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(54) Method and device for the manufacturing of an oblong object from a curable material

(57) The invention pertains to a method and a device for the manufacturing of an oblong object from a curable material, in which the material is forced into a mould (2) by means of a screw conveyor (7,22,23), the outer circumference of which corresponds with that of the object to be manufactured, whereby the mould (2)

moves along with the material forced into it. The mould (2) is provided with a slot (6) that extends in the longitudinal direction of the mould, which slot is shut-off by a stationary shut-off member (16) in the area directly following after the screw conveyor (7).

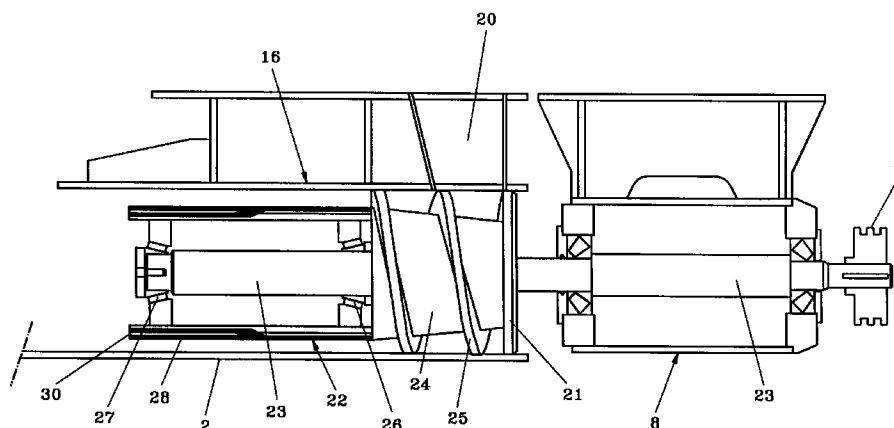


FIG. 3

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Description

The invention pertains to a method and device for the manufacturing of an oblong object from a curable material.

Such a method and device is known from the Swiss patent CH-A-96159. In this known course of things the screw conveyor forces the curable material into a stationary mould. Therewith a large friction force comes about between the curing curable material and the mould. When, for that reason, the length of the mould should be limited, it gives the disadvantage that the work speed is limited, because a minimal staying time in the mould is required to make the shape of the object sufficiently durable, as a result of which a lower work speed is permitted with a shorter mould.

In the International patent application WO 93/20990 a method and device is described for the manufacturing of oblong objects from a curable material, whereby the mould moves indeed, but not in the pressing direction, so that no solution is obtained for the indicated disadvantages. Moreover the shape of the manufactured object is affected by said movement.

To remove these difficulties the invention provides that the mould moves along with the material forced into it and is provided with a slot that extends in the longitudinal direction of the mould, after which the moulded object is taken from the mould and the mould is returned to the screw conveyor to receive and mould an object to be manufactured succeedingly.

The invention gives the possibility, that at the start of the manufacturing the mould is located at the side of the screw conveyor, which is opposite to the pressing direction. This procedure has the advantage, that the forcing out of the curable material can be done continuously. Because with an interruption of the forcing out the risk exists, that the conditions for the forcing out of said material or the time from which it is curable deviate mutually. As a result of which the optimum setting of the work speed would not be quite possible any more. Apart from that a continuous process always gives the highest possible work speed.

According to a further elaboration of the invention it is provided that the screw conveyor is driven by driving means which pass through the slot.

This gives the important advantage, that the driving of the screw conveyor, which preferably is located within the circumference of the mould, is not hampered by the mould, which often permits a more compact and easier construction of a device, with which the method is applied.

According to a further elaboration of the invention it is provided that, for the manufacturing of hollow objects, more in particular tubes, the screw conveyor is followed by a core and that the material is forced through between the mould and the core.

According to a preferred embodiment of the invention it is provided, that the slot is shut-off by a stationary shut-off member in the area following directly after the

screw conveyor.

The invention also provides for a device for applying the method, which, starting from a device that is provided with a screw conveyor, a material supply device for the conveyor and a mould to force the material into and to let it cure, is characterized in that the mould has a slot extending in the pressing direction and that means are provided to let the mould move in the pressing direction.

According to a further elaboration thereof it is provided that the device has a drive for the screw conveyor, which passes through the slot and is coupled to the screw conveyor.

