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Membre et al.

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[54] **METHOD AND A DEVICE FOR INTRODUCING INNER TUBES INTO PNEUMATIC TYRES**

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[52] **U.S. Cl.** **29/235,** 29/451
[51] **Int. Cl.** **B23p 19/02,** B23p 11/02
[58] **Field of Search** 29/235, 234, 282, 451

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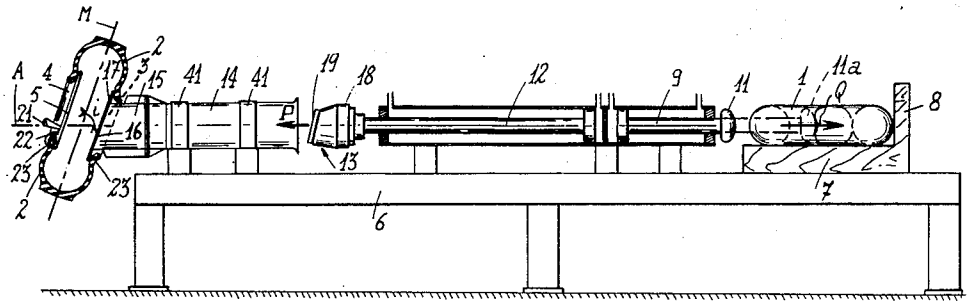
Primary Examiner—James L. Jones, Jr.
Attorney, Agent, or Firm—Young and Thompson

[57] **ABSTRACT**

A method and device for introducing inner tubes which are inflated to a predetermined pressure into tyres, and especially inner tubes of the so-called "puncture-proof" type.

The inner tube is deformed so that the two opposite faces of its inner wall are substantially in contact and is then introduced into an ovalized guide tube terminating in a funnel having an obliquely oriented circular orifice. The orifice is introduced into the opening of the tyre and the inner tube is thrust into the tyre by the ram of a jack. The inner tube is prevented from escaping by virtue of a deflector which is placed in the opposite opening of the tyre.

15 Claims, 17 Drawing Figures



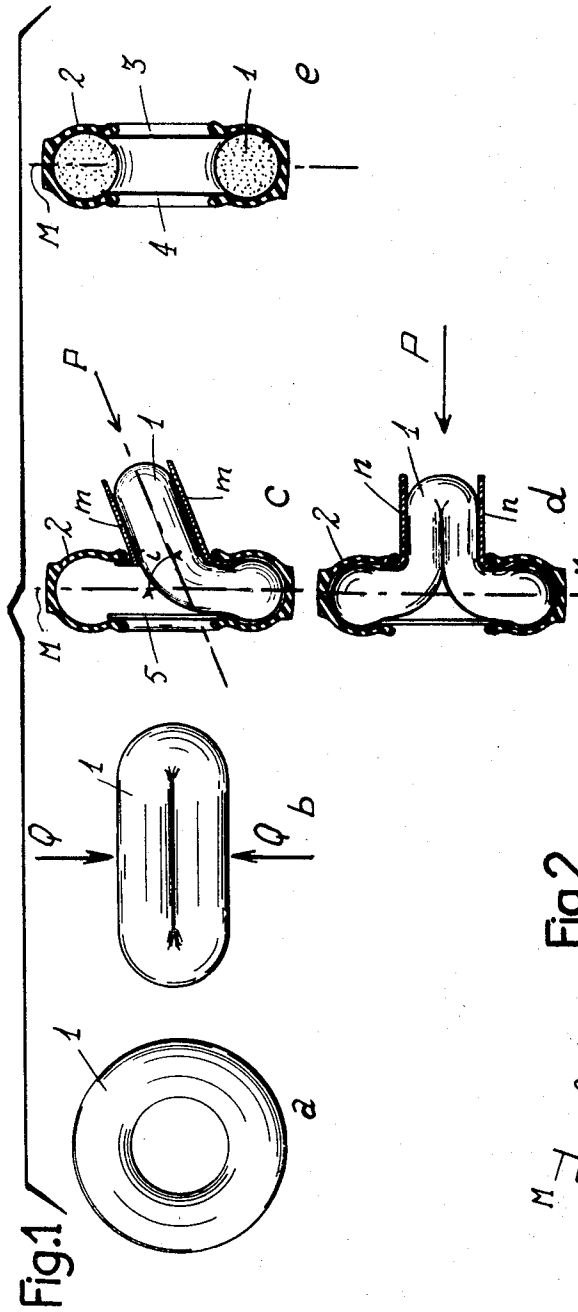


Fig.1

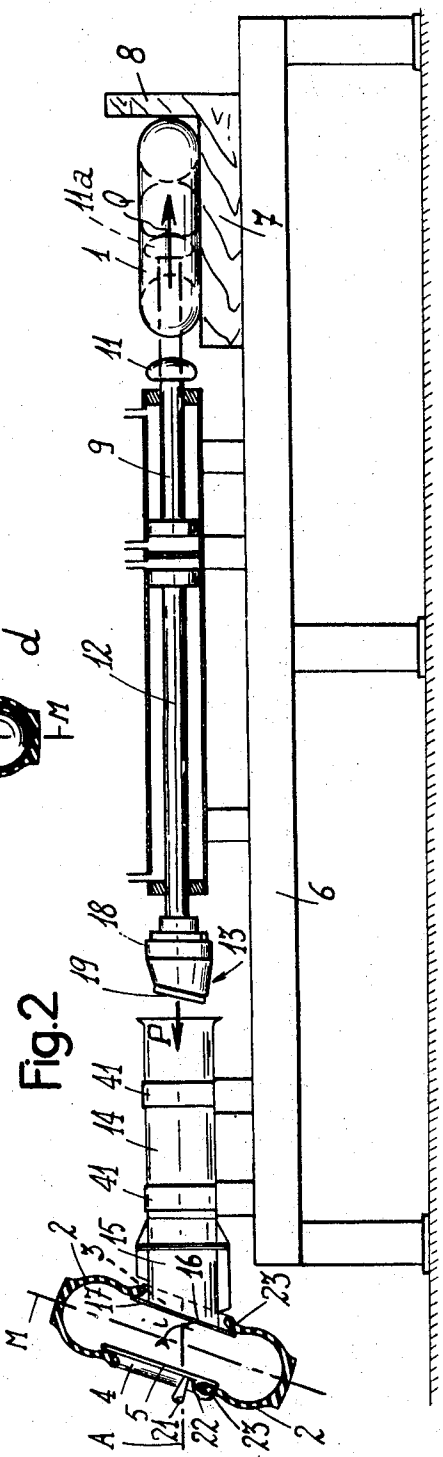
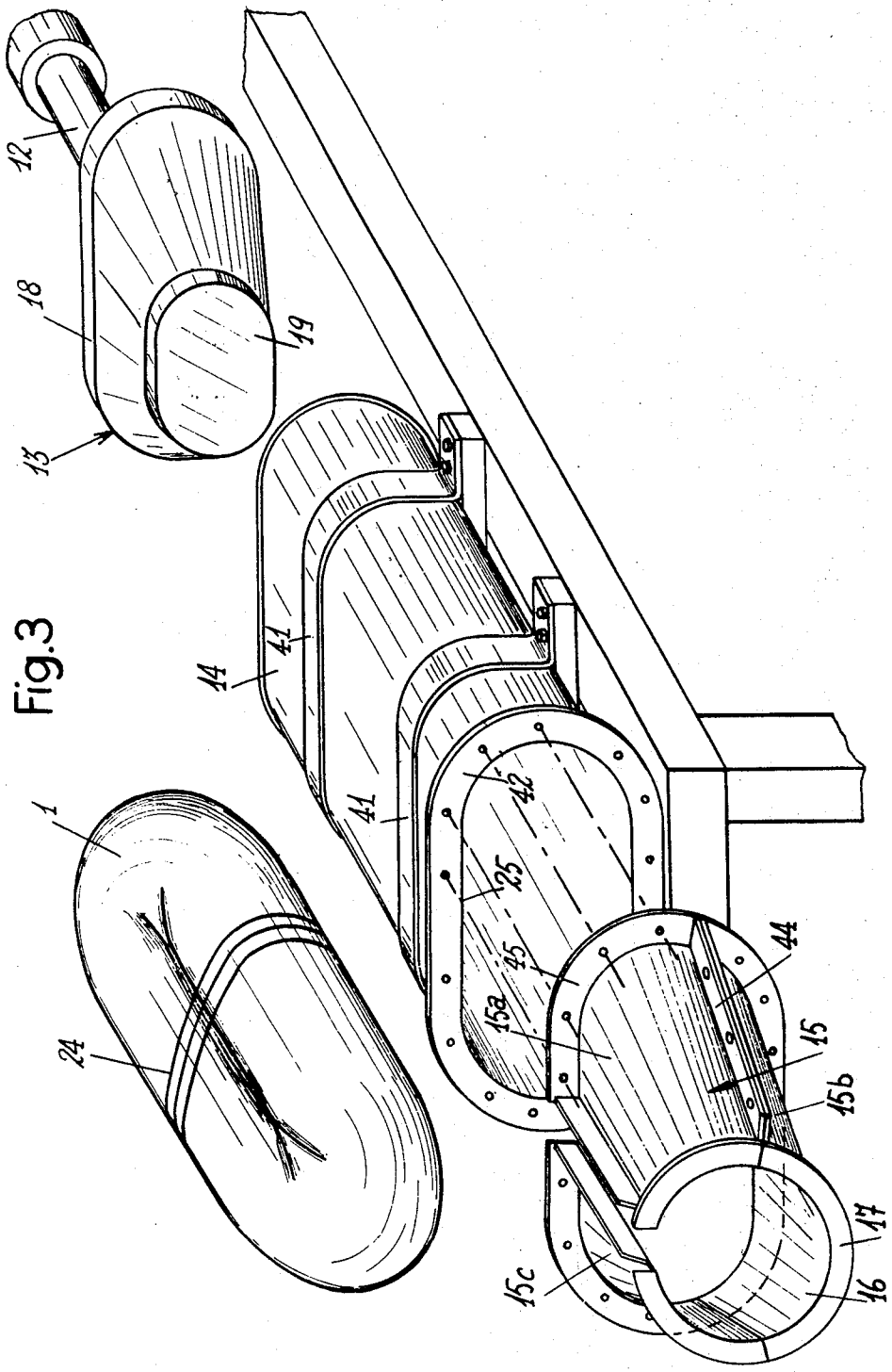


