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W. O. BENNETT, JR.

2,457,631

CYLINDRICAL HAIRSPRING FORM

Filed Sept. 22, 1943

FIG. 2

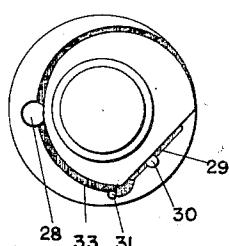


FIG. 1

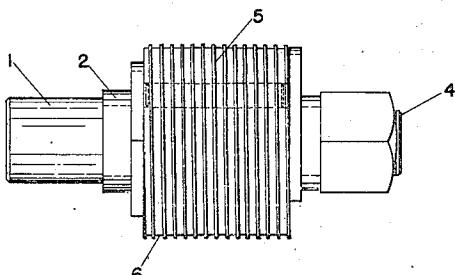


FIG. 4



FIG. 3

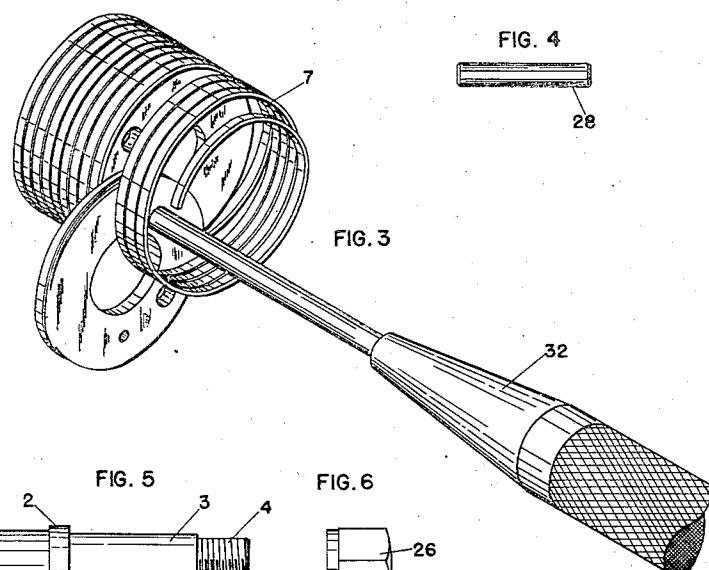


FIG. 5



FIG. 6



FIG. 7

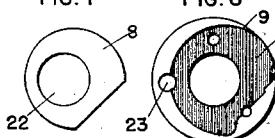


FIG. 8

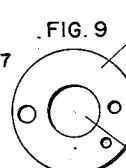


FIG. 9

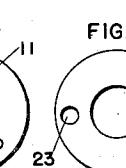


FIG. 10

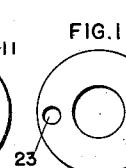


FIG. 11

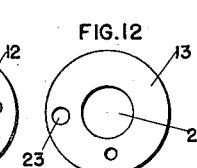


FIG. 12



FIG. 13

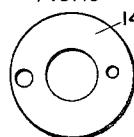


FIG. 14

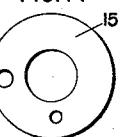


FIG. 15

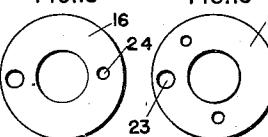


FIG. 16

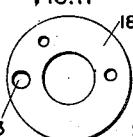


FIG. 17

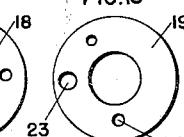


FIG. 18



FIG. 19

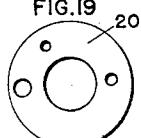


FIG. 20

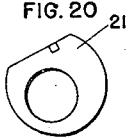


FIG. 21



INVENTOR.

WILLIAM O. BENNETT JR.

BY *James M. Heilman*  
atty.

## UNITED STATES PATENT OFFICE

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## CYLINDRICAL HAIRSPRING FORM

William Ogle Bennett, Jr., Lancaster Township,  
Lancaster County, Pa., assignor to Hamilton  
Watch Company, Lancaster, Pa.

