(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 802 051 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.10.1997 Bulletin 1997/43

(51) Int. Cl.[6]: **B41F 17/00**

(21) Application number: **96830213.3**

(22) Date of filing: **16.04.1996**

(84) Designated Contracting States:
DE ES FR GB IT

(71) Applicant:
Palser Officina Meccanica s.n.c. di Palmeri Salvatore e Serra Maria Paola
21030 Mesenzana (IT)

(72) Inventor: **Palmeri, Salvatore**
21010 Germignaga (IT)

(74) Representative: **Pellegri, Alberto et al**
c/o Società Italiana Brevetti S.p.A.
Via Puccini, 7
21100 Varese (IT)

(54) Pad printer

(57) A novel pad printing method and machine employ a disposable ribbon (12) of a microporous, readily inkable material on which a programmable inkjet head (8) defines an inked ink impression which is thereafter picked up by the pad and transferred onto the workpiece in a usual manner. The method and the machine allow an outstanding control of both specific consumption of ink and of noxious ink vapor emissions. Progressive numbering may be easily programmed, avoiding the use of troublesome clichés incorporating updatable mechanical numerators. Multicolor printing is readily performed without a large inventory of clichés.

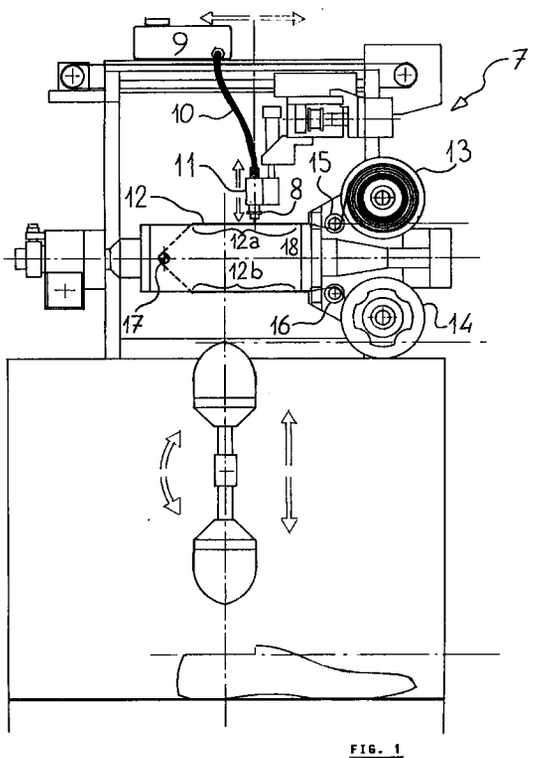

FIG. 1

EP 0 802 051 A1

Description

The present invention relates to a method and relative pad printing devices particularly suitable for the printing of identifying data, marks and similar information onto manufactured articles and products, of plastic or other material hardly suitable to be printed with common inks and/or having nonplanner printable surfaces.

Countless situations exist in which it is necessary to print manufactured article with identifying data, size, dimensions, for a proper management of the articles in their peculiar condition of utilization. Often, such articles are made of a material particularly difficult to be printed on with common inks, as for example thermosetting resins, plastic materials, ceramic and the like. Besides, the printable surface of the workpiece or article is often not sufficiently flat in those particular areas where the printed data must be visible.

A classical example of situations of this type are manufactured articles of manufacture such as the anatomical forms of plastic materials, usually articulated, used in the production process of footwear as modeling and assemblage supports of the different footwear components.

These forms are generally made of polypropylene and the printing of identifying data, for example of the model and size of the footwear for the manufacture of which the form is destined, is relatively complex because of the insufficient propensity of plastic material to retain and fix the ink. In this and in similar situations it is necessary to apply specially formulated inks, commonly containing volatile noxious and solvents, toxic if inhaled over long periods of exposure. The fixing of the inked impression on the workpiece usually requires a heat treatment to "open" the superficial polymeric structures for permanently incorporating the coloring substances and/or the pigments contained in the ink.

Usually, pad printing is the printing method used for these applications.

This method involves the steps of inking an incised surface (in negative or in positive) of a cliché, the picking-up of an inked impression by a transfer pad by pressing it against the inked face of the cliché, and the transfer onto the workpiece surface of the inked impression by pressing the pad on the surface to be printed.

The ink impression so transferred on the surface of the workpiece is eventually fixed permanently by means of a fast heat treatment.

