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(54) OPEN-END SPINNING METHOD AND APPARATUS

(71) We, VYZKUMNY USTAV BAVLNARSKY, of Usti nad Orlici, Czechoslovakia, a corporate body organised and existing under the laws of Czechoslovakia do hereby declare the invention, for which we pray that a patent may be granted to us, and the by which it is to be performed, to be particularly described in and by the following statement:-

The invention relates to the spinning of yarn.

The gist of the open-end spinning technique upon which the invention is based is in that yarn is produced between two counterdirectionally moving surfaces. Separated fibres are supplied by one of said surfaces into the mouth of a wedge-like gap provided between said surfaces in which the fibres are wrapped up onto a created open yarn end rotating by contact with said two surfaces, the yarn being continuously withdrawn from the gap.

Thus, for instance, a spinning method is known wherein fibres are supplied into a wedge-like gap provided between a pair of parallel sucking drums associated with each other in a close but contactless proximity and arranged to rotate in the same direction. On the drums there are provided sucking zones which face each other in said wedge-like gap region.

By twisting continuously supplied fibres in said gap and wrapping them onto the so-called open-end being formed in said gap, there is formed yarn which is continuously withdrawn by a pair of take-off rollers which simultaneously prevent any further twist propagation.

Perforated walls of the sucking drums forming the operating surfaces form a a wedge-like gap widely opening from the closest proximity line. One of the surface moves towards the apex of said wedge-like gap while the other moves in opposite direction, i.e. away from it.

Separated fibres are supplied into the wedge-like gap by air flow in a direction substantially perpendicular to the axes of rotation of said sucking drums. The wedge-like gap is disposed in the region of stationary sucking-in ducts provided in the cavities of the perforated sucking drums. The fibres supplied into the wedge-like gap are sucked by air drawn in from the ambient atmosphere, substantially into the region of apex of said gap where they are caused by the surfaces to wrap onto the freshly built open end of the yarn being continuously withdrawn.

The number of twist turns imparted to the yarn depends on the ratio between the diameter of yarn to be produced between the frictional surfaces of the sucking drums and the diameter of said drums. Since the yarn diameter is many times less than the diameter of the sucking drums, the respective ratio is very high so that at usual yarn take-off velocities, the peripheral velocities of the drums are relatively very small. This constitutes an advantage relative to high speeds of rotation of a rotary chamber open-end spinning unit.

However, the above-described spinning system does not optimalize the effectiveness of such spinning technique. Between the yarn being built and the sucking drums, considerable slippage occurs so that in order to obtain a desired twist number it is necessary to increase many times the number of revolutions of said drums relative to the theoretical value derived from the above-mentioned ratio between the diameter of the yarn and those of the drums.

The wedge-like gap provided between the surfaces which are in contact with the open end of the yarn being built, opens too abruptly and widely from the apex of said space so that its action on the yarn rolling is insufficiently effective. Due to a slippage between the yarn and the frictional surfaces, the fibrous material is excessively heated by contact heat which causes the twist to be thermally set in the yarn, which is disadvantageous with regard to the structure of final yarn and to further processing thereof, such as the manufacture of woven fabrics. This factor is especially important if processing thermoplastic fibres.

The sucking-in ducts of the above-described system communicate via perforated sucking drums directly with the ambient atmosphere. Thus to achieve a sufficient value of subatmospheric pressure necessary for retaining fibres on the drum surface, a considerable subatmospheric pressure has to be produced on the drum surfaces as to compensate for the centrifugal force action. Such subatmospheric pressure value should correspond to the theoretical condition of a high air throughflow connected with an increased power consumption.

Moreover, the system actually comprises a dual supply of fibrous material via two sucking-in ducts, which practice requires an additional power input.

Fibres are conveyed to the wedge-like gap simultaneously by the two sucking drums so that marginal fibres carried along by the drum rotating away from the apex of the wedge-like space, are brought away from the yarn building region, i.e. beyond the sucking-in duct mouth whereby the fibres hurled off the surface , due to the action of centrifugal force, increase the fibre fly-off waste.

Another apparatus for spinning, based on substantially the same principle, comprises a pair of co-operating surfaces provided on revolving rotary carriers. The frictional surfaces rotate in opposite directions and form a wedge-like gap therebetween; the fibre supply zone is provided on one of them which is perforated to this purpose. The perforated surface is substantially embodied as a disc to the sucking zone of which - defined by sucking-in duct mouth disposed below the disc - there are sucked separated fibres continuously supplied by a fibre supply mechanism.

The second surface is provided as a frusto-conical surface in such a way that an element line of said frust-conical surface extends in parallel to a radial line of the disc along the line of the closest proximity of the two carriers.

Fibres sucked onto the disc are continuously conveyed by it into the wedge-like gap to the open end of yarn being built whereby the contact with the two surface they are twisted to form a yarn continuously created and withdrawn by a pair of take-off rollers in radial direction relative to the disc, the yarn being wound by a take-up mechanism onto a package.

The twist number to be imparted to the yarn is given similarly as in the preceding case, by the transmission ratio between the yarn being formed in the wedge-like gap and the two surfaces.

The effect of the aforedescribed solution is practically the same as with the previous spinning apparatus; it is true that the slippage between the co-operating surfaces is somewhat reduced here but is still disadvantageous from the viewpoint of the spinning process effectiveness.

Finally, there is known a spinning apparatus wherein the surfaces are provided on two superposed endless belts driven in such a manner that their strands facing each other move in opposite directions. The axis of the respective guide rolls encircled by the belts are all parallel with one another. Fibrous material is supplied onto a sucking zone provided on the upper strand of the lower belt, and particularly on that part thereof which overlaps the lower strand of the upper belt. The sucking zone is situated upstream and in the place where the horizonral frictional surface of the lower endless belt forms the wedge-like space in cooperation with the frictional surface of the upper endless belt, and more particularly in the section where the latter begins to encircle its guide roll.

Fibres fall from the fibre separating mechanism onto the lower endless belt where they are sucked, by the action of air drawn in from the ambient atmosphere through a sucking duct located between the strands of the lower belt, onto the surface of said lower belt and conveyed to the wedge-like space. By rolling the yarn end between the two surfaces and by continuously wrapping the supplied fibres onto said end there is formed yarn which is continuously withdrawn in the direction perpendicular to direction of movement of the belts. This apparatus has substantially the same disadvantages as hereinabove referred to.

In spite of certain drawbacks, the aforedescribed open-end spinning systems are for some types of fibrous material substantially preferable to rotary chamber open-end rotor spinning systems. The doubtless advantage of the former is a relatively low speed of the rotary elements operating, theoretically, on the basis of a ratio between a small yarn diameter and relatively large diameters of the carriers on which the surfaces are provided.

Although with known open-end spinning systems undesirable yarn slippage occurs, such technique enables, because of said favourable ratio, the output of these systems to be still raised.

It is an object of the present invention to improve the open-end spinning technique including two counter-directionally moving surfaces, and more particularly to eliminate the undesirable slippage of the yarn in the yarn building region.

According to one aspect of the present invention there is provided a method of spinning yarn comprising providing two rotary carriers respectively presenting convex and concave surfaces in confronting relationship with a wedge-like gap therebetween, rotating the carriers in such a manner that the convex and concave surfaces move in opposite directions through the gap, depositing onto one of the surfaces fibres continuously separated from a continuous supplied sliver and, by virtue of the movement of the one surface, conveying the deposited fibres toward the gap, wrapping up the fibres onto a created open yarn end rotating by contact with the two surfaces, and withdrawing the created yarn from the gap in the direction of an imaginary extension of the gap by means of a yarn take-off mechanism adapted to limit the propagation of twist in the yarn.

According to another aspect of the present invention there is provided an apparatus for spinning yarn, comprising two rotary carriers respectively presenting convex and concave surfaces in confronting relationship with a wedge-like gap therebetween, means for rotating the carriers in such a manner that the convex and concave surfaces move in opposite directions through the gap, a mechanism for continuously separating fibres from a continuously supplied sliver and depositing the fibres onto one of the surfaces so that by virtue of the movement of the one surface, the deposited fibres can be conveyed towards the gap in which they can be wrapped up onto a created open yarn end rotating by contact with the two surfaces, and a yarn take-off mechanism for withdrawing yarn from the gap in the direction of an imaginary extension of the gap, the yarn take-off mechanism being adapted to limit the propagation of twist in the yarn.

One of the rotary carriers may be an inner carrier and the other rotary carrier an outer carrier in which the inner carrier is received.

The apparatus comprises various embodiments; thus, for instance, the two surfaces may be cylindrical, or conical, or one thereof in cylindrical and the other conical.

Alternatively, the inner carrier can be embodied as an endless belt having a surface while the other surface is provided on a surface of revolution.

In another preferred embodiment, the surface presented by the inner carrier is perforated and secured on a positively driven hollow shaft connected to a subatmospheric pressure source, is mounted for rotation in a stationary bushing in which opens a duct for supplying fibres from a fibre separating device of the fibre separating and depositing mechanism, the bushing being provided with a longitudinal slot designed for demasking a region of the surface of said inner carrier where such surface is intended to move towards the gap.

In another preferred embodiment, the hollow shaft is mounted for rotation in a support wall provided on the housing of the fibre separating device.

Another preferred embodiment consists in that the outer carrier is mounted for rotation in a cavity of a stationary casing, which casing is frontally shieldable by a support wall in which, opposite the wedge-like gap, a yarn take-off opening is provided.

To enable the spinning-in process it is preferable when the housing of the fibre separating device is mounted by means of its guide portion to reciprocate on the casing between a rear position in which the support wall masks the cavity of said casing, and a front position in which the bushing in uncovered.

The outer carrier is supported by a bearing passing through a neck of a casing.

Between the support wall and a front edge of a cylindrical portion of a casing in which the outer carrier is mounted for rotation there is interposed a sealing ring while between the support wall and the front edge of the outer carrier, a labyrinth is interposed.