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3 Claims. (Cl. 263—2)

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This invention relates to an apparatus for forming hairsprings for marine chronometers or similar timepieces.

The object of the present invention is to provide a form on which an untreated wire can be wound and from which the heat treated wire may be removed without in any way bending or stressing the coils of the treated spring.

In high grade marine chronometers and timepieces of a similar nature where there is need for a very unusual degree of accuracy, the slightest kink, bend or strain which causes internal stresses in the metal will affect the timing, particularly where in the metal of the hairspring. This spring is generally made in the form of a flat spiral for most timepieces but for the more accurate instruments such as chronometers it has been found advantageous to make the hairspring in the form of a cylinder. In making a cylindrical hairspring it is necessary that each end be turned in to reach the position of the balance staff and balance cock to which they are fastened. As hairsprings are made by winding untreated wire on a form, heat treating the wire while on the form, and removing the wire from the form it became necessary to provide a form which a cylindrical hairspring with its turned ends could be removed without in any way straining the treated wire. It is the purpose of the present invention to provide an apparatus upon which the cylindrical shaped hairspring formed with turned ends could be fastened, heat treated and removed without bending or distorting any part of the spring.

It is a further object of the invention to produce a spring which requires no cold working.

It is a further object of the present invention to provide a form which may be used repeatedly.

It is a further object of the present invention to provide a form made up of a number of sections which interfit together provide the complete form and which may be removed separately without distorting the finished product.

It is a still further object of the present invention to provide a form which insures the correct curves for the ends of the hairspring.

The invention is illustrated in the accompanying drawing in which:

Fig. 1 is a front elevation of the assembled form.

Fig. 2 is an end view of the form.

Fig. 3 is a perspective showing the removal of the sections of the form from the completed spring.

Fig. 4 is a view of the alignment pin.

Fig. 5 is a view of the arbor.

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Fig. 6 is a view of the end cap.

Figs. 7 through 20 are views of the several sections, making up the form.

Fig. 21 is a view of the wedge pin.

5 In the drawings an arbor 1 is provided with an annular shoulder 2, a central section 3, a threaded section 4 supports a series of discs which, when assembled, provide a form 5 having a helical guideway 6 for the reception of a spring 7.

10 The form 5 is made up of sections 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and 21 all of which are formed with a central hole 22 to receive the central section 3 of the arbor 1. All of the discs except the two end discs 8 and 21 are formed with an aligning hole 23 and a threaded opening 24. The disc sections 9, 10, 11, 17, 18, 19 and 20 are also formed with a hole to receive a wedge pin 25. A cap nut 26 firmly holds all of these discs on the central section 3 of the arbor 1.

20 In assembling the form 5 the end of the arbor 1 is clamped in a vice with the section 8 abutting the shoulder 2 receiving section 9; the cut-out portion 27 fitting the end section 8. The disc section 10 is now applied to the center section 3, the holes 23 being aligned and the pin 28 inserted in holes 23. In turn, each of the sections are mounted on the central section 3, the correct angular position being determined by the respective relations of the hole 23 in the successive discs. The end section 21 is fitted in a depression in the disc 20 similar to depression 27 in the disc 9 and the cap nut 26 screwed firmly in place. The form is then ready to receive the soft wire used to form the hairspring.

