June 28, 1955 K. E. L. GRETTVE 2,711,863

EXPANSIBLE MANDREL

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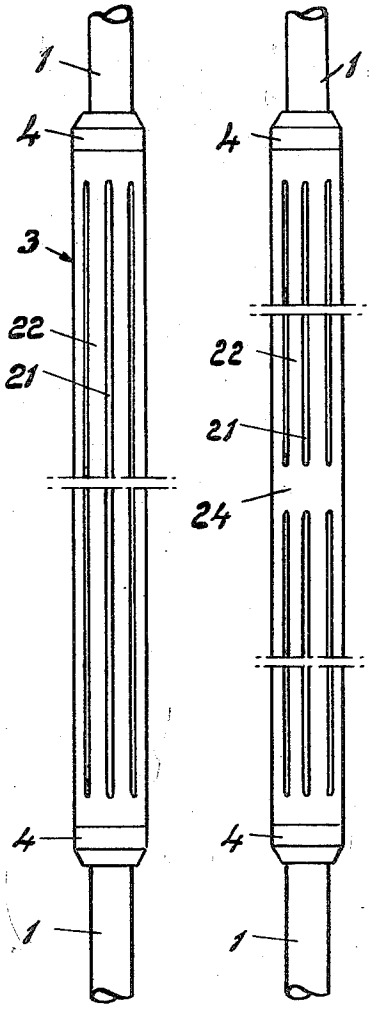
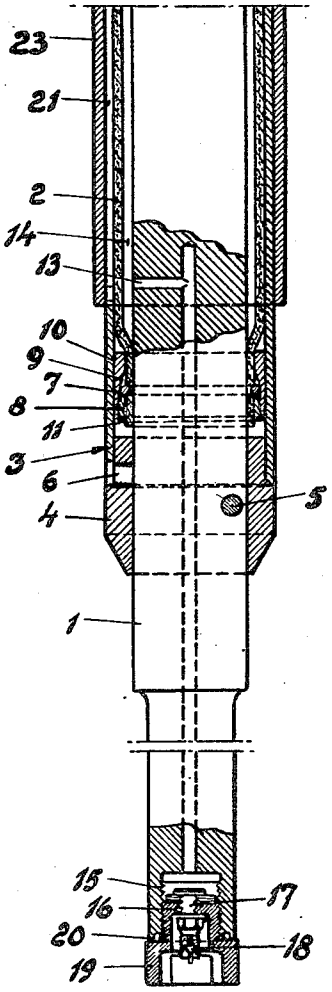
Fig. 1 Fig. 2 Fig. 3





