



(11) **EP 2 818 321 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**31.12.2014 Bulletin 2015/01**

(51) Int Cl.:  
**B41F 35/00<sup>(2006.01)</sup> B41F 35/06<sup>(2006.01)</sup>**

(21) Application number: **14173960.7**

(22) Date of filing: **25.06.2014**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA ME**

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(30) Priority: **26.06.2013 IT BO20130331**

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(54) **Process and apparatus of combined and simplified type for cleaning the cylinders of rotary printing machines**

(57) Process of combined and simplified type for cleaning the cylinders of continuous printing machines, provided with groups of printing cylinders (C1-C1', Cn-Cn'), that act on opposite sides of the endless web (N) to be printed unwound from a reel, wherein each printing cylinder is provided with cleaning means (P1-P1', Pn-Pn') and which includes a primary step for supplying to one or to both opposite sides of said web (N), upstream of the group of printing cylinders, the majority or all (80-100%) of the cleaning liquid with solvent required to clean the cylinders of the printing machine and that can be safely carried by the web also in the subsequent drying step, while said cleaning units (P1-P1', Pn-Pn') of the groups of printing cylinders are entrusted both with the mechanical action and with the secondary supply of any remaining amount (0-20%) of the cleaning liquid with solvent or of a cleaning liquid with low or even no solvent content and proportionally high water content, to maintain at least lubricated and clean the side areas (ZC) of the cylinders that are not in contact with the paper web, providing for the use of cleaning liquids with oil-based solvent, with a limited evaporation factor of the solvent contained therein, so as to be able to use large amounts of these oil-based liquids to decrease the times of current washing and cleaning cycles of printing cylinders, characterized by the fact that said primary step of supplying the cleaning liquid with solvent is carried out intermittently, so that lengths of web (N) to which amounts (Q) of liquid with solvent have been applied are followed by lengths (N') of the web to which said liquid with solvent has substantially not been applied, while the amounts of liquid accumulated upstream of the printing cylinders

(C1, C1') will be applied to said lengths of web (N') in a distributed fashion by the calendaring action that these cylinders exert on the web (N) being drawn, so that these lengths of web (N') will also pass through the cylinders (C1, C1') with amounts of liquid equivalent to those of the lengths wetted in said primary supply step, so that when the feed speed of the web (N) to be printed varies, the interval of time (TB, TB', TB'') elapsing between one step and the subsequent step (TA) for supplying the liquid with solvent is made to vary in an inversely proportional fashion, and also characterised in that constant amounts of liquid with solvent (Q) are supplied to the web (N) in the unit of time.

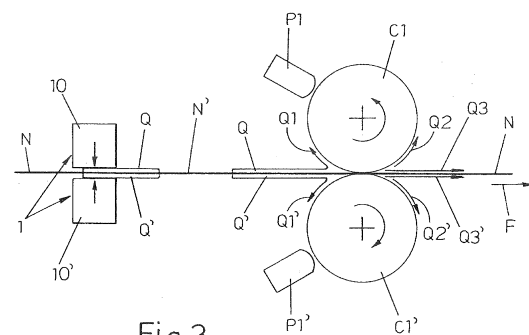


Fig.3

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## Description

**[0001]** The invention relates to a process and to an apparatus of combined and simplified type for cleaning the cylinders of continuous printing machines, for example of the "reel" type, provided with rubber printing cylinders that act simultaneously on opposite sides of an endless web of paper unwound from a reel.

