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(54) Fast-cutting device in a machine for packaging in a film of plastic material

(57) A fast-cutting device in a machine for packaging in a film of plastic material, in said machine there being provided at least two pairs of rollers (12, 13) for feeding a film (11) towards a packaging area, between the two pairs of rollers (12, 13) there being provided a cutting assembly (14, 15, 16) which acts crosswise on the film (11), in said device the cutting assembly (14) comprising at least one blade (15) rotating in the operating phase around a shaft (25) caused to rotate by a gearing system designed to convert a uniform rotation at input into a variable rotation at output (27, 28), being selectively driven by a motor (18) for unrolling the film with interposition of a brake-clutch assembly (22). The said gearing system may be a transmission with elliptical gears (27, 28). In addition, a counterblade (16) may be provided that rotates in the operating phase together with the blade (15) around a shaft (26).

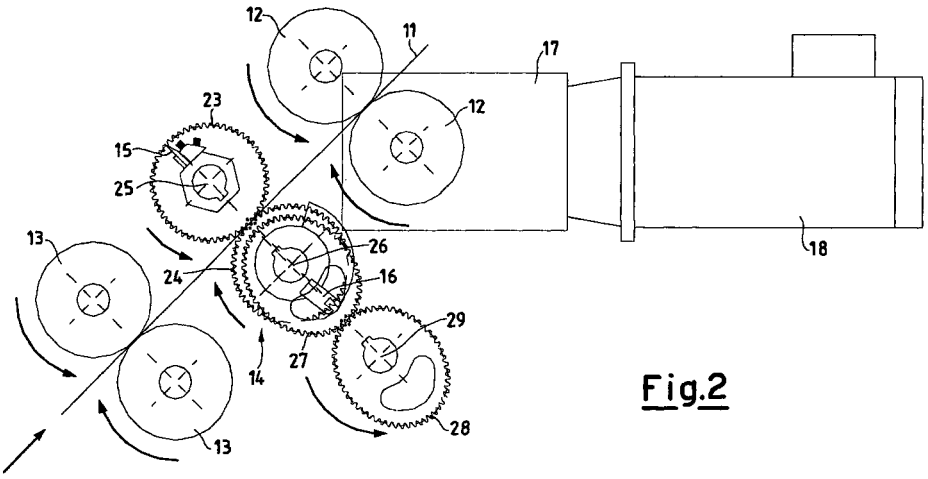

Fig.2

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Description

[0001] The present invention refers to a fast-cutting device in a machine for packaging in a film of plastic material, in particular in a bundling machine.

[0002] In machines for packaging products in a film of plastic material, the film is unrolled continuously and fed towards the packaging area proper, where it receives the product and/or products to be packaged and is wrapped around them.

[0003] In general, the film is cut to the necessary extent by a blade, or else by a blade and counterblade that act on the film. In addition, for appropriate cutting to be obtained there must be a certain ratio between the speed of the periphery of the blade and the speed of feed of the film.

[0004] In some known packaging machines, the movement of the blade and counterblade, where the latter is present, is related to the general movement of the machine. This involves the need for having a cutting assembly that can be displaced and adjusted in position according to the packaging format in order to maintain the correct ratio between blade speed and film feed.

[0005] In other cases, in which the position of the cutting assembly is fixed, it is envisaged that the cutting assembly should be actuated by the motor that unrolls the film so as to maintain constantly a correct speed ratio between the blade and the film. In this case, an actuator or drive assembly must be provided that activates and deactivates the cutting assembly at each required cut of the film.

[0006] This movement is determined, for instance, by an incremental control-of-rotation drive assembly, i.e., a brake-clutch assembly of an industrial type, which is of critical importance whenever there is a high inertia of the load in relation to the r.p.m. of the input shaft, the problems being greater, the higher the speed at which it is attempted to engage the said assembly. At high speed there would in fact be a fast wear due to the stresses induced by the said operation.

[0007] A possible drive assembly may, for example, be represented by a brake-clutch assembly, known as "CB" and manufactured and distributed by Warner Electric.