The pad is commonly made up of a rounded body or cushion of a silicon elastomer that is mechanically pressed in a precisely pre-set and reproducible manner and driven sequentially against the inked surface of the cliché and against the surface of the workpiece. The nature of the silicon material and the stringent requisites of repeatability of the picking-up conditions of the inked impression and of transfer on the surface of the workpiece are such as to assure a precise transfer of a highly defined impression.

Numerous pad printing machines of a high degree of automation, for single or multicolor printing according to a printing procedure referred to as "wet-on-wet", are known wherein three or four dye components are repeatedly applied by overlapping the one onto the other on the workpiece, drawing the respective impressions components from different clichés inked with base colors.

A recurrent requisite of printing the workpieces with or just with one progressive numeration is usually overcome by incorporating in the ink taking-up clichés a conventional updatable multidigit numerator device, capable of being automatically incremented or programmed.

An example of an automatic pad printing machine is the model "Pad Printer" PP-29-MC-E, made by Kent Engineering Co., Ltd. of Hong Kong.

The machine is provided with a plurality of pads and a retractable shelf upon which are installed the clichés, which through a reciprocal motion of the shelf, undergo sequentially the inking, through a standard self-leveling "doctor blade" system, during a retraction phase of the shelf that corresponds to the lowering phase of the pads previously inked on workpieces conveyed on the machine's bench. The clichés are brought again under the pads during a successive extension phase of the shelf that carries them, during which the pads lowers themselves again over the cliché for taking-up the ink.

The nature of the inkable cliché, including or not an updatable numerator, is such to require a certain consumption of ink, part of which is lost and collected with an evident waste of excess ink. Often, the type of ink needed for permanently printing materials that are particularly "refractory" to fixing standard inks, must have a formulation that includes compounds, generally regarded as unhealthy in case of prolonged exposures to the vapors of the ink. Even by implementing vacuum and/or ventilation measures for safety of the operators, the result is however a dispersion in the atmosphere of these compounds.

These problems negatively reconciliate with the use of many clichés to be inked at each cycle.

Another recurrent problem may be generated by the peculiar rheologic characteristics and viscosity of the ink that, especially in the case of updatable numerators installed through appropriate "windows" of the cliché, has the tendency of accumulating and thickening in the necessary clearance spaces of the updatable rollers of the numerator and of being eventually picked-up by the pad and thus transferred onto the workpiece in the form of blurs and improper marking. This situation necessitates of a frequent cleanings of the clichés and of the updatable numerators mechanisms.

The present invention obviates all these problems and drawbacks. It relates to an improved method of pad printing capable of drastically reducing the consumption of ink, of reducing to negligible amounts the emissions of vapors of the ink and of practically eliminating the necessity of periodic cleaning operations of the inkable clichés.

Basically the method of the invention and the relative equipment that implements it are characterized by the elimination of the inkable clichés and by replacing their function with a disposable type of inking support for the impression to be transferred on the workpiece. Said dispensable inking support has a surface writable that may be readily with an appropriate writing system, preferably so-called inkjet printing system. The inkjet impression on the writable surface of the disposable support is then picked up by the pad in a normal manner and is transferred from the pad onto the surface of the printable workpiece, in a conventional manner.

The inking of the writable surface of the disposable support may be accomplished by the use of the writing head of an inkjet printer, suitably mounted on a block movable along three axis under numerical control of a processor, in a way similar to the tracing pen of a conventional plotter.

The writable disposable support may be typically a ribbon of sufficient width, unwound in a virgin state from a feeding bobbin and rewound in a recovery bobbin to be eventually disposed. The disposable ribbon support is incrementally advanced from an inkjet writing position to ink the impression to a picking-up position of the inked impression by the pad.

The support material may be a textile ribbon of a natural or synthetic material with characteristics suitable to furnish a writable surface having an optimizable microporosity in order to facilitate the inking by the inkjet head without blurrings, smears or loss of contour definition. The back face of the ribbon (opposite to the writeable surface) may be sealed by waxing it if necessary or useful in consideration of the porosity of the fabric and the rheologic characteristics of the ink used.

The machine architecture for sequentially perform defining an inked impression onto the face of a fresh segment of the disposable ribbon, advancing the inked portion of the ribbon to an impression picking-up position of by the pad pressed onto the inked area of the disposable ribbon, retracting the inked pad, positioning and lowering it onto the surface of the printable workpiece, simultaneously to the printing of a new impression onto a new fresh segment of the disposable ribbon, may be devised and arranged in different ways, according to general suitability criteria and/or requisites of the particular pad-printing applications.