**[0002]** To perform periodic cleaning of the cylinders of these machines, it is known to operate on the individual cylinders with apparatus of various type, which bring into distributed contact with the surface of the cylinders, for example, a cloth or other means wetted with a cleaning liquid generally composed of a mixture of water and solvent, to remove part of the dirt dissolved by the liquid and/or which delegate removal of this dirt or of the residual dirt to the paper web that is maintained in continuous movement at the right speed and in contact with the cylinders during cleaning and transmits to the cylinders in succession the part of the cleaning liquid evacuated from the groups of cylinders upstream. In particular, the invention refers to the Italian patent no. 1.375.781 dated 5 January 2007, which concerns a method and an apparatus of combined type for cleaning cylinders in continuous printing machines, shown by way of example in the diagram of Fig. 1 of the accompanying drawing, which illustrates a series of two groups of printing cylinders C1, C1' and Cn, Cn', with which there are associated respective cleaning units P1, P1' and Pn, Pn', for example of the aforesaid type, and between which cylinders the web N of paper or other material to be printed travels in the direction F. In the method according to Fig. 1, cleaning liquids with oil-based solvents can be advantageously be used, with the evaporation factor of the solvent substantially halved with respect to that of convention water and solvent mixtures, which for this reason can be used substantially in double the amount and are characterised by a very low water content, so as not to alter the properties of tensile strength of the web N inserted in the printing machine, above all if this is made of paper. In the continuation of the description, when the solvent is referred to, this is always intended as said oil-based solvent. At the exit from the last group of printing cylinders, Cn, Cn', the web N can carry on its opposite sides, for example, around 80 ml of cleaning liquid with solvent, so as to allow the system to substantially halve the printing machine cleaning cycle times, with respect to the cycles that use conventional solvent with a high evaporation factor. According to the diagram of Fig. 1, a large amount of said cleaning liquid with solvent, or all of this liquid, is supplied directly to at least one or both of the opposite sides of the paper web N, by a primary unit 1 located immediately upstream of the entire set of printing cylinders. This primary unit supplies to the side or sides of the web N, usually by spraying and optionally with the aid of roller, doctor blade and/or linear or rotating brush spreading means, an amount of said cleaning liquid with solvent, for example, in the order of around 70-75 ml per second, while

the remaining amount of liquid with solvent (80-75= 5 ml) is split between the various cleaning units P1, P1', Pn, Pn', which will each supply, for example, 2.5 ml of liquid per second. In actual fact, printing machines use more than two groups of printing cylinders, usually three or four, so that each cleaning unit P must normally supply just over one millilitre of liquid with solvent. A very high percentage, in the order of around 80-90% of the cleaning liquid with solvent, is thus carried by the web N that passes through the various printing cylinders in succession, the cleaning units P of which, of cloth or other type, use this liquid originating from the web N and also themselves supply an amount of liquid with oil-based solvent in the order of 10-20%, at least sufficient to maintain the inactive side areas of these printing cylinders, located outside the paper web N and which can be of different width, lubricated and clean. The liquid supplied by the cloth-type cleaning unit P serving the printing cylinders contains the same type of liquid with solvent supplied by said primary unit 1 and may contain a very high percentage of water, which satisfactorily performs the task of lubrication and ensures better removal of the particles and shreds of paper, above all when the web N comprises recycled paper, which has the tendency to turn to dust. This aqueous component, cooperating through friction with the printing cylinder, tends to dry rapidly and the small amount which may reach the web N, finds this latter already impregnated with oil-based solvent and therefore in a substantially impermeable condition. During the wash cycle of the printing machine, if in some of the steps the cleaning units P can remain inactive or operate with reduced or even no solvent supplying only water, the primary unit 1 can be responsible for supplying a correspondingly higher amount, or even all of the solvent that can be safely carried by the web N through the subsequent drying oven. Therefore, the aforesaid supply percentages of cleaning liquid with solvent can be intended as included in the range of 80-100% for the primary unit 1 and the remaining 0-20% split between the assembly of the cleaning units P.

