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(54) Apparatus for automatically washing printing units, particularly in rotary-drum printing machines.

(57) Apparatus for automatically washing, directly in the machine, the printing units of printing machines with magnetizable doctors, comprising two coaxial tubes (2, 3) arranged inside the perforated cylinder (1), the inner tube forming the dye distribution tube, which is connected to a dye feed pump (4), and the interspace (3a) between the tubes constituting a distributor of water for washing the screen cylinder, the roller and the underlying belt (11); the dye pump, the distribution tube and the interspace can be alternatively connected, according to cycles of preset duration, to a pump (21) which feeds pressurized water and to a compressed air source (27); a channel (16) is furthermore associated with the coaxial tubes, is connected to a suction pump (18) and is provided with an array of magnetic plates and openings (17) for creating a negative pressure in the roller, with the drawing and conveyance to the discharge of the drawn water-dye mixture. Advantageously, the complete washing cycle is controlled automatically by a microprocessor in an intermittent and alternated manner so as to create alternated cycles of pressurized water-air, combined with liftings of the cylinder by said magnetized plates and with continuous elimination of the drawn mixture.

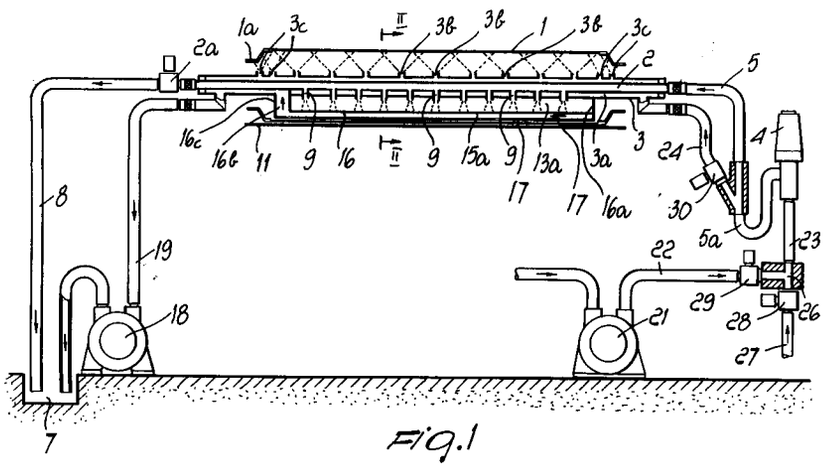

Fig.1

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The present invention relates to an apparatus for automatically washing all the components of the printing units used in rotary-drum machines for printing fabrics and the like, keeping said components in their operating position.

As is known, single- or multiple-dye rotary-drum printing machines for fabrics use printing units which are substantially constituted by a rotary-drum, or screen cylinder, which can rotate on the fabric which is guided by an endless conveyor belt. The dye is fed inside the roller by means of a tubular manifold-distributor. A magnetizable metallic roller, arranged inside the cylinder, is pressed onto the fabric by magnetic attraction, so as to squeeze the dye through the microperforations of the cylinder, thus printing the fabric.

Each printing unit is thus constituted by a screen cylinder, a dye distribution tube and a metallic roller.

It is also known that after each printing operation it is necessary to wash the components of the printing unit and the belt. The endless belt is normally washed and cleaned by a washing unit fitted in the printing machine, while the components of the various printing units are removed from the working surface and are washed inside appropriate washing units which are arranged proximate to the printing machine.

In practice, the operations for washing the printing units consist of disassemblying the cylinders, the dye distribution tubes and the roller from their supports, placing thereof on adapted trolleys and then inserting in the washing units; at the end of the washing, said components are either stored or repositioned on the printing surface in order to allow the printing of another batch of fabric. Furthermore, the printing unit cleaning cycle also requires the cleaning of the dye pump, which is washed automatically.

All these operations entail the use of labor and require rather considerable amounts of time as well as the use of considerable amounts of water especially to wash the dye feed pump.

Furthermore, the operations for disassembling and reassembling the screen cylinders, which are notoriously very delicate, can damage the screen, with obvious severe economic damage.

Finally, the need of washing units, transfer trolleys and various equipment entails the occupation of considerable volume of space proximate to the printing machine.