For holding the yarn end during the spinning-in process, a yarn end gripper is provided on the bushing, in an extension of its longitudinal slot.

This is a merit of the improved spinning system to provide a high output of the apparatus substantially without losses due to the slippage of yarn between the two surfaces.

The essential advantage of this improved spinning system consists in that the yarn is acted upon by two surfaces of which one, relative to the yarn building region, is concave and the other convex. Owing to such an arrangement, the wedge-like gap obtains a very advantageous shape for yarn rolling since said gap widens very slowly or gently so that it minimizes the yarn slippage between the surfaces. In spinning, no heat fixation of twist occurs since the contact temperature of the rolling surfaces is negligible.

In consequence of advantageous friction ratios between the spun yarn and the surfaces, the velocity of said surfaces substantially corresponds to the theoretical velocity or revolutions necessary for imparting the theoretical number of twist turns into the yarn end, the yarn slippage at required adjusted peripheral velocities of the surfaces being negligible. By this factor, the effectiveness of the production relative to known open-end spinning systems is positively influenced.

Preferably air is caused to flow from the ambient atmosphere to the hollow cylinder through the fibre separating mechanism and the supply duct together with the fibres which means that in order to produce, on the perforated surface, a subatmospheric pressure necessary for retaining the fibres, only a relatively small air throughflow is needed, because of the sufficient tightness of the system.

The subatmopheric pressure produced on the perforated surface to retain the fibres thereon and to overcome the centrifugal force the fibres are exposed to, can be relatively low because the cylinder velocity need not be raised in order to compensate for slippage. The inner carrier can have a relatively small diameter allowing it to be received in the cavity of the outer carrier.

The energy input to establish air conditions in the apparatus according to the invention can be reduced to minimum relative to the existing open-end systems discussed above requiring relative high energy input for the production of air. As regards the energy input it is preferable that only one of the surfaces be perforated. However, the condition of depositing the fibres onto the perforated surface conveying them towards the apex of the wedge-like gap has to be complied with. Likewise it is preferable to produce the subatmospheric pressure on the surface of the smaller carrier.

In case of the embodiment wherein the inner carrier is an endless belt provided with the surface whereas the second surface is a surface of revolution, it is preferable that the operative subatmospheric pressure be produced on the surface of revolution only. Such embodiment is further advantageous in that is is possible to utilize the so-called self-ventilating perforation since the fibres adhering to the surface are exposed practically to the same value of centrifugal force as the force of air produced by the subatmospheric pressure so that the consumption air necessary for retaining the fibres on the perforated surface is minimal.

The fact that yarn is twisted without slippage, positively influences the final yarn product which exhibits a substantially better structure than that produced in the prior art systems.

In the apparatus according to the invention it is possible to process both natural and man-made fibres as well as blends thereof, including glass, asbestos, or like fibres, further fibres within a very broad range of titres, and irrespective of staple lengths, such as cotton, or wool types staple fibres. The apparatus is easily operable and provides for a quick and easy spinning-in process.

Thread breakage rate is minimum since the yarn is not exposed to a relatively high spinning tension typical for rotor spinning systems. The tension of the yarn being spun does not depend but upon friction forces prevailing between the yarn and the surfaces, and on the sucking-in force holding the fibres on the perforated surface.

The process of the invention enables, in general, the production of medium and coarse yarn counts. The yarn structure resembles that of orthodox spun yarn except that the yarn surface is more twisted than its core. The yarn is even and practically suitable to all applications. From the viewpoint of yarn evenness it is advantageous that the fibres be accumulated at random on a considerable peripheral area of the surface of the inner carrier. The yarn strength is cared for by that the fibres are maintained in yarn building region in straight condition, due to the action of subatmospheric pressure of air in the air-tight system.

Now it has been found out that the yarn formation can be positively influenced by providing zones of variable suction effect on the perforated surface of the inner carrier, and more particularly in the region of the wedge-like gap.

By establishing an appropriate sucking effect regime on the perforated surface of the inner carrier advantageous conditions are secured for processing fibrous materials of various kinds, staple lengths and titres in an open-end spinning process.

In the cavity of the inner carrier there is produced a subatmospheric pressure manifesting itself by a sucking effect on the perforated surface of said inner carrier, a baffle member is received for localizing the sucking effect on said perforated surface.

The baffle member defines, on the perforated surface of the inner carrier upstream the mouth of the wedge-like gap, a narrow sucking effect field.

In one of the preferred embodiments, the baffle member is a tubular body having an axial slot defined by a front edge and a rear edge, said edges defining, on the perforated surface of the inner carrier upstream the mouth of the wedge-like gap, a narrow sucking effect field while a wall of said tubular body, from the start of the zone of depositing fibres onto the perforated surface of the inner carrier to the front edge of said body, extends away from the inner wall of said perforated surface in such a way that the sucking effect rises on the corresponding portion of the perforated surface up to a sucking effect value which is lower than the value thereof acting in the narrow field provided upstream of the mouth of the wedge-like gap.

According to another embodiment, the baffle member is a segment adapted to bear upon the inner wall of the perforated surface of the inner carrier so that the sucking effect on said perforated surface from the mouth of the wedge-like gap is null in the direction toward the apex of said gap.

The function of the baffle member can be preferably combined with that assumed by the perforations having different sizes and spacings, respectively.

In one embodiment, the perforated surface of the inner carrier is divided into two transverse fields having different densities of perforations having the same diameters while the density of the first field corresponding to the fibre depositing and accumulating zone on the perforated surface of the inner carrier, successively rises up to a value which, in the second field corresponding to the yarn twisting zone proper, is constant.

The perforation density in the first field can vary either in a linear or a travelling wave course.

In an alternative embodiment, the perforated surface of the inner carrier is divided into two transverse fields having the same perforation spacings while the size of perforations of the first field corresponding to the fibre depositing and accumulating zone on the perforated surface of the inner carrier successively rises up to value which, in the second field corresponding to the yarn twisting zone proper, is constant.

Some of the preferred embodiments of the present invention will be hereinafter described, by way of example, with reference to the accompanying schematic drawings, in which:-

Figure 1 is a side view and a partially sectional view of the spinning unit together with the housing of the fibre separating mechanism in rear position;

Figure 2 is a schematic front view of driving mechanism of the open-end spinning machine according to the present invention:

Figure 3 is a sectional view of the spinning mechanism taken through the axis of the outer carrier within the plane perpendicular to the axis of rotation of the combing cylinder, and other partial sectional views thereof;

Figure 4 is a front view of the spinning unit;

Figure 5 is a sectional view taken along the line V-V in Figure 1;

Figure 6 is an enlarged detail view of the wedge-like gap as shown in Figure 5;

Figure 7 is a side view of the spinning unit together with the housing of the fibre separating mechanism in front position, opposite the view shown in Figure 1;

Figure 8 and *12* are perspective views of spinning mechanisms provided with various carrier embodiments;

Figure 13 is an enlarged detail view of a partial cross-section of the spinning unit comprising a baffle member;

Figure 14 is an enlarged detail view of a partial cross-section of the spinning unit comprising another baffle member embodiment;

Figure 15 is an enlarged detail view of a partial cross-section of the spinning unit comprising still another embodiment of baffle member, and shows a diagram of the sucking effect;

Figure 16 is a side view of the inner carrier in which different sizes and spacings of the perforations, respectively, are shown;

Figure 17 is a side view of the inner carrier, showing a shaped baffle member;

Figure 18 is a sectional view taken along the line XVIII-XVIII in Figure 17; and

Figure 19 is a sectional view taken along the line XIX-XIX in Figure 17.

The spinning unit for carrying out the method according to the invention is schematically shown in Figures 1 to 4.

The spinning unit comprises a fibre separating mechanism 1 received in a housing 2, a spinning mechanism 3 housed in a casing 4 communicating with the housing 2, a yarn take-off mechanism 5 and a yarn take up mechansim 6.

The operating members of the fibre separating mechanism 1 which latter substantially corresponds to that used in an open-end rotor spinning unit, are a combing cylinder 7 received in a recess 8 of the housing 2, and a sliver supply mechanism 9 preceding the combing cylinder 7 and received in a recess 10 of the housing 2, the recesses 8 and 10 communicating with each other via a conduit 11 (Figure 3).

The sliver supply mechanism 9 is constituted by a positively driven feed roller 12 and a thrust element 13 which is resiliently forced to said roller and which is affixed by its one end to the wall of the housing 2 by means of a screw 14. The knurled feed roller 12 and the thrust element 13 produce in co-operation a nip zone for a fibrous sliver 15 to be withdrawn from a sliver can 16 and supplied to the combing cylinder 7.

The combing cylinder 7 provided on its surface with combing elements 17 is secured on a shaft 18 mounted for rotation in a hub 19 of the housing 2 and carrying at its end portion a friction roll 20 (Figure 4). The direction of rotation of the combing cylinder 7 is indicated by arrow 21 and that of the feed roller 12 by arrow 22.

The front wall of the housing 2 in which the recesses 8 and 10 are provided is masked by a sealing cover plate 23, preferably made of transparent material and attached to the housing 2 by screws 24.

Out of the housing 2 there projects a fibre supply duct 25 starting in the recess 8 for the combing cylinder 7, and opening in the form of a neck 27 defined by front walls 28, 29 and a bottom 30, into a stationary bushing 26 fixedly connected to the body of said duct 25.

Out of the housing 2 there projects a guide portion 31 coupled by a dove tail joint 32 with the casing 4 to shift thereon (Figures 3 and 5), and a support wall 33 perpendicular to said guide portion 31. A lug 34 provided on the casing 4 is affixed by a screw 35 to the frame 36 of the spinning unit.

The casing 4 has a cylindrical portion 37 merging into a neck 38. The opposite open front side of the cylindrical portion 37 bears, via sealing rings 39, on the support wall 33. In the cylindrical cavity 40 of the casing 4 there is mounted for rotation a carrier 41 embodied, for example, as a hollow cylinder 42 the open front end of which bears, in a contactless manner, on the support wall 33. The cavity 43 of the cylinder 42 is sealed by a labyrinth 44 interposed between the facing sides of the cylinder 42 and the support wall 33 (Figure 3).