INVENTOR
K. E. L. GRETTVE

By Wenderoth, Lind & Ponack
ATTORNEYS

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Fig. 4

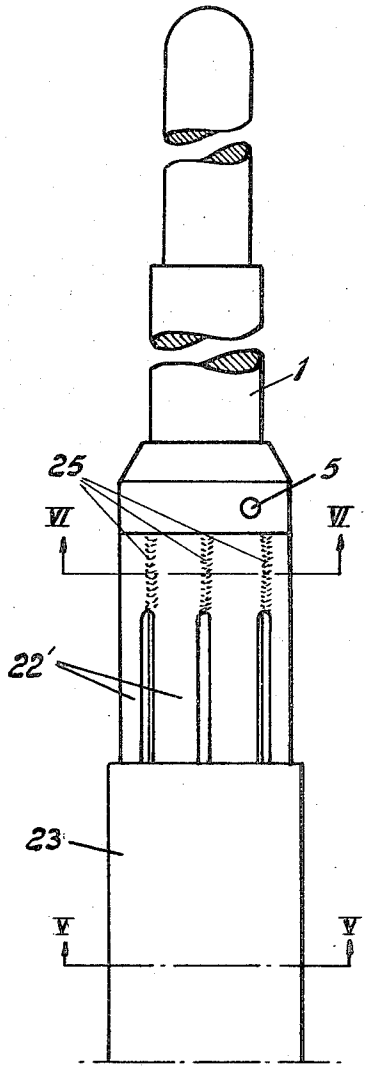


Fig. 5

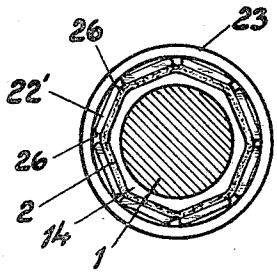


Fig. 6

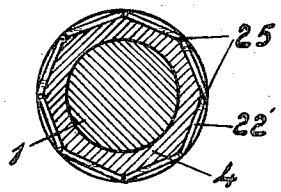


Fig. 7

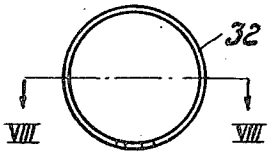
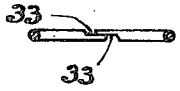


Fig. 8



INVENTOR
K. E. L. GRETTVE
BY Wenderoth, Lind & Ponack
ATTORNEYS

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EXPANSIBLE MANDREL

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Fig. 9

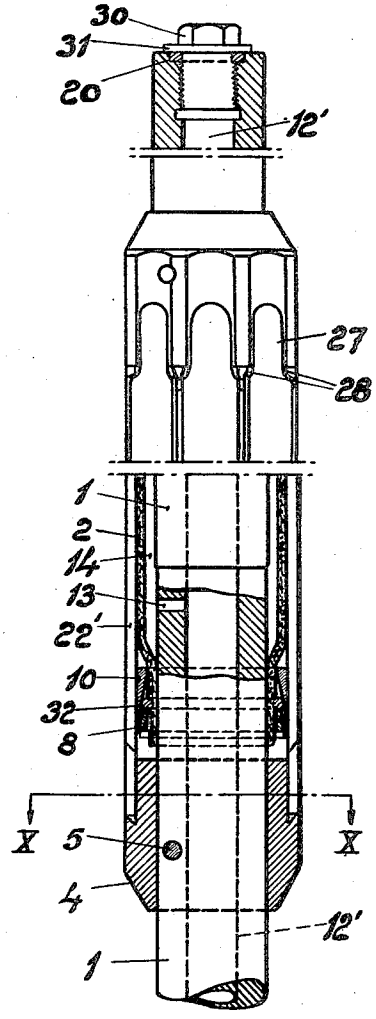


Fig. 10

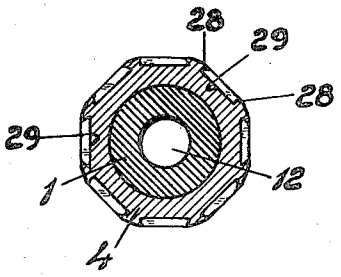
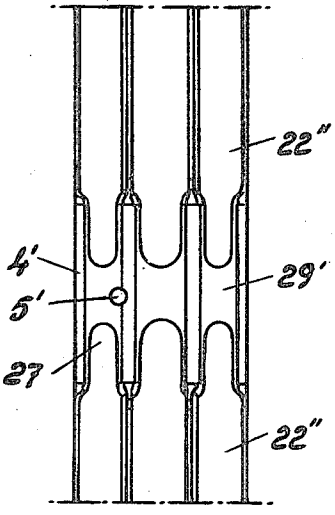