In order to at least partially obviate the onerous operations of washing the printing units in washing units which are separate from the printing machine, an automatic process for washing all the components of each printing unit, while keeping them in working position has already been proposed; said process essentially comprises feeding pressurized water and air inside the cylinder, the dye distribution tube and the dye feed pump, and subsequently removing by suction the water-dye mixture,according to alternating cycles having a preset duration, while keeping the machine running at reduced speed.

Although the dye distribution tube and the pump are well washed, in practice this method does not provide an effective cleaning of the microperforations of the cylinder, of the elbow pipes and of the heads or end rings of the cylinders.

The aim of the present invention is therefore to provide an apparatus, for automatically washing, directly in the machine, the components of printing units of rotary-drum machines, that completely obviates the disadvantages and limitations of both systems for washing on separate washing units and the system for automatic washing by means of alternating cycles of pressurized water and air feed.

An object of the invention is to provide an apparatus for automatically washing rotary-drum printing units which is conceived so as to have a small area occupation, requires extremely reduced washing times and allows the execution of all the operating steps without the intervention of the operator.

This aim, these objects and others which will become apparent from the following description are achieved by an apparatus for automatically washing the components of a printing unit while keeping them in operating position, of printing machines comprising a roller arranged inside a perforated cylinder, an electromagnet means arranged below an endless belt and adapted to keep said roller on the inner surface of said cylinder, and a dye distribution tube which is arranged inside said perforated cylinder and is connected to a dye feed pump, characterized in that it comprises an outer tube arranged inside said perforated cylinder and coaxial to said dye distribution tube, said dye distribution tube being arranged inside said outer tube in order to form an interspace between said dye distribution tube and said outer tube, said dye distribution tube being provided with nozzles for feeding dye inside said cylinder, said outer tube being also provided with nozzles in order that said said interspace may distribute washing water inside said roller, said distribution tube, said interspace and said dye feed pump being alternatively connected to a pump means for feeding washing water and to a compressed air source, through valve means, a hollow body being associated with said outer tube and being connected to a suction pump means, said hollow body being provided with lifting means adapted to lift said roller from said inner surface of said cylinder, said hollow body further-

more having a channel portion arranged at said roller and provided with openings, said pump means being adapted to feed pressurized water at least into said dye feed pump, said dye distribution tube and said cylinder, said at least dye feed pump, dye distribution tube and cylinder being alternatively operatively connected to said compressed air source to be fed with compressed air, said channel portion being connected to said suction pump means for generating a vacuum for conveying the mixture, formed in the cylinder by the washing water and the dye, into said channel and for discharging said mixture.

More particularly, said alternating feed steps of pressurized water and air are programmed so as to be performed while the printing machine rotates at reduced speed and while the printing roller is raised during the cylinder washing cycles and during the step of final drying thereof.

Furthermore, said annular interspace between said coaxial tubes is provided with nozzles along its entire length and with closely spaced end nozzles suitable for allowing the thorough washing of the heads which support the screen cylinders.

Finally, at the end of the dye feed tube which is opposite to the inlet end which is connected to the dye pump, there is an electric valve for closing said tube during the printing operations.

Further characteristics and advantages of the automatic washing apparatus according to the invention will become apparent from the following detailed description of a preferred embodiment thereof, given with reference to the accompanying drawings, which are provided merely by way of non-limitative example and wherein:

Figure 1 is a schematic and partially sectional view of a printing unit for rotary-drum printing machines which uses as doctor, a magnetizable metallic roller, equipped with an automatic washing apparatus according to the invention;

Figure 2 is a schematic cross sectional view of Figure 1, taken along the line II-II, wherein the magnetizable roller is in working position, and

Figure 3 is the same sectional view as Figure 2, wherein the magnetizable roller is partially raised inside the screen cylinder.

With reference to the above figures, a conventional rotary-drun printing unit normally has each rotary-drum, or screen cylinder, rotatably mounted on an endless belt on which the fabric to be printed is glued; the screen cylinder is supported, at the opposite end, by motorized heads, and a rectilinear dye feed tube is mounted coaxially inside said cylinder (or parallel to the axis thereof), is provided with nozzles for distributing the dye inside the cylinder and is connected, at one of its ends, to a dye feed pump. A magnetizable roller is arranged in contact with the lower generatrix of the cylinder 1, which is in turn arranged in contact with the fabric which is anchored to the belt; said roller is constantly attracted toward the carpet by an electromagnet and thus forces the dye, which is emitted by the nozzles of the overlying dye feed tube, to pass through the microperforations of the cylinder, thus printing the fabric.

