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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:	WO 93/10375
F16H 35/02, A24C 1/28	A1	(43) International Publication Date:	27 May 1993 (27.05.93)

(21) International Application Number: PCT/SE91/00783

(22) International Filing Date: 19 November 1991 (19.11.91)

(71) Applicant *(for all designated States except US)*: SWEDISH CIGAR MACHINERY AB [SE/SE]; Box 947, S-391 29 Kalmar (SE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : LIDMAN, Gösta [SE/SE]; Rimsmedsvägen 18, S-393 52 Kalmar (SE).

(74) Agents: KIERKEGAARD, Lars-Olov et al.; H. Albihns Patentbyrå AB, Box 3137, S-103 62 Stockholm (SE).

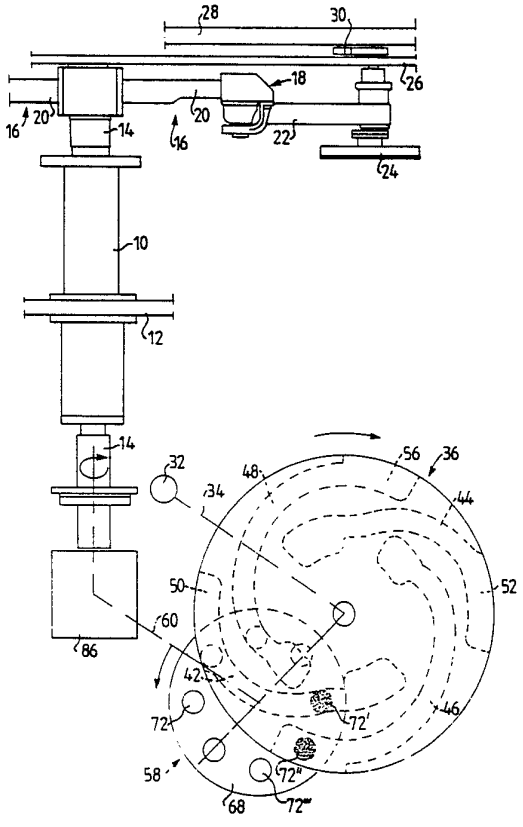
(81) Designated States: US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, NL, SE).

Published
With international search report.
In English translation (filed in Swedish).

(54) Title: DEVICE FOR TRANSMITTING A ROTARY MOVEMENT FROM A DRIVING SHAFT TO A DRIVEN SHAFT TO IMPART TO THE LATTER AN ANGULAR VELOCITY WHICH VARIES RELATIVE TO THAT OF THE DRIVING SHAFT

(57) Abstract

The invention relates to a device for transmitting a rotational movement from a driving shaft (34) to a driven shaft (60), where the driven shaft, in accordance with a predetermined sequence, is imparted an angular velocity during its rotation which varies relative to the driving shaft. The driving shaft (34) has a drive wheel (36) with a plurality of curve grooves (42, 44, 46, 48) which have predetermined curve shapes with a slope which varies depending on the predetermined variation of the angular velocity of the driven shaft (60). The driven shaft (60) overlaps partially the driving wheel (36) and has a plurality of driver curve rollers (72) distributed circumferentially and which are disposed to be sequentially inserted into a respective curve groove in the driving wheel in order to be driven thereby during a portion of the rotation of the drive wheel until the subsequent curve roller (72) in the rotational direction is brought into rolling contact in a subsequent curve groove.



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DEVICE FOR TRANSMITTING A ROTARY MOVEMENT FROM A DRICING SHAFT TO A DRIVEN SHAFT TO IMPART TO THE LATTER AN ANGULAR VELOCITY WHICH VARIES RELATIVE TO THAT OF THE DRIVING SHAFT.

The present invention relates to a device for transmitting a rotational movement from a driving shaft to a driven shaft, where the driven shaft, in accordance with a predetermined sequence is imparted an angular velocity which varies during its rotation relative to the driving shaft.