**[0003]** From Fig. 2 which shows in a plan view the primary unit 1 and the first pair of printing cylinders C1, C1' with the related cleaning means p1, P1' according to the prior art diagram of Fig. 1, it can be seen that the primary unit 1 is arranged in width to work on the webs N of the maximum width usable by the printing machine and which can be provided with means 2 to recover the amount of liquid that this unit 1 supplies laterally to the web N and return it directly to a recovery reservoir 3 with related filter means, when this, as in the example in question, is of a width less than the maximum width that can be used in the printing machine, so that the areas ZC of printing cylinders C at the sides of paper web N will only be reached by a small amount of cleaning liquid with solvent, for example in the order of around 2.5 ml/sec, supplied by the cleaning unit P with which the cylinder is equipped, sufficient to maintain contact between the cloth of the cleaning unit P and the inactive surfaces ZC of the

printing cylinder lubricated and clean. Due to these limited amounts of cleaning liquid with solvent supplied to said areas ZC of the printing cylinders, it is no longer necessary to provide means and cycle times to clean these areas of the cylinders at the end of the cleaning cycle, and therefore it is sufficient to provide small safety containers (not shown) under each cleaning unit P, without having to connect these to recovery circuits.

**[0004]** The primary unit 1 comprises means 4 for controlled feed of the cleaning liquid with solvent to the spray bar or bars thereof, controlled by a processing unit 5, an input 6 of which receives a signal relating to the feed speed of the web N, so that through said means 4 the amount of liquid supplied to the opposite sides of this web N by said first primary unit 1 is automatically adjusted in a manner that is directly proportional to the feed speed of the web N, without exceeding the maximum limits that ensure safe operation of the drying oven that this web N passes through after cooperating with the various printing cylinders. For this purpose, it could be advantageous to provide an operating and logic connection between the processing unit 5 and other means, not shown, that control the feed of liquid to the cleaning units P1, Pn of the printing cylinders, so that if the amount of liquid with solvent supplied by the primary unit 1 increases or decreases, the amount of this liquid with solvent supplied by the assembly of cleaning units P1, Pn will decrease or increase respectively to prevent exceeding the maximum amount of solvent that the web N discharges with the dirt and carries into the drying oven, first during contact with the primary unit 1 and then during cooperation with the printing cylinders,.

**[0005]** The Italian patent no. 1.375.783 dated 5 January 2007 corresponding to the International Application WO 2008/084361, describes how the cleaning liquid with the solvent can be supplied to one or to both sides of the web N, in a variable amount correlated to the feed speed of the web, by related spray bars of a primary unit 1, each of said bars 1 being divided into several adjacent sections 101, with respective nozzles and in which these sections 101 are fed by one or more respective solenoid valves 7, 107, controlled by said processing unit 5 the input of which receives a signal correlated to the width of the web N used, so that the unit 5 can activate or deactivate in groups said solenoid valves 7, 107 to adapt the active width of the spray bar of the primary unit 1 to the width of the web N inserted into the printing machine. The processing unit 5 can be provided with a further input 9 which receives a signal that informs it of any different distribution of dirt on the printing cylinders, so that by supplying one or both of the solenoid valves 7, 107, with the same or different steps and/or opening times, it is possible to supply variable amounts of solvent to the bar sections 101 selected, to adapt operation of the spray bar or bars of the primary unit 1 to the different feed speeds of the web N and consequently to allow, also through the unit 4, reduction of the amount of solvent that is supplied transversely to the web N in the unit of time,

to be able to supply more or less solvent to be destined respectively to more or less dirty areas of the printing cylinders to be cleaned or to implement micro-washing methods.

**[0006]** Also mentioned as prior art is the document EP 816.080 published in 1998, which describes how to clean a printing cylinder by applying upstream of this cylinder oil-based solvent on one side of the paper web, interrupting the inking process of said printing cylinder and increasing the amount of water that this receives from conventional wetting means, making sure that the water only touches areas of the paper web to which the oil-based solvent has already been applied, as otherwise the web could tear. The method therefore provides for an adequate time lag between the step of applying the oil-based solvent to the paper web and that of wetting the printing cylinder with water. This document states that the cleaning process can be performed continuously or intermittently, as practical tests have shown that cleaning carried out in the manner described during a short period of time offers satisfactory results and is obtained with a small waste of paper web. In other words, D1) states that satisfactory cleaning results are obtained if the same cleaning cycle is repeated before the cylinders become very soiled, and therefore if the cycle is repeated for short periods (intermittently) as they are only moderately soiled, the cylinders are cleaned rapidly, in limited times, and the length of paper web use to perform the cleaning cycle, which must therefore be discarded, is limited, with consequent advantages in reducing the costs of the cleaning process.

