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APPARATUS FOR FORMING LINING CAPS FOR BALL AND SOCKET JOINTS

Filed July 15, 1968

3 Sheets-Sheet 1

Fig. 1

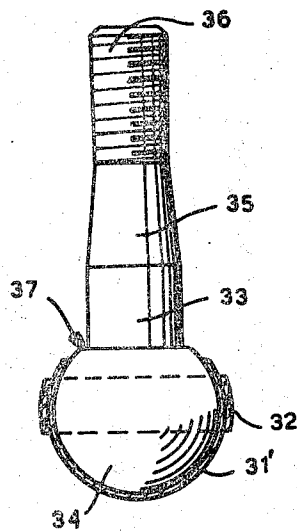


Fig. 4

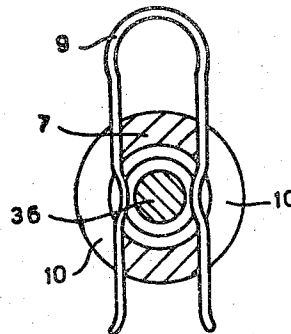
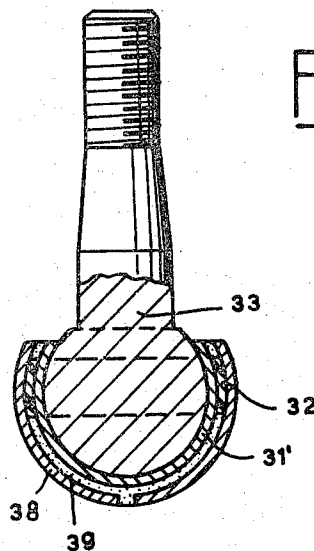


Fig. 5



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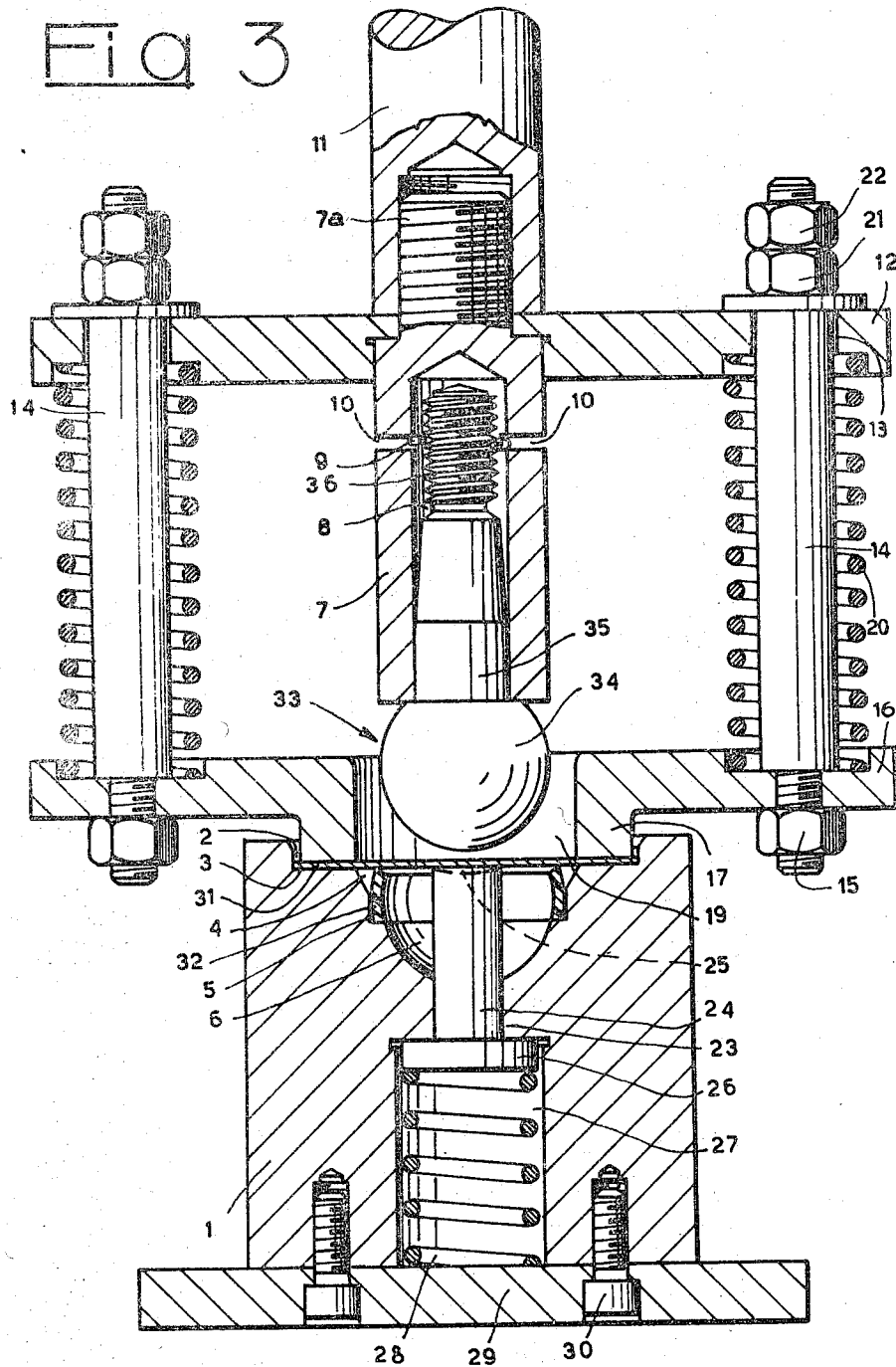
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Fig 3