In order to provide the automatic and simultaneous washing of all the components of a printing unit of this type while they are kept in working position, the present invention provides a highly effective apparatus such as the one illustrated in the above described figures.

More particularly, according to the present invention two coaxial rectilinear tubes 2 and 3 are arranged within a microperforated drum, or cylinder 1, the inner one 2 is the tube which distributes dye during the printing step and water during the washing step, whereas the annular interspace 3a forms a duct for feeding and distributing pressurized washing water inside the cylinder 1, as will become apparent hereinafter.

The dye feed tube 2 is longer than the outer tube 3 and is connected (Figure 1), at one end, to a conventional dye feed pump 4 by means of two portions of flexible tubes or the like 5-5a which are connected to the tube 2 by a quick-coupling 6; at the opposite end, said tube 2 is provided with an electric valve 2a the output whereof is directed to a discharge 7 by means of a pipe 8 the function whereof will become apparent hereinafter.

Dye distribution nozzles 9 are furthermore associated with the inner dye feed tube 2 and pass, with a tight seal, through the cylindrical wall of the outer tube 3 (Figures 1 and 3) so as to feed the dye into the cylinder 1, in the rear region, according to the direction of rotation of said roller, to a printing roller 10 which, according to the invention, is preferably constituted by a cylindrical tubular body made of magnetizable metal. The roller 10 is freely arranged, in a per se known manner, along the generatrix of the cylinder which is in contact with the fabric which is anchored to the endless belt 11, and is attracted against said belt by an electromagnet 12 which is arranged below the belt itself.

A flattened hollow body 15, formed by two facing walls 13-13a, is furthermore associated with the outside of the tube 3 which is coaxial to the dye distribution tube; the lower closure side 13b of said hollow body is at a very small distance from the inner surface of the cylinder and extends substantially along the entire length of the outer tube 3.

The lower end of said flattened hollow body 15 is furthermore preferably closed by a longitudinal wall 15a so as to define a continuous channel 16 which is provided, on its bottom side, with a series

of openings 17 (Figure 1) which are thus close to the inner surface of the cylinder. Said channel 16 is closed at its end 16a and is connected, at the opposite end, to the interspace 3a by means of a tube 16b the vertical wall 16c whereof can be provided with openings. An array of magnetized plates 20, arranged with alternating polarities, is furthermore arranged inside the hollow body 15 (Figures 2 and 3); their function is to attract and partially raise the roller 10 from the cylinder, during the washing cycles, at each interruption of the attraction exerted on said roller by the magnetic unit 12 arranged below the belt 11.

The channel 16 acts as a duct for drawing the mixture, constituted by washing water and dye, produced during the washing cycles of the cylinder and of the distribution tube 2, as will be described in greater detail hereinafter.

The above mixture is removed by suction continuously by a suction pump 18 which is connected to the interspace 3a by means of a tube 19.

In order to allow the washing water, fed into the interspace 3a, to escape in a distributed manner within the cylinder 1, in the cylindrical wall of the outer tube 3 there are equally spaced nozzles 3b, whereas at the ends 1a and 1b of the microperforated cylinder said nozzles are closely spaced, as indicated by 3c in Figure 1, so as to also thoroughly wash the support members, or rings which support the rotating cylinder 1.

The apparatus furthermore comprises a washing water feed pump 21 which is suitable for sending pressurized water into the dye pump 4 through the tubes 22 and 23, inside the interspace 3a through the tube 24 and inside the dye feed tube 2 through the pipe 5a-5; a mixing connector 26 (Figure 1) is furthermore interposed between the pipes 22 and 23 and is also connected to a source of compressed air (not illustrated in the figures) by means of a tube 27 on which an electric cutoff valve 28 is fitted. The electric valves 29 and 30 are also respectively inserted on the tubes 22 and 24.