Preferably the controlling processor of an inkjet plotter printing head is programmed for automatically placing the printing head inside a receptacle after a certain period of inactivity that is to a stand-by condition (waiting for subsequent printing commands.) This coupled to the fact that the impression to be transferred on the workpiece is completely pre-printed (basically in positive) on a flat surface of the disposable support, therefore without any waste of ink, minimizes the use of ink, the consequent emissions of solvent and practically eliminates the problems tied to a correct management of the inventory of clichés (eventually incorporating updatable mechanical numerators) to be inked at each cycle, thus dramatically reducing costs, toxicity and pollution problems.

The different aspects and advantages of the invention will became even more evident through the following description of an important embodiment and by referring to the attached drawing wherein:

Figure 1 is a front view of a pad printer made according to the present invention;

Figure 2 is a side view of the machine of Fig. 1.

With reference to the figures, the machine comprises a bench or platform above which, a system of automatic advancement of the items to be printed may be realized according to any conventional technique for automatically conveying workpieces through a generic work station. In the case illustrated, these items of manufacture are forms 2 of a plastic material 2 for the manufacture of footwear 2.

In the illustrated example, the transfer pad of the inked impression has in a dual form, the pair of pads (3a and 3b) are mounted on an arm 4 supported by an overhanging axle 5 which can rotate by 180°, thus reversing the position of the two pads 3a and 3b.

The arm 5 can be lifted upwards during an ink picking-up phase of the pad 3a that is currently located in the upper position and can be lowered during the printing phase of a workpiece 2 by the pre-inked pad that is currently in the lower position 3b. Of course, the position of the pads alternates during the cyclic operation of the printer.

A frame 6 supports the preplotting assembly indicated as a whole with number 7, including an inkjet printing head 8. An ink reservoir 9 feeds the printing head through the flexible tube 10.

The block 11 that carries the printing head 8 moves along three orthogonal axes, by the action of standard moving mechanisms such as those normally employed in plotters.

According to an embodiment of the invention, the dispensable support on which the impression to be transferred by the pad is predefined (inked) is constituted of a ribbon 12 that unwounds from a feeding roller 13 and rewinds itself on a disposable roller 14. Suitable guide rollers 15 and 16 cooperate with a driving roller 17 in guiding the continuous ribbon 12 during its advancing per increments produced by a stepping motor.

The ribbon 12 runs over smooth surfaces of a block 18, rigidly supported by the frame 6 by means of robust anchor pins so that the upper surface thereof, upon which the ribbon 12 runs, and the lower surface of the block 18 on which runs the same ribbon 12 may provide, the first, for a rigid support of the ribbon 12 during the writing thereon of an inked impression by the inkjet head 8, and, the second, for a perfectly rigid support to the upper pad 3a when this is pressed against the previously inked face of the ribbon 12, which was incrementally advanced by the motor to the position picking-

up of the ink by the pad.

A processor controls the timing of the incremental advancing of the ribbon 12 from an inking position 12a to an ink taking-up position 12b by the pad, coordinating the writing and incremental advancing of the ribbon in synchronism with the printing of the workpiece by the pre-inked pad 3d, the lifting and rotation of the arm 5 to invert the position of the pads, and the successive lifting of the arm 5 to perform a new ink taking by the pad just returned to the position 3a.

As an option, cleaning means may be installed in order to clean the pad surface after each printing phase of the workpiece. In the illustrated embodiment, such means could be operational during the turning by 180° of the arm 5, in a way that in rising from the position 3b to the position 3a the pad rubs on a soft cleaning padding.

The definition of the inked impression on the face of the disposable support, carried out by means of an inkjet printing head permits an outstanding freedom in programming the impressions with any graphic characteristic, numbering and/or explanatory details or wardings in a continually and progressively updatable manner, without requiring the use of a large inventory of clichés or the employment of updatable numerators set in the inkable cliché. The result of this is an extreme flexibility of the pad printer obtained with a relatively contained cost. Another advantage is the possibility offered of defining colored impressions by employing a plurality of inkjet heads each fed with an ink of a base color and positionable and excitable in sequence and in overlap, as in a common color printer.

In these color printing applications, the advantages offered by the method and the machine of the invention when compared with the prior art technique based on the employment of a plurality of clichés with a repeated pad application on the same surface of the workpiece to complete the color composition, are even more pronounced for all the reasons already mentioned, and in particular in relation of a more effective control of polluting emissions and of a reduced consumption of special and generally costly inks and of the fact that preparing of numerous clichés in no longer necessary.