The cylinder 42 is secured on a shaft 45 rotatably supported in a bearing 46 inserted in the neck 38 and locked therein by a grub screw 47. The opposite end portion of the shaft 45 carries a pulley 48.

In a cylindrical cavity 49 of the bushing 26 there is mounted for rotation a carrier 50 embodied, for instance, as a hollow cylinder 51 the peripheral surface of which is provided with a perforation 52 partially shown in the drawing.

The cavity of the cylinder 51 merges into a hollow shaft 53 rotatable in a bearing provided in the support wall 33 and provided with a pulley 54. One extremity of the hollow shaft 53 is connected in a contactless manner to an air duct 55 communicating with a main air collecting pipeline 56 extending along the entire spinning machine and connected to a subatmospheric pressure source to operate the individual spinning units.

The hollow cylinder 51 is placed in close proximity, but in contactless manner, to the inner wall of the hollow cylinder 42 while the cylindrical cavity 49 of the bushing 26 merges into a longitudinal slot 57 out of which a part of the hollow cylinder 51 protrudes. Walls 26′, 26″ of the bushing 26 extending at either side of the longitudinal slot 57, bear as close as possible but contactlessly on the inner wall of the hollow cylinder 42 (Figures 5, 6).

The carrier 41 rotatable in the direction of arrow 58 is provided with a surface 59. Another surface 60 is constituted by the external area of the carrier 50 the rotation of which, indicated by arrow 61, in counter-directional relative to the movement of the carrier 41.

The two surfaces 59 and 60 form, in co-operation with each other, at either side of the region of the closest distance therebetween, wedge-like gaps of which the gap 62 is designed for the invention purpose; in the mouth 62′ of this gap 62, yarn P is produced (Figure 6). The position of the mouth of said wedge-like gap 62 between the surfaces 59, 60 is defined by the diameter of yarn P so that it varies in dependence on the titre of yarn to be spun. The size of said mouth 62′ of the thus defined gap therefore depends upon the yarn diameter. The surface 60 moves towards the apex of said wedge-like gap 62 whilst the surface 59 moves away therefrom, said movements of the surfaces 59 and 60 being necessary for the production of the yarn P.

The wall 26″ merges into the cylindrical cavity 49 as a surface 63 enlarging effectively the capacity of the yarn building wedge-like gap 62. With regard to the yarn producing region, the surface 59 is concave and the surface 60 convex (Figures 5 and 6).

In the support wall 33, opposite the wedge-like gap 62, there is provided a yarn withdrawing opening 64 continuing as a yarn take-off tube 65 (Figures 4 and 7). On the front surface of the bushing 26 adjacent the front wall of the hollow cylinder 42 there is provided, substantially within the axis of the opening 64, a gripper 66 designed for holding the end of the yarn P during the spinning-in process. The gripper 66 is embodied, for instance, as a flat spring of which one end is affixed by a screw 66′ to the bushing 26. The opposite free end of said spring resiliently bears upon the front face of the bushing 26 (Figure 7).

In principle, always one of the surfaces 59 and 60 only is provided with perforation permeable by air. The perforation can be constituted by circular apertures, slits, or the like. Both the perforated and the unperforated surfaces can be made e.g. of metal, or provided with vulcanized rubber coating, or coated with a man-made material layer such as, for example, polytetrafluoroethylene highly elastic polyurethane based material, or the like.

The surfaces 59 and 60 can be glossy, smooth, but preferably mechanically worked as e.g. roughened, or provided with fine depressions, projections, or the like. Yarn P is withdrawn from the wedge-like gap 62, by the yarn take-off mechanism 5.

The housing 2 is supported to reciprocate, by its guide portion 31, in the direction of double-headed arrow 67 on the casing 4 between a rear position (Figures 1 and 3) in which the support wall 33 closes the cavity of the casing 4, and a front position (Figure 7) in which the bushing 26 inclusive of the gripper 66 is uncovered. In both its front and rear positions, respectively, the housing 2 is locked by a spring-loaded pin 68 received in a hole bored in the guide portion 31. The pin 68 is forced by a spring 69 against the casing 4 in which there are provided two pits 70 and 71 defining the two respective extreme positions of the housing 2.

Figure 2 schematically shows driving means of the individual operating mechansims of the machine comprising a plurality of spinning units, the figures showing only one of them.

The drive of the carriers 41, 50 is derived from a main driving belt 72 encircling a driving pulley of an electric motor 73 suspended on the machine frame, and from a guide pulley 74 also rotatably supported on the machine frame. The main belt 72 is tensioned by two rolls 76 and 77. The pulleys 48 of the outer carriers 41 are encircled by the main belt 72 (Figure 4).

The pulley 54 of the inner carrier 50 is driven via a belt 78 from an intermediate roll 79 arranged on an angular arm 80 articulated at joint 81 to the support portion 31. Another intermediate roll 82 having a smaller diameter and arranged at the other side of the roll system, relative to the arm 80, is forced into frictional engagement with the main belt 72 by the action of a torsional spring 83 provided in the joint 81. In the rear position of the housing 2, the intermediate roll 82 is pushed against the main belt 72 which in turn is resiliently forced to the pulley 48 of the outer carrier 41. During the displacement of the housing 2 from the rear to the front position, the operator turns the arm 80 in counteraction to the force of the torsional spring 33 whereby the thus released intermediate roll 82 can be displaced, during its forward movement, beyond the path of main belt 72. By disengaging the intermediate roll 82 from the main belt 72, the pulley 54, on the one hand, comes to a standstill and, on the other hand, the frictional contact between the pulley 48 and the belt 72 is interrupted by disengaging the main belt 72, so that the two carriers 41 and 50 will stop. After the housing 2 has been displaced into the front position, the operator releases again the arm 80 which, due to the action of the torsional spring 83, will return into the starting position.

During the displacement of the housing 2 to the rear position, the operator makes the intermediate roll 82 by short-termed turning of the arm 80, bear on the main belt 72 whereby the belt 78 driving the pulley 54 is set in motion while simultaneously the main belt 72 gets again in frictional engagement with the pulley 48 so that the two carriers 41, 50 are again in motion.

The drive of the combing cylinder 7 is derived from an electric motor 84 (Figure 2). On a through shaft 85 supported in bearings provided in the machine frame, and driven, in a gear ratio, by a pulley 86, a belt 87 and a pulley 88 from said electric motor 84, there are secured frictional discs 89. In the rear position of the housing 2, each of said discs 89 is in engagement with the friction roll 20 secured on the shaft 18 of the combing cylinder 7 (Figures 1, 4). In the front position of the housing 2, the contact between the frictional disc 89 and the friction roll 20 is interrupted (Figure 7).

The yarn take-off mechanism 5 consists of a through take-off roller 90 supported in bearings provided in the machine frame, and a thrust roller 91 rotatably mounted on an arm 92 which, by means of its collar 93, is mounted for rotation on a through rod 94 supported in the machine frame (not shown). The thrust roller 91 is resiliently forced against the take-off roller 90 by a torsional spring (not shown) received in said collar 93. The direction of rotation of the take-off roller 90 and that of the thrust roller 91 is indicated by respective arrows 95 and 96 (Figure 1).

The yarn take up mechanism 6 (Figure 2) comprises a winding roller 97 supported in bearings provided in the machine frame, an oscillating yarn guide 98 with not shown drive means, and a partly shown holder 99 carrying a cross-wound package 100. The holder 99 is tiltable into an upper position in which it is disengaged from the winding roller 97.

The drive of the sliver supply mechanism 9 and of the yarn take-off mechanism 5 is derived from an electric motor 101 via a variable speed gear-box 75.

Each spinning unit is associated with a control unit 102 (Figures 2, 4) arranged on a partly shown crossbeam 103 and designed for controlling the operation of the sliver supply mechanism 9. The control unit 102 is connected via a not shown electric line with a thread breakage detector 104 disposed between the yarn take-off tube 65 and the yarn take-off mechanism 5. The thread breakage detector 104 controls also a light signalization system (not shown) provided on the housing 2.

A part of the control unit 102 is an electromagnetic clutch 105 designed for transmitting the rotational movement of a through shaft 106 supported in bearing provided in the machine frame, and coupled with the variable speed gear-box 75 via a set of gear wheels 107, 108, onto a shaft 109 of the feed roller 12, said shaft 109 being supported in bearing provided in the housing 2.

The sliver supply mechanism 9 is switched off, i.e. the fibre supply to the combing cylinder is cut off by the detector 104 in case of thread breakage or displacement of the housing 2 from the rear position in which the gear wheels 107, 108 are in mesh (Figure 1), to the front position in which the gear wheels 107, 108 are out of mesh (Figure 7).

The variable speed gear-box 75 drives, via pulley 110, belt 111 and pulley 112, the take-off roller 90, and via pulley 113, belt 114 and pulley 115, the winding roller 97 of the yarn take up mechanism 6.

By means of its support wall 33 and its guide portion 31, the housing 2 substantially carries the bushing 26, the inner carrier 50 with its hollow shaft 53, and the air duct 55 the end portion of which is air-tightly mounted to reciprocate in the opening 56′ of the air collecting pipeline 56.

Figure 1 shows the position of the end portion of the air duct 55 in the air collecting pipeline 56 when the housing 2 is in its rear position while Figure 7 shows the same in the front position of said housing 2. The rear position of the housing 2 is substantially the operative position and the front position thereof the inoperative position.

The spinning unit of the invention operates as follows:-

The sliver 15 being withdrawn from the sliver can 16 is supplied to the nip zone between the feed roller 12 and the thrust element 13 and therefrom it advances through the conduit 11 to the combing cylinder 7. The combing elements 17 of the latter comb individual fibres 116 out of the fibre beard whereupon the separated fibres are carried along by the surface of the combing cylinder 7 up to the region where the recess 8 merges into the supply duct 25. In this region, the fibres 116 are hurled by centrifugal force off the combing cylinder 7 and further on, due to their inertia and to the action of subatmospheric pressure manifesting itself by a suction effect in the supply duct 25, they are fed in substantially straight condition into the bushing 26.