Finally, a microprocessor is associated with the above described apparatus and is programmed to adjust the alternating interventions, lasting for preset times, of the water feed pump, of the compressed air pump, of the related electric valves and of the liftings and lowerings of the magnetic roller, according to consecutive and automatic operating cycles which are described hereinafter in detail for a single cylinder; in practice, however, said microprocessor can be programmed for the simultaneous washing of a plurality of cylinders.

At the end of the printing operation, the belt is stopped and the printed fabric is removed; the machine thus has the dye pump 4 motionless, the electric valve 2a of the dye feed tube closed and the electric valves 28-29 and 30 of the pumps also closed.

The apparatus is then preset, by means of a microprocessor and a related selector, for the washing of the cylinder or cylinders, of the dye pump, of the tubes 5 and 5a and of the dye feed tube 2.

The belt and the cylinders are slowly rotated, the suction pump 18 is started and the electric valve 2a of the tube 2 is opened; the pre-washing step thus begins.

The water and air feed pumps are thus started and feed the pressurized fluids into the dye pump, the tubes 5-5a and the tube 2 by means of the electric valves 28 and 29, alternating brief periods of injection of water and air to facilitate the complete cleaning of the above devices.

During this period, the suction pump 18 removes the water-dye mixture through the duct 16, sending it to the discharge 7 by means of the duct 19.

The electric valve 30 is then opened so as to feed water, through already cleaned tubes, into the interspace 3a which, through the nozzles 3b, feeds pressurized water for washing the wall 13a of the box-like body 15.

During this step, the print roller 10 is attracted by the array of magnetic plates 20 and raised from cylinder (after stopping the magnetic attraction unit 12), thus allowing the suction duct 16 to completely draw the water and dye mixture.

This pre-washing step is completed by performing at least two cycles of alternating injection of pressurized water and air; said cycles are performed by means of the electric valves 28, 29 and 30, and after these two cycles the cylinder 1 is automatically raised from the belt for a short period of time, then the belt is accelerated so as to carry forward (i.e. toward the belt washing unit, which is always present on the printing machine) the liquid which has escaped from the cylinder, along the direction of advancement of the belt.

The cylinder is then again placed on the belt, and the electromagnet 12 is energized so as to attract the roller 10 and return it into contact with the lower generatrix of the cylinder; the roller thus squeezes the water which has remained within the cylinder, making it escape through the microperforations.

Once this pre-washing step has ended, said microprocessor starts the thorough washing step with a preset number of water-air cycles alternated with liftings and lowerings of the print rollers in order to allow the removal by suction of the mixture contained in the cylinder and the squeezing of the water through the microperforations in order to wash said cylinder.

At the end of the washing cycles, the cylinder is raised, the roller is moved away from the cyl-

inder by means of said magnetized plates and the belt is accelerated so as to allow it to rapidly remove the water which has accumulated behind the cylinder; said water is then removed by the belt washing unit.

After a few seconds, the cylinder is lowered again and the electromagnet 12 is energized for approximately 10 seconds; this allows the roller 10 to squeeze the water, which is now clean, through the microperforations so as to complete the washing of the cylinder, and the drying step simultaneously begins with the introduction of compressed air through the electric valve 28.

During this step, the cylinder is raised for a short time to facilitate the cleaning of the microperforations with compressed air.

Of course, the above described washing apparatus can be applied to a plurality of printing units of a multiple-dye machine and can be programmed so as to perform the washing, whether simultaneous or in subsequent moments, only of the units which are to be used, excluding from the washing operations any other printing units present on the same machine.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Apparatus for automatically washing the components of a printing unit while keeping them in operating position, of printing machines comprising a roller (10) arranged inside a perforated cylinder (1), an electromagnet means (12) arranged below an endless belt (11) and adapted to keep said roller on the inner surface of said cylinder, and a dye distribution tube (2) which is arranged inside said perforated cylinder and is connected to a dye feed pump (4), characterized in that it comprises an outer tube (3) arranged inside said perforated cylinder and coaxial to said dye distribution tube, said dye distribution tube being arranged inside said outer tube in order to form an interspace (3a) between said dye distribution tube and said outer tube, said dye distribution tube being provided with nozzles (9) for feeding dye inside said cylinder, said outer tube being also provided with nozzles (3b, 3c) in order that said interspace may distribute washing water inside said roller, said distribution tube, said interspace and said dye feed pump being alternatively connected to a pump means (21) for feeding washing water and to a compressed air source (27), through valve means (28, 29, 30), a hollow body (15) being associated with said outer tube and being connected to a suction pump means (18), said hollow body being provided with lifting means (20) adapted to lift said roller from said inner surface of said cylinder, said hollow body furthermore having a channel portion (16) arranged at said roller and provided with openings (17), said pump means (21) being adapted to feed pressurized water at least into said dye feed pump, said dye distribution tube and said cylinder, said at least dye feed pump, dye distribution tube and cylinder being alternatively operatively connected to said compressed air source to be fed with compressed air, said channel portion (21) being connected to said suction pump means for generating a vacuum for conveying the mixture, formed in the cylinder by the washing water and the dye, into said channel portion and for discharging said mixture.