Fig.2

Fig.3



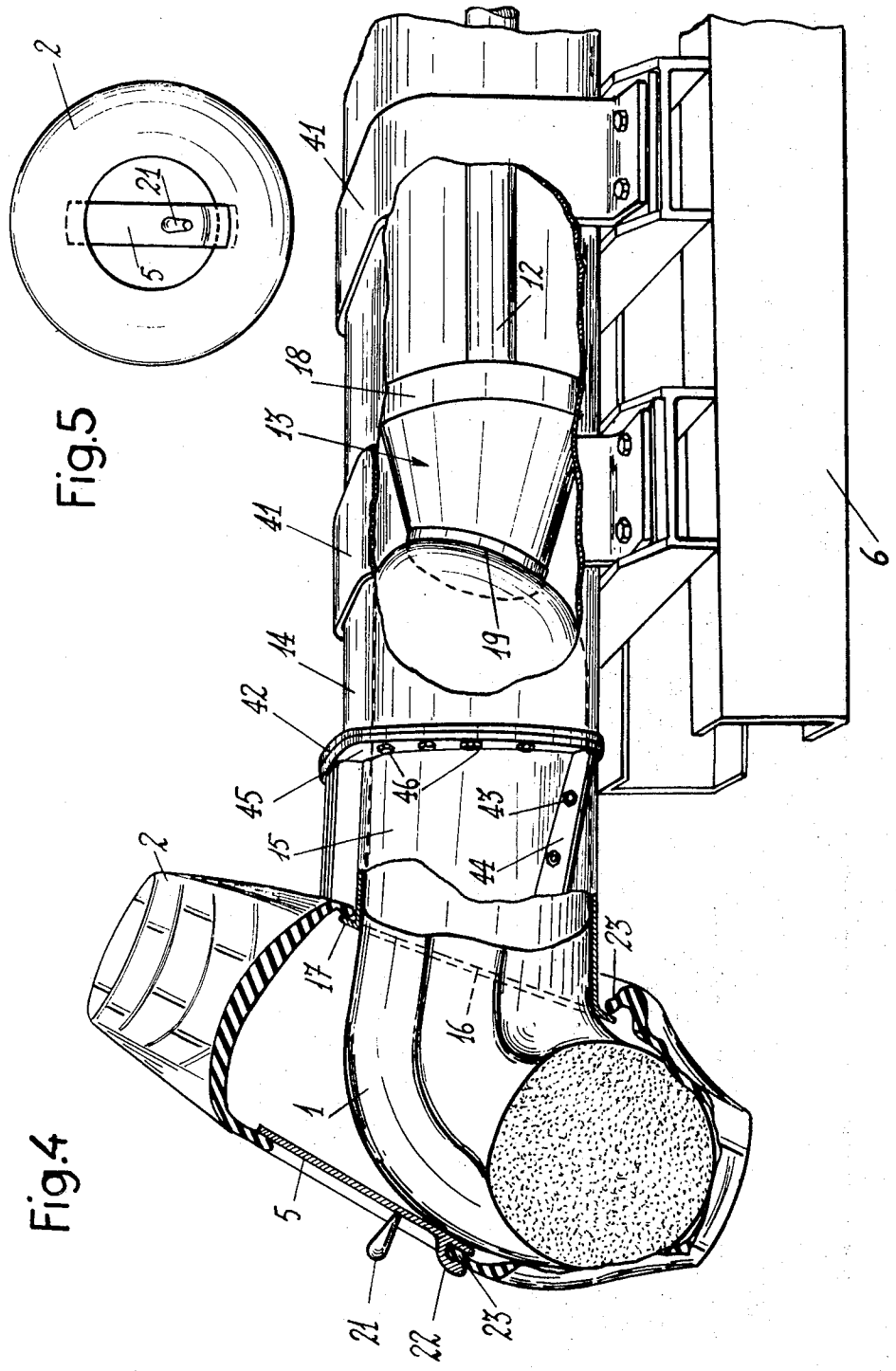


Fig.5

Fig.4

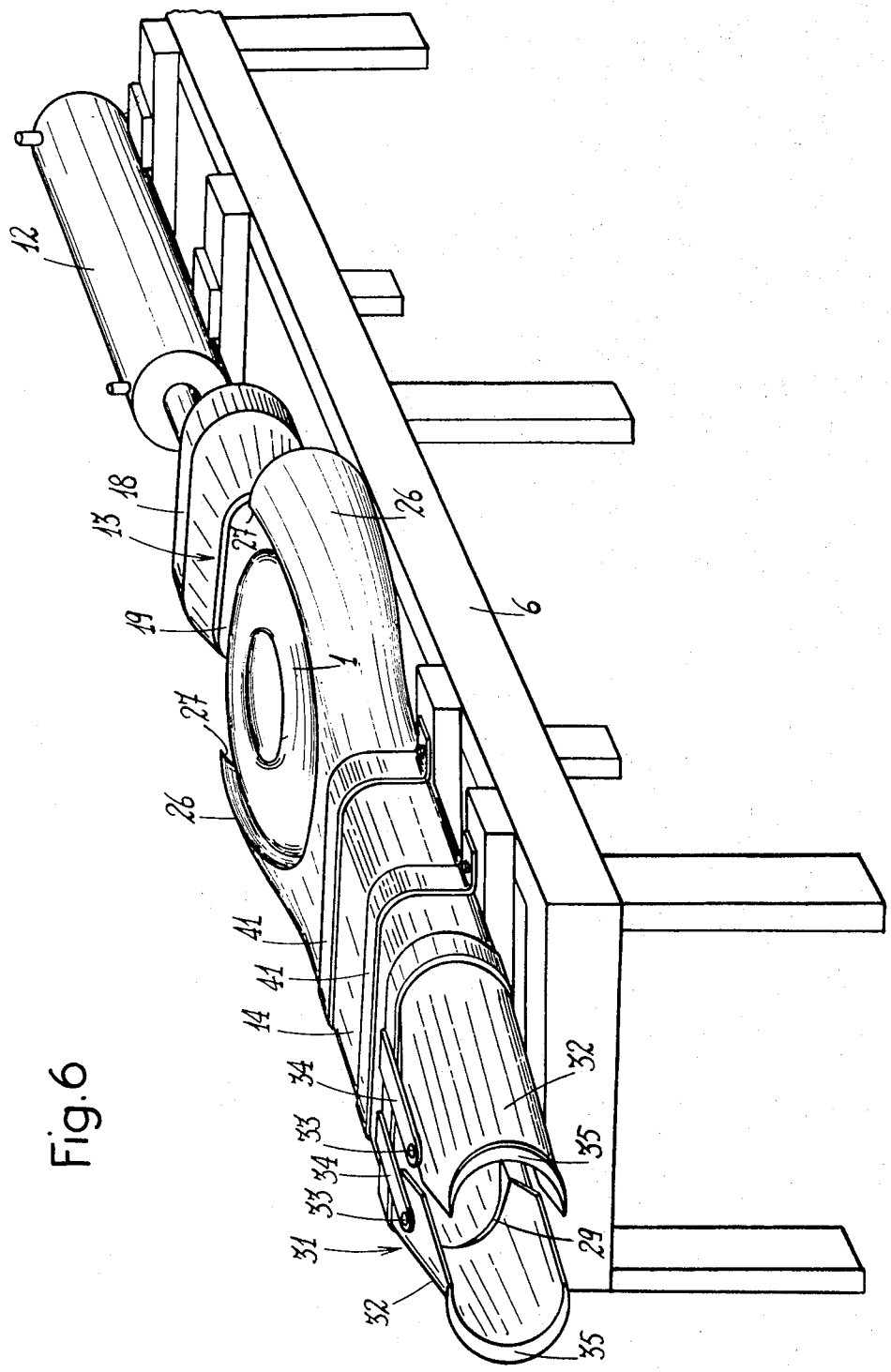


Fig.6

Fig.9

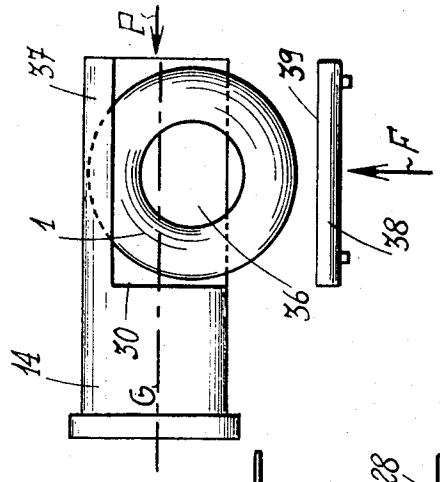


Fig.7

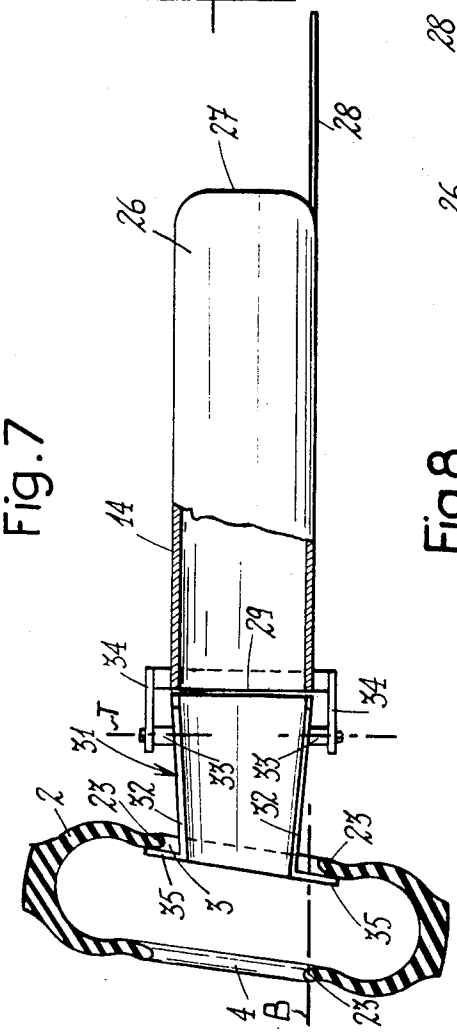


