G. H. HAYES.

FLEXIBLE SHAFTING.

APPLICATION FILED OCT. 5, 1911.

1,091,511. Patented Mar. 31, 1914.

Fig. 1.

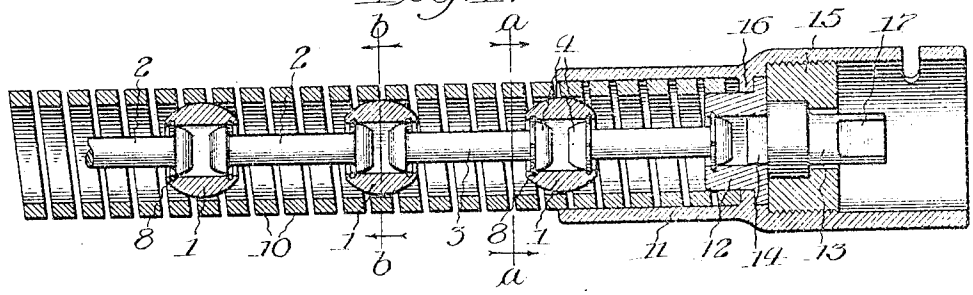


Fig. 2.

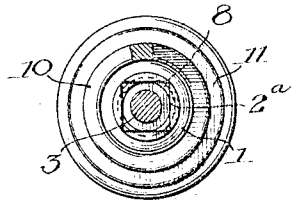


Fig. 3.

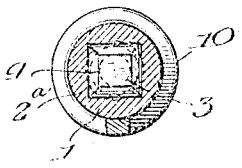


Fig. 4.

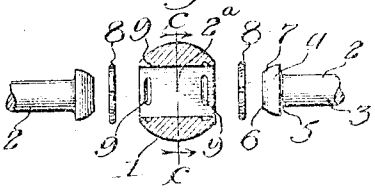


Fig. 5.

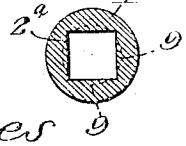
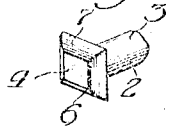


Fig. 6.



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UNITED STATES PATENT OFFICE.

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FLEXIBLE SHAFTING.

1,091,511. Specification of Letters Patent. Patented Mar. 31, 1914.

Application filed October 5, 1911. Serial No. 652,944.

To all whom it may concern:

Be it known that I, GEORGE H. HAYES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Flexible Shafting, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to flexible shafting and is designed to provide a new and efficient shaft of the character described.

More particularly in accordance with one form of carrying out my invention I employ plug and socket members, of which the socket members have longitudinal bores adapted to accommodate the plug members and in which the plug members are inserted within the socket members, and then suitable retaining devices employed to prevent withdrawal of the plug members. In a preferred form of the invention the interior bore of the socket members preferably has a cross-sectional configuration which may be triangular, rectangular, or polyhedral, although the word polyhedral is intended to include any multi-sided plane figure. The socket members then in this embodiment of the invention may be provided with heads having an outline conforming to the outline of the bore at their portion of largest cross-section and tapering toward the extremity of the heads to permit flexibility of the completed structure.

What is above set forth is intended to represent one form of carrying out the invention, although it will be readily seen from the description which will follow in connection with the drawing that my invention is capable of broad application and that the general principles herein are new in accordance with the claims appended.

I will describe more specifically one form of carrying out my invention in connection with the accompanying drawing illustrating one embodiment thereof, in which:

Figure 1 is a sectional view of a flexible shaft constructed in accordance with my invention; Fig. 2 is a sectional view on line *a*—*a* of Fig. 1; Fig. 3 is a sectional view on line *b*—*b* of Fig. 1; Fig. 4 is a view showing the parts in their coöperative relation before assembly; Fig. 5 is a sectional view on line *c*—*c* of Fig. 4, and Fig. 6 is a fragmentary view of one of the plugs employed.