The disposable ribbon 12 may be a ribbon of a cloth of natural or synthetic fiber, for example of the type commonly used in serigraphy, preferably waxed or dressed on the face opposite to the printing face with a layer of impervious material. Other types of microporous ribbons may be used in alternative to a textile ribbon, for example a ribbon of plastic material made sufficiently microporous on the inkable face, or a composite ribbon obtained through laminating together a microporous film and a non porous film, are suitable materials.

Claims

1. A pad printing method comprising cyclic operations of inking of a cliché, taking-up of the inked impression by a transfer pad, transferring the impression onto the surface of a workpiece by pressing the inked pad on the surface to be printed and eventually fixing the pad-printed impression, characterized in that it comprises the steps of defining at each cycle an inked impression on a disposable support by the use of an inkjet printing head;

   taking-up said inked input by pressing a transfer pad on the inked impression defined on said disposable support.

2. The printing method according to claim 1, characterized in that said disposable support is a continuous ribbon of a microporous material, sealed with on the face opposite to a printable microporous face.

3. A pad printer comprising at least a pad of a substantially non permeable resilient material, means for pressing said pad, alternately against the surface of a pre-inkable cliché and against the surface of a printable workpiece, characterized in that it comprises

   of inkjet printing means defining an inked impression on the surface of an inkable ribbon;

   timing means for incrementally advancing said ribbon from a first inking position to a second position where the inked impression is picked-up by said pad.