Fig. 11



INVENTOR
K.E.L. GRETTVE
BY
Wenderoth, Lind & Ponack
ATTORNEYS

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Fig. 12

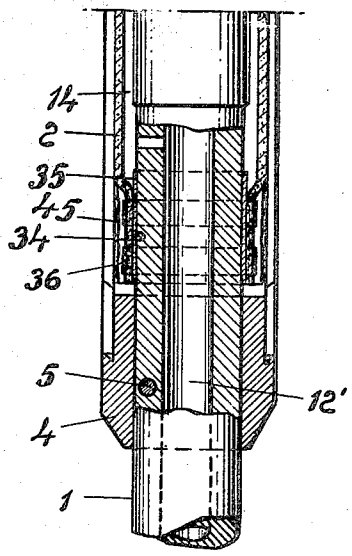
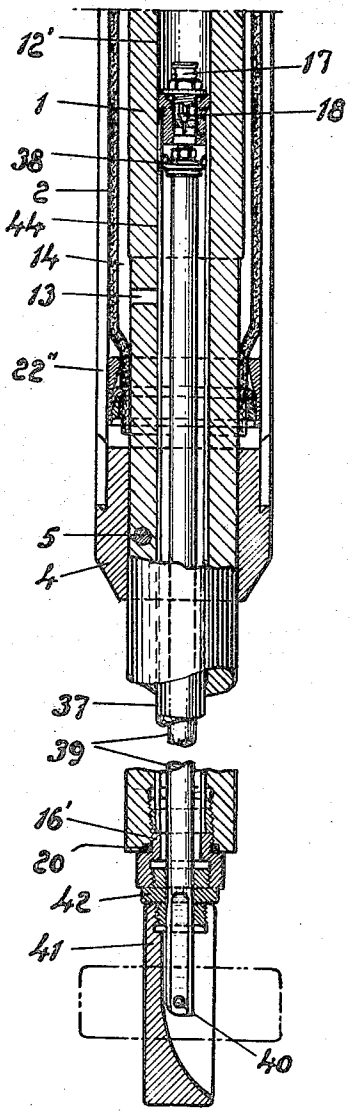


Fig. 13



INVENTOR
K. E. L. GRETTVE

BY
Wenderoth, Lind & Ponack
ATTORNEYS

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EXPANSIBLE MANDREL

Karl Einar Lage Grettve, Lilla Edet, Sweden, assignor to Lilla Edets Pappersbruks AB, Lilla Edet, Sweden, a corporation of Sweden

Application December 27, 1951, Serial No. 263,653

Claims priority, application Sweden November 12, 1951

14 Claims. (Cl. 242—72)

The present invention relates to winder mandrels, and, in particular, to mandrels carrying cardboard tubes or cores on which webs of sheet material such as paper may be wound. More specifically, this invention relates to expansible winder mandrels for rolls of paper, said mandrel comprising a shell, on which the cardboard tube is passed endwise, and a pneumatic expansible means inserted within the shell, the device being such that when forcing air into the expansible means the shell will be pressed radially outwards against the cardboard tube, which on account of the friction between the latter and the shell is caused to rotate with the mandrel. Formerly, the expanding means was constituted by one or more double-walled bags of rubber or some other elastic material. These bags are comparatively expensive to make, and, besides, they are difficult to attach to the mandrel.

One of the objects of the present invention is to simplify the production of such mandrels besides which several other advantages are obtained. Characteristic of the invention is the fact that the expanding means comprises a hose which is passed over a shaft which passes through the mandrel and is attached to the shaft in such a way that the ends of it hold tightly to the shaft which is provided with a device for introducing compressed air into the space between the hose and the shaft, besides which an expanding shell is applied round the outside of the hose, which shell is provided with longitudinal bars which are mutually joined at the ends and are here carried by the shaft.