[0008] A purpose of the present invention is to provide a fast-cutting device in a machine for packaging in a film of plastic material which solves the above problems, adjusting inertia and speed with respect to one another in a sustainable way by the brake-clutch assembly.

[0009] Another purpose is to identify a cutting device that is able to engage precisely whenever necessary according to the amount of film to be cut.

[0010] These purposes according to the present invention have been achieved by providing a fast-cutting device in a machine for packaging in a film of plastic material, as specified in Claim 1.

[0011] Further characteristics are set forth in the dependent claims.

[0012] The characteristics and advantages of a fast-cutting device in a machine for packaging in a film of plastic material, in particular in a bundling machine according to the present invention, will emerge more clearly evident from the ensuing description, which is provided purely to give an explanatory and non-limiting example, with reference to the attached schematic drawings, in which:

Figure 1 is a schematic side elevation of a part of a bundling machine equipped with a cutting device according to the invention;

Figure 2 is a side elevation of a cutting device according to the invention set in a bundling machine, only a minimal part of which is shown, with the blade and counterblade disengaged from one another;

Figure 3 is a side elevation similar to that of Figure 2, but on the opposite side of the bundling machine;

Figure 4 is an exploded view of the driving assembly of the blade and counterblade shown in Figure 2 in the position where they are engaged with one another (cutting of the film) and of the corresponding gearing system;

Figure 5 shows a graph of the variation of speed of the motor - reducer for unrolling the film according to the angle of rotation of 360° of one cycle or step of the bundling machine; and

Figure 6 shows a schematic graph of the plot of the output angular velocity of an elliptical gear with constant input velocity as a function of the angle of rotation of the input shaft.

[0013] With reference to the figures, a fast-cutting device in a machine for packaging in a continuous film of plastic material, in particular in a bundling machine, is shown.

[0014] Figure 1 illustrates only in part one side of the machine in which a continuous film 11 is fed in the direction of a plane 7 for the sliding of products 10 to be packaged, the said products being pushed along, for example, by pushers 9 driven by the main machine motor (not shown). The film 11 is fed between two pairs of counter-rotating feed rollers 12 and 13, which are engaged on the film. The said rollers have the function of unrolling and feeding the film downstream in the direction of a packaging area (not shown).

[0015] It may moreover be noted how, between the two pairs of rollers 12 and 13, an on-line cutting assembly is set, designated as a whole by 14, consisting of a blade 15 and a counterblade 16 (more clearly evident in Fig. 4) which act transversely on the film 11 that is being fed.

[0016] At least one of the rollers 12 is driven in rotation by a reducer 17, which is in turn operated by a motor 18, for instance, a brushless motor.

[0017] Figure 3 further illustrates how the rotational

motion is transmitted between the pairs of rollers 12 and 13 by means of pinions 19 and 20, which are coaxial with a respective shaft for each pair, as well as a gear wheel 21 that is stably connected to an input hub (idealized in 8) of a brake-clutch assembly 22 by means of a chain 30. Of course, also a tensioning pinion 37 is provided, which ensures proper winding of the chain on the various pinions 19, 20 and 21.

[0018] As has already been said, the above brake-clutch assembly 22 constitutes an incremental control-of-rotation drive assembly of a known type, one of said assemblies being, for example, known as "CB" and being manufactured and distributed by Warner Electric.

[0019] According to the present invention, it should now be noted that the cutting assembly 15, 16 is set coaxially with, and stably fixed to, two shafts 25 and 26, which carry two gear wheels 23 and 24. The two gears 23 and 24 mesh together, and the shaft of one of the two, for instance, the shaft 26 of the bottom pulley 24 carries a first elliptical gear 27, which in turn meshes with a further elliptical gear 28.

[0020] The latter elliptical gear 28 in turn is carried by a shaft 29 which is directly connected to the brake-clutch assembly 22 in that it is practically the output hub of the latter.

