

C. FONES & W. J. BAULIEU.

FLEXIBLE SHAFT.

No. 177,490.

Patented May 16, 1876.

Fig 1.

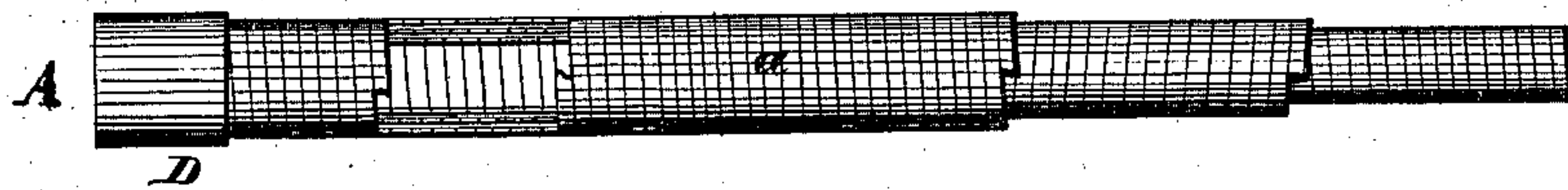
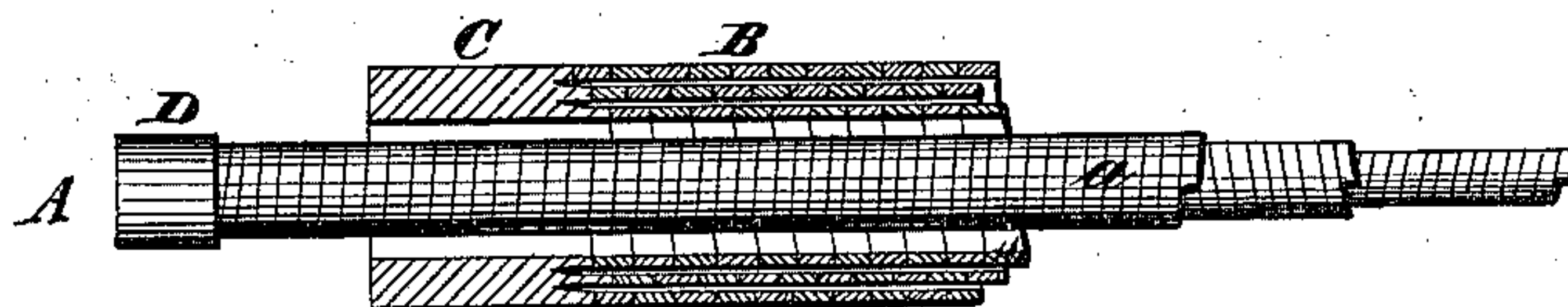


Fig 2.



WITNESSES

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UNITED STATES PATENT OFFICE.

CIVILION FONES AND WILLIAM J. BAULIEU, OF BRIDGEPORT, CONN.

IMPROVEMENT IN FLEXIBLE SHAFTS.

Specification forming part of Letters Patent No. 177,490, dated May 16, 1876; application filed April 28, 1876.

To all whom it may concern:

Be it known that we, CIVILION FONES and WILLIAM J. BAULIEU, both of Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Flexible Shafts, of which the following is a specification:

Our invention relates to a flexible shaft of the class designed for transmitting power from dental engines to the hand piece or tool, and from other motors to the machinery or devices to be operated.

Our objects are so to construct such shafts of this class as are made of separate spring-coils as to increase their efficiency, improve their appearance, add to their strength, lessen the friction between them and their enveloping sheaths or casings, and particularly so to construct the shaft that it may be reversed at the will of the operator without unwinding, or losing any of its strength or power, and run equally well when rotating in either direction. Another object we have in view in the construction of our shafts is the formation of sheaths or casings for the shafts, of construction similar to that of the shafts themselves.

Our invention consists in the construction of the shaft of thin flat strips or ribbons of spring-steel, whereby we are enabled to make a shaft which is very flexible, and at the same time very strong.

Our invention also consists in a sheath or casing of a construction similar to that of the shaft which it envelops.

Our invention also consists of the combination of an inner shaft composed of coiled strips or wires, and an outer shaft, sheath, or casing capable of being used as a sheath simply, or as a shaft.

Our invention further consists of a flexible shaft, formed by combining three or more coils, whether round, flat, or of other suitable outline, wound in opposite directions, whereby is secured an automatic expansion and contraction of the coils, adapting the shaft to operate in either direction in which it may be run, thus rendering the shaft capable of being quickly reversed, and giving it much of the solidity of a straight shaft of unyielding material.

