO—for it is a most useful thing, in addition to staking rollers, to rest a roller on while pressing the hairspring collet to place, perfectly level. Many workmen use a pair of tweezers to press the collet home; sometimes the tweezers slip,

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and the hairspring is damaged—it don't pay to take such risks.

The use of the stumps, supplied with Staking Tools for supporting rollers, while driving the staff, is so very obvious, as to render any detailed explanation unnecessary.

It might be remarked however, that in cases where the staff is slender above the collet, it is wise to use a hollow flat face punch to drive the staff, rather than a conical mouth punch, resting on the cone of the top pivot. The hollow flat face punch should be of such size as would be used to rivet the staff, in short it should rest on the riveting instead of on the arm of the balance.

Some watchmakers prefer in staking rollers, to drive the roller onto the staff instead of driving the staff into the roller. Punches are supplied for roller driving, and the workman may suit his own preference. We think, however, that unless one has *Inverto*, it is better to drive the staff into the roller, for the reason that there is generally not a sufficient range of sizes in hollow stumps to properly support

the staff by the riveting while the roller is being driven.

Instead of using a stump to rest the roller some workmen select a hole in the die that will just receive the staff and roller pin, then center the top of the staff with a suitable punch and proceed with the driving.

To our mind, the special stump shown in Fig. 4 beats the whole outfit; it covers the entire range of rollers of all styles, and does the work perfectly.

REMOVING ROLLERS.

The use of the roller remover stumps also is too obvious to require any special instruction; excepting, possibly, the special stump No. 305, page 71, catalog section. This stump is very useful for roller removing, and can be used for practically all styles and sizes. The roller should be pressed up the taper opening—with lower pivot up—until there is but little shake; then the staff is centered under the punch; this is accomplished by moving both the die



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and the stump until the combined motions bring the staff central. It will not do to center the hole in die, in which the stump fits, except

in a few cases, where the size of roller is such as to bring it at a point in the slot directly over the center of the plug.