[0021] In this way, a gear transmission is obtained which becomes operative when the shaft 29 is connected, by means of activation of the brake-clutch assembly 22, to the drive chain 30. In order to make this connection, the shaft 29, with interposition of springs (not shown), carries a shaped collar 31 having an engagement seat 32 for a rocker arm 33. The rocker arm 33 is centrally pivoted in 34 to the casing of the brake-clutch assembly 22 and is made to rock by a stem 36 of a solenoid 35 which acts as engagement actuator.

[0022] The brake-clutch assembly 22 is of the type mentioned previously in which, as the shaped collar 31 is released, a spring of the brake unwinds from the brake hub, and the clutch spring winds firmly around the free hub and around the output hub, so moving the load, as known and not illustrated. Hence rotation of the output hub or of the shaft 29, which drives the elliptical gear 28, is enabled. The latter gear 28 also drives the first elliptical gear 27 that is fixed to the shaft 26, which, as has been said, in turn carries the corresponding gear wheel 24.

[0023] Rotation of the shaft 26 causes rotation of the counterblade 16 that is stably fixed to it. The other gear 23, by interacting with the gear wheel 24, in turn rotates the shaft 25 and the cutting blade 15.

[0024] According to the present invention, the particular gearing system by means of elliptical gears means that there is a cutting cycle with variable speed of the blade and counterblade with respect to the speed of the motor 18, as may be seen schematically in Fig. 6. Fig. 6 shows in fact a graph of the plot of the angular output velocity of an elliptical gear with constant input speed as a function of the rotation angle of the input shaft.

[0025] The cutting device for separating the head and tail of a film 11 intervenes at each machine step when there is the need to cut the film required for making the bundle or package.

[0026] It is quite important for the action of the blade 15 and counterblade 16 to be correct and co-ordinated at all the speeds at which this action is performed within the machine.

[0027] In brief, for reasons of clarity, the operation of the device according to the invention is here described again in greater detail.

[0028] During feed of the film 11 between one cut and the next, the solenoid 35 is not excited, and a spring 40 keeps the stem 36 pulled out. This exit of the stem 36 causes stable positioning of the opposite end of the rocker arm 33 within the engagement seat 32 made on the shaped collar 31.

[0029] The shaped collar 31 to which the shaft 29 is connected is thus prevented from turning. In this way, the film, as it unrolls, advances in the direction of the packaging area without the cutting assembly intervening.

[0030] When, according to the pre-determined working position of the machine, the film is to be cut, the solenoid 35 is excited and draws the stem 36 back in.

[0031] In this way, the rocker arm 33 is forced to rock and, by turning around the pin 34, disengages its opposite end from the engagement seat 32, so freeing the collar 31, which can thus turn, as well as the output hub or shaft 29.

[0032] In this way, rotation of the pair of elliptical gears is enabled, and this in turn causes the gear wheels 23 and 24 to make one complete turn.

[0033] This rotation also causes simultaneous rotation of the blade 15 and counterblade 16, which, rotating at the same speed but in opposite directions, are directed in the same direction of movement as the film 11 that is to be cut. The blade 15 and counterblade 16 are in phase with one another in such a way that there is no contact between them during all the film-cutting phases.

[0034] It is to be emphasized that the arrangement of the elliptical gears causes the motion to be reduced during the phases of start and arrest of the blade and counterblade. In this way, the effort that the brake-clutch assembly 22 has to make to bring about rotation of the cutting assembly from the stationary condition decreases, and the "blow" that the cutting assembly receives in the disengagement phase is also cushioned. This is due to the fact that the inertia of the cutting assembly with respect to the brake-clutch assembly is reduced in the start and arrest phases (according to the square of the transmission ratio of the gear).

[0035] In addition, the motion of the blade and counterblade in the cutting phase is amplified by the elliptical gear, so that the speed of rotation of the input hub 8 and of the shaft 29 or output hub is lower than the

speed that there would be without elliptical gears, given the same cutting speed.