The air drawn in from the ambient atmosphere via sliver supply mechanism 9 and flowing through the supply duct 25 from the combing cylinder 7 to the perforated surface of the inner carrier 50, expands in the cylindrical cavity 49 of the bushing 26 whereby its velocity decreases. Owing to the air expansion, the supplied fibres scatter within the entire space of the neck 27 and finally adhere to the perforated surface of the inner carrier 50 within the entire space confined by the front walls 28, 29 and the bottom 30. The fibres enter the cavity of the neck 27 by their leading ends and adhere to the perforated surface 60 of the inner carrier 50, due to the subatmospheric pressure prevailing in the interior of said carrier 50. The thus formed fibre scattering causes the fibres to fall at random onto various areas of the surface 60 while some fibres retained on this surface are covered by freshly supplied ones so that a desirable fibre agglomeration occurs. The fibres, in the form of a relatively uniform web, are conveyed by the surface 60 into the mouth 62′ of the wedge-like gap 62 where by frictional contact they continuously wrap up onto the so-called open end of the yarn P rolling on the two surfaces 59, 60 and convert to the yarn P which is continuously withdrawn from said wedge-like gap 62 in the direction of an imaginery extension of the gap by the take-off mechanisms where, by means of the resilient contact between the rollers 90 and 91, the propagation of twist in the yarn is limited from the gap to the yarn take-off mechanism, and finally wound by the take up mechanism 6 onto the package 100.

In case of a thread breakage, the same is signalled by the detector 104 which simultaneously switches off, via electromagnetic clutch 105, the fibre feed to the supply mechanism 9. The operator opens the spinning mechanism by pushing the housing 2 from its rear to its front position whereby the combing cylinder 7, the feed roller 12 and the two carriers 41, 50 (Figure 7) are disconnected from their drives. The yarn take-off and take up mechanism 5, 6 respectively, are always in operation.

The operator tilts off the holder 99 with the package 100 onto the upper position, unwinds a desired length of yarn and introduces its end portion, as by a hook into the take-off tube 65 and the withdrawing opening 64 and leads it over a part of the surface 60 protruding through the longitudinal slot 57 of the bushing 26, under the gripper 66, the yarn P being sucked onto the perforated surface 60, due to the action of subatmospheric pressure of air.

When the spinning mechanism is open, the operator can clean the cavity of the casing 4 and the bushing 26 from fibre and and yarn remainder.

After the yarn P has been caught under the gripper 66, the operator pushes the housing 2 to the rear position in which the drive of the carriers 41, 50 and of the combing cylinder 7 is switched on again, except for the sliver supply mechanism 9 which has been switched off via the detector 104.

During the displacement of the housing 2 to the rear position, the operator removes the yarn from the nip zone of the yarn take-off mechanism so that the yarn P is led outside the detector 104 and re-tilts the holder 99 into the operative position. Owing to the contact of the package 100 with the winding roller 97, the tension of the yarn rises in the section between the gripper 66 and the package 100. Due to this tension, the detector 104 will operate again and sets the sliver supply mechanism 9 in operation, so that fibres are continuously conveyed again to the combing cylinder 7.

As the tension of the yarn P rises, its end portion slips off the gripper 66 and advances on the perforated surface 60 over the yarn building region while its open end, in its way to the yarn withdrawing opening 64, is twisted by the surfaces 59, 60 in such a manner that the fibres continuously supplied to this region, wrap up onto said open end and are twisted in. Simultaneously, the yarn is introduced, either by hand or by means of a known inserter (not shown), into the nip zone of the yarn take-off mechanisms 5 whereupon the spinning process normally continues.

To ensure the continuous yarn spinning-in process it will be necessary to precisely select the length of yarn to be retained by the gripper 66, relative to the yarn take-off speed, yarn count and twist number (tpi).

After the yarn has been spun in, the spinning process is monitored by the detector 104 up to the instant at which, for some, rarely occurring reason, the yarn breaks. In such a case the detector 104 switches off, via the control unit 102, the electromagnetic clutch 105 whereby the fibre supply to the combing cylinder 7 is stopped.

When remedying a thread breakage, the yarn is introduced into the gripper 66 either manually or by suitable means of an automatic spinning-in device.

When the spinning machine stops, simultaneous thread breakages in all the spinning units occur. Before restarting the machine, said simultaneous thread breakages can be remedied either one after the other by hand, which is time-consuming, or by means of a suitable mechanism for a simultaneous spinning-in process.

Automatic devices for either individual or simultaneous spinning-in are known and used in open-end rotor spinning machines so that the application thereof to the apparatus of the invention is obvious.

Figure 8 shows a schematic perspective view of the apparatus for carrying out the process of spinning according to the invention, comprising the outer carrier 41 having the surface 59, the inner carrier 50 having the surface 60, the wedge-like gap 62 provided between said surfaces 59, 60, and the supply duct 25 for supplying the fibres 116 to the perforated surface 60. The yarn P being produced is twisted in the direction of arrow 117. The subatmospheric pressure produced in the cavity of the inner carrier 50 is indicated by arrows 118.

When confronting the present invention with prior art it has been ascertained that a tangential plane 119 drawn to the surface 59 in an element line 120 constituting an intersecting line of the surface 59 with a radial plane 121 extending through the narrowest space 122 between the surfaces 59, 60, lies beyond the wedge-like gap 62. If meeting this condition, any slippage between said surfaces 59, 60 is practically negligible.

Thus for example in a known apparatus having a pair of sucking drums with parallel axes of rotation, a tangential plane in an element line of the drum, which line is an intersecting line of the radial plane with the peripheral surface of the drums, said radial plane being drawn through the narrowest spacing between the surfaces of the sucking drums, passes directly through the wedge-like gap.

Figures 8 to 12 are schematic perspective views of spinning mechanisms with variously shaped carriers 41, 50 of the respective surfaces 59, 60. In the first embodiment depicted in Figure 8 the surfaces 59, 60 are cylindrical. The carrier 41 is embodied as the hollow cylinder 42 and the carrier 50 as the hollow cylinder 51. In this embodiment, the peripheral velocity of the surfaces is the same in the entire region of the wedge-like gap 62 in which the yarn P is produced.

If at least one of the surfaces 59 and 60 rotates at a peripheral velocity that is not the same within the entire yarn building region, there is produced yarn somewhat distinguishing from conventional yarns.

Such conditions can be complied with, for instance, in that at least one of the carriers 41, 50 of the respective surfaces 59, 60 is embodied as a conical surface. Thus the course of peripheral velocity within yarn building section can be adjusted in such a manner that the peripheral velocity of at least one of the surfaces 59, 60 progressively increases in the yarn withdrawal direction, i.e. in the direction of the successive yarn production (Figures 9, 11). The yarn produced under these conditions possesses particular properties; while the yarn core is less twisted and more voluminous, the yarn surface is relatively smooth. An opposite result can be analogously achieved in that the peripheral velocity with the yarn building section decreases in the yarn withdrawal direction (Figure 10).

In the last mentioned case the yarn surface is more voluminous and hairy whereas its core is more twisted and stronger. The two yarn types can be used for manufacturing some special textile products. A common advantage of the two preferred respective embodiments is in the fact that a difference in peripheral velocity of one of the surfaces over the other one gives rise to a favourable moment of yarn end revolution so that no slippage between the yarn and the surfaces occurs.

Figure 8 shows the embodiment comprising the carriers 41, 50, the two respective surfaces 59, 60 of which are cylindrical. The outer carrier 41 is embodied as the hollow cylinder 42 and the inner carrier 50 as the hollow cylinder 51.

Figure 9 shows the embodiment wherein the surface 59 of the carrier 41 is cylindrical whilst the surface 60 of the carrier 50 is conical. The carrier 50 is embodied in this case as a frustrum of a hollow cone 123. Subatmospheric pressure produced in the cavity of the perforated carrier 50 is indicated by arrows 118.

Figure 10 shows the embodiment wherein both surfaces 59, 60 of the carriers 41, 50, respectively, are conical. The carrier 41 is embodied as a frustrum of a hollow cone 124 and the carrier 50 as the frustrum of the hollow cone 123.

Figure 11 shows the embodiment having the carrier 41 the surface 59 of which is provided on the frustrum of hollow cone 124, and the carrier 50 the surface 60 of which is provided on the hollow cylinder 51. Subatmospheric pressure produced in the cavity of the perforated carrier 50 is indicated by arrows 118.

Figure 12 shows the embodiment wherein the surface 59 of the outer carrier 41 is cylindrical while the carrier 50 is embodied as an endless belt 125 on which the second surface 60 is provided. The direction of movement of the endless belt 125 guided by a guide bar 126 and encircling two guide rolls 127, 128 of which one is positively driven, is indicated by arrow 129. The carrier 50 can be supported and driven by using any well-known means thereto, without any technical problems.

In this case, the surface 59 of the carrier 50 is perforated (not shown) while the surface 60 of the carrier 50 is not perforated. The fibres 116 are supplied through the supply duct 25 to the perforated surface 59 which, in the wedge-like gap 62 is exposed to a subatmospheric pressure indicated by arrows 130. In practice, such embodiment is feasible by providing a sucking-off conduit in the wall of the housing 4 and by connecting it to a subatmospheric pressure source.

An advantage of the last-mentioned embodiment residues in a better possibility of producing various shapes of the wedge-like gap. Thus for each particular fibrous material, the shape of the wedge-like gap 62 can be optimalized so as to eliminate slippage of the yarn being built between the surfaces 59, 60. The shape of the wedge-like gap 62 can be e.g. established by selecting an appropriate form of the guide bar 126 which may be made adjustable, swingable, or exchangeable.

