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FASTENING DEVICE

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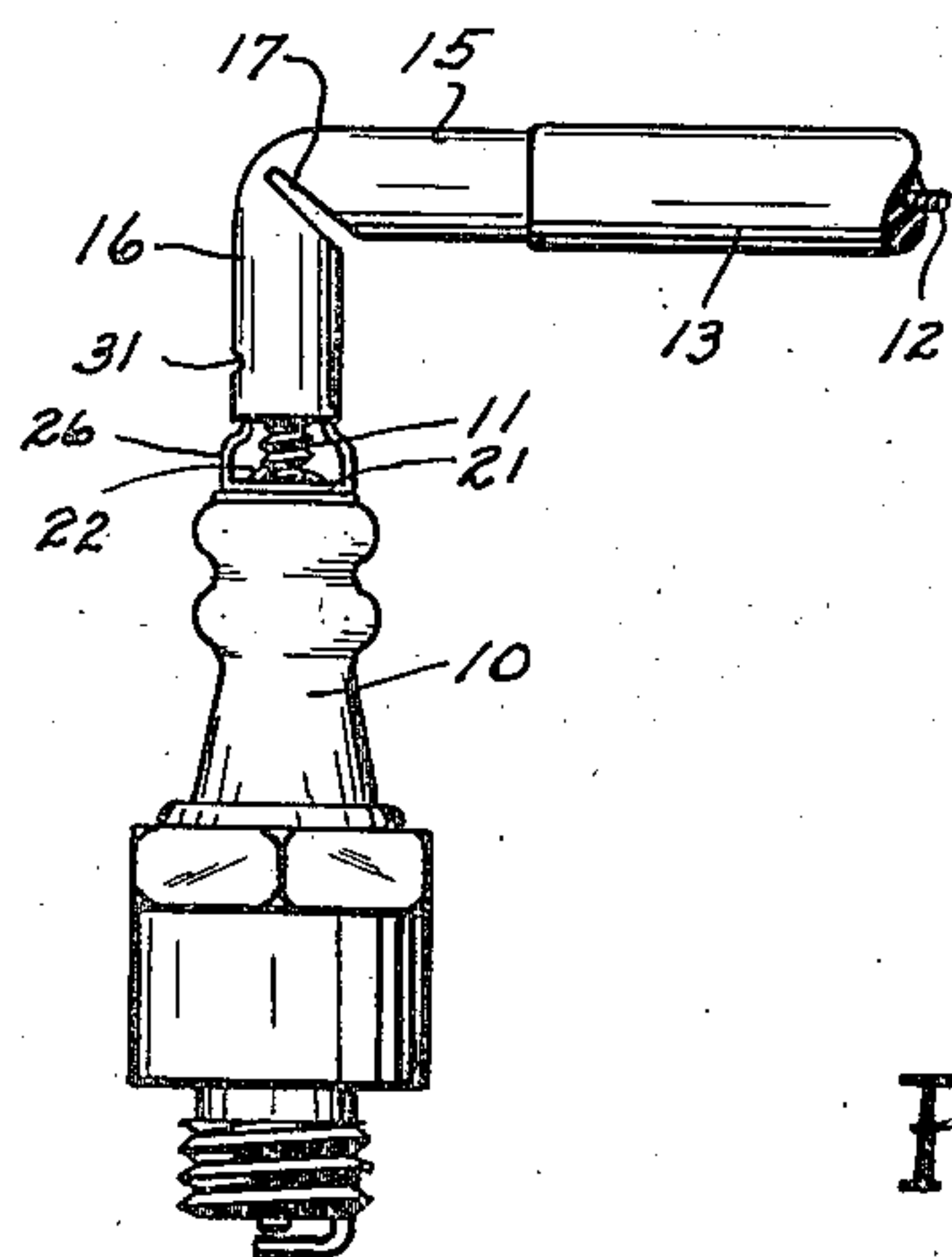