In the following the invention will be explained with reference to the attached drawings, in which Fig. 1 is a side view of a mandrel according to an embodiment of the invention and Fig. 2 is a similar side view of the mandrel as per a somewhat altered embodiment of the invention. Fig. 3 shows a longitudinal section of one end of the mandrel drawn to a larger scale. Fig. 4 is a side view of the opposite end of a mandrel as per a somewhat altered embodiment of the invention. Fig. 5 is a cross section through the mandrel along the line V—V in Fig. 4, and Fig. 6 is a similar cross section but along the line VI—VI in Fig. 4. Fig. 7 is an end view of a ring for clamping the one end of the hose around the shaft passing through and Fig. 8 is a vertical section through the ring along the line VIII—VIII in Fig. 7. Fig. 9 is a side view, partly in longitudinal section, of a mandrel as per still another embodiment of the invention. Fig. 10 is a cross section through the mandrel along the line IX—IX in Fig. 9. Fig. 11 is a side view of the middle part of a relatively long mandrel of the construction shown in Fig. 9. Fig. 12 is a longitudinal section through the one end of the mandrel showing another construction of the device for clamping the hose to the shaft passing through it. Fig. 13 is a longitudinal section through the one end of a mandrel arranged to be pumped up by a handpump.

In the embodiment shown in Figs. 1–3 the main parts of the mandrel are a shaft 1, a hose 2 of rubber or some other suitable elastic material passed over the shaft and

a steel tube, or shell 3, which at either end is supported by a housing 4 which is attached to the shaft by means of a crosswise inserted pin 5. The shell is attached to each housing 4 by a screw 6. Around either end of the hose 2 a helical spring ring 7 is passed which by cooperation between a ring-shaped part 8, which serves as an abutment, and a clamp ring 10 provided with a conical clamp surface 9, is pressed against the outside of the hose. The clamping is effected by moving the ring-shaped part 8 and the clamp ring 10 against each other, causing the ring 7 to press the hose 2 around the shaft 1 so that a good tightening is obtained. The ring-shaped part 8 and the clamp ring 10 are kept in the position they have been moved into by indentations or tongues 11 pressed inwards in the outer rim of the clamp ring. The shaft 1 is provided with an axial bore 12 and with a radial channel 13, by which the bore 12 communicates with the space 14 between the shaft and the inside of the hose 2. At the outer end the boring 12 is provided with screw threads 15, fitting to a nipple 16 with an axially arranged valve 17 of the type which is used on prevailing pneumatic tires on motor cars. The valve is thus provided with a valve plug 18 which is arranged to be pressed inwards by the air current from a compressed air conduit, and after that by means of the air pressure established in the bore 12 is pressed to a tightening contact against a seat in the valve body. Between a cup-shaped part 19 of the nipple 16 for protecting the valve 17 and the outer end of the shaft 1, a packing ring 20 is inserted. In the steel tube 3 a number of longitudinal slits 21 are made, which according to Fig. 1 extend along the whole tube and cease in the neighbourhood of the ends of the tube. The bar-shaped parts between the slits 21 are indicated by 22.

When compressed air is let in through the valve 17 and further through the bore 12, the channel 13 and into the space 14 between the shaft 1 and the hose 2, the latter is expanded and thereby presses the bars 22 bow-like outwards against a cardboard tube 23 passed over the expansible shell 3, on which the paper is to be wound. The friction between the expansible shell 3 and the tube 23 will then be sufficient to cause the tube to rotate with the mandrel.

If the expansible shell 3 is relatively long it may be appropriate to make the slits in the tube to leave at the middle of the tube a part 24 unslitted. In such case the bars 22 on either side of said part 24 will bend outwards arc-like under the internal air pressure, whilst the unslitted part 24 will remain unaffected.

Instead of slitting up a metal tube the expansible shell 3 can be established by joining a number of steel bars 22′ so that an expansible shell of polygonic cross section is formed (see Figs. 5 and 6). The steel bars 22′ are mutually welded together at the ends as indicated at 25 in Figs. 4 and 6. The advantage of this construction is that the bars 22′, when they are bent outwardly, by their side edges 26 will grip firmly in the tube 23 whereby a good friction is established. When the air is let out from the space 14 between the hose 2 and the shaft 1, which is accomplished by pushing the valve plug 18 inwards, the bars 22′ will spring back again into their straight initial position and the cardboard tube 23 can easily be pulled off the mandrel without the inner winding of the cardboard tube being attached to the tube, which often happens when cylindrical expansible shells are used.