It appears from Figures 8 to 12 that fibrous material is supplied to the cavity of the carrier 41 in counterdirection relative to the yarn withdrawal from the wedge-like space 62; an angle included by the axis of the supply duct 25 (not shown) and the axis of the carrier 41 is acute, or at the most null. However, the yarn P is always taken off in the direction of an imaginary extension of the wedge-like gap 62.

An exemplary embodiment of spinning unit according to the present invention is one of many solutions which all endeavour to optimalize the conditions for spinning yarn in a wedge-like space of the spinning mechanism without any slippage.

The essential feature of the invention resides in that fibres are twisted in the wedge-like gap by means of surfaces of which one, relative to yarn building region, is convex and the other concave. Such essential feature can be applied to various constructional embodiment of the spinning mechanism, one of which is described and illustrated in the drawings. Some of the constructional solutions can distinguish from one another in the embodiment of the fibre supply from the fibre separating device to one of the two frictional surfaces which twist the fibres being accumulated in the wedge-like gap, to yarn which is continuously withdrawn. The wedge-like gap in the mouth of which the yarn is produced by a pair of surfaces from fibres being fed by the perforated one by twisting and wrapping them onto the open end of the continuously withdrawn yarn, is embodied according to the invention in such a manner that the rotary carrier of one surface is received in the rotary carrier of the other surface, which construction substantially distinguishes from prior art wherein such wedge-like space is provided between external surfaces of two rotary carriers.

As hereinbefore set forth, it has been ascertained that the formation of the spun yarn can be positively influenced by defining, on the perforated surface of the inner carrier 50, and more particularly in the region of the wedge-like gap 62, suction effect zones.

For the yarn rolling process in the mouth 62' of the wedge-like gap 62 it is preferable, and particularly if coarse yarn types are to be spun, to limit, upstream said mouth 62', the sucking effect onto a narrow area 132 and thus to increase a torsional moment acting upon the yarn P in the yarn twisting zone. Such a torsional moment increase can be attained by suppressing the yarn influencing sucking effect in the region downstream the mouth 62' in the direction toward the apex of the wedge-like gap 62.

In the cavity of the inner carrier 50 (Figure 13) there is received a baffle member 133 designed for defining the sucking effect on the perforated surface of said inner carrier 50. Such baffle member 133 is embodied, for example, as a tubular body 134 housed in the cavity of the inner carrier 50, a not shown flange of said body 134 being secured e.g. by screws to the lateral side of the bushing 26. In said tubular body 134 which forms a part of a cylindrical surface there is provided an axial slot 135 defined by a front edge 136 and a rear edge 137 which edges define on the perforated surface of the inner carrier 50, upstream the mouth 62′ of the wedge-like gap 62 the narrow area 132 on which the sucking effect is produced (Figure 13).

The rear edge 137 of the tubular body 134 is situated in the region corresponding, on the perforated surface, to the mouth 62′ of the wedge-like gap 62. The working width of the axial slot 135 corresponds to a central angle of about 20°. Lateral walls 138, 139 of the axial slot 135 appropriately converge in the direction toward the outer surface of the tubular body 134.

Figure 14 shows another exemplary embodiment of the baffle member 133 formd as a segment body 140 bearing, in a contactless manner on an inner wall 141 of the perforated surface of the inner carrier 50 in such a way that the sucking effect on this area from the mouth 62′ of the wedge-like gap 62 in the direction to its apex 142 is null. However, the sucking effect manifests itself in this case at full extent within the entire portion of the perforated surface, corresponding to the mouth of the neck 27 of the bushing 26, in which portion the supplied fibres are deposited and accumulated.

Further it is preferable that the sucking effect, also in the fibre depositing and accumulating zone around the periphery of the inner carrier 50, may successively grow from the start of said fibre depositing zone up to the narrow area 132 on which the full sucking effect pevails. In this way, it is ensured that even fine short fibres are duly deposited onto the perforated surface of the inner carrier 50 so that such fibres cannot fly off through perforations 52 since in that zone of the perforated surface of the inner carrier 50 where the fibres begin to be deposited, the sucking effect is small. As the layer of fibres successively grows, due to the fibre accumulation on the perforated surface, such layer should preferably adhere more firmly to said perforated surface, due to a higher sucking effect, the fibres thus being prevented by said fibre layer from flying off.

An exemplary embodiment of the baffle member 133 serving to this purpose is shown in Figure 15. The tubular body 134′ is constituted by a wall 143 of a cylindrical surface merging into a wall 144 extending in the arcuate shape to the interior of the tubular member 134′. The axial slot 135 is defined by the front edge 136′ and the rear edge 137′. From the start of the fibre depositing and accumulating zone on the perforated surface of the inner carrier 50 toward the front edge 136′, the wall 144 extends away from the inner wall 141 of said perforated surface in such a way that the sucking effect in the corresponding zone of said perforated surface rises to a sucking effect value which, however, is smaller than that of the full sucking effect on the narrow area 132 formed upstream the mouth 62′ of the wedge-like gap 62. Figure 15 also shows the course of the sucking effect S on the cross sectional area of the inner carrier 50 and the baffle member 133 in the section *a* and the section *b* which latter corresponds to the narrow area 132.

When processing various fibrous materials differing from one another in staple length and fibre titre, it is preferable that the sucking effect along the perforated surface of the inner carrier 50 be not uniform or even but that may rise in the yarn take-off direction.

It, therefore, may be advisable to increase the sucking effect along the perforated surface to a certain value which further on is to be kept constant. However, if processing some fibre types, and particularly in case of fine fibre types, it is preferable, in order to obtain better yarn structure, to make the sucking effect grow in a wavy course.

Figure 16 schematically shows an exemplary embodiment of the inner carrier 50 designed to the purpose.

According to one alternative, the perforated surface of the inner carrier 50 having a length L, is divided into two fields *c* and *d* having each another density of perforation 52; such perforations having the same diameters are shown in the lower broken-off part of the perforated surface of the inner carrier 50. The density of perforations 52 in the first field *c* the length of which corresponds to the fibre depositing and accumulating zone on the inner carrier 50, evenly rises up to a value which, in the second field *d*, is constant, the length of the latter corresponding to the yarn twisting zone proper on the perforated surface of the inner carrier 50. Figure 16, below, shows, in a diagrammatic form, the quantity of the sucking effect S on the perforated surface of the inner carrier 50 along an elementary line (not shown); out of this diagram, a linear course of growth of the sucking effect S in the field *c* is clearly apparent. The sucking effect S rises in the field *c* up to value S_c which, in the second field *d*, is constant.

The qualitatively same effect can be obtained, according to another alternative, by providing perforations 52 having the same spacings but different sizes; in the first field *c*, the size of the perforations 52 successively grows up to a value which, in the entire field *d*, is constant. Such perforations 52 are shown in the upper broken-off part of the perforated surface of the inner carrier 50.

Figure 17 shows the inner carrier 50 having the baffle member 133 in the form as shown in Figure 15; such baffle member 133 enables the sucking effect S to grow in a travelling wave course. The tubular body 134' is provided in the field *c* with notches 145 designed for increasing the sucking effect S in the aforementioned travelling wave course.

Figure 17, below, shows, in a diagrammatic form, quantities of the sucking effect S on the perforated surface of the inner carrier 50 acting along an elementary line 147 passing through the notches 145.

Figures 18 and 19 show, respectively, sectional views taken along the lines XVIII-XVIII and XIX-XIX in Figure 17, said views being taken through the inner carrier 50 in the field *c*, and the variable course of the sucking effect S in the sections *a*, *b* of the perforated surface of the inner carrier 50, the section *a* being situtated within the region of the wall 144 and the section *b* within the region of the axial slot 135.

For the sake of simplicity, the section lines are drawn so as not to cut the perforations.

The possibility of displacing the baffle member 133 in the direction of double-headed arrow 146 (Figures 13 and 14) enables an appropriate adjustment of its position for yarn P of various counts. It is obvious that the zone of twisting fine yarn types is situated closer to the apex 142 of the wedge-like gap 62 than the coarse yarn twisting zone.

In operation, the fibres have adhered, due to the suction effect, to the surface 60 of the inner carrier 50 are carried toward the yarn formation zone where they are twisted to yarn P which, in this zone, i.e. in the mouth 62' of the wedge-like gap 62 is exposed to the action of diverse forces (Figure 13); the surface 59 acts upon the yarn P by a friction force F_1; the yarn portion opposite the apex of the wedge-like gap 62 is acted upon by the sucking effect S produced by subatmospheric pressure of air; the opposite yarn portion is not influenced any more by said sucking effect since the latter is annihilated by the baffle member 133. In the radial direction extending from the inner carrier 50, the fibres being twisted to yarn are moreover exposed to a centrifugal force F.

The fibres circumscribe a circular path along with the active surface of the inner carrier 50 from the fibre deposit line on the perforated surface thereof up to the yarn forming zone; they adhere to this surface due to the action of a sucking effect S which, in said yarn forming zone and further on, is annihilated by the baffle member 133 so that a centrifugal force action is allowed to fully manifest itself in that portion. Analogously, the surface 59 acts upon the yarn P by a force F_2.

The yarn is exposed to a torsional moment which is the sum of the moments of all the aforementioned forces, all the moments acting in the same direction.

The torsional moment can be expressed by the equation

$$M = \frac{D}{2} / \; F_1 + F_2 + S + F /$$

wherein D stands for yarn diameter. Spinning systems which are not provided with any baffle member for annihilating the sucking effect downstream the yarn forming zone, do not exhibit but a moment to be expressed by the equation

$$M = \frac{D}{2} / \; F_1 + F_2 /$$

An advantage of measures for annihilating the sucking effect downstream the yarn forming zone is also in the fact that the sucking effect S can be increased, for instance, in a relatively easy way by adjusting the subatmospheric pressure of air whereby the spinning technology can be optimalized for processing various types of fibrous material.

