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(54) A METHOD OF AND AN APPARATUS FOR OPENING CONVEYING AND DIVIDING TUBULAR CASINGS

(71) We, GERHARD PETER KOMMANDITGESELLSCHAFT 3036 Bomlitz 11, Germany a body corporate organised under the Laws of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a method of and an apparatus for opening, conveying and dividing moist, empty, tubular casings which have been lain flat and are unshirred for effecting the filling and sealing thereof.

According to the invention there is provided a method of opening, conveying and dividing moist, empty tubular casings which have been lain flat and are unshirred for effecting the filling and sealing thereof, wherein the tubular casings are opened pneumatically by reduced gas pressure whose strength can be varied and which is charged on to the exterior of the casings, conveyed pneumatically to the filling and sealing positions in the open condition by conveying means acting alternately on the left or right side of the outer surface thereof, and sealed at one end prior to the filling and during the dividing thereof.

The method according to the invention makes it possible for tubular casings of various diameters to be readily opened, conveyed and divided. Another advantage is that, owing to the pneumatic opening and conveying according to the invention of the tubular casings, the vacuum to be applied to the exterior of the casings for this purpose can be adapted to the gas permeability of the particular tubular casing which is present at any given time. It is thus possible to convey not only tubular casings which are impermeable or only very slightly permeable to gas, but also micro-porous and in special cases even macro-porous tubular casings of commercially known types. If desired, while a front section of tubular casing, which has already been opened in a previous cycle, is conveyed in open condition, an adjacent rear section can be opened.

The invention further provides an apparatus for opening, conveying and dividing tubular casings, comprising means for continuously feeding a moist tubular casing, pneumatically operating tubular casing opening means for applying a reduced pressure of variable strength to the exterior of the casing, pneumatically operating tubular casing conveying means in synchronous operation with the opening means, and dividing and closing means spatially overlapping the conveying means and operable in synchronism therewith, the opening means, conveying means and closing and dividing means being arranged to operate consecutively on the tubular casing, and the tubular casing conveying means comprising a movable mounted tonglike conveying gripper device for grasping and conveying the open tubular casing, which is free from filling, on its outer circumference on alternate sides.

In order to open the tubular casing satisfactorily, it is advantageous to provide the opening unit with at least two tubular casing loosening devices, these being operable to open relatively stiff and independently supported tubular casings. With relatively soft, flexible, non-self-supporting tubular casings, it is advantageous to provide more than two tube loosening devices, for example, 3, 4, 6 or 8 of these devices. The apparatus according to the invention can thus be adapted to very varied tubular casing materials.

It is particularly advantageous if the opening apparatus is mounted slidably on support elements, for example guide rails, in conjunction with holding and guiding devices. The tubular casing opening apparatus can thus be adjusted at a suitable distance from the carriers to fit the respective different lengths of tubular casing to be divided and be determined and fixed until the next change in the length of the tubular casing.

It is also advantageous if the carriers are arranged to one another at a distance because the space remaining between these carriers can then be utilised for clipping off and insertion of loops with the aid of a suitable clipping and loop insertion device which is known *per se*. Furthermore, the carriers move on the associated beams with

corresponding adjustment to the tubular casing length desired later on up to their respective end position dependent thereupon.

Generally speaking, it is sufficient if each carrier, which advantageously has an upper and lower half tong, each has in each of these half tongs a pneumatically operating tubular casing loosening device. However, if tubular casings with insufficient inherent rigidity or insufficient gas impermeability of the tube walls are also to be handled by the apparatus according to the invention, each of the above-mentioned half tongs preferably has not just one, but two or even more loosening devices, whereby the tubular casing to be conveyed is grasped at the same time at a number of positions on its surface, determined externally by reduced pressure and is conveyed with reliable maintenance of its cross section which may vary from oval or elliptical to circular.

The above-mentioned carrier may be such that after disconnecting the reduced pressure source, the release of the pneumatically held tubular casings from the tubular casing loosening devices is accelerated by charging these loosening devices with compressed air. In these cases, it is possible to provide the tube nipple arranged on the loosening apparatus with a forked end piece so that reduced pressure or compressed air may be applied as required via the fork. Instead of a fork, it is also possible to use tube nipples which have been introduced separately into the carrier for applying a reduced or excess pressure, this being somewhat more inconvenient but obviously also possible.

If tubular casings are to be conveyed with as few interruptions as possible using the apparatus according to the invention, this can be achieved, for example by using roller diameters which are as large as possible in the tubular casing unwinding unit.

It is very advantageous to insert a commercially available automatic roller magazine exchange unit upstream of the casing opening and conveying unit according to the invention, so that completely undisturbed continuous operation may be ensured.

In addition, the apparatus of the invention can also be operated with a number of other conventional known devices coupled thereto. It is possible to provide, for example, an optical error detecting instrument for automatic detection of faulty tubular casing regions of the type which may occur with automatic roller exchange and also with product damaged on the unwinding unit.