**[0007]** In the production of a system as described above with reference to the prior art of Figs. 1 and 2, it was very difficult and problematic to provide for the supply by the spray bars of variable amounts of liquid with solvent in relation to the different feed speeds of the web N and in relation to the different transverse positioning of the dirt on the printing cylinders, and therefore it was necessary to devise a new, simpler and more reliable solution to solve this technical problem, said solution forming the subject matter of the present patent application, is summed up in the appended claim 1 and the features and advantages of which will be apparent from the description below, provided with reference to the accompanying drawings, wherein, in addition to Figs. 1 and 2 already considered, it can be observed that:

- Fig. 3 schematically shows, in an enlarged and side elevation view, the primary supply unit with the subsequent first group of printing cylinders and related cleaning apparatus, schematizing the new operating mode according to the invention of the primary supply unit;
- Figs. 4, 5 and 6 show the operating diagrams of the primary supply unit respectively at the maximum feed speed of the web, and at half and a quarter of this maximum speed;
- Fig. 7 shows a simplified block diagram of an em-

bodiment of the apparatus according to the invention.

**[0008]** The improvements concerned originate from the following observations made with reference to the diagram of Fig. 3, where, similarly to the prior art of Fig. 1, the numeral 1 indicates the primary unit for supplying solvent to one or both opposite sides of the web N to be printed that is fed in the direction F and cooperates with the first group of printing cylinders C1, C1' with related cleaning means P1, P1'. When the amounts Q and Q' of liquid with solvent supplied to the opposite sides of the web N by the spray bars 10, 10' of the primary unit 1, and which are fed in the direction F, meet the printing cylinders C1, C1', due to the blocking and calendaring action they exert on the web N, a part of this amount Q1, Q1' is retained upstream of the cylinders, while an amount Q2, Q2' remains attached to the cylinders C1, C1' and follows them in rotation to return to and increase the part upstream Q1, Q1' or to be used by the cleaning means P1, P1', while, due to the porosity of the web N, a third part Q3, Q3' of the liquid with solvent, follows this latter beyond the cylinders C1, C1'. The amounts of liquid with solvent Q1, Q1' retained and accumulated upstream by the cylinders C1, C1' ensure that if operation of the primary unit 1 is intermittent and if a length of web N' without liquid with solvent passes through this unit, said accumulated amounts Q1, Q1' are distributed uniformly over this length of web N' so that the length of web N' will also pass through the cylinders C1, C1' with an amount of liquid equivalent to those Q3, Q3' considered above. These observations led to the following brilliant intuition. To adapt the supply of liquid with solvent by the primary unit 1 when the feed speed of the web N varies, it is possible to make this unit 1 supply constant amounts of liquid with solvent, resulting in substantial simplification of the construction of the supply system, and it is possible simply to vary the interval of time between one supply and the next, to adapt the operation of the primary unit 1 when the feed speed of the web N changes, thanks to buffering and compensated distribution action that occurs downstream of the printing cylinders C1, C1'. The more the feed speed of the web decreases, the more the interval of time between supplies will increase, as illustrated in the example of Figs. 4, 5, 6, which show diagrams of activation of the primary unit, on the ordinates showing the amounts Q of liquid supplied and on the abscissas the time "t". The top parts TA of the diagrams indicate the activities of the primary unit 1, while the bottom parts TB indicate the deactivation time of the primary unit 1. The diagram of Fig. 4 is, for example, correlated to the feed speed Vmax of the web N, while the diagrams of Figs. 5 and 6 are correlated to a feed speed of the web N that is respectively half and a quarter of said speed Vmax and in these diagrams the bottom parts TB', TB'' are characterized respectively by time that is double and quadruple those of the parts TB of the diagram of Fig. 4. If required, it will be possible for areas of the web

N to receive greater or lesser amounts of liquid with solvent than the nominal amounts, to clean respectively more or less dirty areas of the printing cylinders, simply by adjusting the time duration of the top parts TA and/or of the bottom parts TB of the diagrams considered above. With these variations of the time, it will be possible to adjust the amounts of liquid supplied to the web N in relation to its physical properties and/or to its absorbent properties.