In certain branches of industry, a certain process may require that a driven operating shaft be rotated at an angular velocity which varies during its rotation. One example of such industrial activity is cigar manufacturing, where a gripper carried by a driven shaft must capture a wrapper from a pick-up station and transport the wrapper to an apparatus where the wrapper is to be wrapped at a varying wrapping speed about a cigar body and be fixed thereto, whereafter the gripper returns to the pick-up station to pick up a new wrapper.

In a known cigar wrapping machine, the wrapper gripper consists of a suction box adapted to the shape of the wrapper, carried on the outer end of a carrying arm extending radially from an oscillating working shaft, said arm being articulated at its centre portion. The working shaft is driven via a bevel gear which engages a driving toothed segment which supports a cam roller which engages a continuous curve groove in a rotating disc. As the disc rotates, the toothed segment and thus the working shaft are imparted, via an angle transmission, an oscillating movement by the engagement of the cam roller in the curve groove in the disc. The angular velocity of the oscillation movement is thus controlled by the slope

of the curve groove relative to the centre of the disc. Thus the carrier arm for the suction box can be caused to swing back and forth in accordance with a desired pattern of motion, between a pick-up position for the wrappers and a delivery station where the wrapper can be gradually released from the suction box and be wrapped on a cigar body at the same time as the box is moved with varying speed over the length of the body.

Machines of this type have operated for decades with great reliability and precision, and this has resulted in cigar products of high quality. However, the manufacturing capacity of such a machine has been limited to about 30 cigars per minute. In view of this, it has been a goal to increase the manufacturing capacity while retaining high reliability and high quality.

According to a basic idea for solving this problem, it is suggested to double the number of carrying arms with suction boxes, i.e. two diametrically oppositely extending carrying arms each with a suction box at the outer end thereof, allowing the working shaft to perform a rotational movement in one direction with varying angular velocity in accordance with the required pattern of movement for the suction box. The capacity can thereby be doubled by virtue of the fact that pick-up and conveyance of a new wrapper to the wrapping station can be carried out simultaneously with the delivery of a preceding wrapper and the return of the carrying arm with suction box to the pick-up station. With such a doubling of the arm system, it is not possible to use, however, the previously used curve mechanism for controlling the variation in angular velocity of the working shaft carrying the carrying arms in the desired manner for unidirectional rotation.

In order to solve this problem, it is suggested in accordance with the present invention that the driving shaft have a driving wheel, which on one end side has a plurality of curve grooves, which are disposed in a plane normal to the shaft of the driving wheel and have predetermined curve shapes with a varying slope towards the centre of the driving wheel dependent on the predetermined variation of the angular velocity of the driven shaft, and in that the driven shaft has a driven wheel which lies in a plane parallel and adjacent to the driving wheel and partially overlapping the driving wheel, and has a plurality of peripherally spaced curve rollers, which are axially biased to a retractive position in the driven wheel but which, by means of a cam follower in contact with an axial curve can be sequentially brought into axial insertion into a respective curve groove in the driving wheel in order to be driven thereby during a portion of one rotation thereof by rolling contact against the curve groove, until the following curve roller in the rotational direction is brought into rolling contact in a subsequent groove. This design of the device for transmission of rotational movement makes it possible to control the rotation of the driven working shaft and thus the swing movement of the two carrying arms with an angular velocity varying between standing still and a maximum speed during each rotation of the working shaft in accordance with a predetermined pattern of movement as required by the respective carrying arms with suction boxes.

According to a preferred embodiment, the driving wheel has four curve grooves which have pairs with different predetermined curve shapes, the curves with the same curve shape having curve entrances which are located diametrically opposite to each other on the driving wheel and alternating with the two other curve grooves. Thus, the curve grooves in one pair are formed so that when in

engagement with a cooperating curve roller said roller will rotate the driven working shaft during the phase, when the carrying arms are carrying out their respective conveyance movements between the pick-up station and the wrapping station, while the curve grooved in the other pair lying alternatingly between the first pair of curve grooves are formed to perform, when engaged with a cooperating curve roller, a pattern of movement determined by the wrapping process.

The driven wheel has suitably eight curve rollers spaced circumferentially about a common circle. This provides a gear ratio of 1:2 between the continuously rotating driving wheel and the wheel driven with variable angular velocity.