2. Apparatus according to claim 1, characterized in that the complete washing cycle is automatically controlled by a microprocessor to feed pressurized washing water, at the end of each printing operation, in an intermittent manner and alternately with the feeding of pressurized air so as to create alternated water-air cycles combined with cycles of lifting and lowering of said roller.

3. Apparatus according to claim 1, characterized in that said nozzles (3b, 3c) of said outer tube are distributed along the entire length of said outer tube and comprise closely spaced terminal nozzles (3c) adapted to wash the support members which rotatably support said cylinder.

4. Apparatus according to claim 2, characterized in that said alternated feeds of pressurized water and air are programmed so as to be performed while the printing machine rotates at reduced speed and while said roller is kept in a raised position with respect to said cylinder inner surface both during the cylinder washing cycles and during the step of final drying of said cylinder.

5. Apparatus according to claim 1, characterized in that said dye distribution tube (2) is longer than said outer tube (3) and is provided with a dye feed end and with a discharge end, said dye feed end being connected to said dye

feed pump and said discharge end being connected to a valve means (2a) for closing said tube during the printing operations.

6. Apparatus according to claim 1, characterized in that said openings (17) of said channel portion (16) are provided on a bottom side of said channel and on a vertical wall (16c) of said channel, said vertical wall (16c) facing said roller.

7. Apparatus according to the preceding claims, characterized in that a quick-coupling is interposed between the tube (5a) for connecting the dye pump (4) to the dye distribution tube and the distribution tube (2), to allow the cutoff of the pump from the tube, its separate washing, and the feeding of the water-dye mixture directly to the discharge.

8. Apparatus according to the preceding claims, characterized in that said roller is constituted by a magnetizable tubular metallic body.

9. Apparatus according to the preceding claims, characterized in that said lifting means comprises an array of magnetized plates (26) arranged with alternated polarities along said hollow body (15).

