see no hole in the center, and mount it in a light handle. This loop will take up all the oil that any ordinary hole ought to have. Keep it away from soldering fluid, water or dirt, and keep it out of your mouth. Of course, if the balance, spring, etc., are at all greasy or dirty, they should have previously been hung on a wire hook and moved about in a bottle of benzine for a few seconds, then dried by exposure to the air.

(53.) *Timing the spring.* Having now put the movement together, with the hands on, set it to seconds and run it for exactly one minute, changing the regulator till it is correct. Then try it for fifteen minutes, and if it is about right it may be put into the case and hung up for the final regulation. Although I have dwelt upon a large number of details, the workmen should remember that it will take little more time to do his work rightly, if he understands how it ought to be—and it has been the object of these explanations to clearly show the proper method, so that when his work is done it will be correctly done. The isochronal adjustment of the spring will be treated hereafter; also, testing and correcting the poise of the balance. I am aware that there are plenty of blunderheads in the trade who will dispute this or that proposition, which may not agree with their theory or practice. I can assure the reader, however, that the directions given or to be given may be relied upon, and are approved by those best qualified to judge in these matters.

New Tool and Method for Fitting Hair Springs

(54.) In my last article I gave the ordinary method of fitting hair-springs followed by good workmen, with such tools and appliances as every watchmaker has or ought to have in his shop. I shall now describe my own tool and method, by which we may test a spring in every way without injuring it in the least, and in a very short time, so that, if it should not be suitable for the watch on trial, it will still remain as perfect for the finest isochronal adjustment in another watch as when made—a point of considerable importance when fitting fine and costly springs.

(55.) The tool I use is not designed for fitting hair-springs only, but is applicable for measuring heights and distances in fitting staffs, cylinders, pinions, wheels, etc., also for setting and re-setting jewels, upright drilling of pivot holes, etc., chamfering and countersinking, fitting screws, and many other uses, as will be seen hereafter. It is substantially an Upright Holder, carrying arbors for different uses, and so constructed that the upright portion can be moved in any direction to bring the arbor over any hole in the watch, and there fastened. It consists of a clamp, to be fastened to the movement in any convenient place, carrying a round upright rod, movable up, down and on its own center, and having a head through which moves a horizontal slide carrying the vertical arbors.

(56.) The clamp is made from a thick piece of metal, (steel, cast iron or hard brass,) flat on its under surface, nearly rectangular in shape, 1¼ inches long, by 1 inch wide, half an inch thick in the center and one-eighth inch at the edges, with one edge hollowed out to form two projections or claws, one at each corner, and about 1¼ inches apart. Under each of these claws there is a jaw, made something like the jaws on a universal lathe chuck, capable of being fastened parallel with the surface of the clamp, and at any desired distance from it—so as to be screwed to the potance plate alone, or, if necessary, they can take in the whole thickness of the watch movement. The claws are slipped in between the bridges, or upon the plates, wherever a good bearing can be got, and the jaws screwed up to hold the clamp firmly in place—its flat under surface being, of course, in the same plane with the plate of the watch. The jaws can be faced with thin leather or rubber, if thought best, to give them a good hold without much pressure. In that case, they could be clamped directly on the dial without danger. My own tool is made double, having two claws 1¼ inches apart as above, and, on the opposite side of the clamp, two other claws or projections only ¾ inch apart, so that one side or the other will fit readily upon all sizes of movements. The jaws are also reversible, being turned at their center to point towards either pair of claws which are in use.

(57.) Through the center of this piece or clamp is drilled a vertical hole to take an upright steel rod $\frac{1}{16}$ inch in diameter, and about 1½ inches long, having a head at its top, and fastened at any desired height by a screw, like the centers in a bow lathe. In the head is a rectangular slot through which slides, horizontally, a steel strip 1½ inches long, ¼ inch wide, and $\frac{1}{16}$ thick, (a piece of an old pair of tweezers will do,) edge up, and fastened wherever desired by a screw. This strip also has an enlargement or head at its inner end, with a vertical hole to take in the different arbors to be used. These arbors may be the centers of your bow-lathe, or depthing tool, or any others you have already on hand, if you do not wish to make them specially for this tool. But I advise to use tolerably large ones, at least ¼ inch in diameter, so that the head will take in arbors for setting jewels, etc., to be described hereafter. But the arbor we use for hair spring fitting should be reduced to a diameter of about $\frac{1}{16}$ inch for half an inch from each end, so as to penetrate into the smallest places, and also to enable us to bring our false regulator pins near to the center when wanted. One end should be brought to a fine central point, the other tapered down a little, and the end truly and centrally countersunk. Or two sets of arbors can be made, one fine, the other larger, each having its own horizontal slide and head.

(58.) The use of this tool is obvious. Having first fastened the clamp firmly to some part of the movement, the upright rod is inserted with the head at any desired height, and the horizontal slide placed so that the point of its arbor will rest in the balance jewel-hole, when the sides are screwed fast. We reverse the arbor, and bring the other end, which has the female center, down upon the upper pivot of the balance (or any other piece you are fitting,) and hold it upright the same as would be done by the bridge itself. The angle of this female center should be rather acute, *i. e.*, it should be deeper than it is wide at its mouth, so that it can be raised sufficiently to give the pivot freedom and yet not allow it any play sideways. The surface should be well polished and hard, kept clean and free from rust, and it will form a very tolerable substitute for the balance bridge.

(59.) This arbor has two hubs, which slide freely upon it, and are each fastened by a set screw. In each of them is fixed a steel wire, $\frac{1}{16}$ inch in diameter, pointing horizontally outward from the center of its hub. Each of these wires has a smaller hub, which slides to and from the arbor, and is fastened by a screw. One of them has two pins, to represent the regulator, the other has a clamp to grasp the hair-spring instead of the tweezers, and therefore represents a stud. This clamp can be either self-acting and spring-tight, or be opened and closed by a screw. The points are made thin, so as not to touch the adjacent coils of the spring, and both they and the regulator pins point vertically downwards. The two hubs, carrying the clamp