Even if the device according to the invention is especially suited for use in a machine for wrapping wrappers about cigar bodies to increase capacity, the invention is not exclusively limited thereto but can be used in other industrial activities.

Additional characteristics of the invention will be described in more detail below with reference to the accompanying drawings, in which:

Fig. 1 is a schematic composite view of a device according to the present invention used in a machine for transporting wrappers to cigar bodies between a pick-up station and a wrapping station,

Fig. 2 is a schematic view in perspective of the device according to the invention,

Fig. 3 is a partially sectioned side view of the device according to the invention,

Fig. 4 is a partially sectioned side view of a curve roller unit, and

Fig. 5 is an end view of the unit in Fig. 4.

Fig. 1 shows a portion of an installation for transporting wrappers from a pick-up station to a wrapping station in a cigar wrapping machine. This installation consists in principle of a vertical centre pillar 10 which is fixed to a machine table 12 and houses a rotatably journalled working shaft 14. The upper end of the working shaft 14 has two carrying arms 16 extending in an opposite direction which are non-rotatably mounted thereon. Each arm 16 is articulated at 18 in its centre portion, so that the arm has an inner arm portion 20 and an outer arm portion 22. The outer arm portion 22 supports a suction box 24 rotatably journalled about a vertical axis, the underside of said suction box having a shape which essentially corresponds to the shape of the wrapper to be conveyed. Of the left hand carrying arm in Fig. 1, only a portion of its inner arm portion 20 is shown, but despite the fact that it is not shown, it is to be understood that the left-hand carrying arm is identical to the right-hand carrying arm and carries a suction box at its outer end. The pivot movement of the outer arm portion 22 about the joint 18 is controlled in a manner known per se by the upper fixed curve disc 26 which cooperates with a cam roller (not shown) which engages therein. An additional overlying fixed curve disc 28 controls in a manner known per se the rotary movement of the suction box 24 about its own vertical axis by means of a curve roller (not shown) engaging in the curve disc 28. The curve roller, via a lever 30, causes the suction box 24 to rotate in accordance with a curve configuration in the curve disc 28.

The conveyor installation is so arranged in the machine so that when one suction box 24 is in a pick-up position for picking up a wrapper from a feed conveyor, the other suction box 24 will be at a wrapping station where one end of the wrapper is moved, by means of a wrapper needle

(not shown) down against a cigar body which is in an underlying rolling apparatus.

The picking up and conveyance of wrappers from the pick-up station to the wrapping station, as well as the application of the wrapper to the body and the subsequent wrapping of the wrapper on the latter with a relatively low axial feeding speed in the beginning and the end of the wrapping at the conical end portions of the body, and a higher axial feed rate at the intermediate essentially cylindrical portion of the body, requires a very specific rotational movement of the driven work shaft 14 with cyclically varying angular velocity.

A device according to the invention for achieving this cyclically varying rotational speed of the work shaft 14 will now be described.

A drive motor 32, shown schematically in Fig. 1, is joined via a drive shaft 34 to a drive wheel 36 which has an end flange 38 onto which there is fixed a curve disc 40 provided with curve grooves. The disc in the embodiment shown has four finite curve grooves 42, 44, 46, 48, running in the radial plane, curve grooves 42, 44 and 46, 48 respectively being identical pairs and arranged alternating with each other around the disc. Grooves 42, 44 have groove openings 50 and 52, respectively, at the periphery of the curv disc 40, while grooves 46, 48 have groove openings 54 and 56, respectively.

Curve grooves 42, 44 follow an essentially spirally shaped path towards the centre of the curve disc counter to the rotational direction of the disc 40, the slope of each groove varying between the outer groove opening 50 or 52, respectively, and the inner end of the groove depending on the desired variation in angular velocity of the driven work shaft 14 and the speed of swing of the

carrier arms 16 and the conveyance speed of the wrappers from the pick-up station to the wrapping station and the return of the empty suction box 24 to the pick-up station. The two other curve grooves 46, 48 also follow an essentially spiral path towards the centre of the disc in the same direction as the curve grooves 42, 44. The curve grooves 46, 48 also have a slope which can vary between the groove opening 54, 56 and the inner end of the groove depending on the desired variation of the angular velocity of the driven shaft 14 and thus the swing speed of the carrier arm 16 and the suction boxes 24 during the phase when a cigar body is wrapped with a wrapper at the wrapping station or a new wrapper is picked up at the pick-up station.