In the accompanying drawings, Figure 1 represents a longitudinal view, partly in section, of a portion of our shaft of three coils, which is shown as broken off at different points, to more clearly indicate the construction of the shaft; and Fig. 2 a longitudinal view on a reduced scale of the shaft, with a portion of its enveloping shaft, casing, or sheath in section.

A flexible shaft, A, is composed of thin flat strips or ribbons *a*, of spring-steel, coiled, as represented in the drawings, to form smooth-surfaced close-jointed coils, or it may be made of a single strip, turned or bent back at the ends of the shaft. The strips of the adjacent coils are coiled in opposite directions, as shown, for a well-known purpose, and the coils may be three or more in number, as desired.

The twisting-strain on the coils of the shaft, when in operation, is in the direction of the greatest strength, or in the direction of the width of the ribbons or strips *a*, of which the spring-coils are composed. It will thus be seen that by using such strips not only is the strength of the shaft increased, but there is a saving of metal over those shafts made of round wire, as the flat strips may be made quite thin. The shaft is much smoother on the surface than one made of round wire, and is, therefore, less liable to become entangled by catching in the clothes of the operator, or in other objects it may come in contact with. Friction, caused by contact between the shaft and its casing, (when one is used,) is also decreased. The strips of steel being flat, and being necessarily wound obliquely across each other, keep their place, and the coils have no tendency to work into each other, as the coils of round wire do.

A sheath or casing, B, to protect the shaft, constructed in manner similar to that of the shaft, may be employed when desired. The ends of the coils of the sheath may be welded together at both ends, as shown at C, thus dispensing with collars, such as shown at D D, fixed on the ends of the shaft to unite the coils and prevent untwisting or uncoiling. It is obvious that the shaft-coil ends may be welded together like the sheath-coils, or the sheath may have collars or short sleeves on

its ends, if preferred. Although two oppositely-coiled flat strips will answer to good purpose when the shaft is intended to run in one direction only, we prefer to construct our shaft with three coils, making it thereby reversible; and when so constructed, and as shown in the drawings, in turning to the right the inner and outer coils contract while the center coil expands or partially unwinds against the outer coil, and in turning to the left the inner and outer coils expand, and the center coil contracts against the inner coil. Thus we make a self-adjusting shaft with much of the rigidity of a solid shaft. Three or more round wires may be used instead of the flat strips to make a reversible shaft; but we prefer the flat strips because of their superiority for the purpose over the round wire.

The sheath B may be used as a driving-shaft as well as the internal shaft A, to enable two tools or parts of a machine to be driven in opposite directions from the compound shaft thus formed; or, when considerable power is needed to do the work required, the sheath and shaft may be united to a common tool or machine, and to the engine or motor, so as to revolve together.

The connection of the shaft with the engine, and with the tool or device to be operated, may be made in any of the usual ways, and the tubular shaft or sheath B, when used simply as a sheath or casing, is suitably secured in place at its ends in any of the well-known ways, so as to remain stationary during the rotation of the shaft A. In dental practice it is very important that the direction of rotation of the shaft should be readily reversible, in order to protect the soft parts of the mouth in certain positions in which the operator is compelled to work. Our three-coil shaft, (whether of round wire or flat strips,)

therefore, has a great advantage over those of the usual construction, intended to run only in one direction. It is also much stronger than the flexible shafts as usually heretofore made, and with it we can drive a tool or use it for work that they are incapable of.

We are aware that two coils of round wire have been formed into a flexible shaft by being wound in opposite directions. Such a shaft, however, is not reversible, and we do not claim such construction. We are not aware that any flexible shaft prior to our invention had been composed of any number of flat steel strips, as described, or of three or more coils of round wire or flat strips coiled in opposite directions.

We claim as of our own invention—

1. A flexible shaft, constructed, as hereinbefore described, of spring-coils, composed of flat metallic strips or ribbons, coiled in reverse directions.

2. The sheath or casing, constructed, as hereinbefore described, of spring-coils composed of flat metallic strips or ribbons coiled in reverse directions, and adapted to envelop the shaft.

3. The combination, substantially as hereinbefore set forth, of the shaft composed of reverse coils, and the similarly constructed enveloping-sheath.

4. The hereinbefore-described flexible shaft, composed of three or more coils, with the adjacent coils wound in opposite directions, to render the shaft reversible.

In testimony whereof we have hereunto subscribed our names.

CIVILION FONES.
WM. J. BAULIEU.

Witnesses:

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