**[0009]** The supply apparatus can therefore be produced with a simplified solution as shown in Fig. 7, in which solenoid valves 7 are provided for shutting off the sections 101 of the spray bars 10, 10' of the primary unit 1 connected hydraulically to a simplified unit 104 for feeding cleaning liquid at substantially constant pressure and in which the solenoid valves 7 are electrically connected to the processing unit 5 provided with the three inputs 6, 8 and 9 already mentioned with reference to Fig. 2, but which now only requires to control the different times of said solenoid valves 7, without it being necessary to adjust other parameters of flow rate and/or pressure in the circuit that feeds the cleaning liquid to the spray bars, as was instead provided for by the prior art. Usefully, the processing unit 5 can be provided with a supplementary input 11 to be informed of the physical and /or absorbent properties of the web N, to consequently modify the time control of the solenoid valves 7 according to predetermined software.

**[0010]** Said steps of supplying the liquid to the opposite sides of the web N to be printed are usually synchronised, as shown in Fig. 3, so that these sides have opposed lengths in the same conditions, to both of which said amounts Q of liquid with solvent have been applied and opposed lengths of web N to which no liquid with solvent has been applied. When webs N with particular physical properties are used, it may instead be useful to alternate said steps of supplying liquid to opposite sides of the web N to be printed, so when liquid with solvent Q is applied to one side of the web, no liquid with solvent is applied to the corresponding length on the opposite side of this web, all in a manner that is intuitive and easily implementable by those skilled in the art.

**[0011]** It is understood that the description refers to a preferred embodiment of the invention, to which numerous variations and constructional modifications can be made, without however departing from the basic principle of the invention, as described, illustrated and as claimed below. In the claims, the references indicated in brackets are purely indicative and do not limit the scope of protection of these claims.

## Claims

1. Process of combined and simplified type for cleaning the cylinders of continuous printing machines, provided with groups of printing cylinders (C1-C1', Cn-Cn'), that act on opposite sides of the endless web