It is also possible, if desired, to operate the apparatus according to the invention not in conjunction with the abovementioned devices already known *per se,* such as for example a tubular casing section filling and seaming unit, but to deposit the tubular casings which have been opened and conveyed by the apparatus according to the invention and are sealed at one end, empty. These "pre-opened" casings can then be filled and seamed selectively in a subsequent separate operation. This can have the advantage, for example, that such pre-opened casing sections, depending upon the casing material, no longer have the disadvantage even in the moist state of adhering very firmly to each other, making it very difficult to slide the tubular casing sections on to a filling spout, in contrast to which the handling of so-called "pre-opened" tubular casing sections for filling purposes is quite simple. Furthermore, if the quantity of filling prepared is insufficient to fill all the casing sections, the apparatus according to the invention can continue running to produce empty pre-opened tubular casing sections.

In use of the invention it is possible to seal the casings using commercially available fastening knots with loops for hanging filled tubular casings, or to dispense with the use of fastening knots, when plastic tubular casings are used, by sealing the ends of the skins by welding these ends together.

As a further variation, a tubular casing which is not only moist or hydrated but which is also preserved with the aid of a suitable preparation may be handled.

The tubular casings may of course either be ordered in moisture-retaining marketable and transportable packing in order to provide the desired properties or may also equally well only be hydrated or moistened instead shortly prior to use in the invention.

If the apparatus according to the invention is to be operated in functional units with subsequent processing machines known *per se,* then this may be carried out with known filling and seaming machines, for example, with devices of the type known from German Auselgeschrift No. 21,24,282.

Tubular casings with very varied diameters may be processed by means of the invention.

The use of the invention is susbstantially independent of the tubular casing materials. Thus, for example, both tubular casings made of cellulose substances such as cellulose regenerate or cellulose derivatives, with and without fibre reinforcement, and also tubular casings made of collagen, starch, polyamides, polyvinyl chloride, polyvinylidene chloride, and other macromoleculator compounds may be handled. When particularly sensitive tubular casing materials are being handled it is advisable to coat the moving conveyor devices with flexible soft PVC or rubber substances.

The following is an example of the method of the invention. A commercially available continuous fibre-reinforced tubular casing

containing a cellulose substance, with 12% by weight moisture, based on the weight of absolutely dry material, a wall strength of 100 my and a diameter of 60 mm is drawn off at a speed of 15 m per minute in 30 steps per minute each of 50 cm, is opened by means of a vacuum of 700 Torr and is conveyed over a distance of 150 cm, in 3 steps each of 50 cm, to the dividing position and one-sided seaming position. There, the opened tubular casing is either carried off empty or is filled with a pasty product to be packed, for example sausage meat, and is subsequently sealed in known manner and carried off. A weight of 1.5 to 2 tons per hour or commercially available sausage meat may be processed in this way.

In the accompanying drawings:

Fig. 1 shows an opening, conveying and dividing apparatus according to the invention in combination with a tube unwinding unit, and a filling and seaming unit;

Fig. 2 is a section through the conveying apparatus according to the invention taken along line II—II in Fig. 1;

Fig. 3 is a section through the conveying apparatus according to the invention taken along line III—III in Fig. 1;

Fig. 4 is a plan view of the conveying apparatus with omission of some components;

Figs. 5.1, 5.2, 5.3, 5.4 and 5.5 are five sketches showing functionally diagrammatic views of the successive steps in the movement of the carrier groups;

Fig. 6 shows a tubular casing opening apparatus;

Fig. 7 shows a section through the tubular casing opening apparatus taken along line VII—VII in Fig. 6; and

Fig. 8 shows a partial section through the tubular casing opening apparatus taken along line VIII—VIII in Fig. 6.

The machine 1 shown in Fig. 1 comprises a tubular casing preparation machine unit 2 which is preceded by the unwinding unit 3. The unit 3 comprises a winding core 4 with a corresponding take-up in disc which tension pins 5*a*, 5*b*, 5*c* and 5*d* are inserted. A tubular covering 6 is wound round the tension pins. A tubular casing opening apparatus 7, which follows the unwinding unit 3 and which is illustrated in more detail in Figs. 6, 7 and 8, incorporates a tubular casing lifting device 9*a*, 9*b*. Portion 9*b* has been omitted from Fig. 6 for ease of illustration. The device 9*a*, 9*b* comprises movable guided tubes 42*a*, 42*b* which open into corresponding nozzles 43*a*, 43*b*. The guided tubes and nozzles are connected via bearings 45*a*, 45*b* to a stroke control means not shown here. The ends of the tubes 42*a*, 42*b* remote from the nozzles 43*a*, 43*b* are connected to tube nipples 44*a*, 44*b* bearing connection pieces.