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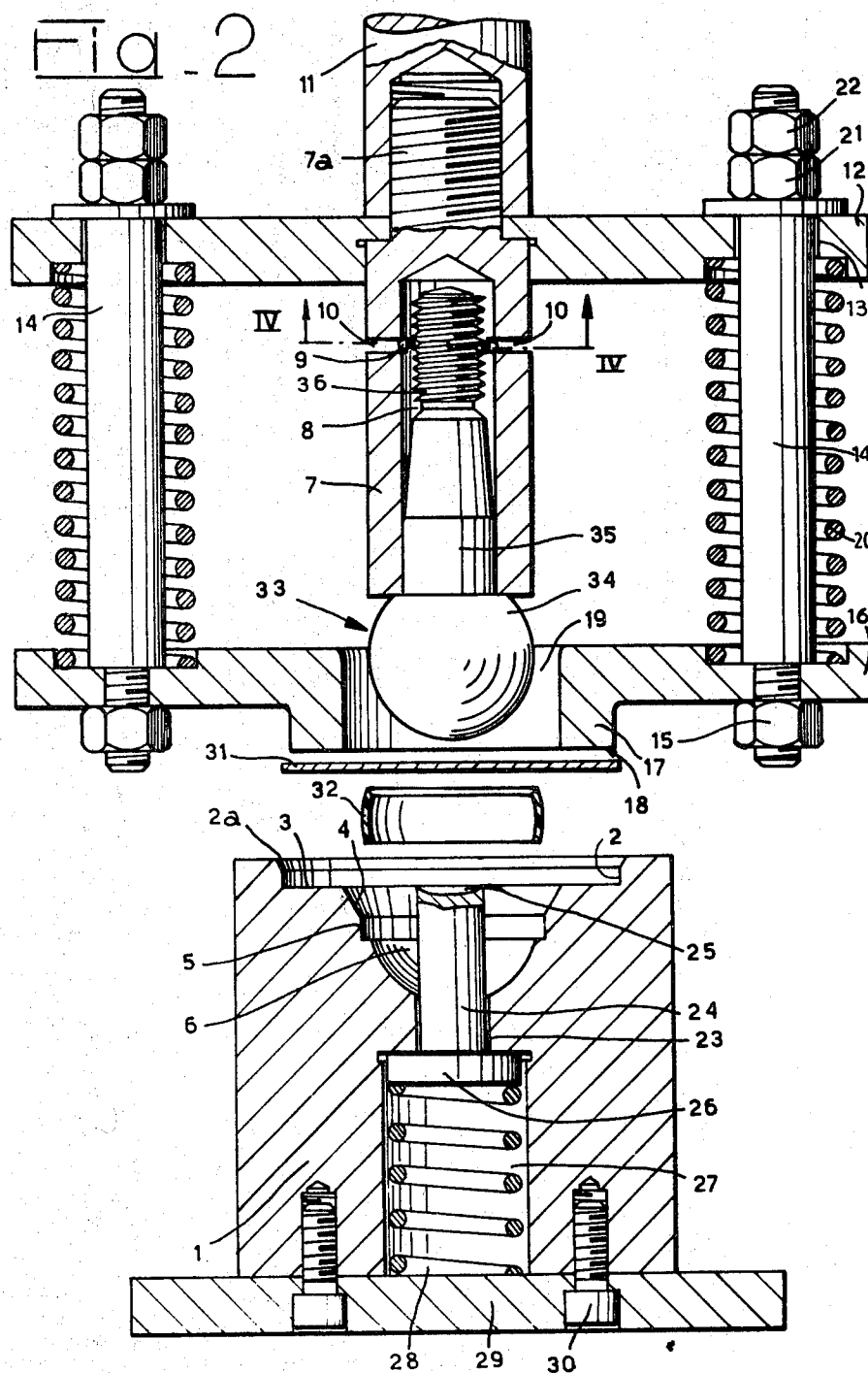
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APPARATUS FOR FORMING LINING CAPS FOR BALL AND SOCKET JOINTS