FIG. 1

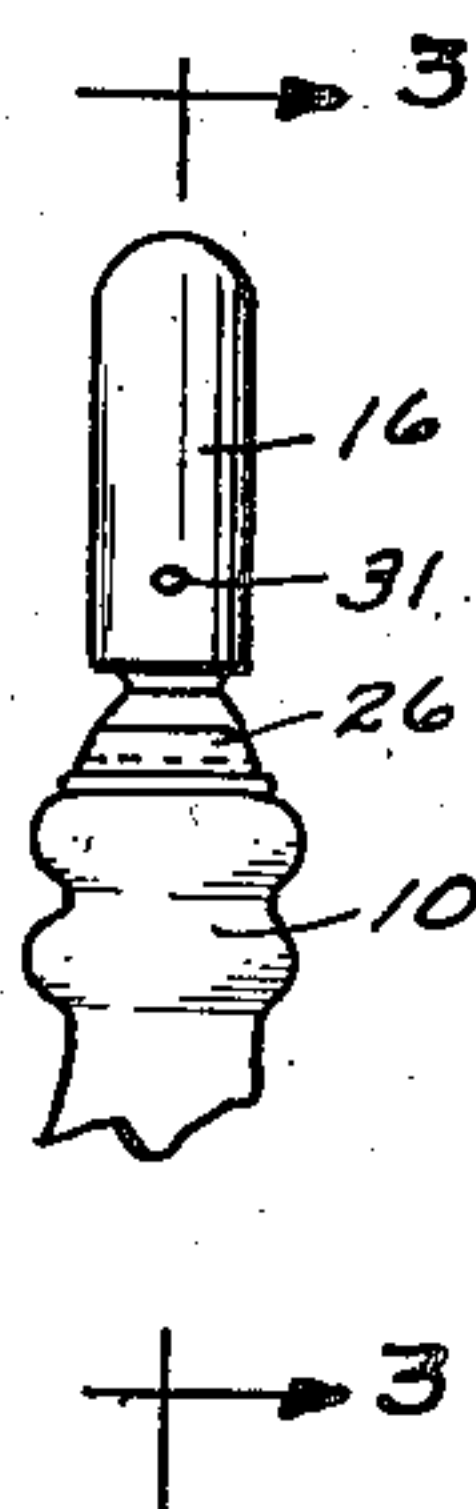


FIG. 2