WHAT WE CLAIM IS:-

1. A method of spinning yarn comprising providing two rotary carriers respectively presenting convex and concave surfaces in confronting relationship with a wedge-like gap therebetween, rotating the carriers in such a manner that the convex and concave surfaces move in opposite directions through the gap, depositing onto one of the surfaces fibres continuously separated from a continuous supplied sliver and, by virtue of the movement of the one surface, conveying the deposited fibres towards the gap, wrapping up the fibres onto a created open yarn end rotating by contact with the two surfaces, and withdrawing the created yarn from the gap in the direction of an imaginary extension of the gap by means of a yarn take-off mechanism adapted to limit the propagation of twist in the yarn.

2. A method as claimed in claim 1, wherein the one surface is perforated and in the region where the one surface moves towards the gap a suction is applied through the perforations whereby to at least aid in depositing the fibres onto the one surface and in conveying the deposited fibres towards the gap.

3. An apparatus for spinning yarn, comprising two rotary carriers respectively presenting convex and concave surfaces in confronting relationship with a wedge-like gap therebetween, means for rotating the carriers in such a manner that the convex and concave

surfaces move in opposite directions through the gap, a mechanism for continuously separating fibres from a continuously supplied sliver and depositing the fibres onto one of the surfaces so that by virtue of the movement of the one surface, the deposited fibres can be conveyed towards the gap in which they can be wrapped up onto a created open yarn end rotating by contact with the two surfaces, and a yarn take-off mechanism for withdrawing yarn from the gap in the direction of an imaginary extension of the gap, the yarn take-off mechanism being adapted to limit the propagation of twist in the yarn.

4. An apparatus as claimed in claim 3, wherein one of the rotary carriers is an inner carrier and the other rotary carrier is an outer carrier in which the inner carrier is received.

5. An apparatus as claimed in claim 4, wherein the two surfaces are cylindrical surfaces.

6. An apparatus as claimed in claim 4, wherein the two surfaces are conical surfaces.

7. An apparatus as claimed in claim 4, wherein one of the surfaces is cylindrical and the other a conical surface.

8. An apparatus as claimed in claim 4, wherein the inner carrier is an endless belt presenting one of the surfaces while the other surface is a surface of revolution.

9. An apparatus as claimed in claim 4, wherein the surface presented by the inner carrier is perforated and is secured on a positively driven hollow shaft connected to a subatmospheric pressure source, and is mounted for rotation in a stationary bushing in which opens a duct for supplying fibres from a fibre separating device of the fibre separating and depositing mechanism, the bushing being provided with a longitudinal slot designed for demasking a region of the surface of said inner carrier where such surface is intended to move towards the gap.

10. An apparatus as claimed in claim 9, wherein the hollow shaft is mounted for rotation in a support wall provided on the housing of the fibre separating device.

11. An apparatus as claimed in claim 9, wherein the outer carrier is mounted for rotation in a cavity of a stationary casing, which casing is frontally shieldable by a support wall in which, opposite the wedge-like gap, a yarn take-off opening is provided.

12. An apparatus as claimed in claim 10, wherein the housing of the fibre separating device is mounted by means of its guide portion to reciprocate on the casing between a rear position in which the support wall masks the cavity of said casing, and a front position in which the bushing is uncovered.

13. An apparatus as claimed in claim 9, wherein the outer carrier is supported by a bearing passing through a neck of a casing.

14. An apparatus as claimed in claim 10, wherein a sealing ring is interposed between the support wall and a front edge of a cylindrical portion of a casing in which the outer carrier is mounted for rotation.

15. An apparatus as claimed in claim 10, wherein a labyrinth is interposed between the support wall and the front edge of the outer carrier.

16. An apparatus as claimed in claim 9, wherein a yarn end gripper is provided on the bushing as an extension of its longitudinal slot.

17. An apparatus as claimed in claim 4, wherein the surface presented by the inner carrier is perforated and in the cavity of the inner carrier there may be produced a subatmospheric pressure manifesting itself by a sucking effect on the perforated surface of said inner carrier, and a baffle member is received for localizing the sucking effect on said perforated surface.

18. An apparatus as claimed in claim 17, wherein the baffle member defines, on the perforated surface of the inner carrier upstream of the wedge-like gap, a narrow sucking effect field.

19. An apparatus as claimed in claim 17, wherein the baffle member is a tubular body having an axial slot defined by a front edge and a rear edge, said edges defining, on the perforated surface of the inner carrier upstream the mouth of the wedge-like gap, a narrow sucking effect field while a wall of said tubular body, from the start of the zone of depositing fibres onto the perforated surface of the inner carrier to the front edge of said body, extends away from an inner wall of said perforated surface in such a way that the sucking effect rises on the corresponding portion of the perforated surface up to a sucking effect value which is lower than the value thereof prevailing in the narrow field provided upstream the mouth of the wedge-like gap.

20. An apparatus as claimed in claim 17, wherein the baffle member is a segment adapted to bear upon the inner wall of the perforated surface of the inner carrier so that the sucking effect on the perforated surface, from the mouth of the wedge-like gap, is null in the direction toward the apex of said gap.

21. An apparatus as claimed in claim 17, wherein the perforated surface of the inner carrier is divided into two transverse fields having a different density of perforations having the same diameters while the perforation density of the first field corresponding to the fibre depositing and accumulating zone on the perforated surface of the inner carrier successively

rises up to a value which in the second field corresponding to the yarn twisting zone proper, is constant.

22. An apparatus as claimed in claim 21, wherein the perforation density of the first field rises in a linear course.

23. An apparatus as claimed in claim 21, wherein the perforation density of the first field rises in a travelling wave course.

24. An apparatus as claimed in claim 17, wherein the perforated surface of the inner carrier is divided into two transverse fields having the same perforation spacings while size of perforations in the first field corresponding to the fibre depositing and accumulating zone on the perforated surface of the inner carrier successively rises up to a value which in the second field corresponding to the yarn twisting zone proper, is constant.

25. An apparatus as claimed in claim 19 and in at least one of claims 21 and 24, wherein the wall of the baffle member is provided, in the region of the first field of the perforated surface of the inner carrier, with notches to raise the sucking effect on the corresponding zone of the perforated surface of the inner carrier in a travelling wave course.

26. A method of spinning yarn, substantially as hereinbefore described with reference to the accompaying drawings.

27. An apparatus for spinning yarn, substantially as hereinbefore described with reference to the accompanying drawings.

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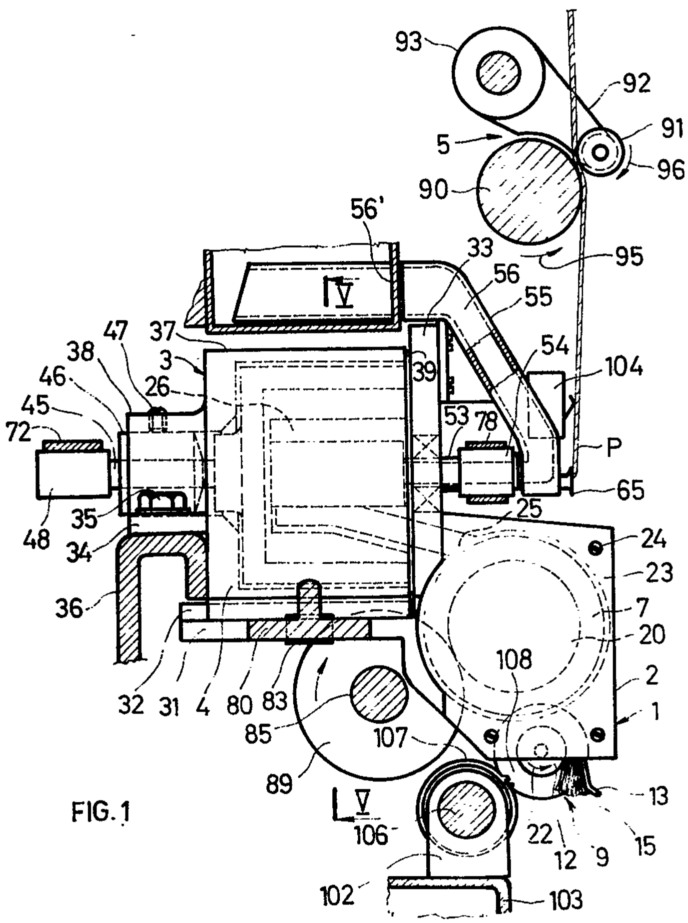
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FIG. 1