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52,593/67, Patent 808,396

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U.S. Cl. 29—200

6 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for forming lining caps for ball and socket joints has a shaping die has a hemispherical cavity conforming to the curvature of the socket. A first and a second annular seating are formed in the die coaxially with each other and with the hemispherical cavity. A fabric disc is located on the first seating. A resilient ring is located on the second seating and surrounds the hemispherical cavity. A holder for the ball member of the joint presses the ball portion thereof onto the fabric disc and presses the disc through the resilient ring and into the hemispherical cavity, whereby the disc is shaped into its proper form and is surrounded by the resilient ring. The resilient ring holds the shaped cap on the ball.

This invention relates to the forming of socket lining caps for ball and socket joints.

Such socket lining caps are generally made of non-metallic low friction material and are difficult to form accurately on account of the inherent resiliency of the material. Thus, when a cap of such material is drawn from a disc-shaped blank, the material tends after drawing to resume its initial shape, departing from the required curvature. Moreover, such a drawn cap may exhibit crimping or cracks along its periphery, adversely affecting its function as a low-friction lining.

Broadly, the invention provides apparatus for forming from a resin-treated fabric disc a lining cap for a ball and socket joint, the apparatus comprising a shaping die adapted to be located in a press and having a hemispherical cavity conforming in curvature to the socket of the joint, a first annular seating formed in the die with its axis passing through the center of the hemispherical cavity, the first annular seating being adapted to receive the fabric disc, a second annular seating formed in the die coaxially with the first annular seating and surrounding the hemispherical cavity, the second annular seating being adapted to receive a resilient ring, a holder for a ball member of the joint, the holder being adapted to be fitted to the press to cooperate with the die, and an annular edge-gripping member connected resiliently to the holder and adapted to cooperate with the first annular seating to grip resiliently the edge of a fabric disc located in the first annular seating.

The invention will be more clearly understood from the following description, given by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a part-sectional side view of a ball member of a ball and socket joint fitted with a socket lining cap formed by the apparatus of the invention;

FIG. 2 is an axial sectional view of apparatus for forming socket lining caps according to one embodiment of the invention;

FIG. 3 is an axial sectional view similar to FIG. 2 showing the apparatus at the start of a moulding operation;

FIG. 4 is a cross-sectional view on the line IV-IV of FIG. 2; and

FIG. 5 is a part-sectional side view of a ball and socket

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joint incorporating the ball member and socket lining cap of FIG. 1.

Referring to FIG. 1, a metal ball member 33 for a ball and socket joint comprises a substantially spherical head 34 mounted on a shank 35 having a screw-threaded end portion 36.

A lining cap 31' formed from resin-treated fabric of low friction coefficient is fitted closely over the ball member 33 and retained thereon by a resilient plastics ring 32. The ring 32 is in the form of an equatorial strip of a hollow sphere having the same curvature as the ball head 34, the ring 32 encircling the ball member 34 equatorially and gripping the cap 31' resiliently.

The lining cap 31' is formed in situ on the ball member 33 by means of the apparatus illustrated in FIGS. 2, 3 and 4, as hereinafter described.

