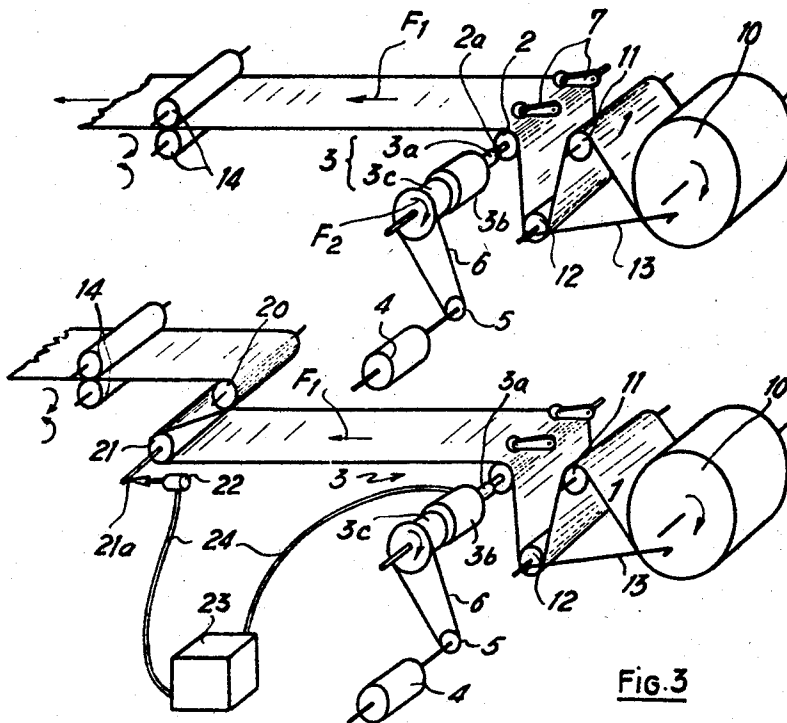
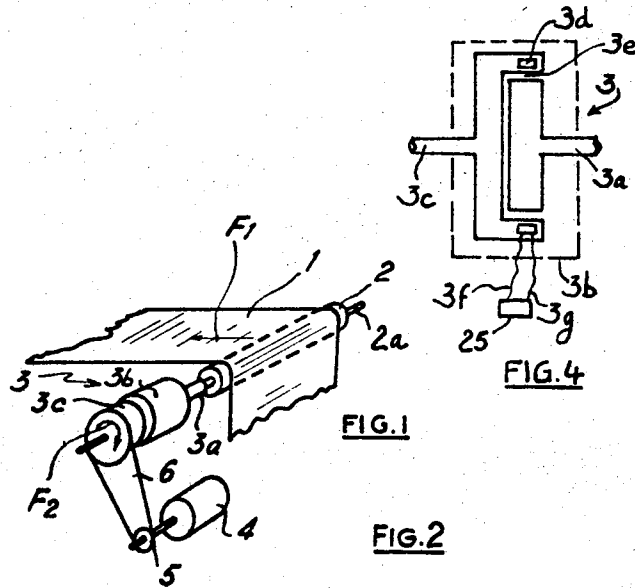


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 PAYING OUT UNDER TENSION OF PRODUCTS IN SHEET  
 FORM, PARTICULARLY PAPER SHEET  
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## PAYING OUT UNDER TENSION OF PRODUCTS IN SHEET FORM, PARTICULARLY PAPER SHEET

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### ABSTRACT OF THE DISCLOSURE

Improvements in paying-out under tension sheets in which there is a device for controlling the supply tension of a flexible continuous sheet traveling to a machine, such as a printing machine, including a guide assembly with at least one roll or roller disposed in the path of the sheet and driven by it, a torque transmitting device establishing a mechanical connection between the assembly motor which tends to drive the guide assembly with at least one roller in the opposite sense to that in which it is effectively driven by the sheet.

In many technical fields it is necessary to supply a machine which operates in a continuous or discontinuous manner from a flexible sheet which is unrolled from a reel. Such is the case in particular for the supply of paper sheets for printing machines.

In general, it is desirable to be able to maintain the tension of such supply sheets constant whatever may be their instantaneous speed of travel. In particular, the webs of paper serving to supply printing machines and above all those which exert on the paper web a non-continuous pull, it is important in the majority of cases to maintain the tension of the web constant at a predetermined value which is in particular a function of the nature of the web and of the operating conditions of the machine being supplied and which remains constant in spite of variations in the speed of travel, in particular possible stoppages of the web.