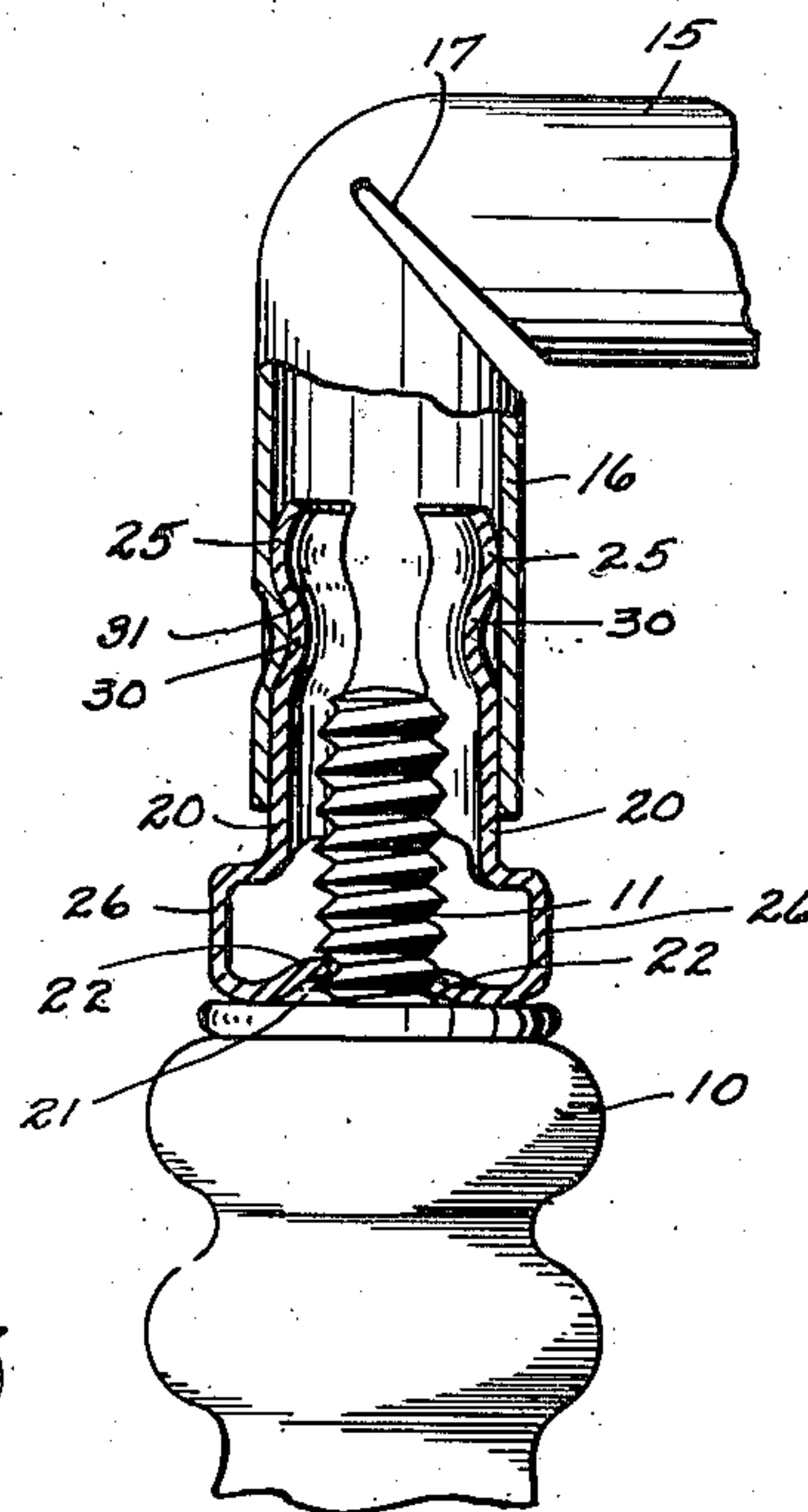


FIG. 3