[0036] There is thus a start of rotation at a reduced speed, followed by a cut at amplified speed and return to the initial position, with end of turn at a reduced speed. The ratios of the gear wheels and elliptical gears are chosen in such a way as to have a correct ratio of peripheral speed of the blade 15 and counterblade 16 with respect to the speed of the film 11 at the moment of cutting. The general situation of the variations in speed must be derived from the graphs of Figures 5 and 6.

[0037] As generally occurs, it is moreover possible to envisage that the rollers 12 connected on the reducer 17 have a diameter that is slightly greater than that of the rollers 13 upstream, so that the peripheral speed upon contact between the rollers 12 is slightly greater than the speed upon contact between the rollers 13. In this way, tensioning of the film is achieved between one cut and the next, so that the blade and counterblade can operate properly.

[0038] The presence of the elliptical gears enables gearing-down of the motion of the blade and counterblade in the phases of engagement and disengagement, and gearing-up in the cutting phases.

[0039] In brief, in this way the blade and counterblade perform one complete turn at each engagement and disengagement of the brake-clutch assembly 22. It is moreover to be noted that, to obtain a given ratio between blade-counterblade speed and film feed during the cutting phase, the speed of entry to the brake-clutch assembly is lower than the speed that would be obtained without elliptical gears. Finally, as has just been said, upon engagement and disengagement the motion of the blade and counterblade is geared down with respect to the input shaft, and hence the inertia of the blade and counterblade with respect to the brake-clutch assembly is less.

[0040] In this way, there is much less wear on the brake-clutch assembly because, during engagement and disengagement there is a lower speed with much less inertia, even though the required and correct ratio between the blade-counterblade speed and film feed during the actual cutting phase is maintained.

[0041] The foregoing is obtained very simply and in a very compact way, and using a brake-clutch assembly that is commercially available.

[0042] It is moreover to be pointed out that the arrangement of two elliptical gears 27 and 28 may, in an equivalent way, for the person skilled in the branch, be replaced by so-called "rocker" devices of various types. In an equivalent way, the "rocker"devices produce at output a variable speed even though they have a uniform input speed.

[0043] In addition, the arrangement of the blade and counterblade can more simply be replaced by just one blade.

Claims

1. A fast-cutting device in a machine for packaging in a film of plastic material, there being provided in said machine at least two pairs of rollers (12, 13) for feeding a film (11) towards a packaging area, there being provided between the two pairs of rollers (12, 13) a cutting assembly (14, 15, 16) which acts crosswise on said film (11), characterized in that said cutting assembly (14) comprises at least one blade (15) rotating in the operating phase around a shaft (25) caused to rotate by a gearing system designed to convert a uniform rotation at input into a variable rotation at output (27, 28), being selectively driven by a motor (18) for unrolling the film with interposition of a brake-clutch assembly (22).

2. A cutting device according to Claim 1, characterized in that said gearing system is a transmission with elliptical gears (27, 28).

3. A cutting device according to Claim 1, characterized in that a counterblade (16) is moreover provided which rotates in the operating phase with said blade (15) around a shaft (26).

4. A cutting device according to Claim 1, characterized in that, when said cutting device is inactive, said brake-clutch assembly (22) is blocked in the position where it is disengaged from rotation with said motor (18) by an actuator (35, 36, 33) which engages a seat (32) made on an engagement collar (31) connected to an output hub (29) of said brake-clutch assembly (22).

5. A cutting device according to Claim 4, characterized in that said actuator comprises a solenoid (35) a stem of which (36) causes said rocker arm (33) to rock so that it engages said seat (32).

6. A cutting device according to Claims 2 and 3, characterized in that said two shafts (25, 26) to which said blade (15) and counterblade (16) are fixed, in turn carry, stably fixed to them, two gear wheels (23, 24), one (26) of said two shafts (25, 26) carrying stably fixed to it one first (27) of said two elliptical gears (27, 28).

7. A cutting device according to Claims 2 and 3, characterized in that said two elliptical gears (27, 28) are arranged in such a way that their rotation causes a slow engagement motion of said blade (15) and counterblade (16), fast cutting of said film (11), and a slow disengagement motion of said blade (15) and counterblade (16).