Fig.8

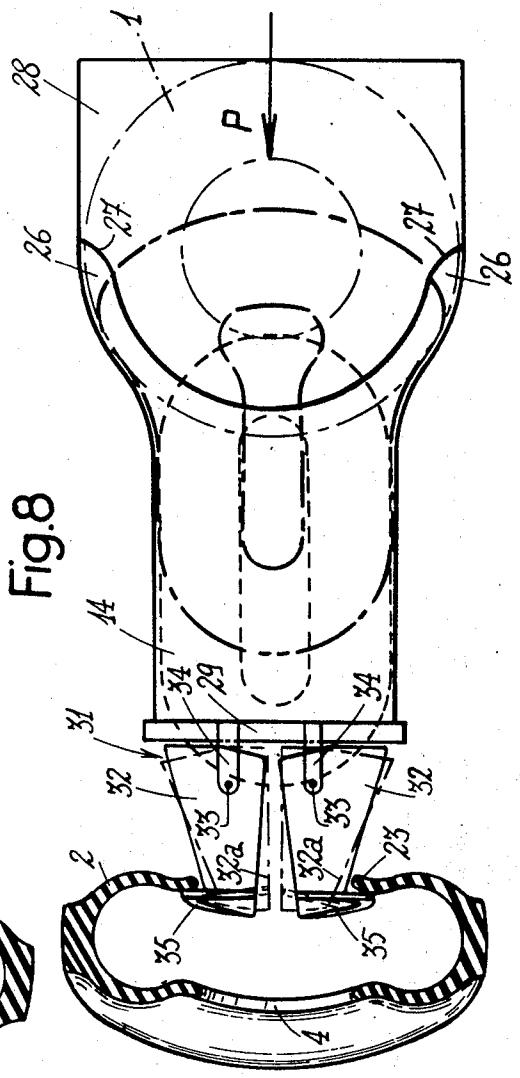


Fig. 10

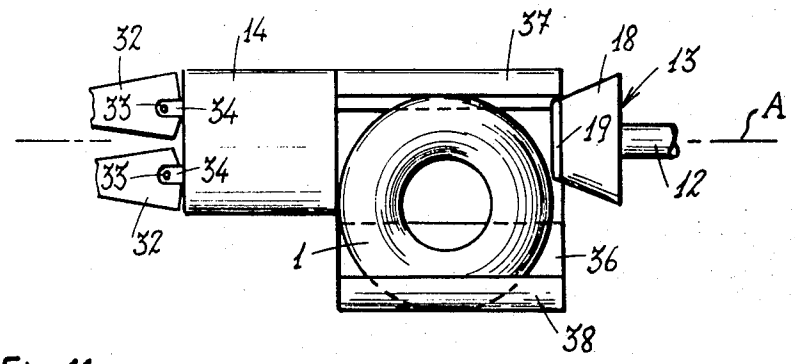


Fig. 11

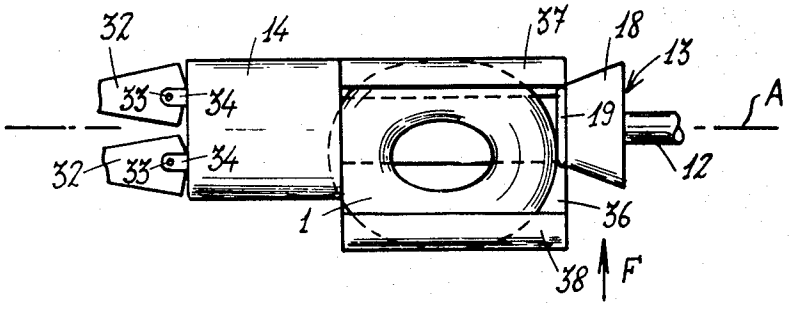
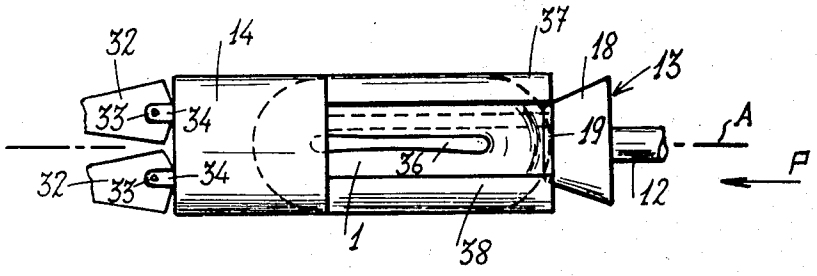