Another elaboration of the invention provides that the screw conveyor is provided with a core extending in the pressing direction. This gives the possibility to manufacture hollow objects, in particular tubes. A considerable constructive simplification can be obtained if the core is coupled to the screw conveyor in the direction of rotation. Therewith it is also accomplished, that the manufactured object will not stick to the core, because a relative movement exists in between. It has to be taken into account, that various curable materials, like synthetic materials, wether or not provided with filling materials, shrink to some extent, which can lead to clenching to the core. Sticking to the core on the other hand is prevented by this phenomenon. In other cases a better handling can be obtained by friction reduction, by rotatably connecting the core to the screw conveyor.

In order to always permit the hollow object to shrink according to a further elaboration of the invention it can be provided that the core is provided with a covering, which can be impressed radially at least at the side directed away from the screw conveyor.

Such a covering can consist of a sleeve of for example neoprene, that is provided with axial openings at the side directed away from the screw conveyor, which have the shape of a triangle with an acute vertical angle, with the vertical angle at the side of the axis, the base near the outer surface and with an inclined position relative to the radius of the sleeve.

The invention provides for the possibility to adjust and control the pressing force of the curable material in a rather simple manner.

Accordingly a further elaboration of the invention provides that means are provided for to exert an opposite force on the mould, opposite to the pressing direction. For example this force may be derived from a piston-cylinder system, with an adjustable counter pressure, or from a braking or friction device, which also is preferably adjustable.

According to still a further elaboration of the invention the device is such that the screw conveyor is provided with a material supply which passes through the slot. This also gives the possibility, with regard to the supply of material to the screw conveyor, to let the supply take place through the mould without any obstruction.

The screw conveyor can have a helicoidal shaped

rib on a cylindrical or conical core. Naturally it is also possible that it is provided with a double or other plural screw.

However in order to distribute the force, exerted by the conveyor on the material delivered by it, evenly over the total circumference of its outlet, it can be provided that the screw conveyor at its outlet is provided with short pressure blades, having the direction of the helical line of the conveyor and which are distributed over the outlet gap of the conveyor.

The invention is elucidated in the following on hand of the drawing, in which an example of an embodiment is shown with the objects to be manufactured being tubes with the same length as the moulds and which are not provided with connecting sockets or the like. However it will be clear, that the invention is not restricted thereto and also comprise the manufacturing of solid objects, such as piles, and is suitable for the manufacturing of poles and tubes with a larger length than that of the mould and that at the end of a manufactured object a variation from the sectional shape is possible, such as a connecting socket.

In the drawing:

fig.1 shows a top view of a device according to the invention;

fig.2 shows a section through a part of fig.1 over the line II-II;

fig.3 shows a view of fig.1, and

fig.4 shows a detail of the screw conveyor.

In fig.1 four moulds are indicated with 1,2,3 and 4, which consist of a cylindrical surface part 5 and a slot or slit 6, which takes up for example 95° of the circumference of the circle. The mould 1 with its left end is held against the right end of mould 2, after it is moved from the drawn position to the left.

The mould 2 embraces with its right end a conveyor screw 7, which is driven through a thrust bearing 8 by a pulley 9. This pulley has such a diameter, that the driving belt or rope for said pulley is not obstructed by the mould, such as 1. As a result of which it is possible to drive the conveyor screw close to the bearing 8 and to move moulds from the left to the right around the conveyor screw at the same time.

After the mould 2 has reached the position indicated with 2', it is moved in transverse direction to the location of mould 3. In the mean time mould 1 is being moved to the location of mould 2.

At the location of mould 3 a further curing takes place first. However when a next mould is to be moved to the location of mould 3, that position has to be free. This can be done by moving the mould at that location to the location of mould 4, whereby it is possible to hold the moulded tube located in the mould and to have it move sideways till in the location of tube 10. Of course it is also possible to let the tube cure in the mould until the mould has to be moved to the location of mould 1. In that case the mould has to be pulled from the tube and

the tube has to be moved away. If longer curing times are required it is possible to provide a store for moulds at the location of mould 3 and to remove the tubes from the moulds only then when they have occupied the last place in that store.