The entire opening apparatus 7 is slidably arranged on support elements which include an end plate 46 and bearing bushes 47*a* and 47*b* arranged on beams 19*a* and 20*a*, so that the bearing bushes may be arrested by a fixing device 48 located in the bush 47*a*. Carriers 8*a*, 8*b*, 8*c*, and 8*d* are also arranged on the beams 19*a*, 19*b*, 20*a* and 20*b* and each of the carriers 8 is provided with two of the tubular casing opening elements 10*a*1, 10*b*1, 10*c*1, 10*d*1 and 10*a*11, 10*b*11, 10*c*11, and 10*d*11.

The movement of these carriers described in more detail in the mode of operation described below of the apparatus is positionally characterised in Fig. 1 by the letters "A", "B" and "C" and in Fig. 4 by "A" and "B". It should be noted here that the carriers 8*a*, 8*b* are each shown three times in Fig. 1 to illustrate their various positions A, B and C, with the position of the carrier 8*b* in position B corresponding to the later position of the carrier 8*a* in position C (cf, also the positions of carriers 8*a*, 8*b*, 8*c* and 8*d* in Figs. 4 and 5).

Figs. 2 and 3 show the structure of one of these carriers 8*c* with its associated carrier holder and its saddle apron slide 18*c*.

Each carrier is designed as a moving tong which may be charged with gas pressure and accordingly contains devices for charging with vacuum and super pressure as well as elements which make the tongs movable. Four upper half tongs 24*a*, 24*b*, 24*c* and 24*d* are thus movable connected via tong journals 31*a*, 31*b*, 31*c* and 31*d* to lower half tongs 25*a*, 25*b*, 25*c* and 25*d* in the four carriers. One device is inserted in each of the eight resulting half tongs for charging with different gas pressures. Each device consists of a tube 26, a tube nipple 27, a nozzle 28 and an adjusting nuts 29 for the casing tube 26.

The lifting apparatus i.e. 10 may be moved with the aid of the associated coupling bearings 30*a*, 30*b*, 30*c* and 30*d* owing to their movable mounting in the half tongs 24 and 25. The tongs are opened and closed by four associated tong control cylinders 34*a*, 34*b*, 34*c* and 34*d* respectively which adjust the tongs via tong lever couplings 35*a*, 35*b*, 35*c* and 35*d* with associated tong couplings 32*a*, 32*b*, 32*c*, 32*d*, 33*a*, 33*b*, 33*c* and 33*d*. Each entire tong system, which is referred below simply as a carrier, is movably and adjustably mounted on a respective carrier support 17*a*, 17*b*, 17*c* and 17*d* by means of the above-mentioned tong journals 31*a*, 31*b*, 31*c* and 31*d* and by means of tong control cylinder fastenings 36*a*, 36*b*, 36*c* and 36*d*. These four carrier supports in turn are movably mounted with the respective saddle apron slides 18*a*, 18*b*, 18*c* and 18*d* which are movably arranged on the beams 19*a*, 19*b* and 20*a* and 20*b* by means of associated carrier support bearings 37*a*, 37*b*, 37*c* and 37*d* in such a way that they can tilt with the aid of a respective carrier support control cylinder

38*a*, 38*b*, 38*c* and 38*d* connected to a respective one of the carrier supports 17*a*, 17*b* 17*c*, 17*d* via carrier cylinder couplings 39*a*, 39*b*, 39*c* and 39*d*. The carriers are axially shiftable to provide for conveying the tubular casings. Axial shifting is obtained by corresponding piston rods 22*a*, 22*b*, 22*c* and 22*d* (of which only rods 22*a* and 22*b* are visible in Fig. 1) which shift the saddle apron slides 18*a*, 18*b*, 18*c* and 18*d* and which are coupled to a respective fork head 23*a*, 23*b*, 23*c* or 23*d*, so that the assembly causes movement by pneumatic charging of corresponding associated compressed air cylinders 21*a*, 21*b*, 21*c* and 21*d*. Thus, the cylinder 21*a* moves the carrier 8*a* and the compressed air cylinder 21*b* moves the carrier 8*b*. The compressed air cylinders 21*c* and 21*d* control and cause corresponding movements of the carriers 8*c* and 8*d*. The compressed air cylinders 21*c* and 21*d* are not shown in the drawings, but are given reference numerals for case of identification in the ensuring description. The cross beams 19*a*, 19*b* are surrounded by upper guide bushes 40*a*, 40*b*, 40*c* and 40*d* and lower guide bushes 41*a*, 41*b*, 41*c* and 41*d* inserted in the saddle apron slides 18*a*, 18*b*, 18*c* and 18*d*.

In addition, a bush 49 with a fixing screw 50 and a buffer plate 51, a bush 52 with a fixing screw 53 and a buffer plate 54, and a bush 55 with a fixing screw 56 and a buffer plate 57 are adjustably arranged on a common rail 58 which supports all three bushes 49, 52 and 55.

In the above-mentioned embodiment elements 49*a* to 57*a* are arranged on a rail 58*a* which runs parallel to the rail 58. The elements 49*a* to 57*a* and the rail 58*a* are not visible in the drawings, being obscured by the other elements, but perform the same function as the elements 49 to 57 and the rail 58.