In certain special cases, it may moreover be desirable to control the tension of the paper in accordance with a predetermined law as a function of the mean speed of web.

The present invention relates for this purpose to a device for controlling the supply tension of a flexible continuous sheet travelling to a machine, especially of a web of paper travelling to a printing machine, comprising a guide assembly with at least one roll or roller disposed in the path of the sheet and driven by it, a torque transmitting device establishing a mechanical connection between this assembly motor which, characteristically, tends to drive the guide assembly with at least one roller in the opposite sense to that in which it is effectively driven by the sheet.

The torque transmitting device ("coupling") is a mechanical or electro-mechanical device capable of transmitting a predetermined torque. Characteristically, in its use in accordance with the invention, the coupling operates in the opposite direction to its normal direction of operation in which it transmits a driving torque from a motor: in this case it effectively transmits a torque which tends to oppose the advance of the sheet, that is to say a resistive torque. In these conditions, the coupling slip which has an angular value equal to the sum of the speeds of the coupling and the roller (in revolutions per minute) prevents at each instant an opposing tension torque equal to that necessary to obtain slip. When the sheet stops, the roller stops, the coupling always rotates backwards and the stationary sheet is always subjected

to a tension. It is to be noted that the tension torque is independent of the angular value of the relative displacements of the roller and coupling, this value only causing a proportional heating of magnetic or mechanical origin.

The following description and the accompanying drawings, given above all by way of non-limiting example will make better understood how the invention may be put into effect.

In the accompanying drawings:

FIG. 1 shows diagrammatically a sheet tensioning device in accordance with the invention;

FIG. 2 illustrates the application of this device to a paper supply system for a printing machine;

FIG. 3 shows a variant of the installation of FIG. 2; and

FIG. 4 is a diagram of an electromagnetic coupling of a type known per se which may be used for the purposes of the invention.

In accordance with the invention, in order to maintain constant the tension of a web 1, particularly a web of paper, which is drawn off in a continuous or discontinuous manner in the direction of the arrow  $F_1$ , the web is made to pass over a roller 2 which turns in one direction on a shaft 2a under the motive action of the paper.

The shaft 2a of the roller is fixed to the rotor 3a (output) of a coupling 3 which moreover comprises a support casing 3b and a rotating stator (input or control) 3c.

When a motor 4, for example an electric motor, rotationally drives the stator 3c of the coupling in the direction of the arrow  $F_2$ , for example through the intermediary of a pulley 5 and a belt 6, this stator rotationally drives, through the intermediary of the coupling means, the rotor 3a in the direction which tends to make the roller 2 turn in the opposite direction to that caused by the movement of the paper.

The coupling means which depends on the type of coupling used (friction coupling, powder-type electromagnetic coupling, or the like) would preferably be a magnetic powder located in a space lying between the stator and the rotor of the coupling, this latter being then of the electromagnetic powder-type, as for example the coupling made by the Jaeger Company. FIG. 4 shows diagrammatically and entirely by way of example the principles of such a coupling and in it can be recognised the rotor 3a and the rotating stator 3c in a casing indicated by 3b. The reference 3e indicates a clearance in which is located the magnetic powder which a coil 3d tends to orientate so as to form a more or less compact mass between the rotor and the stator when a current flows through the coil. This current is fed to the coil by brushes or any other appropriate means, and the electric wires 3f, 3g indicated in FIG. 4 are only shown as an illustration of the conductors for supplying current to the coil of the coupling. Moreover, there is seen in FIG. 4 a control assembly 25 comprising in particular a potentiometer which enables the supply conditions of the coil 3d to be varied and consequently the value of the driving torque exerted on the rotor 3a by the rotating stator 3c to be varied. In that the installation shown in FIG. 2 and in the installation shown in FIG. 3, the coupling is used in such a manner that its rotor 3a is driven by the paper in the opposite direction to the direction of normal rotation which the rotating stator 3c would impress on this rotor under the action of the motor 4. The result of the two opposing actions exerted on the roller 2 by the web of paper and by the coupling gives to this web a constant tension the value of which corresponds to the adjusted value of the torque of the coupling. This constant tension is exerted throughout the movement of the web 1, whatever the law of this movement and it is exerted during stoppage of the band with the same value.

The possibility of adjusting the value of the driving torque of the electromagnetic powder coupling of the type described very advantageously permits the corresponding adjustment, to any desired value, of the tension of the paper web, independently of variations in its speed of travel. For example the tension may be adjusted proportionally to the square of the mean speed of the paper.