Fig.2 shows schematically a section over the line II-II of fig.1. Again the mould 2 is visible, with the slot with an angle of aperture of 95° . The mould 2 is stiffened with welded on angular beams 11, which are welded to the end plates 12. Each welded on angular beam is provided with one or more sliding or friction members 14, which are supported by guides 15. These guides 15 are mounted in the H-beams 13 that extend in the longitudinal direction of the device. A shut-off plate for the slot 6 is indicated with 16, which is supported by an upper frame 17.

The upper frame 17 also carries a feed funnel 18, provided with a conical screw conveyor (not shown), with a driving motor 19. From there a supply 20 goes to the slot 6 in the mould 2. As can be seen, the supply 20 passes through the slot 6, so that the supply to the screw conveyor is not obstructed by the moulds, such as 2. The tube depicted in fig.2, which here also is indicated with 10, is shut-off directly after the supply 20 by a shut-off plate 21. Consequently a tube such as 10 is bounded externally by the mould, such as 2, and a shut-off plate 21. When the mould in fig.1 moves further to the right it passes the end of the shut-off plate 21, but at that time the curing has advanced to such an extent, that the circular shape can be maintained.

In fig.3 on a larger scale than in fig.1 the driving pulley 9, thrust bearing 8, conveyor screw 7 and the core 22 carried by it are shown. The thrust bearing 8 is carried by the upper frame 19 (vide fig.2). The conveyor screw by means of axis 23 is fixedly connected to the pulley 9. The conveyor screw 7 has a conical inner body 24 with a helical member 25. Through bearings 26 and 27 freely rotatable with respect to the inner body 24 the core is connected to that body. This core supports at its outer circumference a sleeve 28, which at its surface directed away from the screw conveyor is provided with openings with the mouths at its head face. This part being relatively highly resilient as a result thereof, so that it can give way in inward direction, in case the tube shrinks during the curing thereof.

Fig. 4 shows an axial view of the end of the screw conveyor. The end of the inner body is indicated with 32 and the front face of the core with 31. The sector 33 depicts the end of the helical line 25. In order to homogenize the force exerted by the conveyor screw over the whole circumference of the ring 32, a second helical line 34 is welded to the inner body, which diametrically opposite the end 33 of helical line 25 exerts a thrust on the mass to be compressed. As a matter of course more of such helical line ends can be distributed over the circumference of 31. The homogenization of the pressure achieved by this measure not only gives a more regular thickness of the moulded tube, but with the increase in pressure made possible, also to a better curing and the

possibility to use less binding agent in for example a mixture of filling materials and a binding agent on base of a synthetic material, more in particular a synthetic resin.

Claims

1. Method for the manufacturing of an oblong object from a curable material, in which the material is forced in a mould by means of a screw conveyor, the outer circumference of which corresponds with that of the object to be manufactured, whereby the material cures sufficiently in said mould to be lifted from the mould, **characterized in that** the mould moves along with the material forced into it and is provided with a slot that extends in the longitudinal direction of the mould, after which the moulded object is taken from the mould and the mould is returned to the screw conveyor to receive and mould an object to be manufactured succeedingly. 5 10 15 20
2. Method according to claim 1, **characterized in that** the screw conveyor is driven by driving means which pass through the slot. 25
3. Method according to claim 1 or 2, **characterized in that** the object to be manufactured is hollow, whereby the screw conveyor is followed by a core and the material is forced through between the mould and the core. 30
4. Method according to claim 1-3, **characterized in that** the slot is shut-off by a stationary shut-off member in the area directly following after the screw conveyor. 35
5. Device for applying the method according claims 1-4, provided with a screw conveyor, a material supply device for the conveyor and a mould to force the material into and to let it cure, **characterized in that** the mould has a slot extending in the pressing direction and that means are provided to let the mould move in the pressing direction. 40
6. Device according to claim 5, **characterized in that** it is provided with a drive for the screw conveyor, which passes through the slot and is coupled to the screw conveyor. 45
7. Device according to claim 5 or 6, **characterized in that** the screw conveyor is provided with a core extending in the pressing direction. 50
8. Device according to claim 7, **characterized in that** the core is coupled to the screw conveyor in the direction of rotation. 55
9. Device according to claim 7 or 8, **characterized in that** the core is provided with a covering, which can

be impressed radially at least at the side directed away from the screw conveyor.