1599101 COMPLETE SPECIFICATION

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Sheet 2

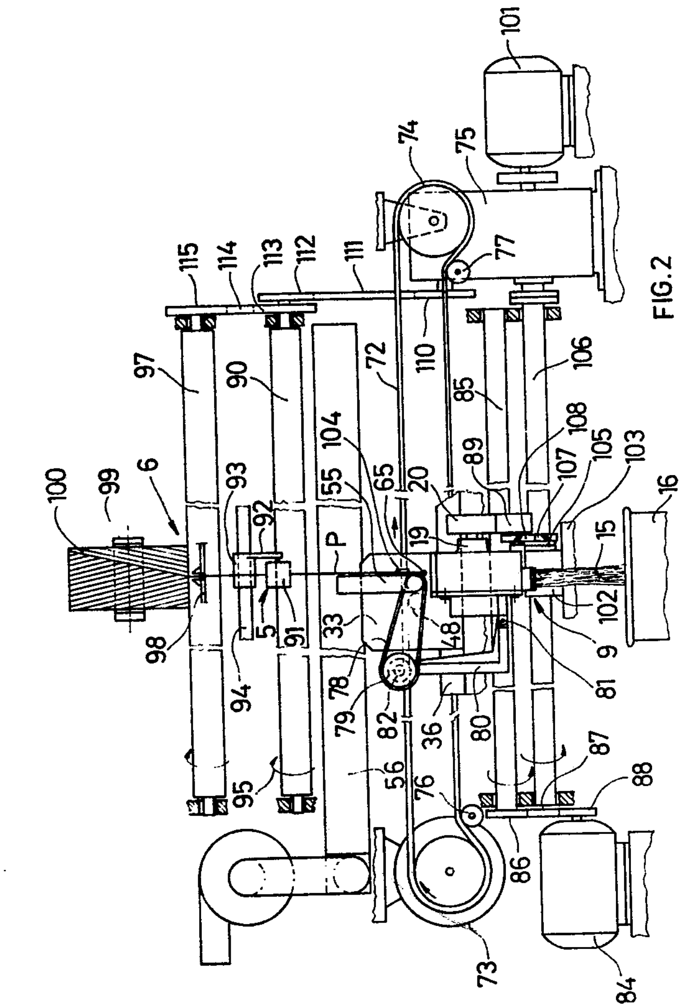

FIG.2

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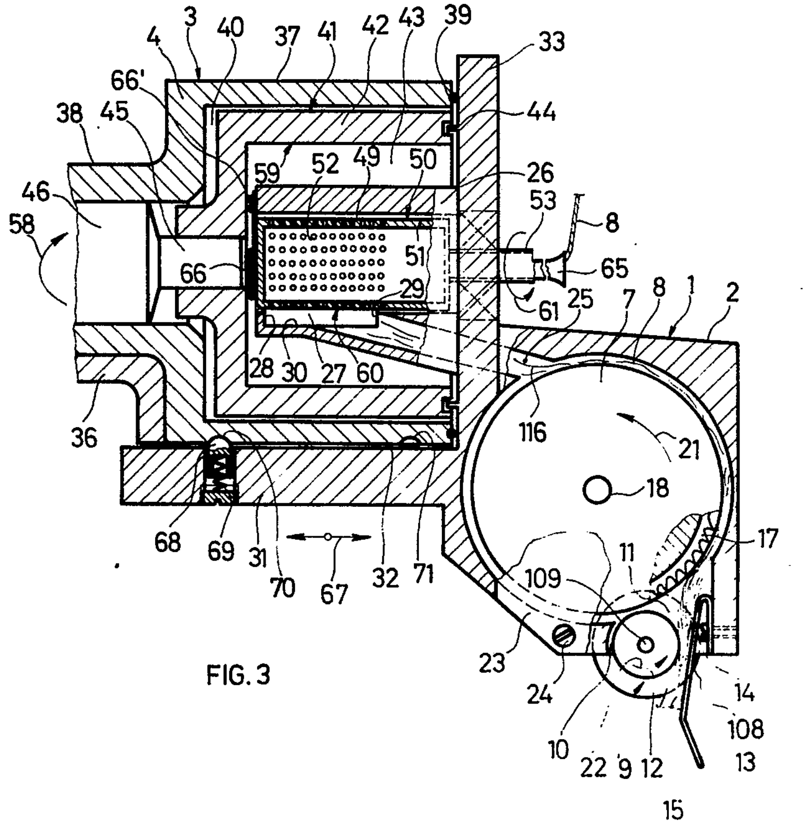

FIG. 3

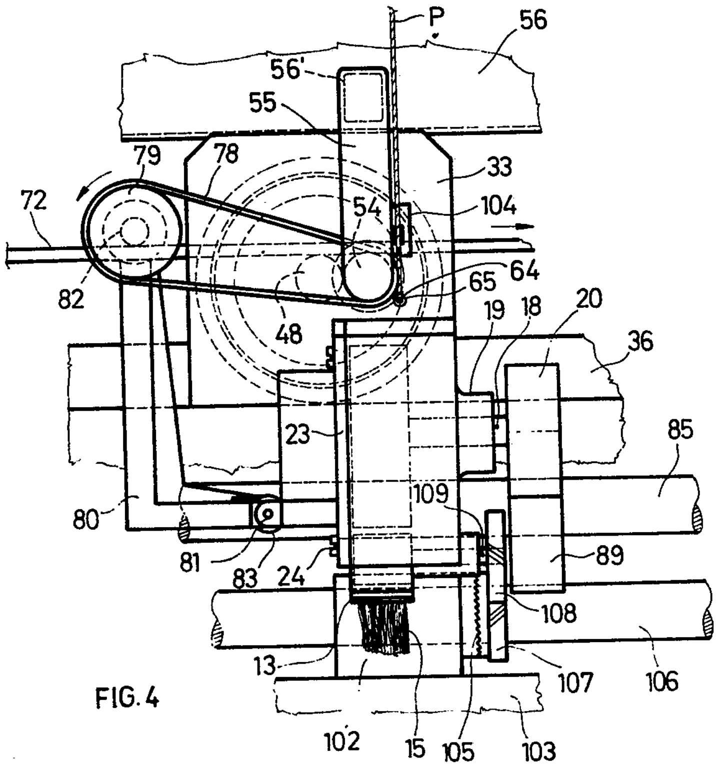
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FIG. 4

1599101 COMPLETE SPECIFICATION

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Sheet 5

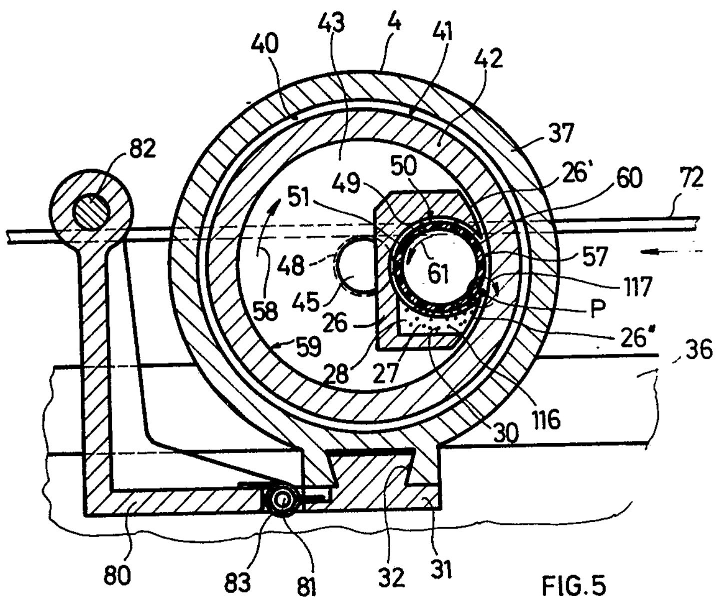

FIG.5

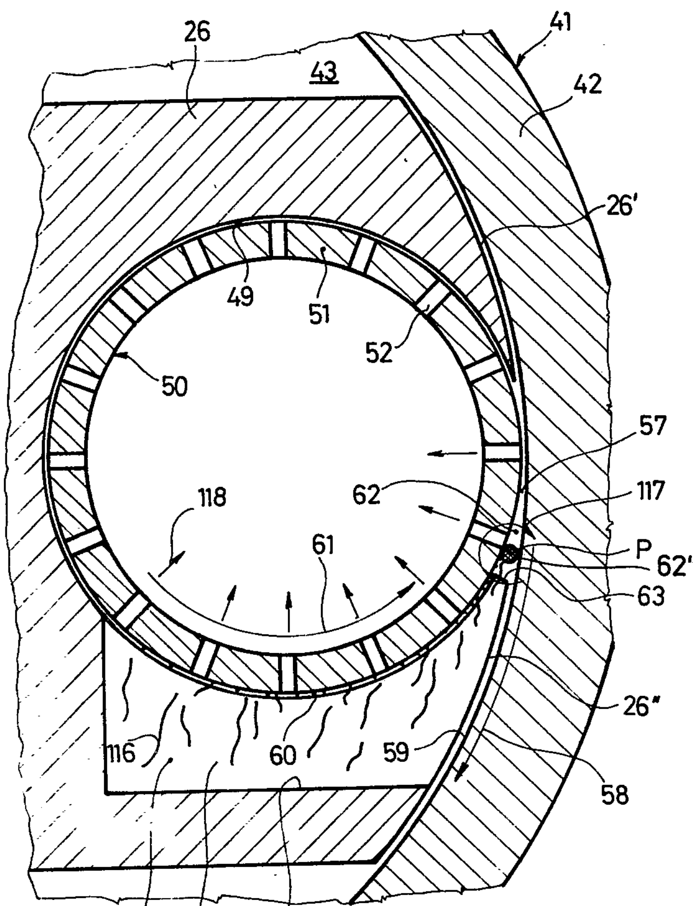
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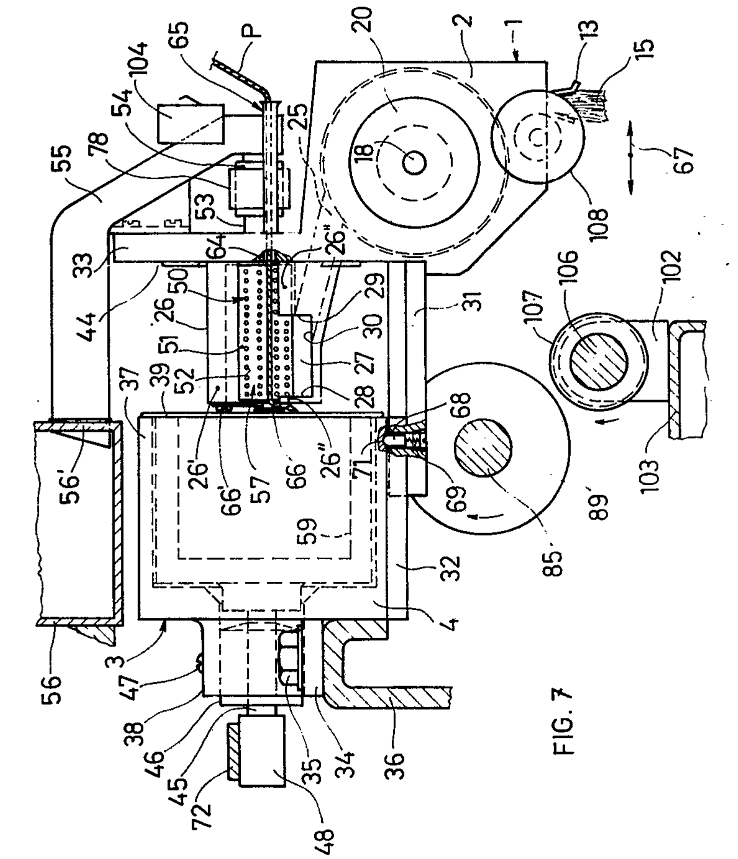
FIG.6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26'
66'
57
66
26"
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FIG. 7