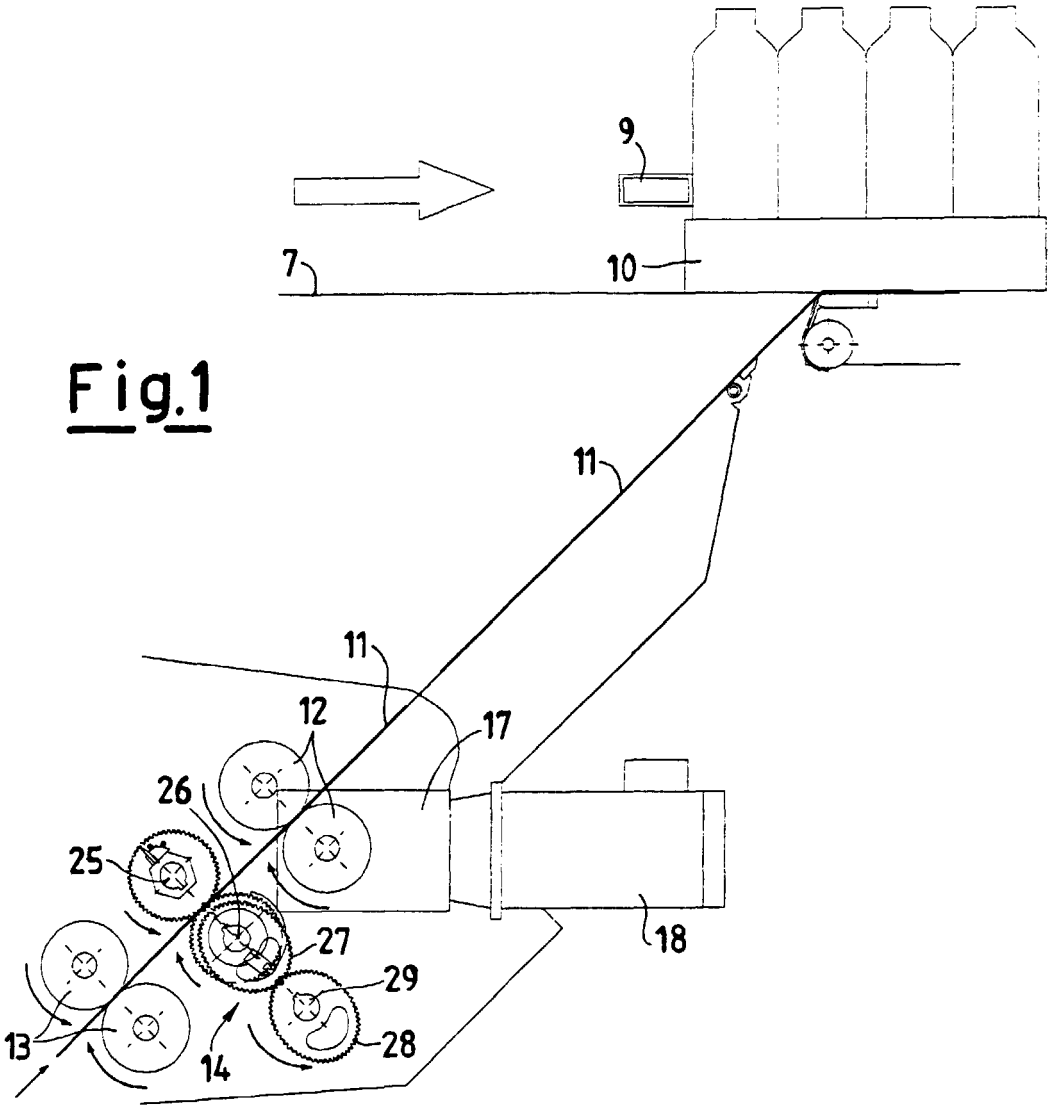
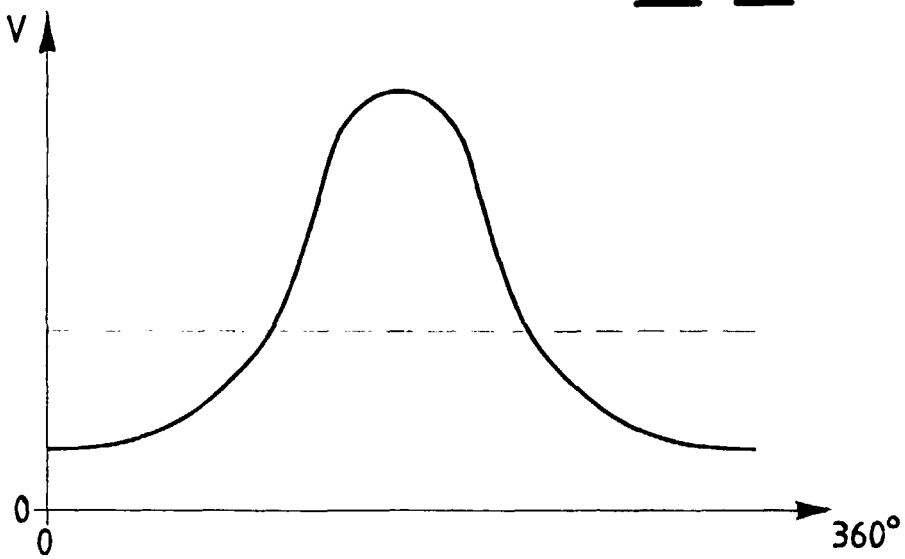