In the system illustrated in FIG. 2, the paper web 1 is unrolled from a reel 10 and thereafter passes over a roller 11 with a fixed axis and a roller 12 with a moveable axis mounted on an assembly of arms 13 as disclosed in French Patent No. 1,356,991, filed on Feb. 7, 1963, in the name of the applicants. From the roller 12, the web 1 is returned to the roller 2 forming part of the tension regulating device in accordance with the invention. Pressure rollers 7 apply the web 1 against the roller 2. A pair of opposed driving rollers 14 serve to drive the web for the supply of the printing machine.

When the paper web stops, the roller 2 also stops but as the coupling rotates always in the opposite direction, the stationary paper is always under tension.

In the installation shown in FIG. 3, an absolute regulation of the tension of the paper is obtained. This installation comprises the same elements as the installation shown in FIG. 2, indicated by the same reference numbers. Moreover, it comprises an assembly of two rollers 20 (fixed) and 21 (moveable), which transmit mechanically through the intermediary of the moveable shaft 21a the tension of the paper to a pick-up 22 which transduces it into an electrical magnitude. This electrical magnitude is compared in a regulation system 23 which a reference magnitude and the difference which may exist between the two values is used to control the current which flows in the coil 3d of the coupling.

In the figure, the regulation assembly comprising the system 23 and the conductors 24 connecting the pick-up 22 and the coupling 3 to this system have only been shown very diagrammatically bearing in mind that this "reaction" is a technique which is well-known in itself and which has no need of being described in detail in the present text. It will be understood that the regulation system causes a variation of the value of the torque of driving of the rotor by the stator in such a sense that the tension of the web is rendered equal or substantially equal to the value corresponding to the reference magnitude.

It will also be understood that the electromagnetic powder-type coupling which is preferably used may however be replaced by a coupling of another type, of adjustable torque mounted in such a manner that this torque tends to oppose the rotation of the roller in the sense sought by the web.

What is claimed is:

1. A device for regulating the tension of a flexible continuous sheet traveling to a machine, such as a web of paper traveling to a printing machine, comprising at least one roller disposed on the path of the sheet and driven by the sheet in one direction of rotation, a driving motor, coupling means including a slip coupling, said coupling means coupling said driving motor to said roller to urge said roller to rotate in the opposite direction to that in which it is rotated by said sheet, said coupling comprising

a rotor fixed to said roller, a rotatable stator drivably coupled to said motor and means for transmitting driving torque from said stator to said rotor, said means for transmitting a driving torque from said stator to said rotor comprising a magnetic powder and a coil for creating a magnetic field to which said powder between said rotor and said stator is subjected in accordance with the passage of an electric current through said coil.

2. A device according to claim 1, and including a potentiometer for adjusting the value of the current passing through said coil in order to adjust the value of the driving torque of said coupling.

3. A device according to claim 1, and further comprising a tension pick-up for transducing the tension of the sheet into an electrical magnitude, regulating means for comparing said magnitude with a reference magnitude and for controlling as a result of said comparison the value of the current flowing in said coil whereby to vary the tension of said sheet in order to reduce the difference between the value of the electrical magnitude and the value of said reference magnitude.

4. A device according to claim 1, in which the pick-up co-operates with a moveable roller displaced by the sheet by an amount depending on the tension of said sheet.

5. A device for regulating the tension of a flexible continuous sheet traveling to a machine, such as a web of paper traveling to a printing machine, comprising at least one roller disposed on the path of the sheet and driven by the sheet in one direction of rotation, a driving motor, coupling means including a slip coupling, said coupling means coupling said driving motor to said roller to urge said roller to rotate in the opposite direction to that in which it is rotated by said sheet, said coupling comprising a rotor fixed to said roller, a rotatable stator drivably coupled to said motor and means for transmitting driving torque from said stator to said rotor, and a tension pick-up sensitive to the tension of the sheet and acting on the value of said driving couple to maintain this tension at a predetermined value.

6. A device for regulating the tension of a flexible continuous sheet traveling to a machine, such as a web of paper traveling to a printing machine, comprising at least one roller disposed on the path of the sheet and driven by the sheet in one direction of rotation, a driving motor, coupling means including a slip coupling, said coupling means coupling said driving motor to said roller to urge said roller to rotate in the opposite direction to that in which it is rotated by said sheet, and pressure rollers for applying said sheet against said roller.

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