Fig. 12



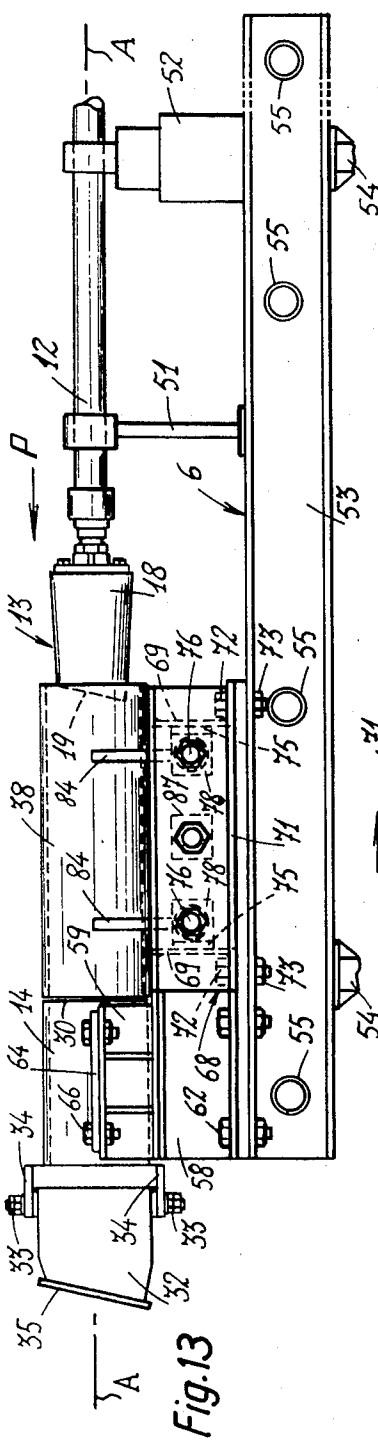


Fig.13

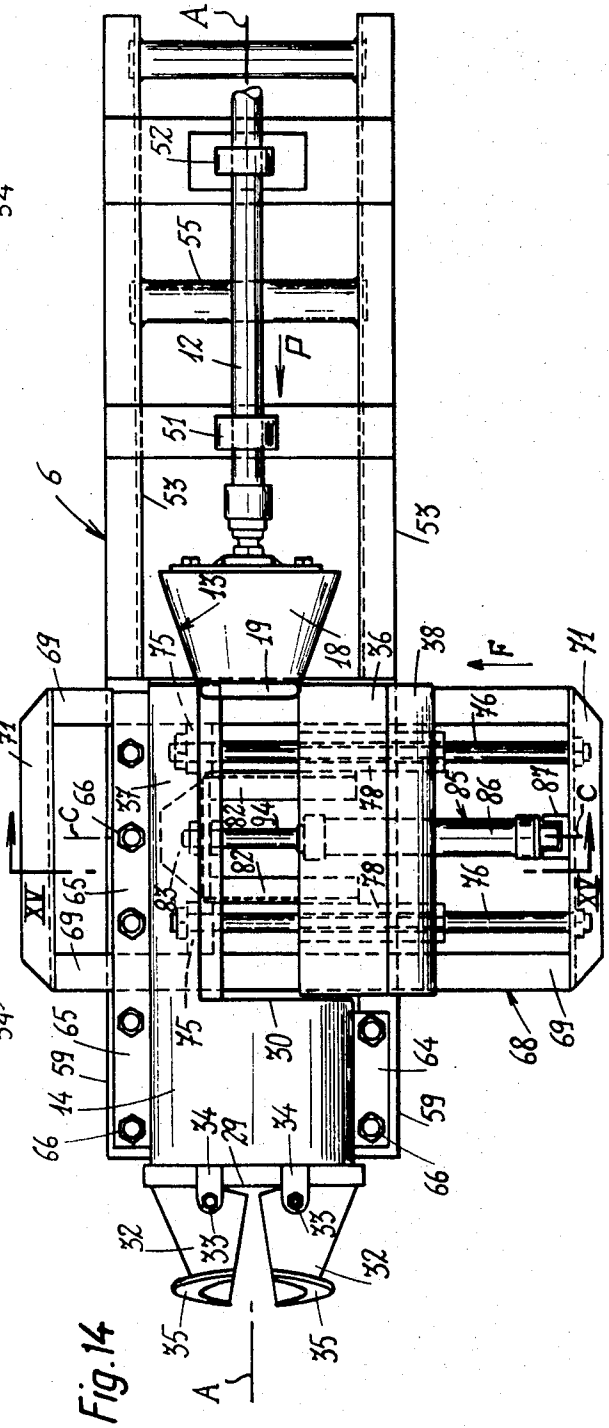


Fig.14

Fig. 15

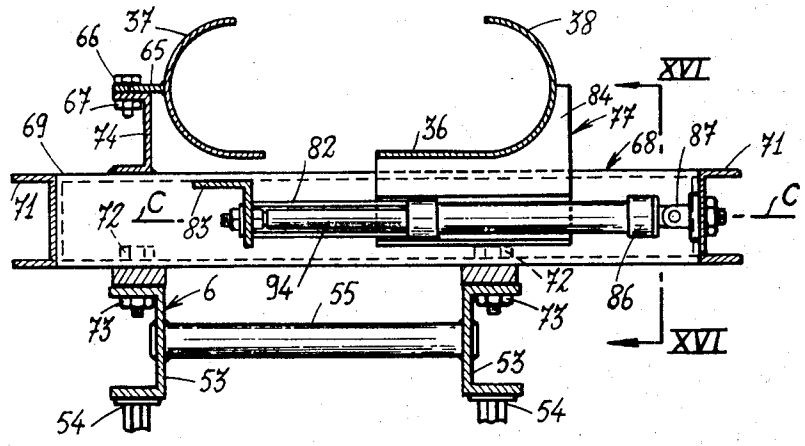


Fig. 16

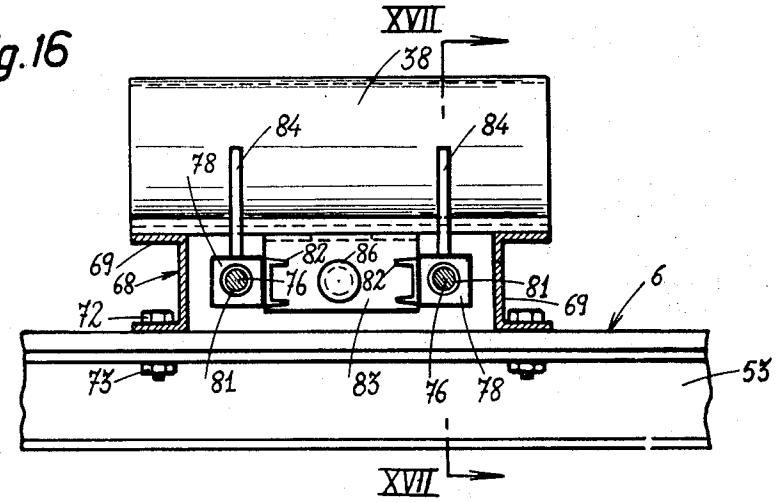
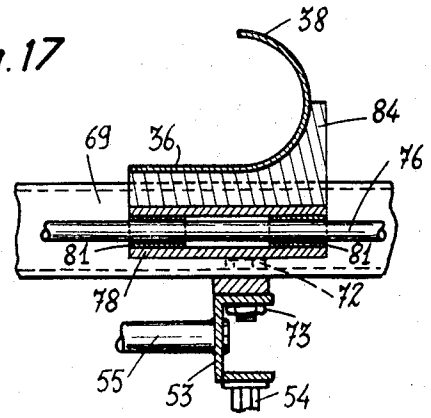


Fig. 17



METHOD AND A DEVICE FOR INTRODUCING INNER TUBES INTO PNEUMATIC TYRES

This invention relates to a method and a device for introducing air tubes which are inflated to a predetermined pressure into rubber tires, and especially air tubes of the so-called "puncture-proof" type.