Fig.1

Fig.6



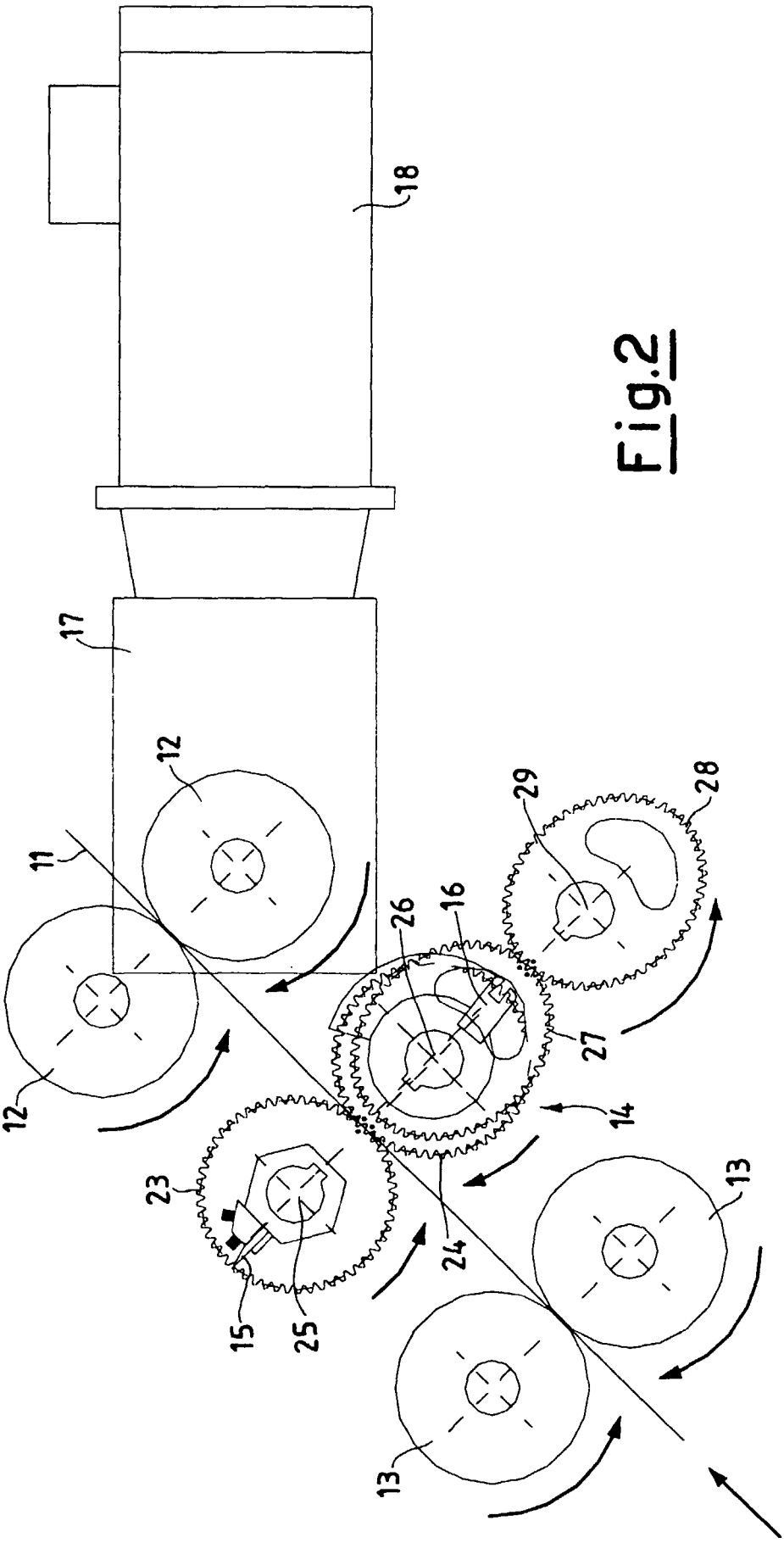


Fig.2

Fig.3