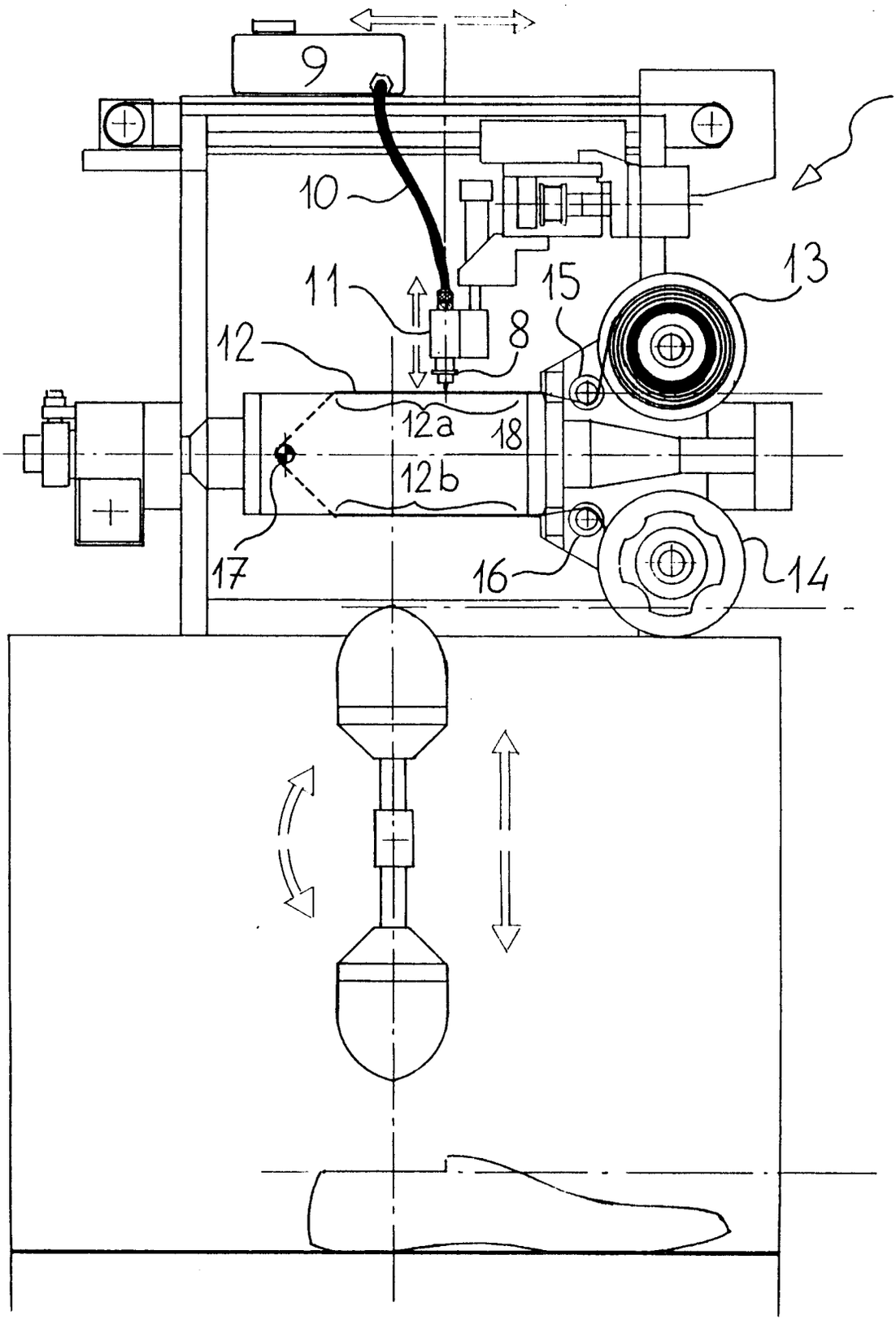

FIG. 1

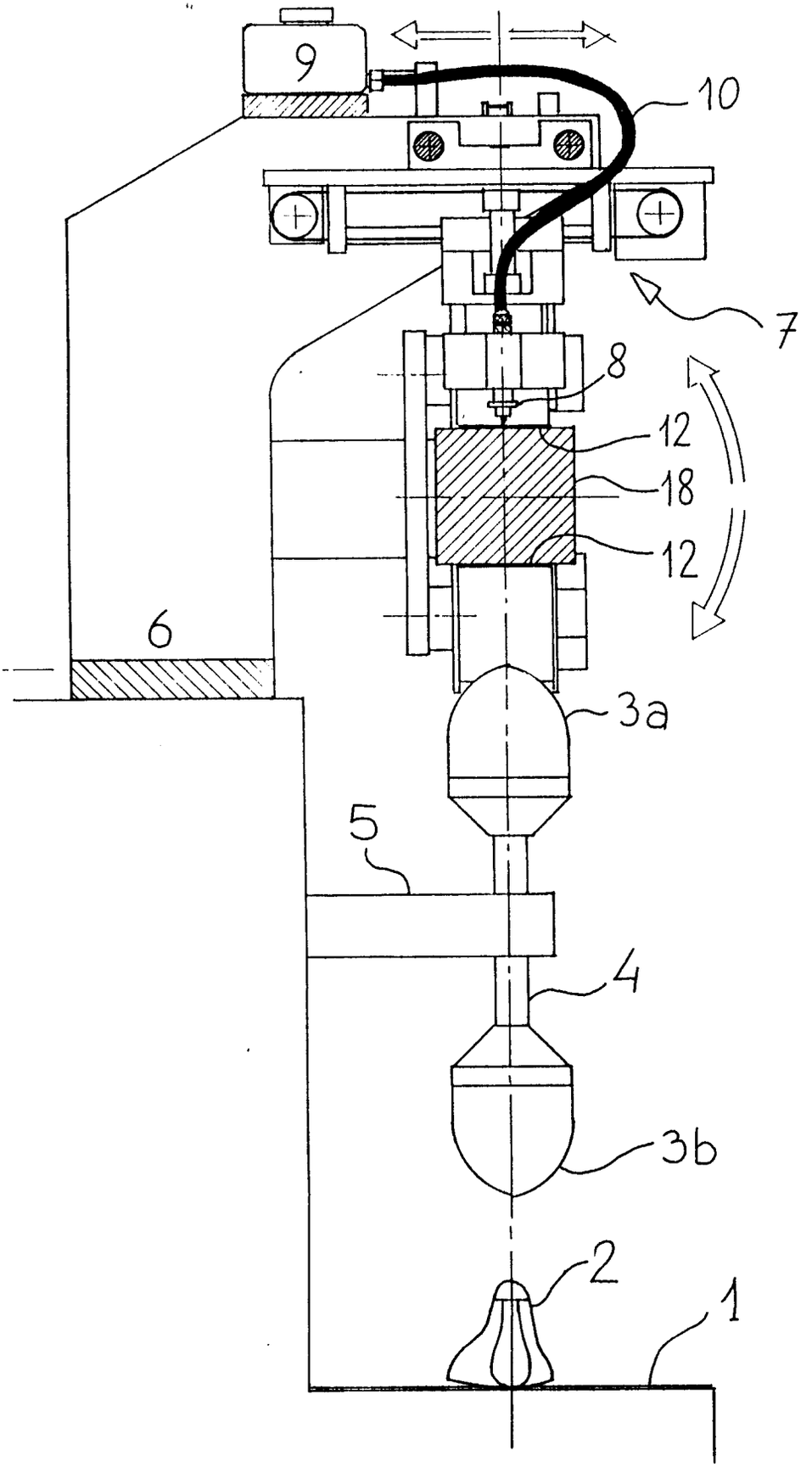

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 83 0213

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.6)
A	DE-A-44 11 213 (ABB PATENT)		B41F17/00

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 September 1996	Loncke, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)