Among other advantages, the invention is of particular interest in the glass industry in which the handling trolleys must be fitted with pneumatic tyres by reason of the fragility of the products being transported and in which the glass fragments which are strewn over the floor are a very frequent cause of punctures. It is with a view to preventing such incidents that so-called "puncture- proof" air tubes are fitted on these trolleys.

An air tube of this type is designed in the form of an annular inner tube of moulded rubber having a large number of independent compartments which are inflated during manufacture to a predetermined pressure of the order of 2.3 kg/cm^2. The introduction of a so-called "puncture-proof" inner tube into a pneumatic tyre is a very difficult operation since the inner tube as manufactured has a volume which is greater than that of the housing provided for the tube within the tyre casing. This arrangement makes it possible to increase the internal pressure from 2.3 kg/cm^2 to approximately 7 kg/cm^2.

In the present state of the technique, a satisfactory solution to this problem has not been found and the fitting of a so-called "puncture-proof" inner tube inside a tyre remains a laborious manual operation which is both time-consuming and tedious.

The aim of this invention is to permit the possibility of carrying out this assembly easily, rapidly and economically.

In accordance with the invention, the method whereby inner tubes inflated to a predetermined pressure and especially puncture-proof inner tubes are introduced into tyres essentially consists in causing the deformation of the inner tube in order to ensure that the two opposite faces of its inner wall are brought substantially into contact, in then thrusting the inner tube into the tyre in a direction parallel to those faces which have been brought substantially into contact while confining the tube laterally, in inserting the tube obliquely through the opening of one face of the tyre, in preventing the tube from escaping from the opening of the other face of the tyre during introduction while guiding said tube towards the internal periphery of the tyre, and in continuing to thrust the tube forward until it is finally placed in position inside the tyre.

In this method, the front end of the inner tube which is inserted into the tyre comes up against a surface which closes at least to a partial extent the tyre face which is opposite to the introduction face. The front end aforesaid widens out since it is no longer confined laterally, is then guided by the closure surface towards the internal periphery of the tyre and fits in position within this latter. As the thrust continues to be exerted, an increasingly large portion of the inner tube comes into position inside the tyre and conforms to the shape of this latter. Finally, the rear end of the inner tube is thrust inside the tyre. As soon as it is fully engaged therein, the tube is abruptly restored by virtue of its elasticity to the toric shape which it had been given at the time of manufacture and fills the space which had still remained free within the interior of the tyre; thus the inner tube completes the positioning operation of its own accord.

In accordance with the invention, the device for introducing inner tubes inflated to a predetermined pressure into tyres and especially inner tubes of the so-called puncture-proof tyre as intended in particular for the application of the method aforesaid, essentially comprises a tube which serves to guide and confine the inner tube and terminates in a funnel for the injection of the confined inner tube, said funnel being provided with an orifice which is oriented at an oblique angle with respect to the axis of the guide tube and intended to be engaged within the opening of one face of the tyre, means being provided on said funnel for securing said tyre, a jack provided with a ram which is capable of sweeping the guide tube, and a removable deflector which is intended to close the opening of one face of the tyre at least to a partial extent.

In this device, confinement is carried out by means of a guide tube, thrust is exerted by a jack, and the connection between the guide tube and the tyre is provided by means of a funnel. A removable deflector serves both to close the tyre face which is opposite to the tube-introduction face and to guide the front end of the inner tube towards the internal periphery of the tyre.

In a preferred embodiment of the device according to the invention, said device comprises on the one hand an inner-tube support plate located upstream of the guide tube and provided with two side-plates which can be variably spaced in order to cause deformation of the inner tube, the clamping faces of said side-plates being parallel to the mid-plane of the guide tube. Said device is further equipped with a jack which controls the relative displacement of the two side-plates aforesaid so as to ensure that the space provided between said two plates in the position of deformation to be given to the inner tube corresponds to the upstream orifice of the guide tube.

The foregoing embodiment has proved particularly satisfactory in practice since it has been found that this device leads to the following unexpected result: the same equipment can be employed for introducing inner tubes of different sizes (provided that they remain fairly close in value) into tyres which correspond respectively to said inner tubes without entailing any consequent need to modify the structure of said equipment. Numerical examples which illustrate this observation will be given hereinafter.

In a preferred arrangement, one of the side-plates for causing deformation of the inner tube is stationary and placed in the line of extension of the guide tube whilst the other side-plate is capable of moving at right angles to the axis of said guide tube, the support plate which is located upstream of the guide tube being rigidly fixed to the movable side-plate.

By virtue of this arrangement, the inner tube which is intended to be fitted in the tyre can very readily be deposited on the support plate.

In one advantageous form of construction, the device comprises a chassis which is placed transversely with respect to the axis of the guide tube, said chassis being adapted to carry on the one hand the movable side-plate which is slidably mounted relative to said chassis and, on the other hand, the jack for controlling said movable plate. The guide tube, the stationary side-plate and the chassis are removable.

Under these conditions, when the device is no longer suited to the dimensions of the inner tube to be introduced into the tyre, it is only necessary to remove the guide tube, the stationary side-plate and the chassis and then to replace these latter by a guide tube and a stationary side-plate having the requisite dimensions and by another chassis which carries a suitable movable side-plate and jack, experience having shown that the same ram could be employed quite satisfactorily for inner tubes of all sizes.

Further advantages and properties of the invention will become apparent from the detailed description which now follows.

A number of embodiments of the device, including the preferred form of construction which is accompanied by explanatory diagrams, are illustrated in the accompanying drawings which are given solely by way of example without any limitation being implied, and in which:

FIG. 1 is a diagram representing different steps of the method.

In this figure, the drawing *a* illustrates the inner tube which is to be fitted in the tyre and which has been inflated to a predetermined pressure.

The drawing *b* illustrates the deformed inner tube, two opposite faces of its inner wall having been brought substantially into contact.

The drawings *c* and *d* are diagrams representing two axial cross-sections of the tyre at right angles to each other, the front end of the inner tube being introduced into the tyre.

The drawing *e* is an axial sectional view of the tyre showing the inner tube after this latter has been fitted in position.

FIG. 2 is a part-sectional view in side elevation showing a first embodiment of the device;

FIG. 3 is a partial view in perspective to a larger scale and corresponding to FIG. 2;

FIG. 4 is a partial view in perspective with parts broken away and corresponding to FIG. 3, showing the engagement of the front end of the inner tube within the tyre;

FIG. 5 is a front view in elevation showing the deflector mounted within the opening of one face of the tyre;

FIG. 6 is a view in perspective showing a second embodiment of the device;

FIG. 7 is a partial view in side elevation with parts broken away and corresponding to FIG. 6;

FIG. 8 is a plan view with parts broken away and corresponding to FIG. 7;

FIG. 9 is a diagrammatic plan view showing a third embodiment of the device;

FIGS. 10 to 12 are explanatory diagrammatic plan views showing the successive steps of deformation of the inner tube by means of a device in accordance with the preferred embodiment of the invention;

FIG. 13 is a view in side elevation showing the complete device aforesaid;

FIG. 14 is the corresponding plan view in which the movable side-plate is located in an intermediate position;

FIG. 15 is a sectional view to a larger scale and taken along line XV—XV of FIG. 14;

FIG. 16 is a sectional view taken along line XVI—XVI of FIG. 15;

FIG. 17 is a sectional view taken along line XVII—XVII of FIG. 16.

In accordance with the method which forms the subject of the invention, the inner tube 1 (shown in FIG. 1*a*) which is assumed by way of example to be a tube of the so-called puncture-proof type is inflated to a predetermined pressure, then deformed at the outset as a result of opposite actions Q so that the two opposite faces of its inner wall are brought substantially into contact (as shown in FIG. 1*b*). This shape is maintained by lateral confinement (by means of guiding surfaces *m* and *n*) and the inner tube 1 is thrust into the tyre 2 in a direction parallel to those faces which have been brought substantially into contact by introducing the tube at an oblique angle through the opening 3 on one face of the tyre 2 (as shown in FIGS. 1*c* and 1*d*).