In the apparatus according to the invention, further devices may be arranged which are known *per se*, and a detailed description of these known devices is therefore not included herein. These known devices are sealing, clipping, separating and tube inserting device 11, an automatic filling revolver 12 with the filling tubes 13 and 14 attached to the revolver, a so-called "skin break" 15 and a clipping and closing apparatus 16 for sealing the filled sausage casing.

Figs. 5.1 to 5.5 show the operation cycle of the apparatus according to the invention. The tubular casing 6 which is wound on the unwinding unit 3 (see Fig. 1) is drawn from the unwinding unit 3 which comprises the rotatably mounted winding core with the take-up disc 4 and the tension pins 5*a*, 5*b*, 5*c* and 5*d* and is drawn forward through the tubular casing opening apparatus 7 of the preparation machine 2 to the carrier 8*a* located in position A of the tubular casing conveyor consisting of the carriers 8*a*, 8*b*, 8*c* and 8*d*. The tubular casing is then opened and kept open pneumatically by the opening apparatus 7 with its lifting devices 9*a*, 9*b* and by the pneumatic tubular casing lifting devices 10 located in the carriers 8*a*, 8*b*, 8*c* and 8*d* respectively.

The tubular casing 6 in the resulting opened state is then conveyed by the movement of the carrier 8*a* from position A into position B, the carrier 8*b* preceding the carrier 8*a*.

The carriers 8*c*, 8*d* which have pivoted out run simultaneously in the opposite direction, that is to say from position C into position A, where they then remain in the rest position.

In the meantime, this casing is sealed in a manner known *per se*, described above, in position B between the carriers 8*a* and 8*b* holding the tube and is severed adjacent the sealing position on the side thereof nearer the unwinding unit 3.

The unsevered part of the tubular casing 6 remains fixed at its end in position B by carrier 8*a*, so that position B corresponds spatially to position C with respect to carrier 8*a*. The carrier 8*b* conveys the separated part of the tubular casing from position B into position C with further shifting of the casing on to the filling tube 13.

The advancing carrier 8*b* as a member of the carrier group 8*a*, 8*b* located in position C then pivots from the imaginary tubular casing conveying axis and out of the region of rotation of the automatic filling revolver 12 of the tubular casing filling machine. Thereupon, the carrier 8*a* pulls the tubular casing 6 forward on to the newly introduced filling tube 14 which has previously been freed from the section of the tubular casing 6. A mechanical support (not shown) for this tubular casing in this position which is necessary if the tubular casings are not sufficiently self supporting may be provided.

The casing is then grasped in position A by the carrier group 8*c*, 8*d* which is arranged on a different guide apparatus from carrier group 8*a*, 8*b*.

The carrier 8*a* is loosened and its tong-like holder opens from the tubular casing 6 and pivots from the imaginary tubular casing coveying axis. The tubular casing 6 is then brought from position A into position B by the carrier group 8*c*, 8*d* and thus introduces the next cycle of operation.

The above-mentioned movements of the carrier 8*a* and 8*b* into their positions A, B and C shown in Figs. 1, 4 and 5 are controlled in the following manner. The position of the carrier 8 in position A is determined by the saddle apron 18*a* stopping against the buffer plate. The position of the carrier 8 in position B is correspondingly determined by the compressed air cylinder 21*a* guiding the saddle apron slide 18*a* on to

the buffer plate 52. The compressed air cylinder 21*b* then conveys the saddle apron slide 18*b* from position B until the fork head 23*b* stops against the buffer plate 54.

The components of the apparatus not shown in Figs. 1, 4 and 5, which control the carriers 8*c* and 8*d* utilise a corresponding and identical mode of operation.

The cycle set out in the above description of the operation of the apparatus according to the invention can now be repeated as many times as desired, the section 6′ of the tubular casing formed continually in this way being sealed on one side with the aid of a sealing, clipping, severing and loop inserting device 11 known *per se* in position B and is severed having been cut to length. By rotating the automatic filling revolver 12 (part of the known tube casing filling and clipping machine), which is provided with at least two filling tubes 13 and 14, the tubular casing section 6′ arranged on the tube 13 is guided into position D required for filling the casing. The filling tube 14 now guides the tubular casing, which is designated by 6″ in Fig. 1, through a conventional pressure charging means for filling the casing with a pasty material, for example sausage meat, a so-called "skin brake" 15 guiding the tubular casing 6″ in known manner during the filling process and ensuring by braking that the filling of the casing is compact. The closing and clipping apparatus 16 then seals the filled tubular casing 6″ thus formed, for example a sausage, in the usual manner directly after the filling process.

Numerous variations of the method and apparatus described above are possible. Thus, an automatic arresting means for securing the fixing device on the beams 19*a* and 20*a* may also be used instead of the fixing apparatus 48 arranged on the tubular casing opening apparatus 7 for the journals 47*a* and 47*b*. The same applies to the corresponding fixing apparatus for the carrier 8.