The apparatus comprises a shaping die 1 formed centrally in its upper face with a compound cavity. The compound cavity comprises a first shallow cylindrical recess 2 having an outwardly flared upper edge 2a and a base constituted by a first annular flat seating 3. A second shallow cylindrical recess 5 is formed concentrically inwardly of the recess 2 and connects with the first seating 3 by way of an outwardly flared frusto-conical surface 4. A second annular flat seating is constituted by an annular shoulder between the cylindrical wall of the recess 5 and a hemispherical cavity portion 6, the latter having a curvature conforming to that of the desired lining cap 31'. The first and second annular seatings are coaxial, their common axis passing through the center of the hemispherical cavity.

A tubular holder 7 is mounted above the die 1 coaxially with the compound cavity thereof. The holder 7 is provided with a blind axial bore 8 open at its lower end and adapted to receive the shank 35 of the ball member 33. The ball member 33 is secured releasably in the bore 8 by means of a U-shaped harmonic steel spring clip 9 (FIG. 5) the opposite arms of which are introduced through tangentially-extending slots 10 in the tubular wall of the holder 7 to engage the shank 35 between adjacent threads of the threaded portion 36 thereof. The ball member 33 is fitted into the bore 8 so that a flat annular shoulder 37 (FIG. 1) at the junction of the spherical head 34 and the shank 35 abuts the lower end of the holder 7.

At its upper end the holder 7 is provided with an externally screwthreaded extension 7a by which the holder 7 is connected to a vertically movable part 11 (part only of which is shown) of a pneumatic, hydraulic, or other convenient form of press (not shown).

A support plate 12 which is rectangular in plan view has a central bore through which the extension 7a passes and is clamped to the movable press part 11 by the holder 7 so as to lie in a horizontal plane. The plate 12 has two holes 13 at opposite edges in which vertical cylindrical rods 14 are slidably mounted. The rods 14 are secured at their lower ends by means of nuts 15 to a horizontal movable presser plate 16, which is also rectangular in plan view.

The presser plate 16 is formed with an integral downwardly-projecting annular flange 17 having a flat annular lower face 18 which is coaxial with and adapted to fit into the first recess 2. The flange 17 surrounds a central bore 19 in the plate 16, the bore 19 being of a sufficient diameter to permit the head 34 of the ball member 33 and the tubular holder 7 to pass therethrough.

The rods 14 are surrounded coaxially by helical springs 20 which bias the movable plate 16 away from the support plate 12. At its upper end, above the plate 12, each rod 14 is provided with an adjustable stop nut 21 which is locked in position by means of a lock-nut 22 and which determines the vertical spacing between the plates 12 and

16 in the inoperative condition of the apparatus (FIG. 2).

The die 1 is formed with a central vertically extending bore 23 in which a push member 24 is slidably mounted. The push member 24 is formed at its upper end with a concave part-spherical surface 25 conforming in curvature to that of the hemispherical portion 6 of the mould cavity. At its lower end the push member 24 is provided with an enlarged head 26 which is slidable in a vertical cylinder 27 formed in the bottom face of the die 1. The push member 24 is biased upwardly by a helical spring 28 within the cylinder 27 acting on the head 26 and bearing against a bottom closure plate 29 which is secured to the die 1 by means of screws 30. In its inoperative position (FIG. 2) the upper end of the push member 24 is disposed level with the plane of the first annular seating 3.

Lining caps 31' (FIG. 1) are formed using this apparatus from punched discs 31 of resin-treated fabric. The disc 31 is placed on the first annular seating 3, of the first die recess 2 with the movable press part 11 raised (FIG. 2). The resilient plastics ring 32 is placed in the second die recess 5. Before placing the disc 31 and ring 32 in the die 1, layers of adhesive are first applied to the internal part-spherical surface of the ring 32 and to a circular zone of the surface of the disc 31 which forms the external equatorial surface zone of the eventual lining cap 31'. The ball member 33 is fitted into the tubular holder 7 and retained therein by the clip 9.

The movable part 11 of the press is then lowered towards the die 1, whereupon the annular flange 17 grips resiliently the entire edge of the disc 31 between the lower face 18 and the first seating 3. The disc 31 is then engaged centrally by the head 34 of the ball member 33 and its central portion is gripped between the head 34 of the ball member 33 and the part-spherical end surface 25 of the push member 24. The push member 24 therefore serves to hold the disc 31 coaxially with respect to the ball member 33 and the resilient ring 32.