30 35 The form 5 is removed from the vice inserted in a chuck which is not shown as it forms no part of the invention other than to provide a convenient means for turning the form. Turning of the form 5 wraps the wire 7 around the form following the spiral 6, the initial holding of the spring wire 7 being made by fitting the wire in the groove 33 formed between the end section 8 and the cut out portion 27 of section 9, the wire being wedged against the edge 29 by the wedging

40 45 pin 25 in the hole 30. A pin 31 mounted at the point where the wire makes a sharp bend prevents any buckling or backing up of the wire at the time the wedge pin is driven in. This, of course, is not important in initially securing the wire but after the spring has been wound the importance of preventing any slack in the wound wire while securing the loose end cannot be stressed too strongly. After having been wound

50 55 on the form 5, the loose end of the spring is secured in a manner similar to the first fastening

by a wedge pin 25 used against the side of disc 21 in a manner similar to that previously described. The wound wire is then given the necessary heat treatment, cooled and ready for removal of the form 5 from the completed spring. It is necessary that the removal of the form be accomplished without in any way cold working either by forcing or bending the spring wire, although a small movement of the spring which does not produce a permanent distortion will not affect its timekeeping qualities.

In the removal of the spring the form 5 is again held in a vice, the cap nut 4 unscrewed and the central arbor 1 removed. With the removal of the arbor the openings 23 are exposed and the aligning pin 28 may be driven out. The device is then removed from a vice by means of a jack screw 32, having a threaded end which fits the threaded opening 24, the discs are separated and removed one at a time. The relation of the successive discs are such that no two successive threaded holes are aligned and the tool 32 having a threaded portion greater than the thickness of any one disc will, on being threaded into the opening of any disc, bear against the metal of the successive disc and gently separate the successive discs one at a time. It is then possible to spread the coils of the finished spring slightly so that these thin discs may be passed between the coils as shown in Fig. 3, as it is impossible to slide the spring off the form or the form from the spring because of the preformed inturned ends. In this way the spring 7 is removed from the form 5 by having the form removed from the spring a section at a time. It is thereby possible to produce a spring in which the convolutions have not been disturbed and in which there is no internal stress or strain which has always been present in hairsprings of this type. Such a spring has produced a notable increase in the timekeeping qualities of the more accurate instruments such as marine chronometers and has materially lessened the job of assembling the hairsprings which formerly had to be bent by hand to the correct curve to fit the balance end.

What is claimed is:

1. A form for holding cylindrical hairsprings with preformed inturned ends during heat treatment comprising an arbor, a series of discs consisting of inner discs and end discs, said inner disc being substantially identical and said end disc being formed to receive the ends of the spring

in a predetermined configuration, discs being adapted to be placed upon the arbor, means for aligning said discs in predetermined position, a spiral guideway formed by the periphery of said discs to receive a wire and means for anchoring the inturned ends of said wire at each end of the assembled discs.

2. A form for holding cylindrical hairsprings with preformed inturned ends during heat treatment comprising an arbor, a series of discs formed with a central opening receivable on said arbor, said series of discs including two end disc sections and a number of substantially identical intermediate sections, the periphery of the intermediate sections forming a spiral guideway to receive a wire, the two end sections formed to receive the ends of the wire in a predetermined manner, means for holding the discs in close relation and means for anchoring the ends of said wire.

3. A form for holding cylindrical hairsprings with preformed inturned ends during heat treatment comprising an arbor, an annular shoulder on said arbor, a series of discs each formed with a central opening, an aligning opening and a threaded opening positioned on said arbor each of said discs having a peripheral groove and together forming a cylinder having an external spiral guideway, to receive a wire, an alignment pin passing through the aligning holes and properly positioning said discs, wedge pins securing the ends of said wire and a jack screw fitting the threaded opening of the discs for removing said discs successively without distortion of the wire subsequent to spring forming process.

WILLIAM OGLE BENNETT, JR.

#### REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS			
Number	Name	Date	
25,294	Weimer	Aug. 30, 1859	
109,826	Kline	Dec. 6, 1870	
477,525	Ferrell	June 21, 1892	
1,215,775	Campbell	Feb. 13, 1917	
1,483,985	Price	Feb. 19, 1924	
1,928,727	Johnson	Oct. 3, 1933	
2,142,865	Zabel	Jan. 3, 1939	
2,236,206	Becker	Mar. 25, 1941	
2,236,907	Hoffsommer	Apr. 1, 1941	
2,306,925	Aicher	Dec. 29, 1942	