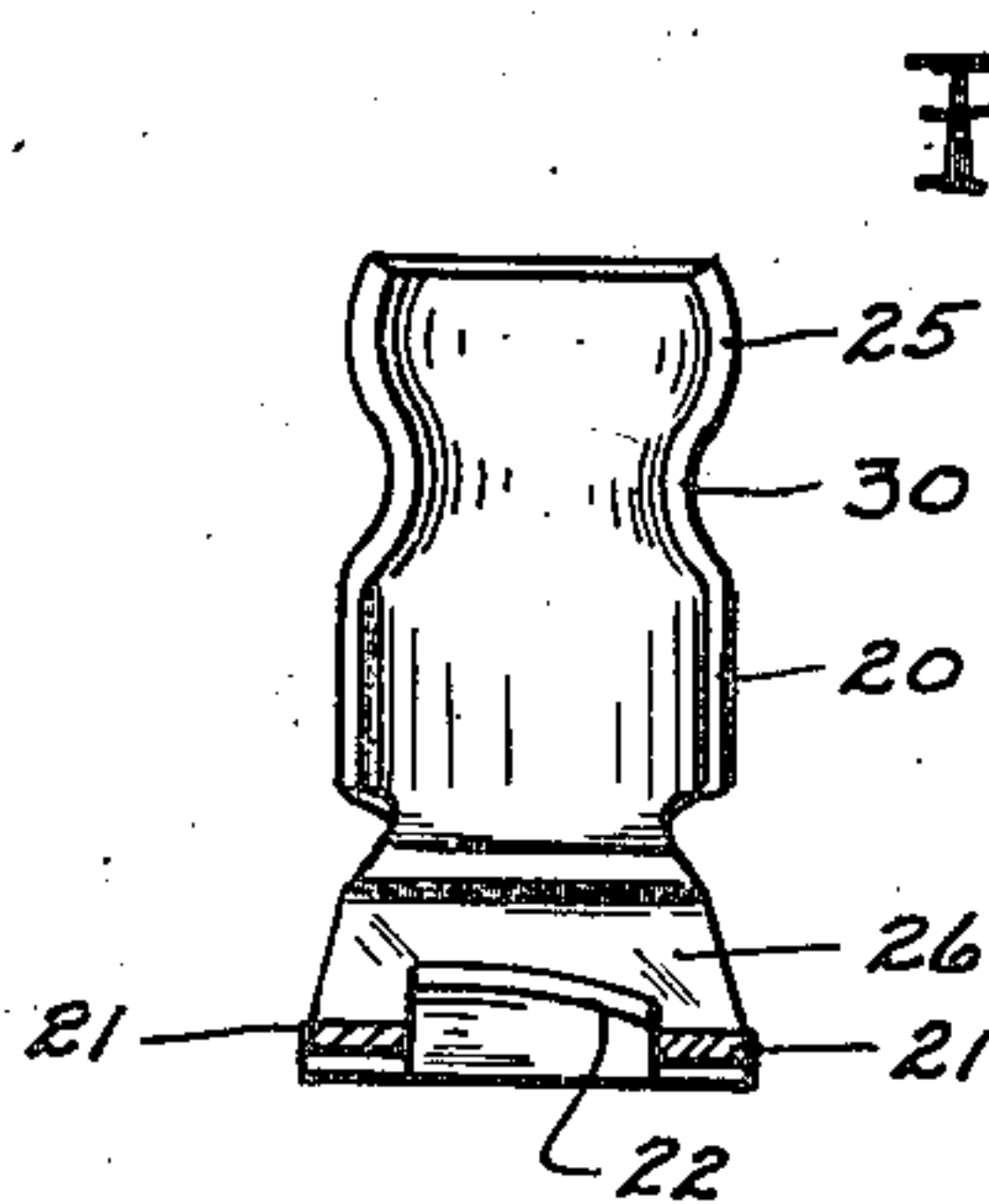


FIG. 5