The inner tube is prevented from escaping through the opening 4 of the other face of the tyre 2 by closing this opening by means of a deflecting surface 5 which is substantially parallel to the mid-plane M of the tyre 2.

The angle *i* which the direction of thrust P exerted on the inner tube 1 makes with the plane M is advantageously of the order of 50° to 70° and friction forces are appreciably reduced by coating the inner tube 1 with a lubricant such as soft soap. The thrust P is exerted on the inner tube 1 by a surface which is substantially parallel to the plane M. During the oblique introduction of the inner tube 1 through the opening 3, deformation of the two juxtaposed sections of said inner tube is produced by transverse confinement so as to ensure that said tube has a substantially circular general contour, the diameter of which is comparable with that of the opening 3. As a result of abutting application against the deflecting surface 5, the front end of the inner tube 1 is no longer confined laterally and accordingly widens. In addition, the tube is guided by said surface 5 towards the internal periphery of the tyre 2 and fits into position therein. The thrust P is maintained, with the result that an increasing proportion of the inner tube 1 is fitted within the tyre 2. As soon as the rear end of the inner tube 1 has passed through the opening 3, the elasticity of said tube is such that this latter at once reverts to its toric shape and is completely in position within the tyre 2.

There are different methods of carrying out the initial deformation of the inner tube 1 in accordance with the invention.

In a first mode of execution shown in FIGS. 2 to 4, the inner tube 1 is compressed laterally and tied, then engaged within a guide tube, the ties being progressively removed as the inner tube 1 is inserted into the guide tube. The method of assembly is then semi-automatic.

In a second mode of execution shown in FIGS. 6 to 8, deformation of the inner tube 1 is caused by thrusting this latter towards the opening 3 of the tyre 2 while confining the inner tube laterally and progressively in such manner as to result in ovalization of said tube. In this case, the method of assembly is automatic.

In a third mode of execution, one embodiment of which is illustrated diagrammatically in FIG. 9, the inner tube is deformed by application of thrust and lateral confinement between two parallel surfaces. The tube is then pushed into the opening 3 in a direction parallel to the two surfaces aforesaid while maintaining

its lateral confinement. The method of assembly is automatic in this case also.

In all cases, fitting of the inner tube **1** within the tyre **2** can be carried out easily and rapidly by means of the method in accordance with the invention.

In a first embodiment of the device according to the invention as shown in FIGS. **2** to **4**, a frame **6** carries a platform **7** provided with a back-plate **8**, a first jack **9** having a head **11** which is directed towards said back-plate **8**, a second jack **12** placed in opposition to the first jack **9** and adapted to carry a ram **13**, and a guide tube **14** having the design function of guiding and confining the inner tube **1** and having an oval cross-section. Said guide tube **14** has the same axis A as the jack **12** and is fixed on the frame **6** by means of clamping hoops **41**.

That end **25** of the guide tube **14** which is remote from the jack **12** terminates in an oval flange **42** which is intended to permit removable mounting of a funnel **15** which has the same axis A as said tube. The funnel **15** is constituted by three removable longitudinal elements **15***a*, **15***b*, **15***c* which are connected together by means of bolts **43** passed through longitudinal flanges **44**.

When assembled together, the elements **15***a* and **15***c* are not contiguous since experience has shown that no useful purpose is served by a close connection in the upper portion of the central plane. At the end nearest the guide tube **14**, the funnel **15** has an ovalized contour and carries a flange **45**, the contour of which corresponds to that of the flange **42**. The flanges **42** and **45** are intended to be secured to each other by means of removable bolts **46**, for example.

At the end remote from the guide tube **14**, the funnel **15** terminates in a substantially circular orifice **16**, the plane of which makes an angle *i* of the order of 50° to 70° with the axis A. The orifice **16** has a diameter which is slightly smaller than that of the opening **3** of the tyre **2** and is provided with an external flange **17**.

The ram **13** has a flattened body **18** which is adapted to fit within the guide tube **14** and terminates in a thrust face **19** which makes an angle *i* of the order of 50° to 70° with the axis A.

The device further comprises a removable deflector **5** (as shown in FIGS. **2** and **4**) consisting of a plate fitted with a handle **21** and terminating in a yoke **22** which is intended to be placed astride of a bead **23** of the tyre **2** on the side corresponding to the opening **4** of this latter.

The device which has just been described operates as follows:

The guide tube **14** is detached from the funnel **15**, the components of which are disassembled so as to introduce their flanges **17** through the opening **3** into the interior of the tyre **2** within which the inner tube **1** is to be mounted. The introduction of the flanges **17** and subsequent juxtaposition of these latter within the tyre **2** are facilitated by the fact that some components of the funnel **15** are not in juxtaposed relation. After the flanges **17** have been positioned within the tyre **2**, the components of the funnel **15** are re-assembled. Since the diameter of the orifice **16** of the funnel **15** is slightly smaller than that of the opening **3** of the tyre **2**, this latter is accordingly centered on the funnel **15** and at the same time maintained by means of the flanges **17**. The deflector **5** is then placed within the opening **4** of the tyre **2** by mounting its yoke **22** astride of the tyre bead **23** (as shown in FIG. **5**).

In addition, the inner tube **1** which is to be fitted within the tyre, for example a tube of the so-called puncture-proof type, is placed on the platform **7** against the back-plate **8**. Deformation of the inner tube is caused by applying the head **11** of the jack **9** against said tube and by exerting a thrust in the direction Q until the two opposite faces of the inner wall of the inner tube **1** are brought substantially into contact (the shape being indicated in dashed lines in FIG. **2**, in which the final position of the head **11** is shown at **11***a*). The inner tube **1** is then bound by means of ties **24** (shown in FIG. **3**) in order to maintain the deformation of said tube. The complete assembly is then coated with a lubricant such as soft soap and engaged within the downstream orifice **25** of the guide tube **14** while removing the ties **24** progressively as the inner tube **1** is introduced into the guide tube **14**.

Once the inner tube **1** has been introduced over a distance corresponding to three-quarters of its length within the guide tube **14**, the funnel **15** is fixed on this latter by means of the bolts **46** which are inserted through both flanges **42** and **45**. The jack **12** is then actuated and thrusts the inner tube **1** into the funnel **15**, then into the tyre **2** against the deflector **5** (as shown in FIG. **4**). The front end of the inner tube **1** comes into abutment against the deflector **5**, then widens and is accordingly guided by the deflector **5** towards the lower peripheral portion of the tyre **2** so as to fit in position within this latter.

The movement of the inner tube **1** as just described is greatly facilitated by the angle of inclination of the mid-plane M of the tyre **2**, of the deflector **5** and of the bearing face **19** of the ram **13** relatively to the axis A. As the inner tube **1** continues to be thrust forward, a progressively greater portion of said tube is placed within the tyre **2**. Finally, the rear end of the inner tube passes through the opening **3**, whereupon the tube abruptly opens out by virtue of its elasticity and comes into position within the upper peripheral portion of the tyre **2**. The inner tube **1** thus fits within the tyre of its own accord. The deflector **5** is then removed, the funnel **15** is detached from the guide tube **14**, the components of said funnel are disassembled and the flanges **17** of these latter can thus be withdrawn from the tyre **2** which is thus finally released.

In one application of said device which relates to the fitting of a so-called puncture-proof inner tube within a tyre having dimensions of 600 × 9, use was advantageously made of a jack **12** for the application of a thrust P of the order of 50 kg/cm² by means of the bearing face **19** of the ram **13**.

The device which has just been described has the advantage of ensuring automatic assembly of the inner tube **1** within the tyre **2** after said tube **1** has been introduced within the guide tube **14** and the funnel **15** which carries the tyre **2** has been placed in position on said guide tube **14**.

In a second embodiment of the device according to the invention as shown in FIGS. **6** to **8**, the same reference numerals have been assigned to elements which are similar to those of the first embodiment. The frame **6** carries the jack **12** and the guide tube **14**; this latter is provided at the upstream end thereof with two symmetrical confinement wings **26** delimiting a flared inlet orifice **27**, the diameter of which corresponds substan-

tially to that of the inner tube **1** in the rest condition, said wings **26** being so shaped as to converge obliquely towards the walls of the guide tube **14.** Provision is made on the upstream side of the guide tube **14** for a support plate **28** on which the inner tube **1** can be placed prior to mounting in the tyre.