10. Device according to one or more of claims 5-9, **characterized in that** means are provided for to exert an opposite force on the mould, opposite to the pressing direction.
11. Device according to claim 10, **characterized in that** the means exerting the opposite force comprise a piston-cylinder system, with an adjustable counter pressure.
12. Device according to claim 10, **characterized in that** the means exerting the opposite force comprise friction members with an adjustable friction force.
13. Device according to claims 5-12, **characterized in that** the screw conveyor is provided with a material supply which passes through the slot.
14. Device according to one or more of claims 5-12, **characterized in that** the screw conveyor at its outlet is provided with short pressure blades, having the direction of the helical line of the conveyor and which are distributed over the outlet gap of the conveyor.

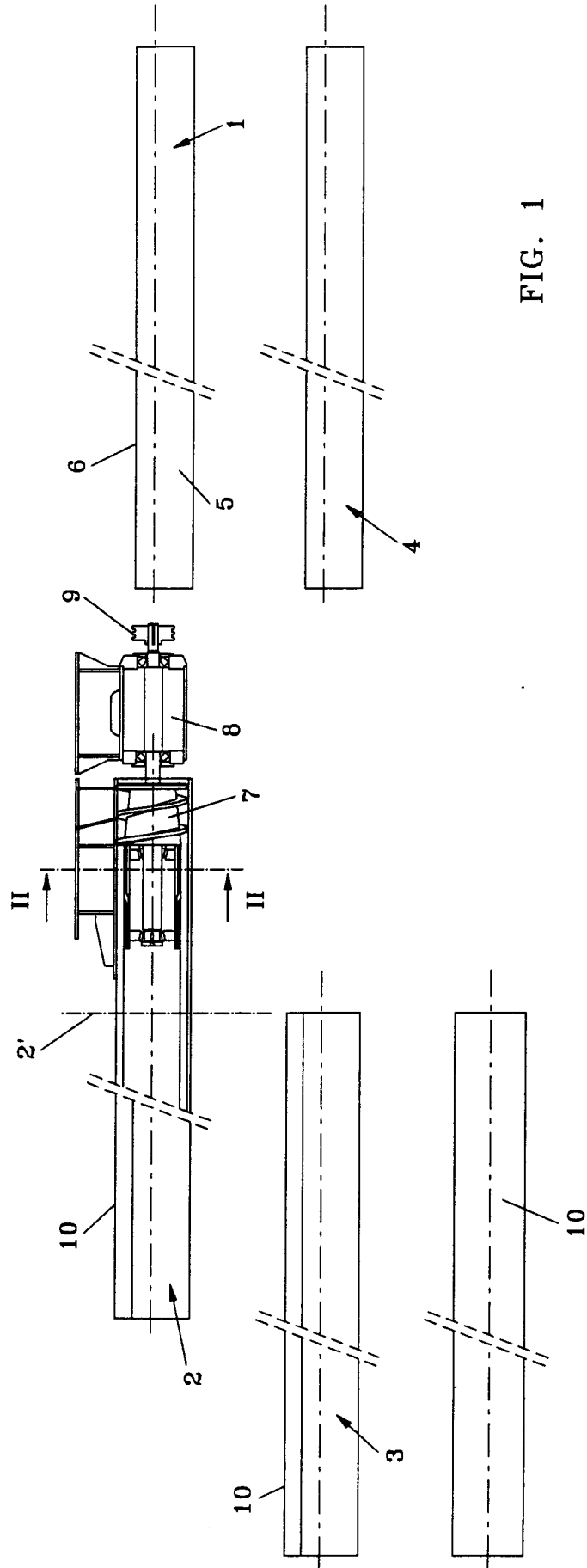


FIG. 1

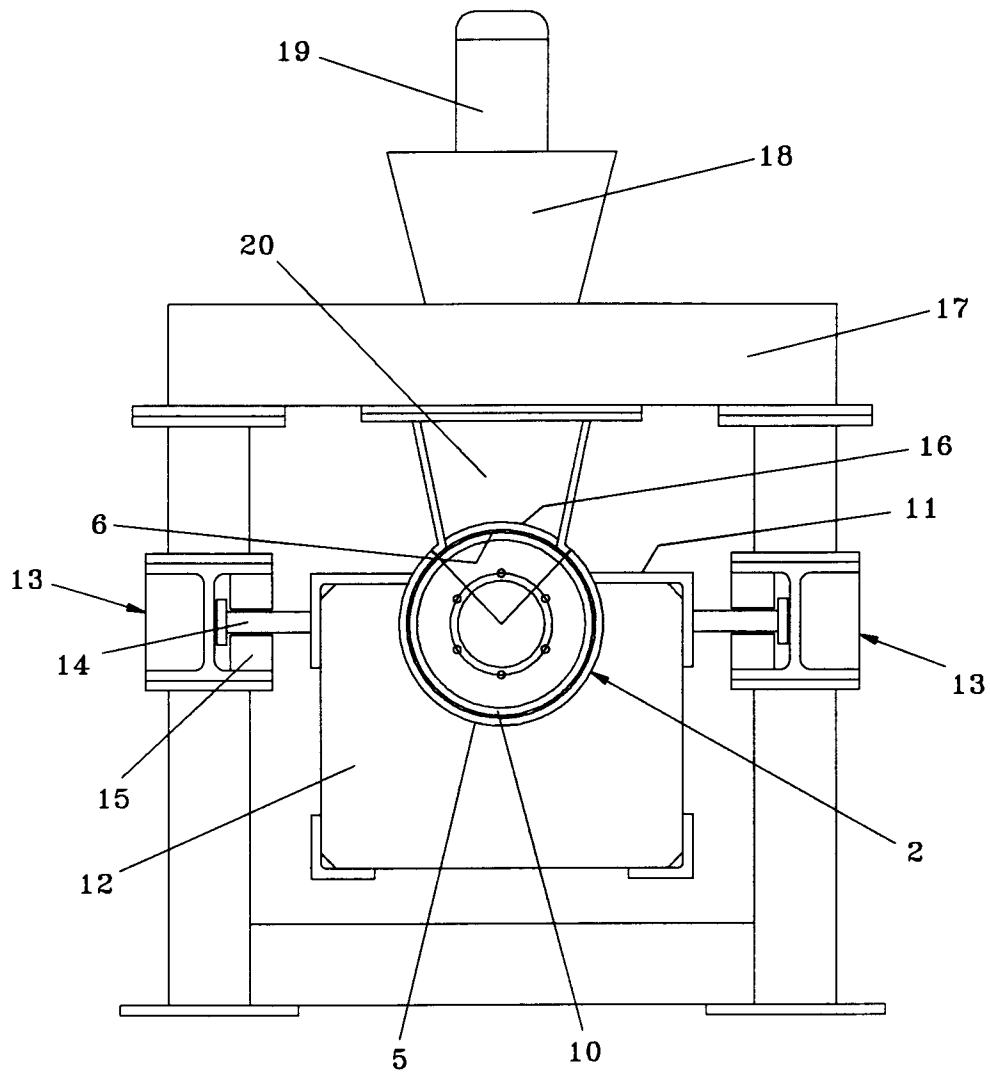


FIG. 2

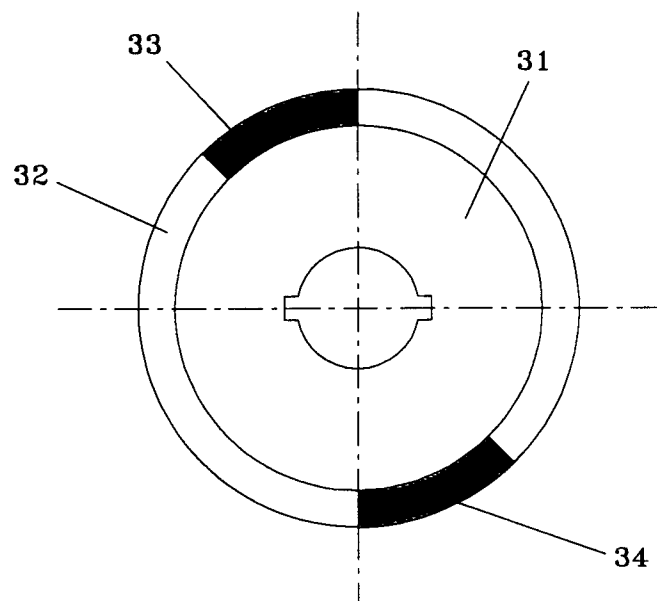


FIG. 4

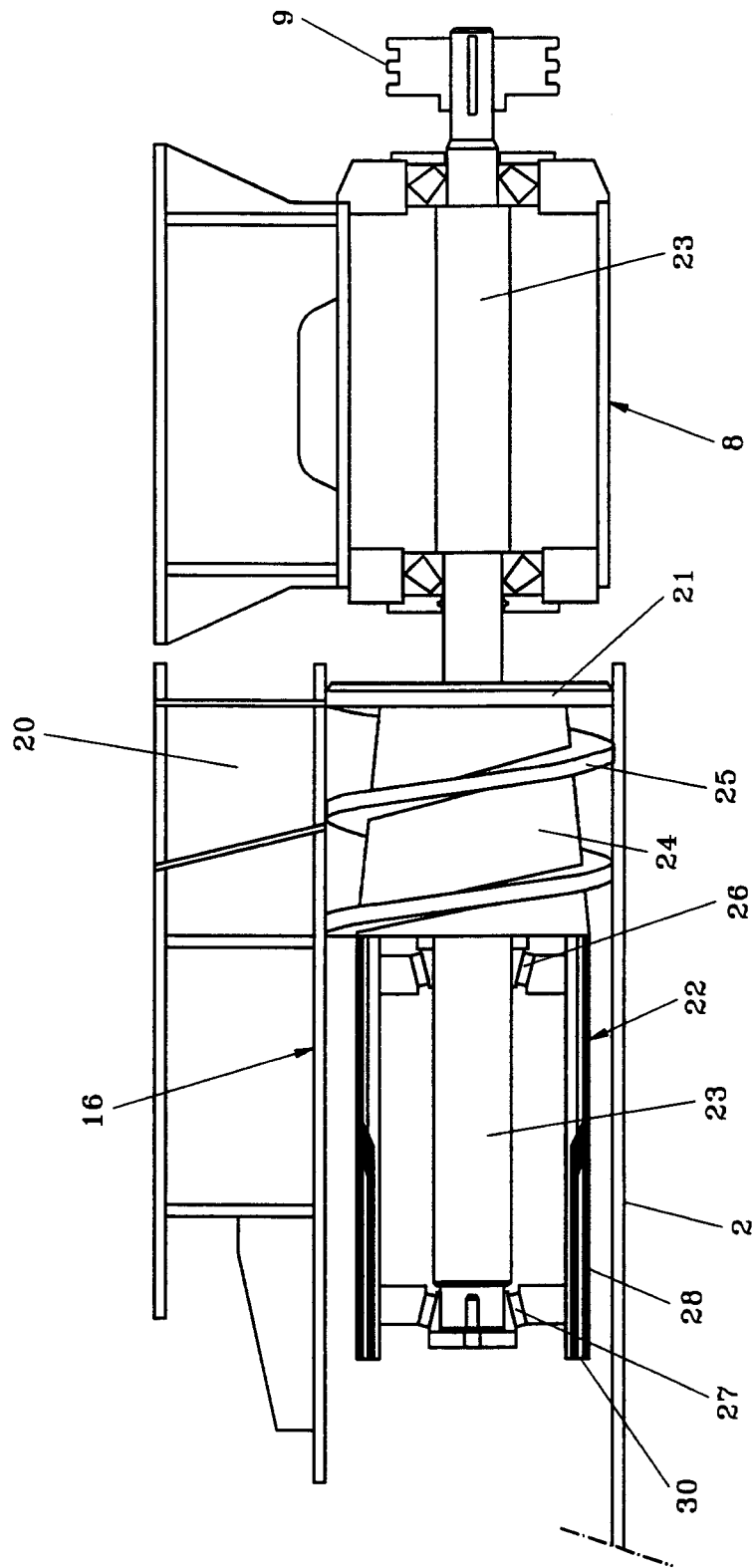


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 3049

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 309 328 A (PARMA OY) * column 3, line 65 - column 5, line 32; figure 1 *	1,5	B28B21/06 B28B21/52
A	--- US 1 539 303 A (G. C. DEBAY) * the whole document *	1,3,5,7	
A	--- US 1 858 956 A (H. HEPPERLE) * page 1, line 71 - page 1, line 84 * * page 1, line 94 - page 2, line 61 * * figures 1-3 *	1,3,5,7, 10-12	
A	--- FR 2 450 677 A (J. A. MAYRL) * the whole document * -----	1,3,5,7, 9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B28B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		3 February 1997	Gourier, P
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