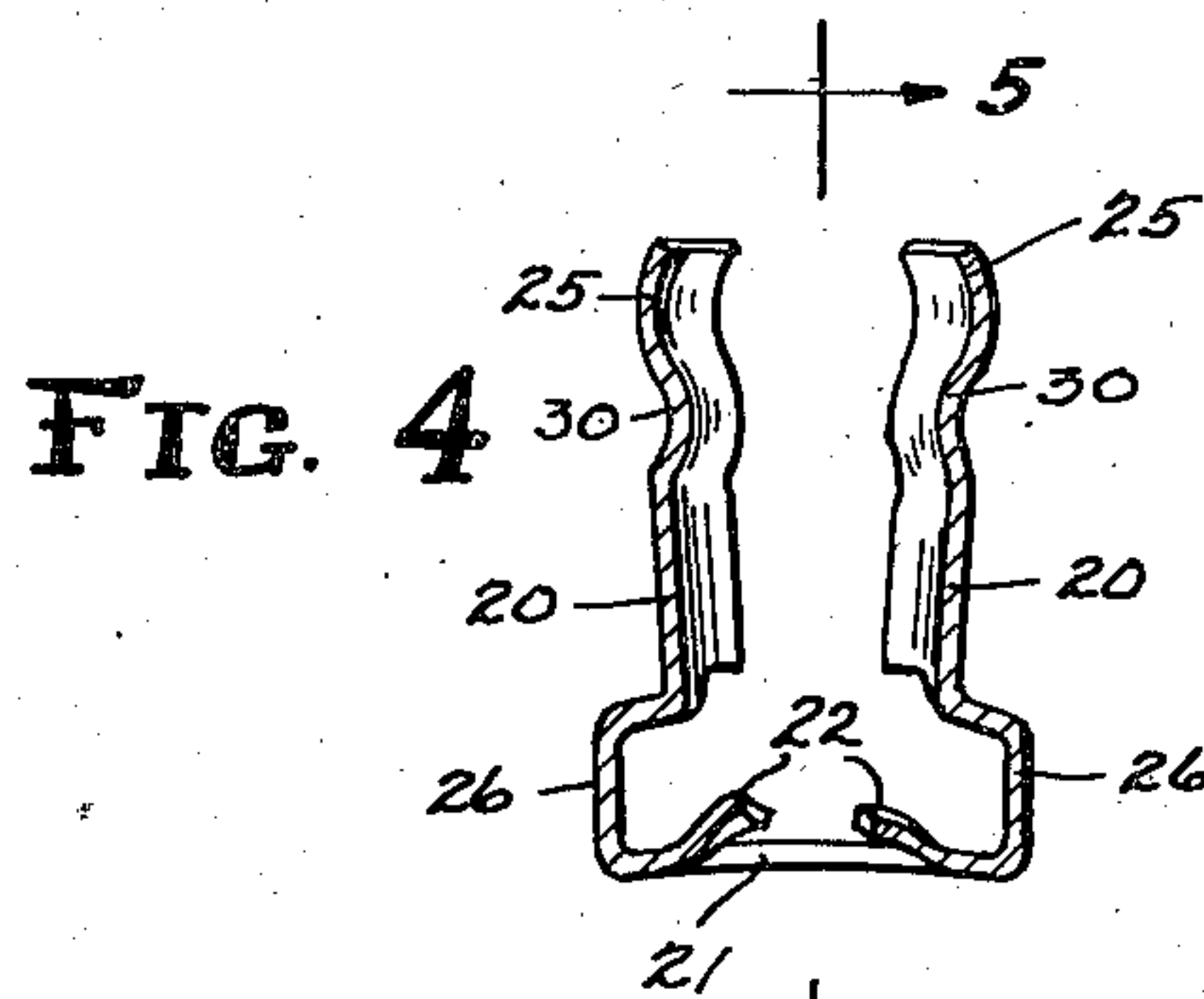


FIG. 4

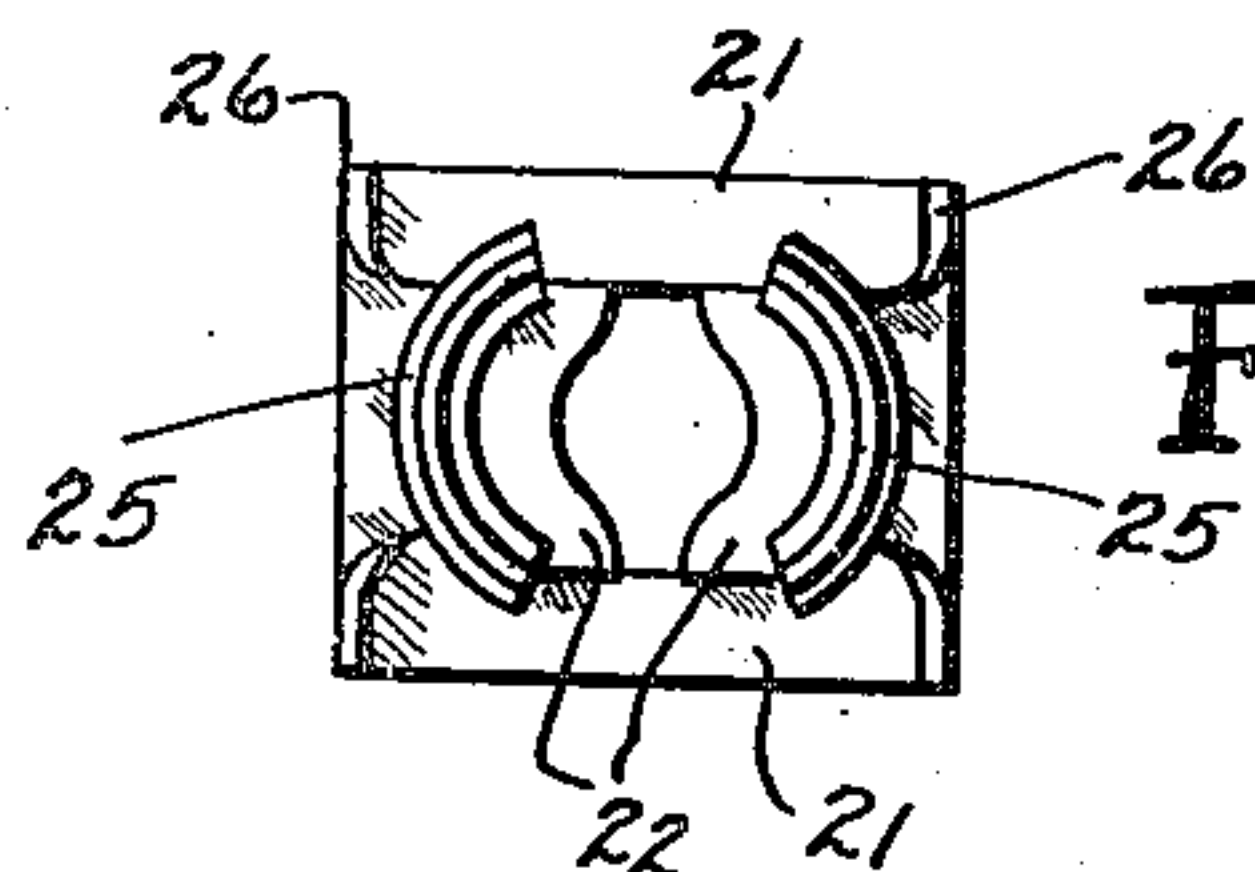