The spatially overlapping rhythmical coordination of the elements of the apparatus according to the invention ensures low friction adaptation of commercially available tubular casing filling and closing machines to the opening, conveying and dividing apparatus according to the invention.

WHAT WE CLAIM IS:—

1. A method of opening, conveying and dividing moist, empty tubular casings which have been lain flat and are unshirred for effecting the filling and sealing thereof, wherein the tubular casings are opened pneumatically by reduced gas pressure whose strength can be varied and which is charged on the exterior of the casings, conveyed pneumatically to the filling and sealing positions in the open condition by conveying means acting alternately on the left or right side of the outer surface thereof, and sealed at one end prior to the filling and during the dividing thereof.

2. A method according to claim 1, wherein during pneumatic opening and conveyance of the tubular casings, the reduced pressure is applied to the exterior of the casing adapted to the differing gas permeability of the different casing wall present at any time.

3. A method according to claim 2, wherein the reduced pressure is adapted to the gas permeability of micro-porous tubular casing.

4. A method according to claim 2, wherein the reduced pressure is adapted to the gas permeability of macro-porous tubular casings.

5. A method according to claim 1, wherein the opening step comprises opening a front region of a tubular casing, and conveying the same open while an adjacent rear section is simultaneously opened.

6. An apparatus for opening, conveying and dividing tubular casings, comprising means for continuously feeding a moist tubular casing, pneumatically operating tubular casing opening means for applying a reduced pressure of variable strength to the exterior of the casing, pneumatically operating tubular covering conveying means in synchronous operation with the opening means, and dividing and closing means spatially overlapping the conveying means and operable in synchronism therewith, the opening means, conveying means and closing and dividing means being arranged to operate consecutively on the tubular casing, and the tubular casing conveying means comprising a movably mounted tonglike conveying gripper device for grasping and conveying the open tubular casing, which is free from filling, on its outer circumference on alternate sides.

7. An apparatus according to claim 6, wherein the tubular casing opening means comprises at least two tubular casing lifting devices.

8. An apparatus according to claim 7, wherein the tubular casing opening means comprises holding and guide devices slidably mounted on support elements.

9. An apparatus according to claim 8, wherein the conveying means includes actuatable carriers arranged at a distance from each other.

10. An apparatus according to claim 9, wherein each carrier has a first half tong and a second half tong.

11. An apparatus according to claim 10, wherein each of the half tongs has at least one tubular casing loosening device.

12. An apparatus according to claim 10, wherein each of the half tongs has two

tubular casing loosening devices.

13. An apparatus according to claim 11 or 12, wherein each of the tubular casing loosening devices comprises tube nipples.

14. An apparatus according to claim 13, wherein the tube nipples each have a tube fork end piece.

15. An apparatus according to any one of claims 6 to 14, which is adapted to handle tubular casings of various diameters.

16. A method of opening, conveying and dividing moist, empty tubular casings, substantially as herein described with reference to the accompanying drawings.

17. An apparatus for opening, conveying and dividing moist, empty tubular casings, substantially as herein described with reference to the accompanying drawings.

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1603931 COMPLETE SPECIFICATION
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Sheet 1