There is mounted on the ovalized outlet orifice **29** of the guide tube **14** a funnel **31** made up of two half-shells **32** having a substantially frusto-conical internal shape. Each half-shell **32** aforesaid is provided with two coaxial pins **33** pivotally mounted in support brackets **34** which are fixed on the guide tube **14.** The axis T of each pair of pivot-pins **33** is located at right angles to the base plane B of the guide tube **14.** Each half-shell **32** is provided with an external flange **35** at the end remote from the guide tube **14.** The shape and arrangement of the half-shells **32** are such that, in the position **32***a* in which these latter are in closest proximity to each other (namely in the position shown in chain-dotted lines in FIG. **8**), the maximum external distance or relative spacing of the half-shell flanges **35** is smaller than the diameter of the opening **3** of the tyre **2** and that in their position of maximum relative spacing (shown in full lines in FIG. **8**), said distance is greater than said diameter.

The device which has just been described operates as follows:

The two half-shells **32** are closed so that the flanges **35** of these latter can be engaged within the opening **3** of the tyre **2** and are then separated so that the tyre is maintained against the two half-shells **32** by means of the flanges **35.** The deflector **5** is then placed within the opening **4** of the tyre **2,** the yoke **22** of said deflector being placed astride of the tyre bead **23.**

In addition and as shown in thin chain-dotted lines in FIG. **8,** the inner tube **1** to be fitted is laid on the support plate **28** against the orifice **27** after having been coated with a lubricant such as soft soap. The jack **12** is then actuated; under the thrust P, the inner tube **1** slides between the wings **26** while being compressed, begins to penetrate into the guide tube **14** and assumes the elongated shape at the front end as shown in thick chain-dotted lines in Fig. **8.** Since the length of the rectilinear portion of the guide tube **14** corresponds substantially to that of the inner tube **1** in the elongated position, said inner tube in turn assumes this shape after it has been completely introduced into said guide tube as shown in dashed lines in FIG. **8.**

The front end of the inner tube **1** then penetrates into the funnel **31** while forcibly displacing the half-shells **32** against the bead **23** of the tyre **2** which is thus firmly maintained against the funnel **31** by the flanges **35.** Positioning of the inner tube **1** within the tyre **2** is then carried out as in the first embodiment of the device. When the tube-fitting operation is completed, it is only necessary to bring the two half-shells **32** together and the tyre **2** is accordingly released.

The form of construction and mode of operation which have just been set forth offer the following advantages:

Attachment of the tyre **2** to the funnel **31** takes place immediately and the same applies to the removal of said funnel.

The inner tube **1** need only be engaged within the device in the rest condition without any previous deformation.

Fitting of the inner tube **1** within the tyre is fully automatic.

It is worthy of note that the thrust exerted on the inner tube **1** in the direction P makes it possible by virtue of the deflecting action of the curved wings **26** to ensure elongation in the direction of forward displacement of said inner tube.

The complete tube-fitting operation including attachment of the tyre **2** to the funnel **31** followed by removal of this latter is therefore carried out with maximum ease, rapidity and economy.

A third embodiment of the device according to the invention is illustrated in FIG. **9** in a preferred form of construction which differs from the second embodiment only in that portion of the device which relates to the introduction of the inner tube **1** into the guide tube **14.** A support plate **36** located between the jack **12** and the guide tube **14** is provided with two side-plates **37** and **38** for the deformation of the inner tube **1.** The side-plate **37** is placed in the line of extension of the guide tube **14** and the clamping face **39** of the side-plate **38** is parallel to the mid-plane G of the guide tube **14.** A jack which is not shown in the drawings controls the relative displacement of the side-plates **37** and **38** in the direction of the arrow F or in the opposite direction. The space formed between the side-plates **37** and **38** in the position of deformation to be given to the inner tube **1** corresponds to the upstream orifice **30** of the guide tube **14.**

Provision is made in the preferred embodiment aforesaid for one advantageous mode of execution in which the movable side-plate **38** carries the support plate **36.** The cross-section of the side-plate **37, 38** along a plane at right angles to the axis A of the guide tube **14** approximates to a half-circumference.

FIGS. **10** to **12** illustrate diagrammatically the operation of that portion of the device which relates to the introduction of the inner tube **1** into the guide tube **14.**

The inner tube **1** which is to be fitted within the tyre and is shown in FIG. **10** is first coated with a lubricant such as soft soap, then placed on the support plate **36** and engaged within the side-plate **38** between the ram **13** and the guide tube **14.** The inner tube is deformed by displacing the side-plate **38** towards the side-plate **37** in the direction of the arrow F. In the position of the side-plate **38** which is shown in FIG. **11,** the inner tube **1** is partly ovalized; when clamped between the side-plates **37, 38** and the face **19** of the ram **13,** aaid inner tube begins to penetrate into the guide tube **14.**

In FIG. **12,** the side-plate **38** is at the end of travel and, at this point, is located in the line of extension of the guide tube **14** in the same manner as the side-plate **37.** The inner tube **1** which has undergone deformation in the direction of the arrow F to the full extent has penetrated further into the guide tube **14.** The thrust P of the ram **13** will be applied to the inner tube in order that this latter should pass through the guide tube **14** and be introduced into the tyre casing **2** (not shown) which is attached to the ends **35** of the half-shells **32.**

The third embodiment just described and the second embodiment both offer the same advantage in that the inner tube **1** is fitted within the tyre **2** in a fully automatic operation which is therefore easy, economic and rapid.

In addition, the inner tube **1** can very conveniently be placed on the support plate **36** since this latter is brought completely to one side of the frame **6** for the loading operation.

Moreover, the inner tube **1** is securely held in position by the side-plates **37** and **38** as it undergoes deformation by virtue of the semicircular cross-sectional shape of these latter.

It has also been proved by experience that a device in accordance with the third embodiment could be employed for introducing inner tubes **1** having different although fairly closely related sizes into tyres **2** which correspond respectively to said inner tubes **1** without entailing any need to modify the dimensions of the components of the device under consideration.

For example, a single set of components can be employed for introducing into tyres **2** inner tubes **1** having the following dimensions:

rim of 200 mm: 6 × 9; rim of 250 mm: 6.5 × 10

rim of 225 mm: 15 × 4.5 × 8; 5 × 8.

Another set of components having larger dimensions permits the introduction of inner tubes **1** having the following dimensions:

rim of 300 mm: 7 × 12

rim of 375 mm: 7.5 × 15; 8.25 × 15.

It has also been found that inner tubes **1** having very different dimensions could be thrust into the guide tube **14** by one and the same ram **13.**

FIGS. **13** to **17** show one mode of execution of the third embodiment which is designed to permit rapid changing of any components which have to be replaced by others in order to change-over from the introduction of one inner tube **1** to the introduction of another tube having distinctly different dimensions.

As shown in FIGS. **13** and **14,** the frame **6** is made up of two channel-iron side-stringers **53** which are joined together by welded tubular cross-members **55.** The frame **6** is supported on welded legs **54.**

Supports **51, 52** for the jack **12** which carries the ram **13** are provided at one end of the frame **6** whilst the other end of this latter serves to mount the guide tube **14.** To this end, two superposed channel sections **58, 59** are mounted on each side-stringer **53** and parallel to these latter. Said channel sections are welded to each other and joined together transversely by means of flat bar-iron members (which have not been illustrated). The channel sections **58** are fixed on the side-stringers **53** by means of bolts **62** fitted with nuts.

The guide tube **14** is provided on each side with two flanges **64, 65,** each flange being fixed on the top flange of one of the channel sections **59** by means of bolts **66** fitted with nuts.