In Figs. 9 to 11 incl. an imbodiment of the driving mandrel is shown in which the expansible shell has been given still another form. Here the steel bars 22″ are not welded together. Their ends 27 are shaped so that their side edges 28 converge radially outwardly. These ends are put in dovetail slots 29 in the housings 4. By this arrangement the bars 22″ during their arc-like bend-

ing outwards under the internal air pressure will be able to slide axially a little with their ends in the dovetail slots 29. In the disclosure according to Figs. 9 to 11 incl. the shaft 1 consists of a tube with an axial bore 12'. In this case a nipple 16 provided with a valve 17 may be attached at either end of the shaft 1. However, one of the ends can also be closed by means of a screw plug 30 with a tightening ring 20 inserted between the corresponding end of the shaft and a flange 31 on the screw plug.

If the mandrel is relatively long, a housing 4' can be attached to the shaft 1 placed approximately at the middle of the shaft and fixed to the latter by means of a pin 5'. This housing 4 corresponds in its shape with the housings 4' at the ends of the shaft, with the exception that the housing 4 is provided with grooves 29' which extend along the whole length of the housing. The bars 22'' at either side of the housing 4' consequently can be bent arc-like outwardly by action of the internal air pressure.

In Fig. 3 a helically wound ring 7 is used for clamping the end of the hose 2 to the shaft 1. However, also a ring 32, preferably of steel and of the shape shown in Figs. 7 and 8 can be used. This ring at its ends is provided with a step 33 and the ends of the ring overlap each other as shown especially in Fig. 8.

In Fig. 12 a device is shown by which the tightening of the hose 2 around the shaft is simplified. According to this embodiment on both ends of the shaft is passed a piece of hose 34 of comparatively thin rubber material and the hose 2 is at its corresponding end fixed to the piece of hose 34 by way of example, by rubber solution in such a way that the inner end 35 of the piece of hose 34 protrudes freely into the hose 2. The end of the hose 2 is kept firmly pressed against the shaft 1 by a metal strip 36 or the like. The internal pressure in the space 14 will press the inner end 35 of the piece of hose 34 into a tightening contact with the outer side of the shaft 1.

In the embodiments described above the valve 17 is intended to be connected to a source of compressed air for the purpose of pumping up the hose 2. If such a source is not available, the hose can be pumped by means of an ordinary bicycle pump. Then it is suitable—as shown in Fig. 13—to exchange the nipple 16 shown in Fig. 3 for a special nipple 16' which is attached to one end of the cylinder 37 of a pump 38 provided with an ordinary plunger by means, for instance, of the kind which is used for pumping up bicycle tires. The plunger shaft 39 of the pump, at the outer end provided with a handle 41 turnably attached to the shaft by means of a pin 40, is axially slidable through a housing 42 which is screwed to the outer end of the nipple 16'. The inner end of the cylinder 37 is closed by means of a plug 43, in which is provided a valve 17 suitably of the same type as shown in Fig. 3. Between the bore 12' and the cylinder 37 of the pump there is an angular space 44 through which the air let in through the valve 17 can pass on to the channel 13 and from there to the space 14 between the shaft 1 and the hose 2. At the opposite end of the shaft 1 a discharging valve may be arranged, so that the compressed air can be let out from the space 14 when the cardboard tube is to be removed.

Naturally further embodiments than those disclosed in the attached drawings fall within the scope of the invention. Also other expanding means than the hose 2 shown in the drawings can be used for the arc-like bending outwards of the bars 22, 22' and 22'' of the expansible shell 3.

The mandrel can be provided with devices to protect the bars 22, 22' and 22'' of the expansible shell from being bent outwards by the internal air pressure to a degree above the elastic limit of the material. As an example of such a device can be mentioned a sock or cover 45 (Fig. 12) of some strong textile material which is loosely passed over the hose and which will be strained when the hose 2 is extended, and at a certain internal pressure will stop further extension and bending outwards of the bars of the expansible shell 3.