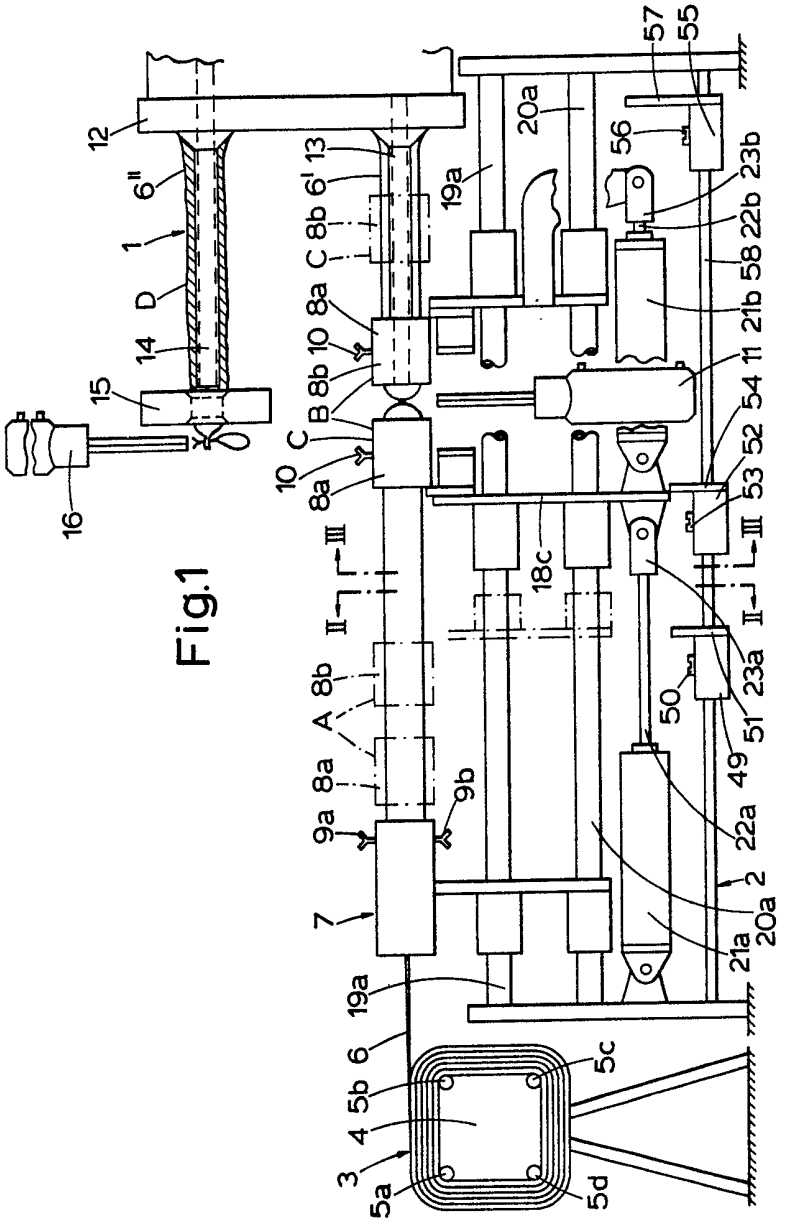

Fig.1

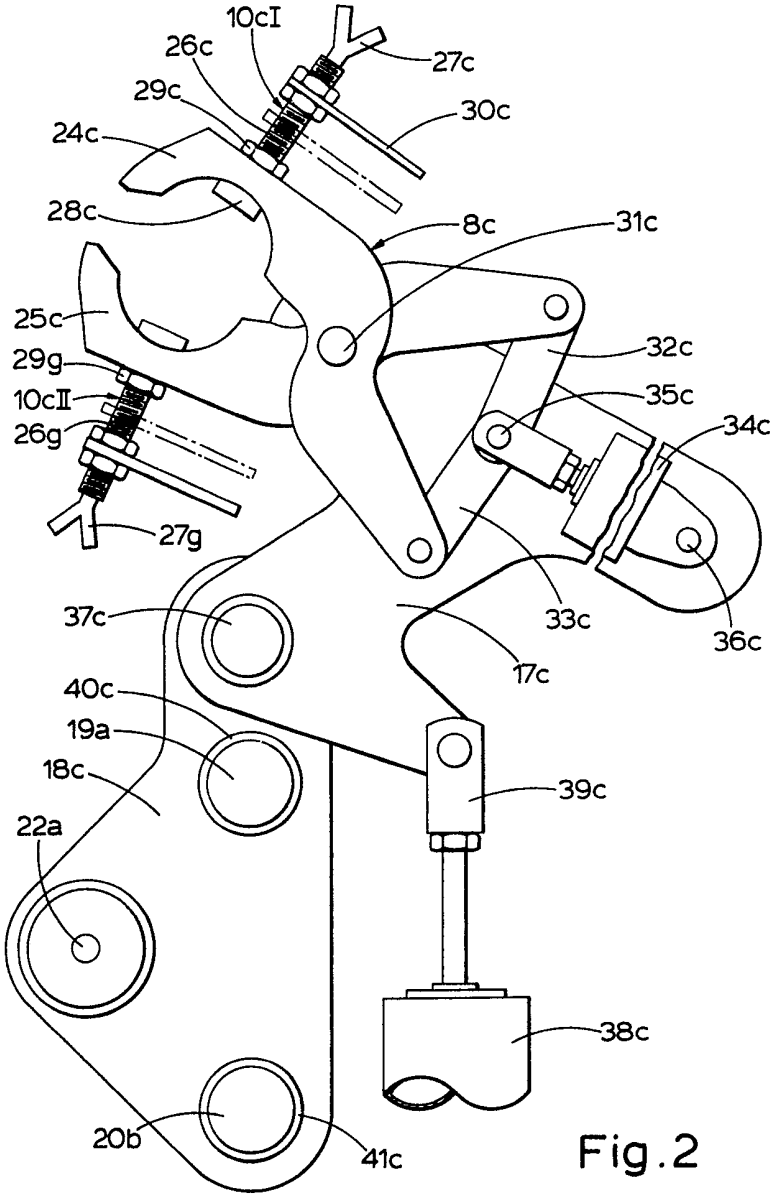
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Fig.2