The stationary side-plate **37** forms one piece with the guide tube **14** while also constituting an extension of this latter over a part of its transverse cross-section and the flange **65** extends along the full length of the side-plate **37.**

Between the channel sections **58, 59** and the supports **51, 52,** the frame **6** carries a transverse support structure or chassis **68** constituted by two channel-iron side members **69** located at right angles to the side-stringers **53** and joined together by means of two welded channel-section cross-members **71.** The chassis **68** is removably fixed on the side-stringers **53** by means of bolts **72** fitted with nuts **73.**

At the same end as the stationary side-plate **37** (as shown in FIG. **15**), the side members **69** carry a welded channel-section cross-member **74** which is located vertically above the side-stringer **53** and on which is supported the flange **65** of the side-plate **37,** said flange being fixed in position by means of bolts **66** fitted with nuts **67.**

Within the interior of the chassis **68,** the web of each side member **69** carries a bracket **75** (as shown in FIGS. **13** and **14**), one end of a circular-section guide rod **76** extending parallel to the side member **69** being fixed on said bracket. The other end of each guide rod **76** is fixed in the cross-member **71** which is remote from the side-plate **37.**

The movable side-plate **38** and the support plate **36** which is integral with this latter are joined by means of plates **84** placed edgewise to a carriage **77** (shown in FIGS. **15** to **17**) which is slidably mounted on the two guide rods **76.** The carriage **77** is provided with two tubular slide-blocks **78** fitted with internal sleeves **81** which are slidably mounted on the guide rods **76.** The top faces of said slide-blocks **78** are designed to receive the plates **84.**

The slide-blocks **78** are secured in rigidly fixed relation by means of a thrust head made up of two channel-section members **82** which are braced by a transverse angle-iron member **83.**

The end of the operating rod **94** of the jack **85** is attached at the center of the angle-iron member **83.** Said jack works in extension so as to control the displacement of the sliding carriage **77** and therefore of the movable side-plate **38.** The axis of the jack **85** is perpendicular to the axis A of the guide tube **14.** The end of the body **86** of the jack **85** is secured by means of a yoke **87** to that cross-member **71** of the chassis **68** which is remote from the stationary side-plate **37.**

It is apparent that the operating rod **94** of the jack **85** controls the position of the sliding carriage **77** by means of the angle-iron member **83** and therefore controls the position of the movable side-plate **38.**

The components of the device which have to be replaced in order to change-over from the introduction of one inner tube **1** to the introduction of another inner tube having distinctly different dimensions are the guide tube **14** fitted with its two half-shells **32,** the side-plates **37** and **38,** the support plate **36** and the jack **85.** By virtue of the mode of execution hereinbefore described, the substitution of one set of components for another set is an extremely easy and rapid operation. The components to be replaced can be detached from the frame **6** as a complete unit simply by unscrewing the bolts **62** and **72.**

It is also possible to begin by removing the bolts **66** which serve to secure the flange **65** of the stationary side-plate **37** to the cross-member **74;** this has the effect of releasing the side-plate **37** from the transverse chassis **68.** The bolts **62** are then detached; this makes it possible to remove as a single unit the guide tube **14** fitted with its half-shells **32,** the side-plate **37** which is rigidly fixed to said tube together with their channel-section supports **58, 59.** Finally, the bolts **72** which secure the transverse chassis **68** to the two side-stringers **53** are detached and this makes it possible to remove as a single unit the chassis **68,** the movable side-plate **38** fitted with the support plate **36** and the jack **85.**

The device which has been described in the foregoing offers the following advantages in addition to those already mentioned in connection with the third embodiment:

the movable side-plate **38** is maintained exactly parallel to the axis A of the guide tube **14** by the two guide rods **76.**

The guide tube **14** and the stationary side-plate **37,** the chassis **68,** the movable side-plate **38,** the support plate **36** and the jack **85** constitute a removable assembly. This assembly can very readily and very rapidly be replaced by another assembly when the dimensions of the inner tube **1** to be introduced make it necessary to do so since this only involves the removal and replacement of a few bolts. The frame **6** and the ram **13** do not need to be replaced even when the dimensions of the inner tube **1** vary over a very wide range of sizes. The device in accordance with the mode of execution hereinabove described in connection with the third embodiment therefore makes it possible to reduce to a strict minimum both the capital cost of equipment and the number of handling operations which are necessary, even when the inner tubes to be introduced into the tyres differ in size to a marked degree.

It must be understood that the invention is not limited to the embodiments which have just been described and that many alternative modes of execution of these latter may be contemplated without thereby departing from the scope of the invention.

For example, the base of the guide tube **14** could be inclined to the horizontal.

It would also be possible to adapt to the first embodiment the funnel **31** which is provided with two half-shells **32** as described in the second embodiment.

The funnel **31** could be fitted with an elastic system which tends to draw the two half-shells **32** together.

The stationary side-plate **37** could also be separate from the guide tube **14** and mounted on the chassis **68.**

What we claim is:

1. A device for introducing inner tubes inflated to a predetermined pressure into tyres and especially inner tubes of the so-called puncture-proof type, wherein said device comprises a tube which serves to guide and confine the inner tube and terminates in a funnel for the injection of the confined inner tube, said funnel being provided with a substantially circular orifice which is intended to be engaged within the opening of one face of the tyre, means being provided on said funnel for ensuring attachment to the tyre, a jack comprising a movable ram which is capable of sweeping the guide tube, and a removable deflector which is capable of closing the opening of one face of the tyre at least to a partial extent.

2. A device according to claim **1,** wherein the injection funnel comprises a flat elongated body which is joined to the guide tube and terminates in a substantially circular orifice, the plane of said orifice being oriented at an oblique angle with respect to the axis of the guide tube.

3. A device according to claim **2,** wherein the funnel is removably mounted at the downstream end of the guide tube with respect to the direction of the thrust exerted on the inner tube.

4. A device according to claim **1,** wherein the guide tube has confinement wings which delimit an inlet orifice and the diameter of said orifice corresponds substantially to the diameter of the inner tube in the rest condition, said wings being so arranged as to converge towards the walls of the guide tube proper.

5. A device according to claim **1,** wherein said device comprises on the one hand a support plate located upstream of the guide tube and provided with two side-plates which can be variably spaced in order to cause deformation of the inner tube, the clamping faces of said side-plates being parallel to the mid-plane of said guide tube, and on the other hand a jack which controls the relative displacement of said side-plates, and wherein the space between said two side-plates in the position of deformation to be given to the inner tube corresponds to the upstream orifice of said guide tube.

6. A device according to claim **1,** wherein the ram has a flattened body which is adapted to the guide tube and terminates in a thrust face which is substantially parallel to the plane of the opening of the funnel.

7. A device according to claim **1,** wherein the removable deflector comprises a plate terminating in a yoke which is intended to be placed astride of the tyre bead.

8. A device according to claim **1,** wherein the funnel which is placed at the outlet of the guide tube is constituted by an assembly of removable elements for introducing into the tyre projecting portions of the funnel which are intended to maintain the orifice of said funnel within the interior of said tyre.

9. A device according to claim **1,** wherein the funnel which is placed at the outlet of the guide tube has two half-shells of substantially frustoconical internal shape which are pivoted about axes located at right angles to the base plane of the guide tube and terminate in projecting portions for retaining the tyre, said half-shells being so arranged that the maximum external spacing of said retaining projecting portions in the positions of maximum closure of said half-shells is smaller than the diameter of the opening of the tyre faces and that said spacing is larger than said diameter in the positions of maximum separation of said half-shells.

10. A device according to claim **3,** wherein one of the side-plates for the deformation of the inner tube is stationary and placed in the line of extension of the guide tube whilst the other side-plate is movable at right angles to the axis of said guide tube, wherein the support plate which is located upstream of the guide tube is rigidly fixed to the movable side-plate.

11. A device according to claim **10,** wherein the two side-plates for the deformation of the inner tube are provided along a plane at right angles to the axis of the guide tube with a cross-section which is approximately a half-circumference.

12. A device according to claim **10,** wherein said device comprises a chassis which is placed transversely with respect to the axis of the guide tube and carries on the one hand the movable side-plate which is mounted for sliding motion with respect to said chassis and on the other hand the jack for controlling said movable side-plate.

13. A device according to claim **12,** wherein the chassis is carried by a frame which supports the guide tube, the stationary side-plate which is rigidly fixed to the guide tube being supported on the chassis aforesaid.

14. A device according to claim **13,** wherein the guide tube, the stationary side-plate, the chassis which carries the movable side-plate and its control jack are removably mounted on a frame on which the ram and ram-actuating jack are permanently fixed.

15. A device according to claim 13, wherein the guide tube and the stationary side-plate on the one hand and the chassis which carries the movable side-plate and its control jack on the other hand constitute respectively two sub-assemblies which are removably mounted on a frame on which the ram and ram-actuating jack are permanently fixed.

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