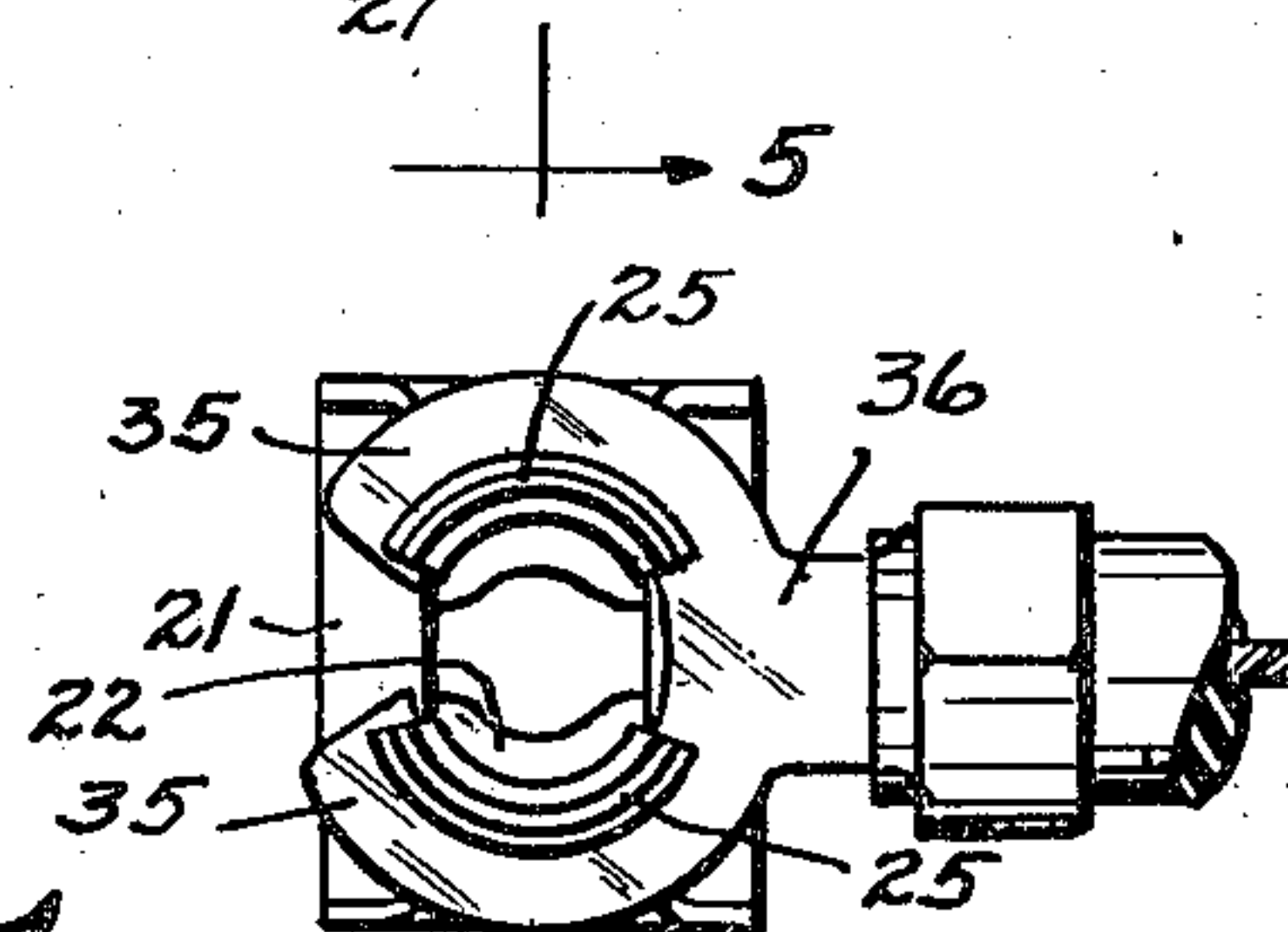