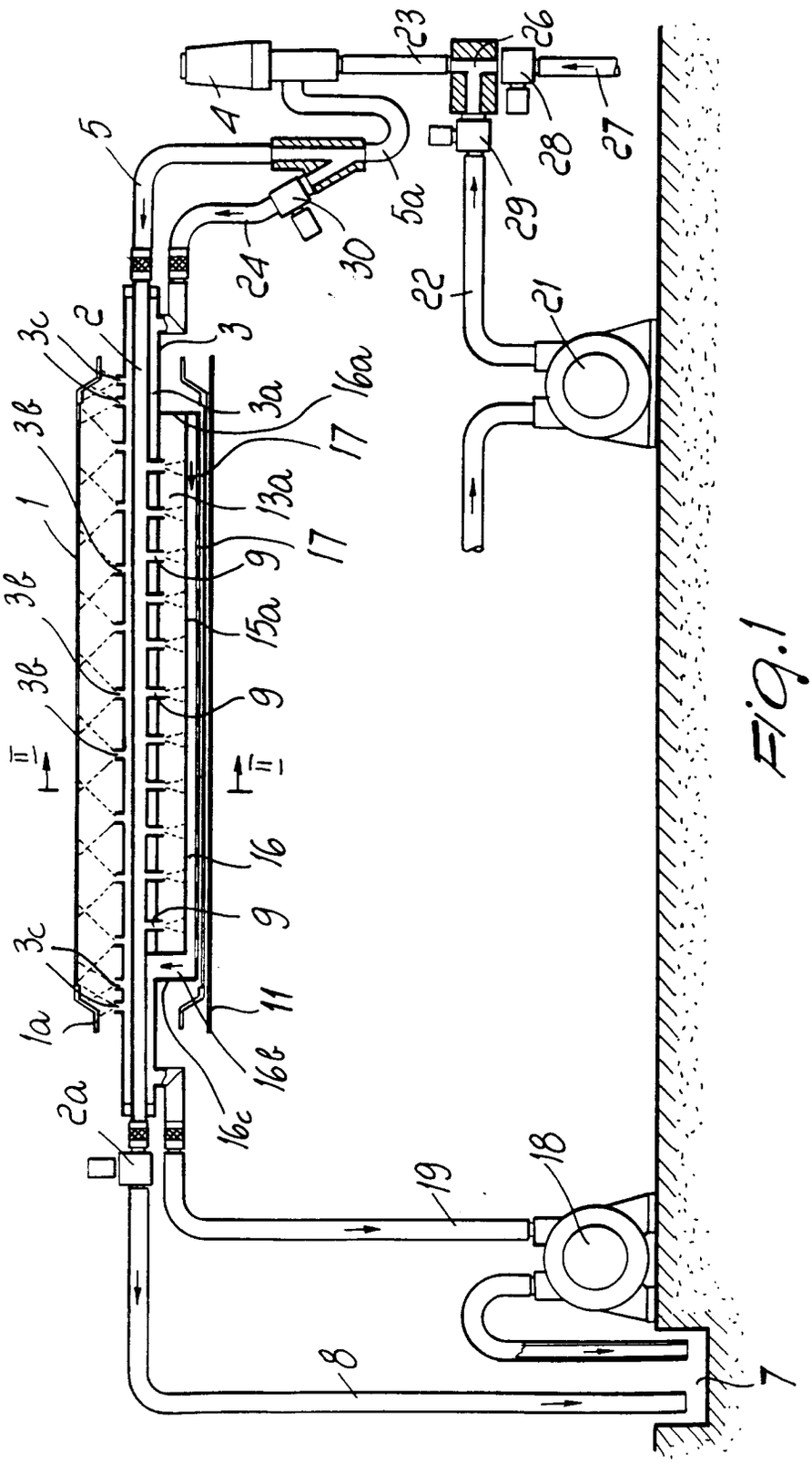
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Fig.1

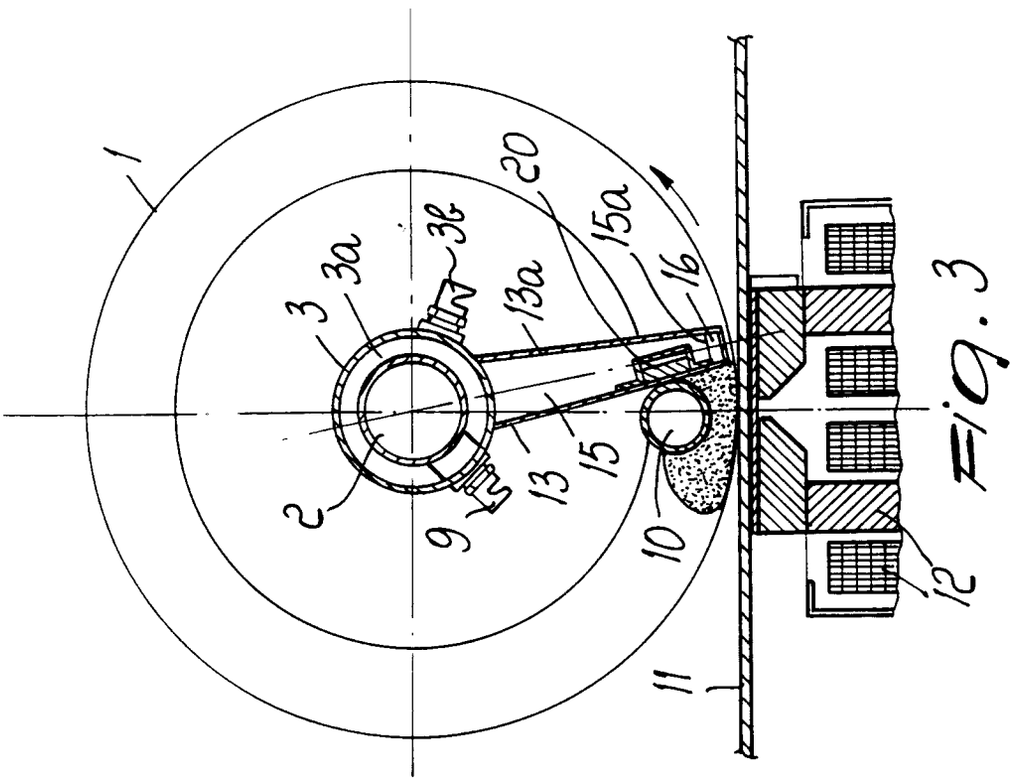
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Fig. 3