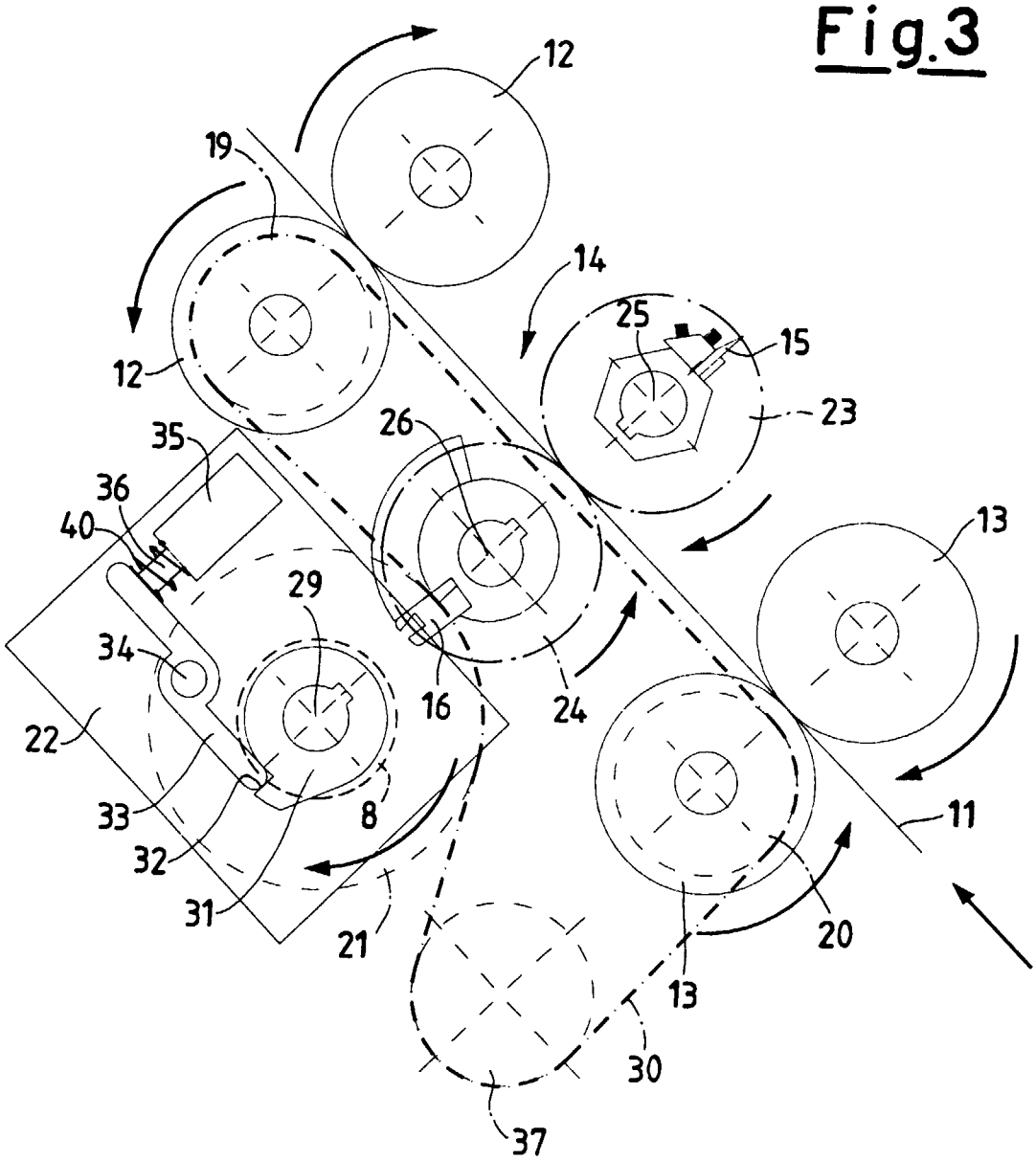

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