The drive wheel 36 is arranged to rotate a driven wheel 58 disposed in an adjacent radial plane and which partially overlaps the drive wheel 36. The driven wheel 58 has an output shaft 60 lying parallel to the drive shaft 34. The driven wheel 58 has in the embodiment shown eight curve roller units 62 distributed evenly about a common circle. As can be seen in Fig. 4, each curve roller unit 62 has a cylindrical housing 64 with a round mounting flange 66 at one end. The flange 66 has four through-holes 67 (Fig. 5) for fixing each housing 64 to an end flange 61 of the driven wheel by means of screws (not shown). Through the housing 64 there extends a rod 70, one end of which (the left hand end in Fig. 4) supports a rotatable driver curve roller 72, and the other end of which supports a cam follower roller 74. The rod 70 is biased by a spring 76 to a retracted position in the housing 64 as is shown with solid lines in Fig. 4.

The cam follower rollers 74 of the curve roller unit 62 are disposed, as the driven wheel 58 rotates, to be in rolling contact with a cam element 78 running angularly in the radial plane. The cam element 78 has two sloping

ramp portions 80 and 82 and a raised portion 84 lying therebetween.

The cam element 78 is so disposed that when a cam roller unit 62 is in a position such that its cam follower roller 74 is up on the raised portion 84 of the cam element 78, its curve roller 72 is in a projecting position such as shown in Fig. 3 and with dash-dot lines in Fig. 4, thus bringing the curve roller 72 into rolling contact with a cooperating curve groove in the curve disc 40 on the drive wheel 36.

In the position shown in Fig. 1, a curve roller 72', which is in rolling contact with the curve groove 42 and is thus acted on by the rotation of the drive wheel 36 and transmits the rotation to the driven wheel 58, has almost reached the end of the groove 42. During this time, the next curve roller 72" has been raised by the ramp 80 and has, when the curve roller 72' has left its groove 42 by moving down the sloping ramp 82 on the cam element 78, been brought via the groove opening 54 into rolling engagement with the curve groove 46, the configuration of which primarily controls the movement of the carrier arm 16 during the wrapping phase at the wrapping station. When this phase has been completed, the next curve roller 72"' is lifted by the ramp 80 and is inserted into the curve groove 46 via the groove opening 52, so that the carrier arm 60 can be moved to or from the wrapping station or the pick-up station for wrappers.

During the rotation of the drive wheel 36, the curve rollers 72 are brought one by one into rolling engagement with the respective curve grooves 42, 44, 46 and 48 to thus transmit the rotation to the driven wheel 58 at varying angular velocity in accordance with the desired predetermined pattern of movement as determined by the shapes of the curve grooves. Only during a short period

do the rolling engagements overlap each other, and therefore only one driver roller 72 at a time normally transmits the force from the drive wheel 36.

In the embodiment shown, the driven wheel 58 has eight curve roller units 62, which means that the gear ratio between the weels 32 and 58, which rotate in opposite directions, will be 2:1. The wheel 58 drives the working shaft 14 via the shaft 60 and a bevel-gear 86 of suitable gear ratio, so that the working shaft 14 is imparted the desired rotational speed, e.g. 30 rpm.

Even though the device for transmitting motion according to the invention has been described above in connection with an installation for conveying wrappers from a pick-up station to a wrapping station in a cigar manufacturing machine in order to increase the production capacity thereof, the invention is not limited to this specific application but can be used for other industrial activity. The number of curve grooves on the drive wheel and the number of curve roller units on the driven wheel, as well as the curve configuration of the curve grooves can be varied to fullfil desires made at each occasion for each individual application.