FIG. 6

FIG. 7



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## UNITED STATES PATENT OFFICE

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## FASTENING DEVICE

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1 Claim. (Cl. 173—259)

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The invention pertains to fastening devices and particularly those adapted for use in connecting a high tension conductor to the spark plug of an internal combustion engine.

An object of the invention is to make a connecting device which will permit the conductor to be readily attached to a spark plug simply by a push-on type of connection, and which will thereafter be retained in satisfactory electrical connection, notwithstanding the fact that the vehicle might be subjected to excessive vibration during use. Additionally, the invention contemplates a connecting device by means of which any conductor may be readily removed, or any spark plug may be readily replaced without disturbing the connection to any of the other spark plugs on the engine.

The present invention is illustrated in the preferred embodiment in the drawings in which Fig. 1 shows a spark plug having a high tension conductor attached thereto; Fig. 2 is an end view of a portion of the spark plug and attached conductor shown in Fig. 1; Fig. 3 is a partial section taken on the plane indicated by the line 3—3 in Fig. 2, but on a larger scale; Fig. 4 is a vertical section taken through the adapter embodying the present invention; Fig. 5 is a section taken through Fig. 4 on the plane indicated by the line 5—5; Fig. 6 is a top plan view of the fastener, and Fig. 7 is a top plan view of the use of my fastener with a modified form of spark plug connector.

In the drawings, 10 represents a spark plug having a stem 11 projecting therefrom which, in the embodiment illustrated is threaded through the extent of the projecting portion. The high tension conductor which is to be attached to the spark plug is indicated at 12 as being enclosed within an insulating housing 13. The end of the conductor is electrically connected to a terminal which embodies a metallic tube 15, a portion 16 of which is shown as extending at a right angle to the axis of the conductor. A kerf 17 in the tube facilitates bending thereof to provide the part 16 without causing any portion of the tube to buckle during the bending operation.

To connect the terminal of the high tension conductor to the spark plug, the present invention contemplates the use of a fastening device in the form of an adapter that can be quickly attached to the stem of the spark plug and can be readily held thereagainst notwithstanding the degree of vibration to which the engine is subjected during use. The invention also comprises a construction which will permit a swiveling ac-

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tion of the conductor with respect to the spark plug without affecting the electrical connection therewith.