I claim:

1. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially and outwardly, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside round said hose with a plurality of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means.

2. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially and outwardly, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside and around said hose with a number of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, said hose being provided at an end thereof with a clamp housing, an abutting part and with an expansible ring clasping said end of said hose and arranged to press said end of the hose into tightening contact with said shaft by cooperation between a clamp housing and an abutting part.

3. An expansible mandrel according to claim 2, wherein said expansible ring is a helically wound ring of steel material.

4. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially outwards, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside and around said hose with a plurality of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, said hose being provided at an end thereof with a clamp housing, an abutting part and with an expansible ring clasping said end of said hose and arranged to press said end of the hose into tightening contact with said shaft by cooperation between a clamp housing and an abutting part, said clamp housing being provided with a conical inner surface and being arranged to force said expansible ring with its conical surface against said hose by moving said abutting part into said clamp housing.

5. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially and outwardly, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside and around said hose with a plurality of longitudinal bars the ends of which are carried by the shaft in a way to allow them to slide in the longitudinal direction of said shaft with-

out being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, said longitudinal hose being provided at an end thereof with a piece of a hose of thin elastic material, which is passed onto said shaft and is attached to said longitudinal hose in such a way that a part of said piece of hose protrudes freely into said longitudinal hose.

6. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially and outwardly, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside and around said hose with a plurality of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, said shaft being provided with an axial bore having a radial channel by means of which the bore communicates with a space between said hose and said shaft.

7. An expansible mandrel according to claim 6 wherein the outer end of said bore is provided with a valve having a valve seat and a valve plug which is arranged to be forced in tightening engagement against the valve seat by means of the internal pneumatic pressure in the space between said hose and said shaft.

8. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially and outwardly, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside and around said hose with a plurality of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, said shaft being provided with a tube having an axial bore and a radial channel by means of which the bore communicates with a space between said hose and said shaft, and a valve applied at both ends of said bore.

9. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially and outwardly, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside round said hose with a plurality of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, said shaft being provided with an axial bore and with a radial channel by means of which the bore communicates with a space between said hose and said shaft, said bore being provided with a valve applied at one end thereof and a plug entirely closing the bore at the opposite end thereof.

10. An expansible mandrel according to claim 8, wherein a plunger air pump is inserted in one end of said bore, a nipple attached to the end of the cylinder of said pump through which the plunger shaft passes and said cylinder being in operative tightening engagement with the corresponding end of said shaft to position the valve applied at the opposite end of the pump cylinder inside of said bore.

11. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially and outwardly, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside and around said hose with a plurality of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, said bars being arranged to provide the cross section of said expansible shell in a polygonal shape.

12. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially and outwardly, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside and around said hose with a plurality of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, a housing on said shaft, said bars having their ends inserted into guides in the circumference of said housing on said shaft.

13. An expansible mandrel according to claim 12, wherein said guides have a dovetail-shaped cross section and the ends of said bars have side edges which converge outwardly.

14. An expansible mandrel having an expansible shell and pneumatic means adapted to actuate said shell radially outwards, said pneumatic means comprising a hose which is passed over a shaft passing through the mandrel, means for securing the ends of said hose tightly to said shaft and means for letting in compressed air in a space between the hose and the shaft, said expansible shell being provided outside and around said hose with a plurality of longitudinal bars the ends of which are carried by the shaft to allow them to slide in the longitudinal direction of said shaft without being displaced radially outwardly and to cause the middle part of said bars to be bent bowlike outwardly due to the action of said pneumatic means, said hose further provided with a cover of a strong textile material, which loosely fits over said hose and is adapted to be strained when the hose is extended to limit further extension and the bending outwards of said bars of said extensible shell at a predetermined internal air pressure.

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