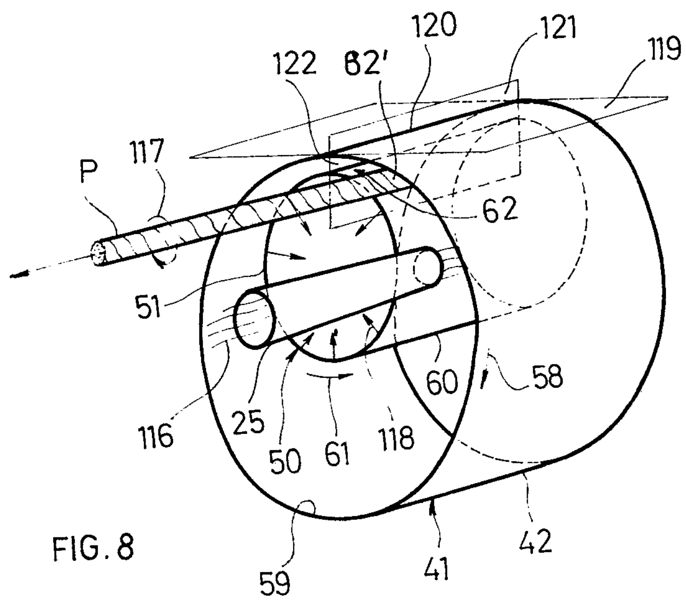

FIG. 8

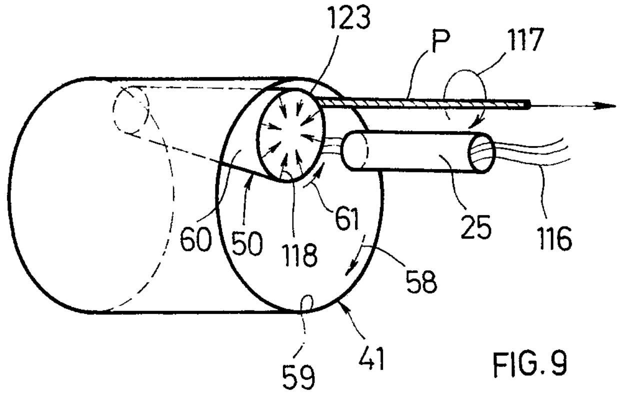
123
P
117
60
50
118
61
25
116
58
59
41

FIG. 9

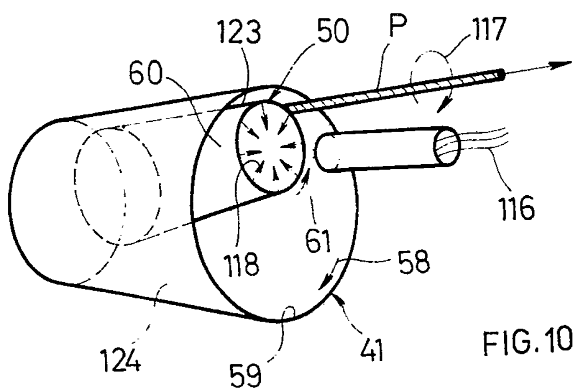
123
50
P
117
60
116
118
61
58
124
59
41

FIG. 10

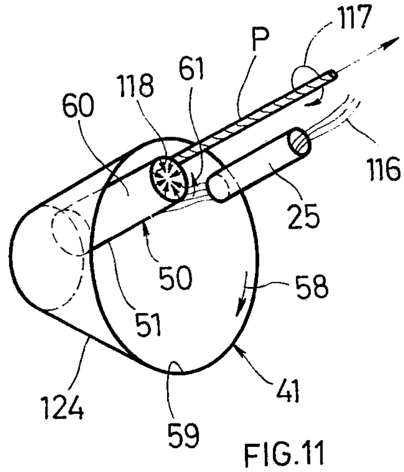
117
P
61
118
60
116
25
50
58
51
124
59
41

FIG.11

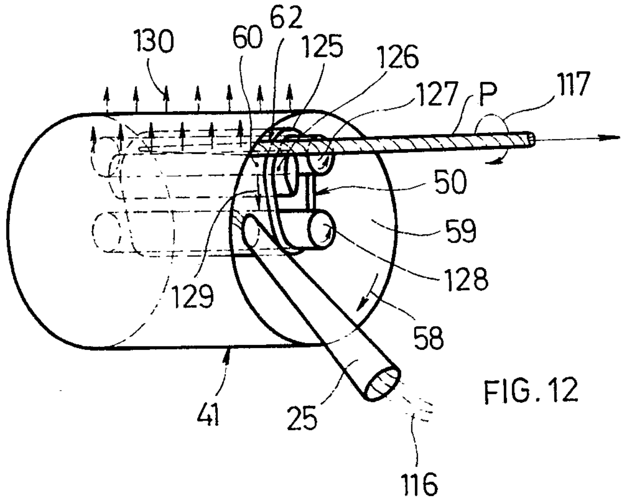
62
130
60
125
126
127
P
117
50
59
129
128
58
41
25
116

FIG. 12

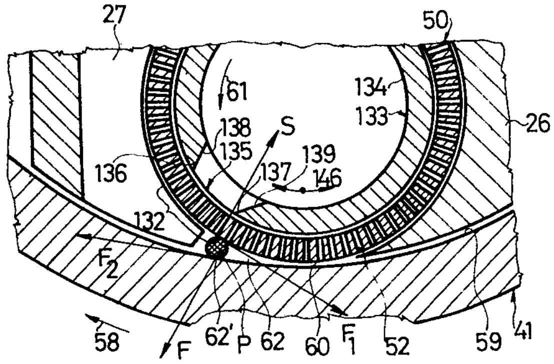
27
50
61
134
133
26
138
135
S
139
136
137
146
132
F_2
58
F
62'
P
62
60
F_1
52
59
41

FIG. 13

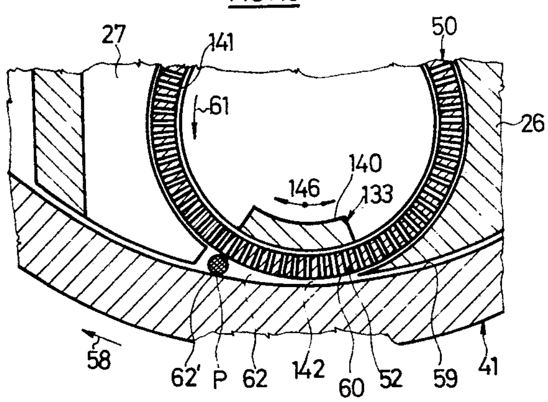
27
141
50
61
26
140
146
133
58
62'
P
62
142
60
52
59
41

FIG. 14

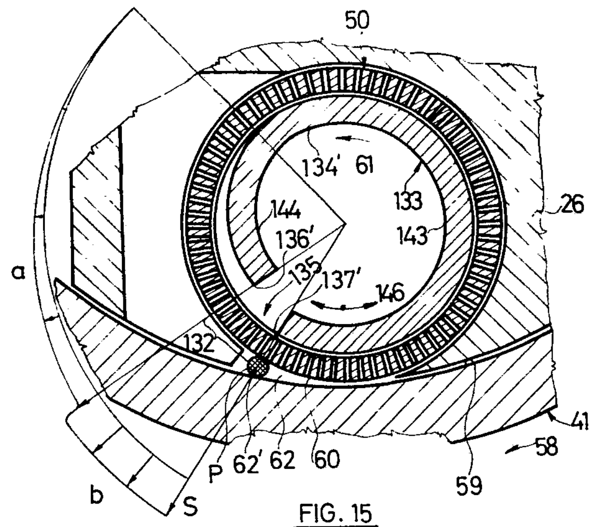
50
134'
61
133
26
144
136'
143
a
135
137'
146
132
41
58
P
62'
62
60
59
b
S

FIG. 15

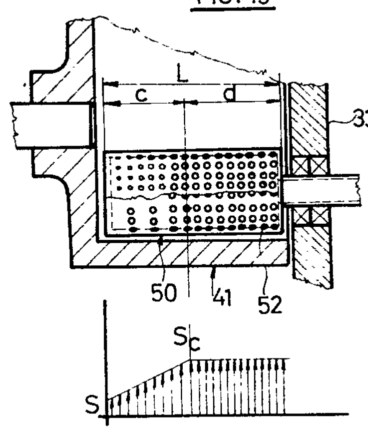
L
c
d
33
50
41
52
Sc
S

FIG. 16

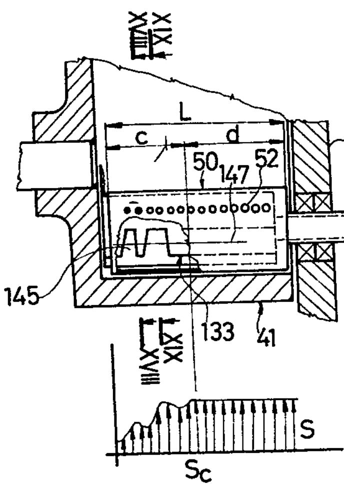

FIG. 17

FIG. 18

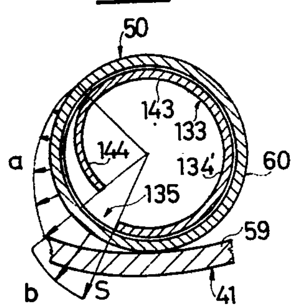

FIG. 19