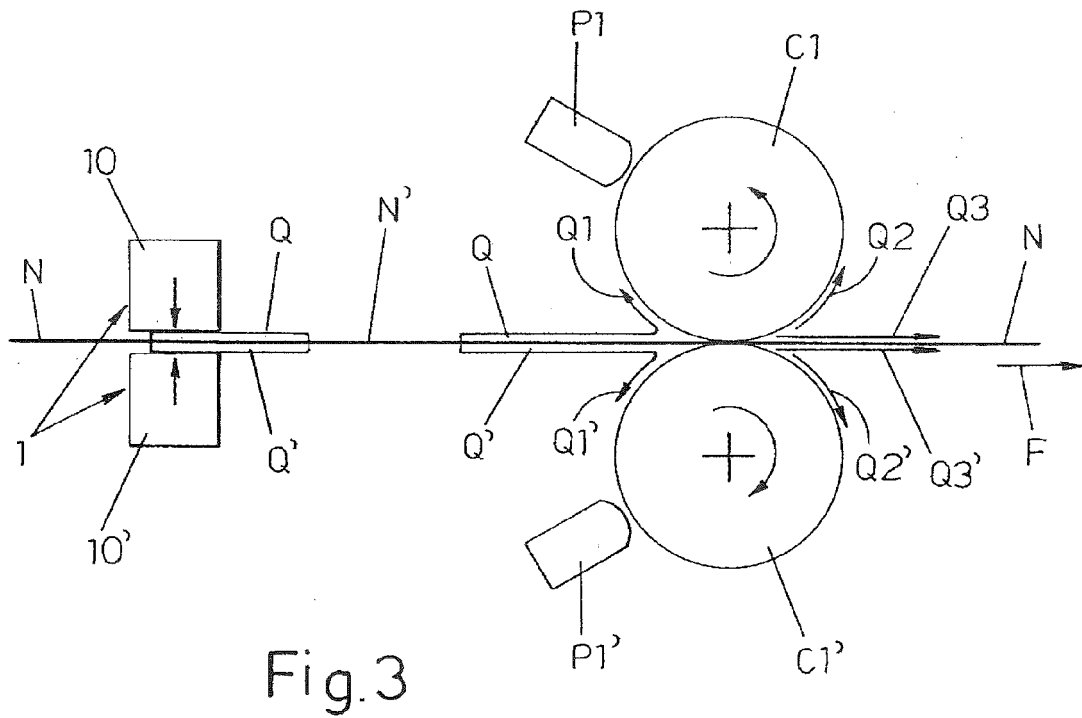
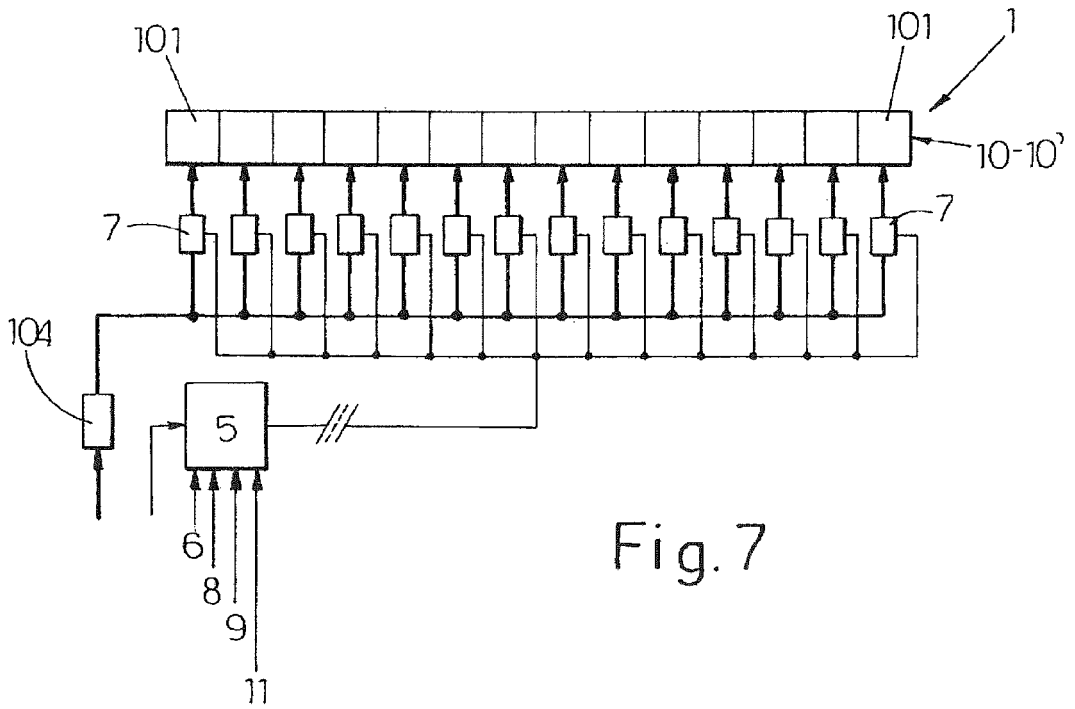
(N) to be printed unwound from a reel, wherein each printing cylinder is provided with respective cleaning means (P1-P1', Pn-Pn') and which includes a primary step for supplying to one or to both opposite sides of said web (N), upstream of the group of printing cylinders, the majority or all (80-100%) of the cleaning liquid with solvent required to clean the cylinders of the printing machine and that can be safely carried by the web also in the subsequent drying step, while said cleaning units (P1-P1', Pn-Pn') of the groups of printing cylinders are entrusted both with the mechanical action and with the secondary supply of any remaining amount (0-20%) of the cleaning liquid with solvent or of a cleaning liquid with low or even no solvent content and proportionally high water content, to maintain at least lubricated and clean the side areas (ZC) of the cylinders that are not in contact with the paper web, method that provides for the use of cleaning liquids with oil-based solvent, with a limited evaporation factor of the solvent contained therein, so as to be able to use large amounts of these oil-based liquids to decrease the times of current washing and cleaning cycles of printing cylinders, **characterised in that** said primary step of supplying the cleaning liquid with solvent is carried out intermittently, so that lengths of web (N) to which amounts (Q) of liquid with solvent have been applied are followed by lengths (N') of the web to which said liquid with solvent has substantially not been applied, while the amounts of liquid accumulated upstream of the printing cylinders (C1, C1') will be applied to said lengths of web (N') in a distributed fashion by the calendaring action that these cylinders exert on the web (N) being drawn, so that these lengths of web (N') will also pass through the cylinders (C1, C1') with amounts of liquid equivalent to those of the lengths wetted in said primary supply step, **characterised in that** when the feed speed of the web (N) to be printed varies, the interval of time (TB, TB', TB'') elapsing between one step and the subsequent step (TA) of supplying the liquid with solvent is made to vary in an inversely proportional fashion, and also **characterised in that** constant amounts of liquid with solvent (Q) are supplied to the web (N) in the unit of time.