CLAIMS

1. Device for transmitting a rotational movement from a driving shaft (34) to a driven shaft (60), where the driven shaft in accordance with the predetermined sequence, is imparted an angular velocity during its rotation which varies relative to the driving shaft, c h a r a c t e r i z e d in that the driving shaft (34) has a driving wheel (36), which on one end side has a plurality of curve grooves (42, 44, 46, 48), which are disposed in a plane normal to the shaft of the driving wheel (36) and have predetermined curve shapes with a varying slope towards the centre of the driving wheel (36) dependent on the predetermined variation of the angular velocity of the driven shaft (60), and in that the driven shaft (60) has a driven wheel (58) which lies in a plane parallel and adjacent to the driving wheel (36) and partially overlapping the driving wheel (36), and has a plurality of peripherally spaced curve rollers (72), which are axially biased to a retractive position in the driven wheel but which, by means of a cam follower (74) in contact with an axial curve (78) can be sequentially brought into axial insertion into a respective curve groove (42, 44, 46, 48) in the driving wheel in order to be driven thereby during a portion of one rotation thereof by rolling contact against the curve groove, until the following curve roller in the rotational direction is brought into rolling contact in a subsequent groove.

2. Device according to Claim 1, c h a r a c t e r i z e d in that the driving wheel (36) has four curve grooves (42, 44, 46, 48), which have pairs of different predetermined curve shapes, the curves with the same curve shape having curve entrances (50, 52, 54, 56) which are located diametrically opposite to each other on a

driving wheel (36) and alternating with the two other curve grooves.

3. Device according to Claim 2, c h a r a c t e r - i z e d in that driven wheel (58) has eight circumferentially spaced curve rollers (72).

4. Device according to Claim 3, c h a r a c t e r - i z e d in that the curve rollers (72) are distributed about a common circle on the driven wheel (58).

5. Device according to one of Claims 1-4, c h a r - a c t e r i z e d in that the curve grooves (42, 44, 46, 48) have openings at the periphery of the driving wheel (32).

6. Device according to one of Claims 1-6, c h a r - a c t e r i z e d in that the curve grooves (42, 44, 46, 48) are disposed in a round disc (40) which is removably fixed on a wheel flange (38) anchored on the driving shaft (34).

7. Device according to one of Claims 1-6, especially in a machine for conveying wrappers from a pick-up location to an apparatus for wrapping cigar bodies with the wrappers, said machine comprising a vertical, rotatable working shaft (14), on which there are non-rotatably mounted two diametrically extending carrier arms (16) each supporting a suction box (24) adapted to the shape of the wrapper at the outer end of the carrier arm (16), in order to rotate the working shaft (14) in one rotational direction with varying angular velocity during each rotation in accordance with a desired pattern of movement for the suction boxes (24).

8. Device according to Claim 7, c h a r a c t e r -

i z e d in that the driving wheel (36) is arranged to rotate at constant rotational speed.

9. Device according to Claim 7 or 8, c h a r a c t e r - i z e d in that the driven wheel (58), and thus the working shaft (14), is arranged to rotate during each rotation, with an angular velocity which varies between standing still and a maximum rotational velocity.