Fig.4

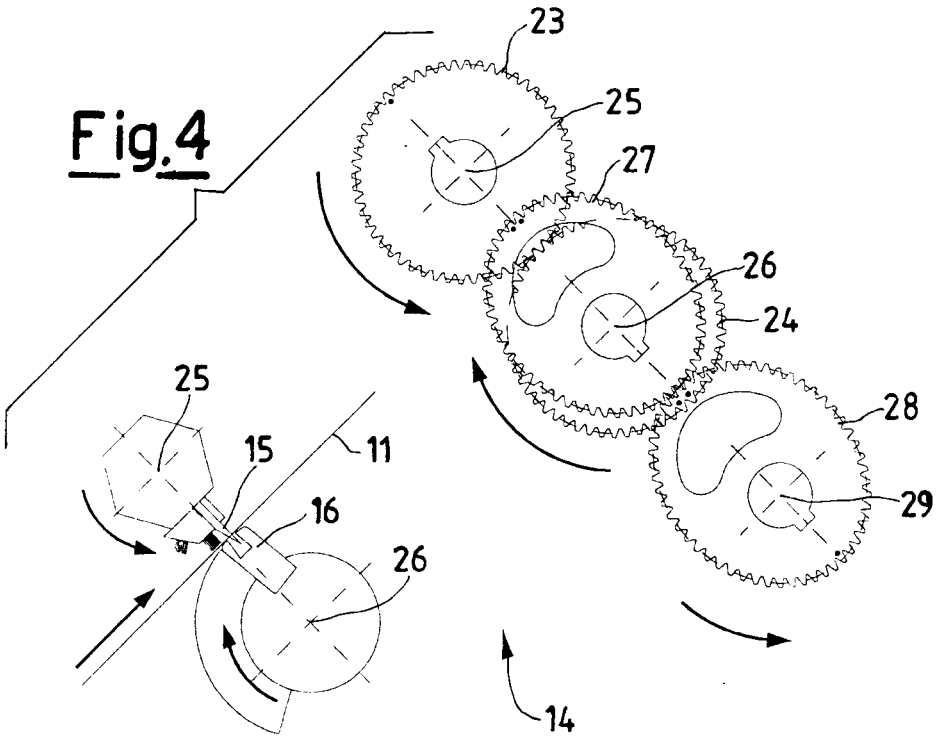

Fig.5