2. Process according to claim 1), **characterised in that** said steps of supplying liquid to the opposite sides of the web (N) to be printed are synchronised with one another, so that the opposite sides of the web have opposed lengths to which said amounts (Q) of liquid with solvent are applied and lengths of web (N') to which no liquid with solvent is applied.
3. Process according to claim 1), **characterised in that** said steps of supplying liquid to the opposite sides of the web (N) to be printed are alternated, so that when liquid with solvent (Q) is applied to one side of

the web, no liquid with solvent is applied to the corresponding length on the opposite side of this web.

4. Process according to claim 1), wherein said steps (TA) of supplying liquid with solvent are **characterised by** constant time durations also when the feed speed of the web (N) varies.
5. Process according to claim 1), wherein said steps (TA) of supplying liquid with solvent are **characterised by** time durations that can vary in relation to the amount of dirt on the printing cylinders and/or to the absorbent properties of the web (N).
6. Apparatus of combined and simplified type for cleaning the cylinders in continuous printing machines, particularly for implementation of the method according to the preceding claims, which comprises a primary supply unit (1) with related spray bars (10, 10') for supplying liquid with solvent to opposite sides of the web, wherein each bar is divided into several adjacent sections (101) with respective nozzles and wherein these sections (101) are fed by at least one respective solenoid valve (7) that shuts off the circuit for feeding the cleaning liquid with solvent, and which is controlled by a processing unit (5) with a first input (8) which receives a signal correlated to the width of the web (N) used, so as to activate or deactivate in groups said solenoid valves (7) to adapt the active width of said spray bars (10, 10') to the width of the web (N) inserted into the printing machine, said processing unit (5) being provided with a second input (6) which receives a signal relating to the feed speed of the web (N) to adjust the activation and deactivation times of said solenoid valves of the active sections (101) of the bars (10, 10') in relation to the feed speed of the web (N), and wherein the processing unit (5) can optionally be provided with a third input (9) which receives a signal that informs it of any different distribution of dirt on the printing cylinders and a fourth input (11) that informs it of the physical and/or absorbent properties of the web (N), **characterised in that** said solenoid valves (7) are hydraulically connected to a simplified unit (104) for feeding cleaning liquid at constant pressure, the solenoid valves 7 being electrically connected to said processing unit (5) arranged to control the different times thereof according to said process claims, without it being necessary to adjust other parameters of flow rate and/or pressure in the circuit that feeds the cleaning liquid, to automatically adapt the apparatus to webs (N) of different width, which are fed at different speeds, which are more or less absorbent and which are destined to cooperate with more or less dirty areas of the printing cylinders.