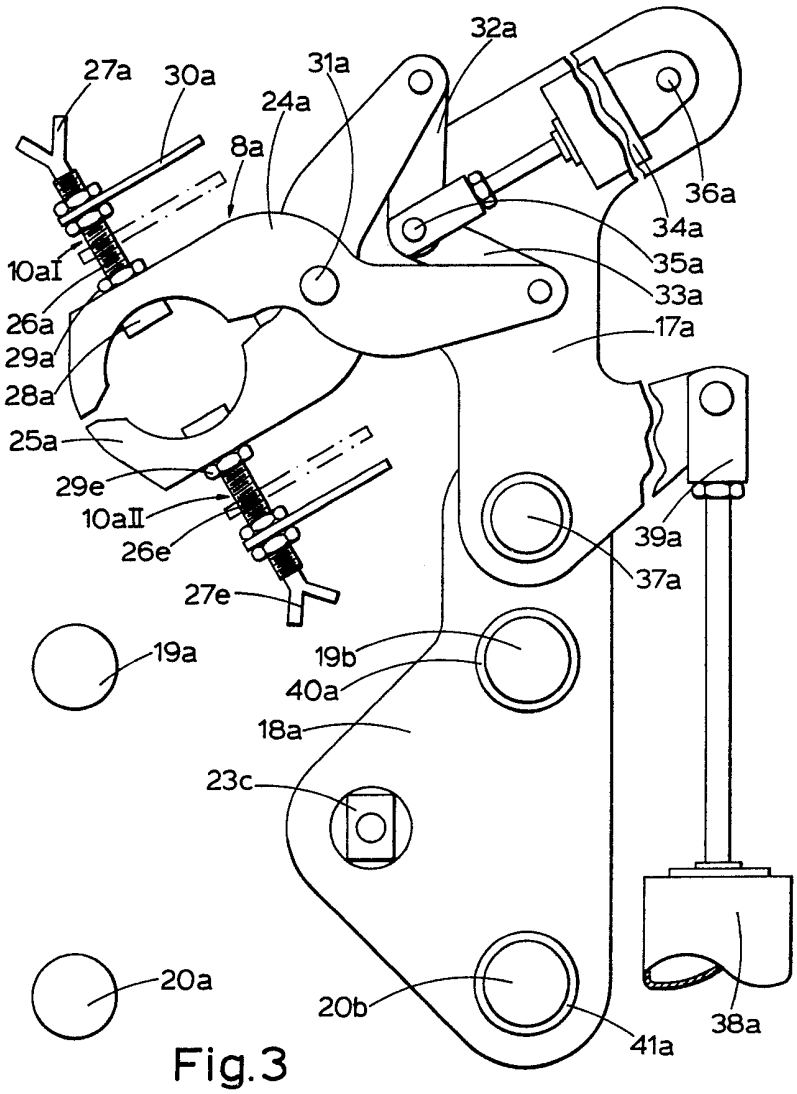
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Fig.3

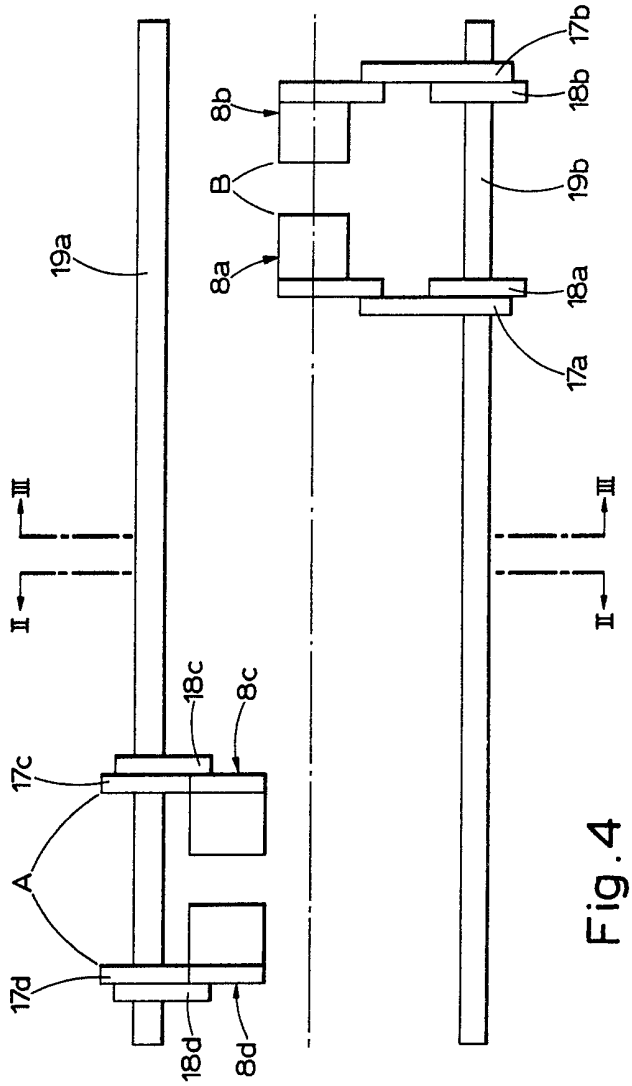
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Fig. 4