Referring more particularly to Fig. 1, I show a portion of a flexible shaft and its terminating connecting socket at one extremity. The shaft may be extended at its opposite extremity and united to some suitable driving mechanism or driven mechanism as is well understood. In accordance with my invention, I employ for the construction of my improved flexible shaft socket members 1, 1 associated with suitable plug members 2, 2. In the preferred form, two plug members are associated with each socket member. The socket members are shown more clearly by reference to Figs. 4 and 5 in which it is seen that the socket members may have, if desired, a partial spherical outline with squared ends and may have a central bore 2^a of rectangular outline or configuration. The socket members 2 as shown more clearly in Figs. 4 and 6 have shanks 3 and heads 4, which heads have at their portion of largest cross-section, namely at 5, an outline substantially conforming to the outline of the bore 2^a. The heads then taper toward a portion of decreased cross-section as at 6, which taper is preferably along the lines of an arc as indicated at 7. It will thus be seen that the plug members may be inserted within the socket member and upon rotation of either one, the other will rotate as the outline of the bore conforms to the outline of the head. It will likewise be seen that in thus constructing the devices it is new to provide two elements such as the plug and socket members which may be permitted to move longitudinally of each other and yet maintain their corresponding satisfactory power transmitting relation. Likewise the tapering construction of the head 4 permits a bending or angular displacement between the plug and socket members, while yet maintaining the same or substantially the same satisfactory power transmitting relation between the said plug and socket members. It will thus be seen that plug and socket members have a construction likewise, irrespective of the longitudinal movement between them in which a bore of polyhedral cross-section is associated with a head of similar outline for power transmitting purposes. The plug members are inserted within the socket members and then suitable

springs 8 may be forced within the socket members and held within grooves 9, 9 provided in said socket members to prevent withdrawal of the plug members all as is more clearly apparent from the assembly view of Fig. 1. A very efficient power transmitting shaft is thus provided. The power transmitting shaft may be surrounded by a coiled spring 10 if desired to provide a practically continuous cylindrical outline therefor, which spring may be fastened within as by brazing, to a terminal socket 11. An end socket 12 is provided for the last plug member 2 which also has a bore of polyhedral outline. An attachment element 13 having a projection 14 fits into the element 12 and is held therein by means of a screw-threaded clamping element 15 having screw threaded engagement with the interior of the terminal socket 11. A shoulder 16 on the terminal socket coöperates with the element 15 to hold the parts 12 and 13 together. Suitable connection devices may be inserted within the open end of the terminal socket 11 to coöperate with the tongue 17, whereby to unite the shaft to a prime mover or driven element as the case may be.

The simplicity of the structure will thus be apparent and the general features involved also.

While a specific shaft constructed in accordance with my invention has herein been described, I do not limit myself to such specific form as already stated, but broadly claim as new and desire to secure by Letters Patent the following:

1. A flexible shaft having a socket member provided with a longitudinal bore throughout its length, of plug members having heads adapted to enter the opposite ends of said bore, said heads being entirely inclosed by said socket member and being capable of longitudinal movement with respect to each other within said socket member, each plug member consisting of a rod provided with an upset portion to form a head at each extremity thereof, the outline of said heads corresponding to the outline of said bore and tapering circularly from their point of largest cross-section in one direction, the said bore being non-circular in cross-section, and means provided upon said socket member to prevent withdrawal of said plug members from said socket member.

2. A flexible shaft having a socket member provided with a longitudinal bore of substantially the same cross-section throughout, said member having a spherical contour, of plug members having heads adapted to enter the opposite ends of said bore, said heads being entirely inclosed by said socket member and being capable of longitudinal movement with respect to each other within said socket member, each plug member consisting of a circular rod provided with an upset portion to form a head at each extremity thereof, the outline of said heads corresponding to the outline of said bore and tapering circularly from their point of largest cross-section in one direction, the said bore being non-circular in cross-section, and means provided upon said socket member to prevent withdrawal of said plug members from said socket member, said means including circular spring rings and a plurality of alined apertures within the socket member engaged by said rings.

In witness whereof, I hereunto subscribe my name this 28th day of September A. D., 1911.

GEORGE H. HAYES.

Witnesses:
MAX W. ZABEL,
HAZEL JONES.