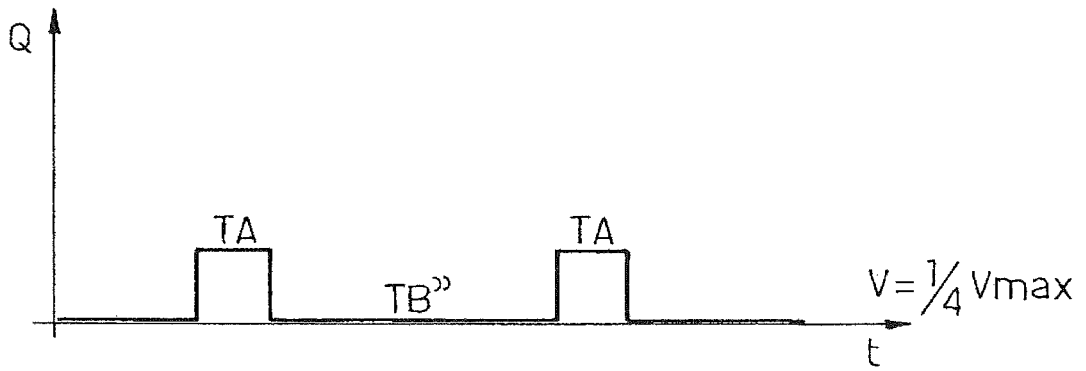


Fig. 6

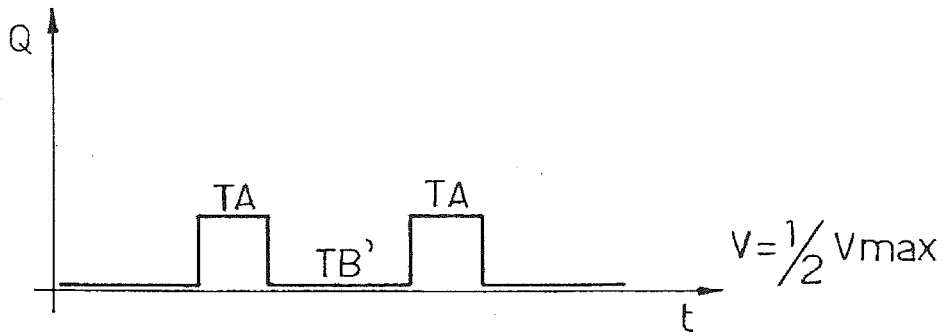


Fig. 5

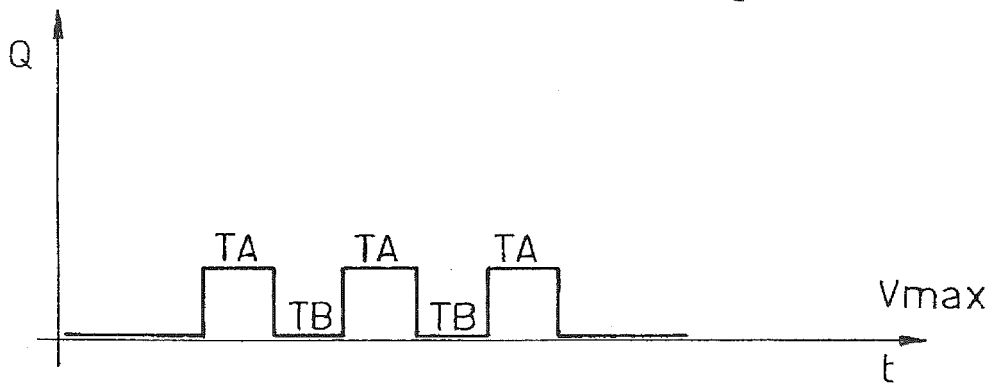


Fig. 4



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