The preferred manner of making the fastening device is to bend a strip of sheet metal to a substantially U-shape wherein the arms are indicated at 20, and the connecting portion at 21. The connecting portion has an aperture for receiving the spark plug stem and has means carried thereby for threadedly engaging the stem. In the illustrated form, the thread engaging means on the fastening device comprises a pair of tongues 22 which are integral with the body portion, and which extend upwardly and inwardly and have a thickness of less than the pitch of the thread, whereby the tongues will enter the thread groove on the stem and function as a nut to permit attachment to the stem. Additionally, the tongues are yieldable so that they are drawn down toward the base during the tightening operation, thereby operating to hold the device securely on the spark plug. Additionally, the spring-like characteristics of the thread-engaging portion exert a constant pressure against the thread to maintain a vibration resisting connection therewith.

The fastener is intended to hold the conductor terminal in position by spring tension and accordingly as shown in Fig. 4, the arms normally diverge from the connecting portion. The overall distance at the outer portion of the arms is greater than the internal diameter of the tubular terminal 16 so that pressure must be exerted to force the tube over the arms. In Fig. 3 the arms are shown within the tubular conductor where they are constrained against movement laterally with respect to each other by the walls of the tube, and where the natural tendency of the arms to spread apart is utilized for holding the conductor in place.

To facilitate insertion of the fastener arms into the tube, the end portions 25 of the arms are curved inwardly so as to provide a camming action whereby the tube can be inserted merely by exerting an endwise thrust thereon against the arms of the fastener. To assure a firm engagement between the arms and the tube wall, the arms are curved transversely so as to conform to the shape of the wall.

For the purpose of enabling the fastener to be threaded onto the stem, the lower portions 26 of the arm lie in a flat surface which may be engaged by a wrench for imparting the final turn that is intended to cause movement of the tongues 22 with respect to the base portion 21, and thereby



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result in the self-locking action heretofore described.

It is desirable that the conductor terminal be permitted to swivel upon the spark plug, and accordingly, this may be accomplished by indenting each arm, as at 30, for the entire width of the arm and providing a protuberance 31 on the wall of the tube 16 that coacts with the indentation to permit swiveling action of the tube without permitting axial movement with respect to the fastener arm.

In Fig. 7 the fastener is shown in use with a modified form of spark plug connector of the type which has a forked end 35. The connector is forced endwise against the grooved portions 30 of the arms 20, whereby the arms are caused to enter the recess 36 and then to spring outwardly into abutting engagement with the walls of the recess.

A fastening device made in accordance with the present invention may be constructed of a one-piece strip of sheet metal and suitably tempered to impart the desired spring-like characteristics to the arms and to the thread engaging portion, whereby a self-sustaining spark plug adapter is readily obtained. The invention thus provides an extremely simple arrangement for effecting the snap-on connection between the conductor terminal and the spark plug, and at the same time assures a vibration-proof connection to the plug, together with a swiveling action of the conductor with respect to the plug.

I claim:

A one-piece sheet metal fastener for use as a spark plug adapter comprising a strip of sheet metal bent intermediate its ends to define a fastener base and spring arms at opposite sides of said base extending in the same general direction in generally parallel and spaced relation, said spring arms having flat portions adjacent the fastener base defining spaced flat surfaces

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adapted to be engaged by a tool to rotate the fastener, and the free end portions of said arms adjoining said flat portions being bent transversely to define axially extending cooperating tubular portions yieldable toward and from each other for engaging a terminal member, said fastener base having an opening for receiving the threaded stem of a spark plug and integral resilient thread engaging means adjacent said opening projecting upwardly out of the plane of the fastener base for threadedly engaging said threaded stem of the spark plug upon rotation of the fastener to applied position thereon, said integral projecting thread engaging means in the tightened position of the fastener on said threaded stem being adapted to be tensioned toward the fastener base in positive thread locking engagement with the threaded stem of the spark plug to provide a vibration resisting connection therewith.

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