Fig.5

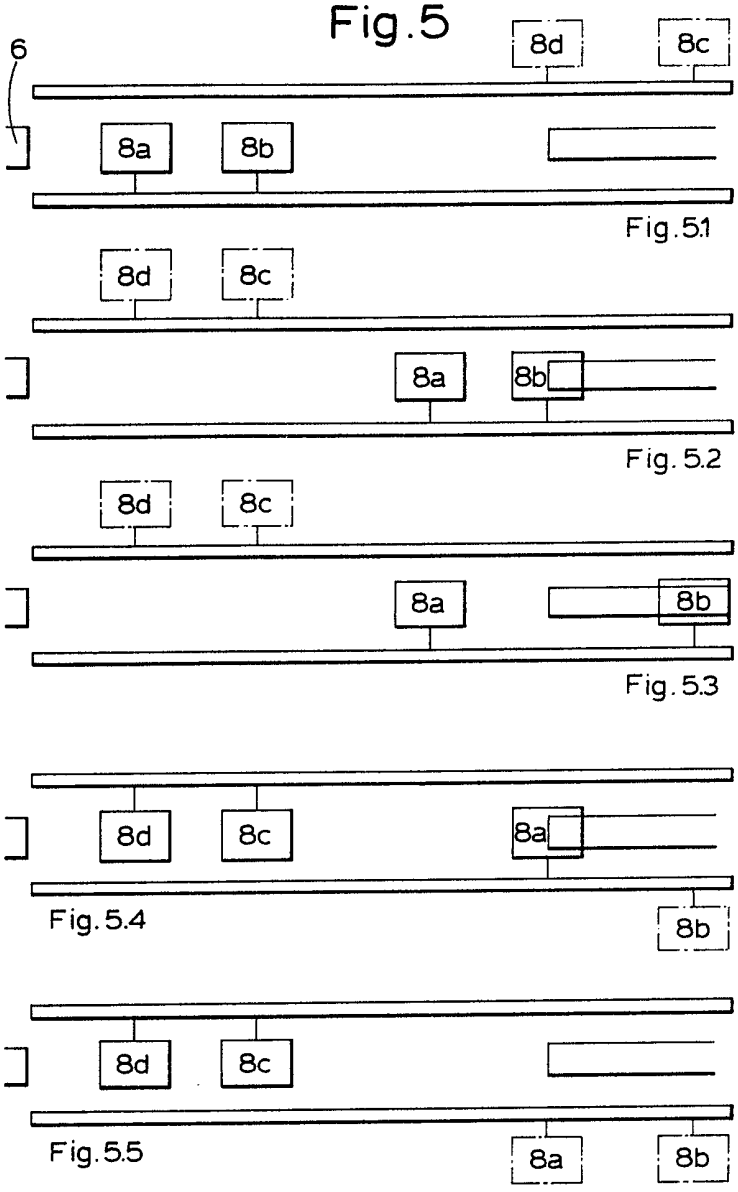

Fig.5.1

Fig.5.2

Fig.5.3

Fig.5.4

Fig.5.5

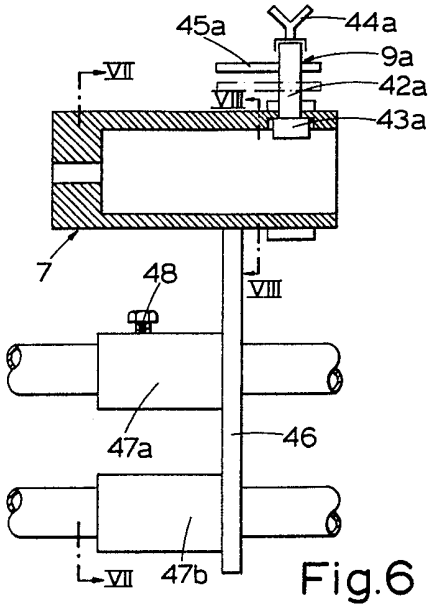

Fig.6

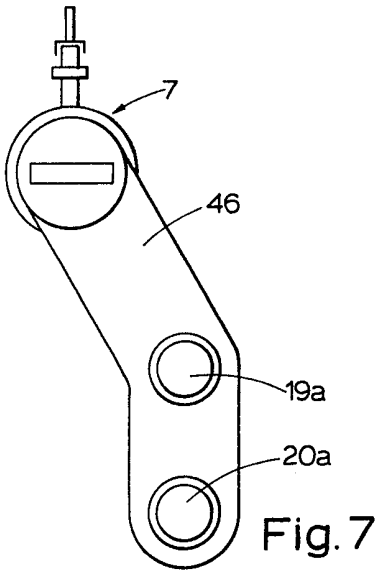

Fig.7

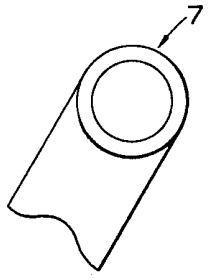

Fig.8