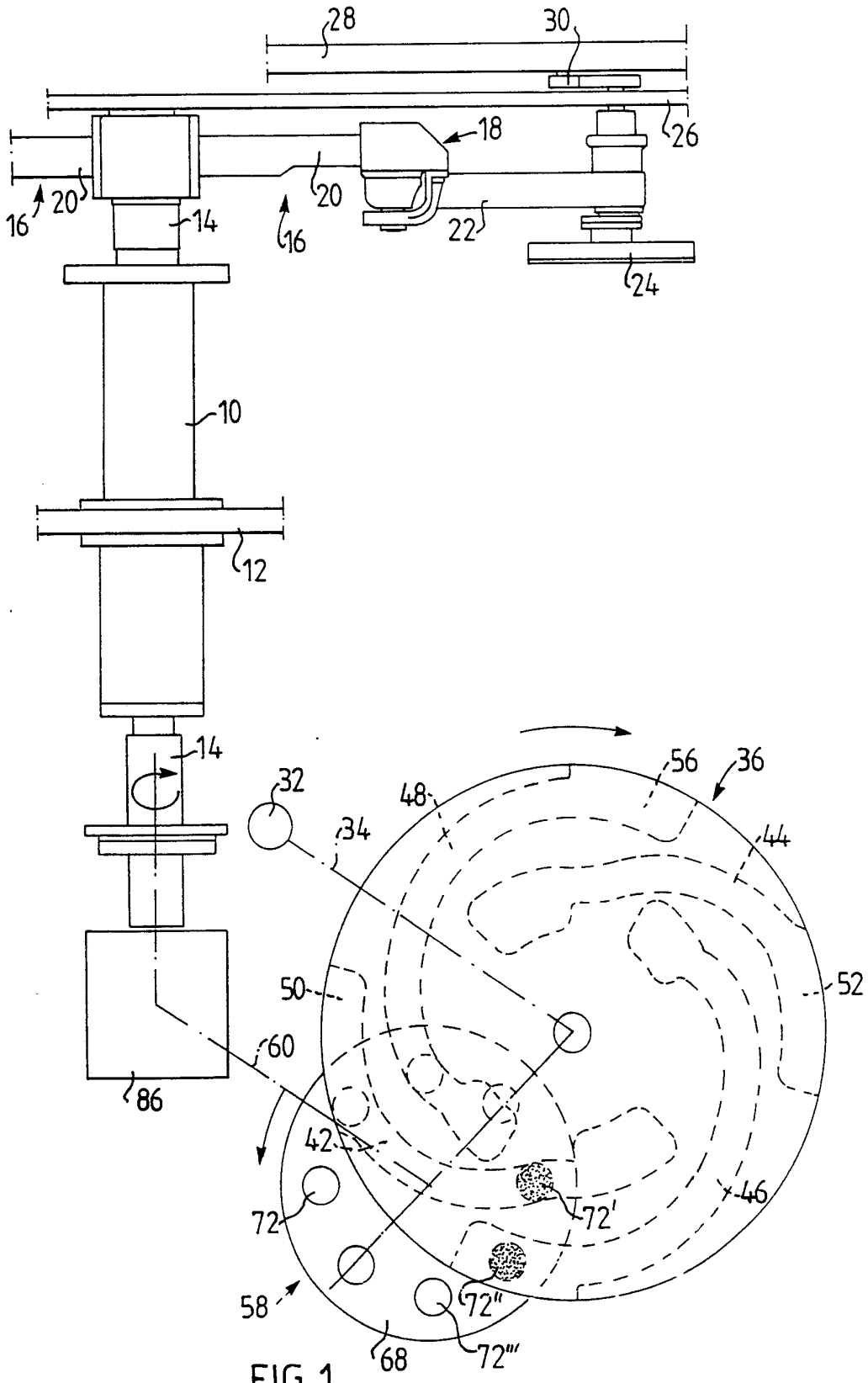

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FIG. 1

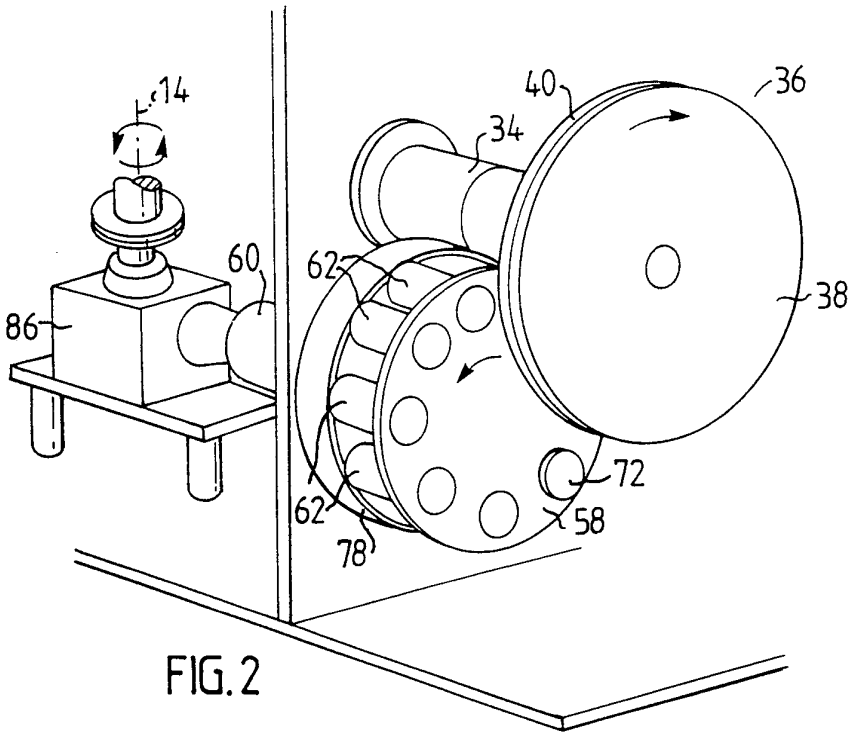


FIG. 2

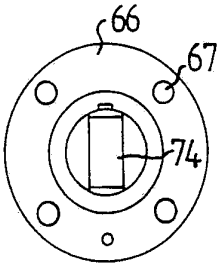


FIG. 5

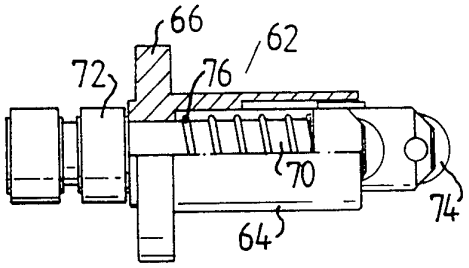


FIG. 4

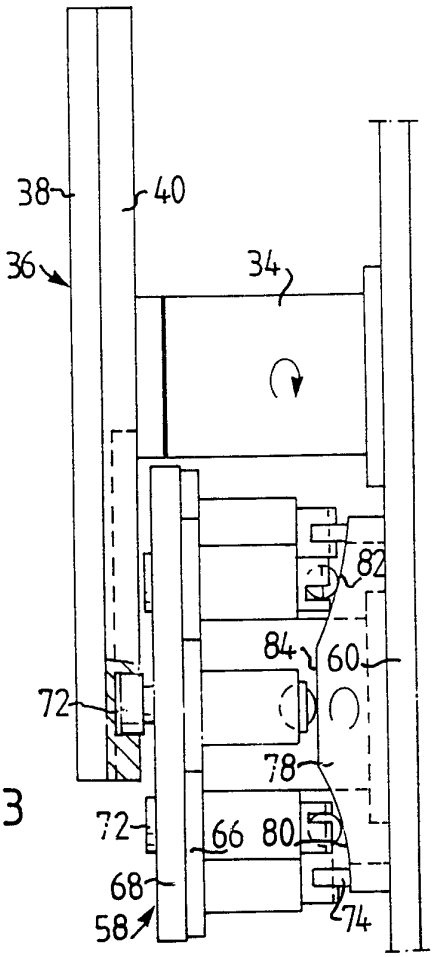


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00783

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: F 16 H 35/02, A 24 C 1/28

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	F 16 H; A 24 C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	EP, A2, 0194670 (BROCKFELD & MEYER GMBH & CO.) 17 September 1986, see the whole document --	
A	US, A, 4625575 (P.A. LE BRAS) 2 December 1986, see the whole document --	
A	GB, A, 1504581 (HARRIS CORPORATION) 22 March 1978, see the whole document --	

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* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
5th June 1992	1992 -06- 24
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Per-Olof Warnbo

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 91/00783

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 30/04/92 The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US-A- 4625575	86-12-02	EP-A-B- 0182593	86-05-28
		JP-A- 61119868	86-06-07
GB-A- 1504581	78-03-22	CH-A- 593195	77-11-30
		DE-A- 2511342	75-10-09
		JP-A- 50130084	75-10-14
		US-A- 3918336	75-11-11