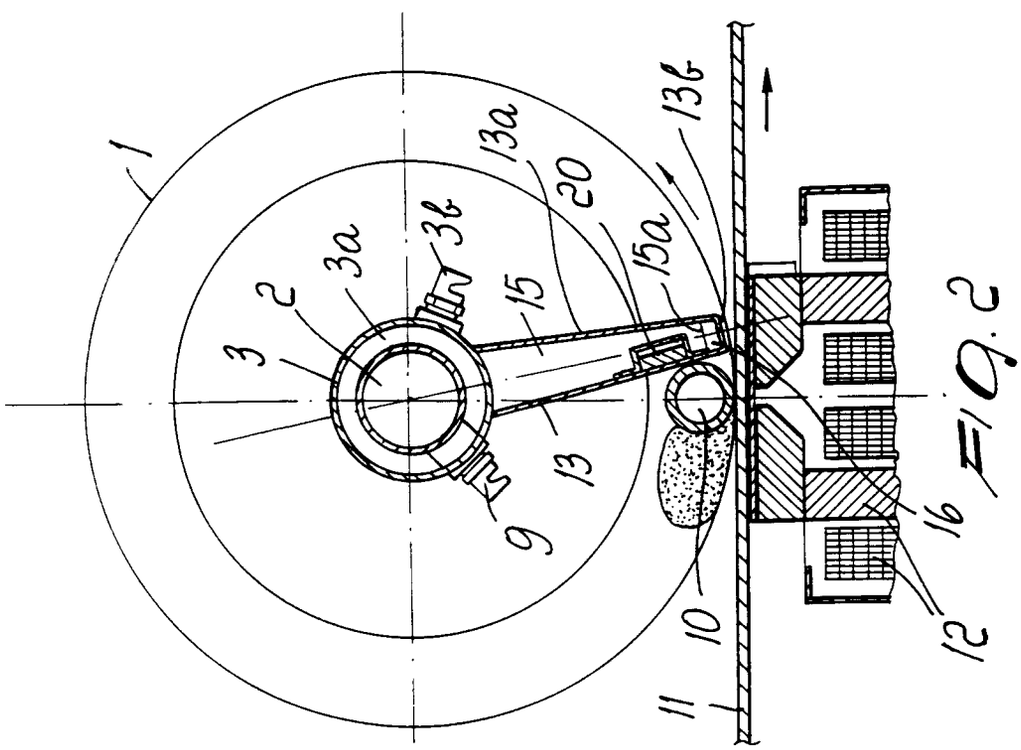
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Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 4502

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.5)
A	EP-A-0 277 481 (REGGIANI MACCHINE S.P.A.) * the whole document * ---	1,2,4-9	B41F35/00
A	EP-A-0 364 918 (MASCIONI S.P.A.) * the whole document * ---	1,3	
A	AT-A-338 209 (P. ZIMMER) ---		
A	EP-A-0 056 630 (FIRMA SAUERESSIG GMBH) ---		
A	PATENT ABSTRACTS OF JAPAN vol. 10, no. 2 (M-444)(2059) 8 January 1986 & JP-A-60 168 657 (TOUSHIN KOGYO K.K.) 2 September 1985 * abstract * -----		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 APRIL 1992	BOURSEAU A.M.

CATEGORY OF CITED DOCUMENTS

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