As the part 11 is further lowered, the fabric of the disc 31 is drawn uniformly over the surface of the spherical head 34 by the combined effect of the downward movement of the head 34 and the edge-gripping of the disc by the plate 16. The results in intimate face-to-face contact between the fabric and the spherical head 34, and crimping of the fabric, which would oppose the retaining action of the resilient ring 32 by preventing the ring from closing uniformly on to the head 34, is substantially avoided.

The head 34 in lowering passes through the ring 32, which is sufficiently resilient to permit the insertion of the head 34, until the head 34 is fully inserted in the matrix cavity and the disc 31 is moulded into the desired cap 31'. The moulded cap 31' is held resiliently against the surface of the head 34 by the resilient ring 32, which, in the fully inserted position of the head 34, grips the cap 31' equatorially (FIG. 1). The ring 32 is bonded to the external surface by the cap 31' by the previously applied adhesive.

Suitable plastics material for the resilient ring 32 are amide resins, the resilient properties of which are such that breakage of the ring 32 on introduction of the head 34 is avoided.

Upon completion of the disc shaping step, which is carried out entirely at room temperature, the springs 20 cause the plates 12, 16 to move apart to their inoperative relative position (FIG. 2) in which the plate 12 is engaged by the stop nuts 21. The apparatus is then ready for the start of a further shaping operation.

FIG. 1 shows the ball member 33 upon completion of the shaping operating with the shaped lining cap 31' fitted thereto together with the resilient ring 32. By using the ball member 33 itself as, in effect, the male shaping member, the step of stripping the formed cap 31' from the mould is avoided, and the ball member 33 with the lining cap 31' attached can proceed directly from the cap-forming step to the next step in the process of manufacturing the ball and socket joint.

The next step entails fitting a metal socket member 38 over the formed cap 31' and bonding the cap 31' and ring 32 to the socket member 38 by means of a bonding layer 39 (FIG. 5). The bonding layer 39 typically comprises a mixture of a phenol resin and asbestos. The ball member 33 is freely rotatable in the assembled lining cap 31' and socket member 38, giving a low-friction ball and socket joint having substantially no play.

We claim:

1. Apparatus for forming from a resin-treated fabric disc a lining cap for a ball and socket joint, the apparatus comprising a shaping die adapted to be located in a press and having a hemispherical cavity conforming in curvature to the socket of the joint, a first annular seating formed in said die with its axis passing through the center of said hemispherical cavity, said first annular seating being adapted to receive said fabric disc, a second annular seating formed in said die coaxially with said first annular seating and surrounding said hemispherical cavity, said second annular seating being adapted to receive a resilient ring, a holder for a ball member of the joint, said holder being adapted to be fitted to said press to cooperate with said die, and an annular edge-gripping member connected resiliently to said holder and adapted to cooperate with said first annular seating to grip resiliently the edge of a fabric disc located in the first annular seating.

2. Apparatus as claimed in claim 1, including a push member mounted for sliding movement centrally in said die and means resiliently urging said push member into a position in which it projects into said hemispherical cavity, whereby, upon insertion of the ball member into said cavity, said push member resiliently forces the central portion of a said fabric disc against the surface of the ball member.

3. Apparatus as claimed in claim 2, in which the normal inoperative position of said push member the end thereof which engages said fabric disc is disposed substantially level with the plane of said first annular seating.

4. Apparatus as claimed in claim 3 in which said end of said push member which engages said fabric disc is formed with a concave part-spherical surface conforming in curvature to that of said hemispherical mould cavity.

5. Apparatus as claimed in claim 1 in which said ball member has a shank provided with a screw-threaded portion and said holder has a bore adapted to receive the shank of said ball member, the ball of said bore having two diametrically opposed tangentially-extending slots which communicate with the portion of the bore which receives a screw-threaded portion of the said shank, and including a U-shaped spring clip having arms which enter respective said slots and engage said screw-threaded shank portion thereby to lock said ball member in said bore.

6. Apparatus as claimed in claim 1, in which the edge-gripping member comprises a movable plate having a central aperture through which a said ball member may pass, said movable plate being adapted to seat upon said first annular seating, the apparatus including a support plate parallel with said movable plate and having fixed to it holder rods connecting said support plate to said movable plate and permitting movement of said movable plate towards and away from said support plate and biasing said movable plate away from said support plate.

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THOMAS H. EAGER, Primary Examiner

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