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(54) **PROCESS FOR PLATING OUTER PERIPHERAL SURFACE OF HOLLOW ROLLER AND APPARATUS FOR AUTOMATICALLY ATTACHING OR DETACHING CASSETTE TYPE HOLLOW ROLLER.**

(57) A process for plating the outer peripheral surface of a hollow roller adapted for plating copper or chromium on the outer peripheral surface of a hollow roller and especially a gravure printing block roller and an apparatus for automatically attaching or detaching a cassette type hollow roller. The conventional mechanism for automatically attaching or detaching a gravure printing block roller by chucking both ends of the horizontal roller and rotating the roller should be provided at each of the plating machines. This apparatus, on the other hand, eliminates all the plating machines and also the automatic attaching and detaching operations of the hollow rollers at the respective plating machines. Only the automatic hollow roller attaching and detaching mechanism portion is separated from the machine body and formed into the shape of a cassette. Thus, the hollow roller is detached merely at the initial and the last of the plating steps, but retained to be gripped with the hollow roller by the cassette midway of the step and sequentially moved to the series of the machines. This apparatus chucks the hollow roller R with energizing supports (22A, 22B) at the ends of a pair of spindles (21A, 21B) axially movable at least at one side of a suspending frame (13) and prevents the supports from being plated with plating liquid by liquid preventive caps (23A, 23B) at the outside of the spindles. Thus, this apparatus can move the frame (13) by a hoist.

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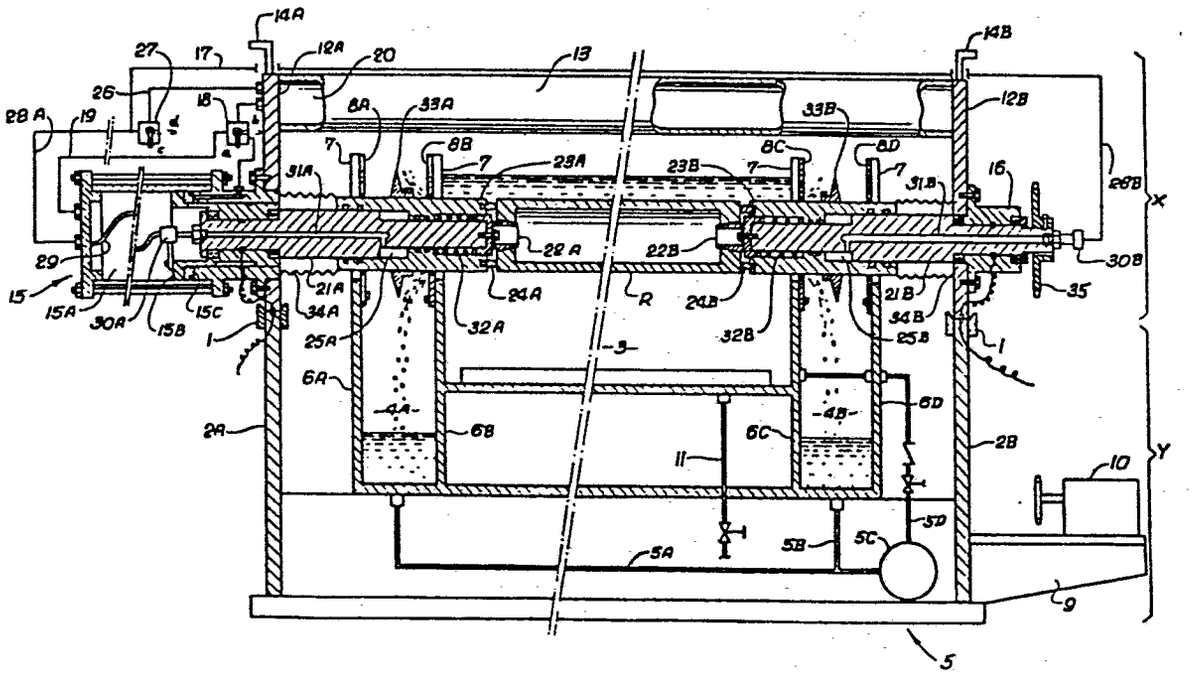
FIG. 1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6D
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DESCRIPTION

FIELD OF THE INVENTION

This invention relates to methods for plating printing rollers and more particularly to plating of photogravure plates and to mounting apparatuses for such rollers utilized in the plating method.

BACKGROUND OF THE INVENTION

In order to provide homogeneous plating of a gravure roller, at least a part of the roller surface must be immersed in a process solution and the roller must be rotated with precision at a specified constant rate. In addition, in order to carry out the plating in a short time period, it is desireable to immerse the whole body of the roller in the process solution. Consequently, because the gravure roller is hollow in shape, some action must be taken to prevent the process solution from leaking to the inside of the roller.

With such a necessity, in conventional plating processes for gravure plate making, action is taken as follows: a spindle is inserted through the hollow gravure roller; both ends of the roller are supported with a pair of ring shaped charge-supporters provided on the spindle; ring shaped leak-proof caps are provided on the spindle to cover both of the charger-supporters and seal the ends of the roller; and the

completed set-up is then mounted on a pretreatment apparatus, then mounted on plating apparatus, and then mounted on a after-treatment apparatus. However, in such a procedure, manual mounting is indispensable, and complete automatization has been hindered. Also, in such a process a great amount of man power is required and work efficiency is low.

In addition, in another conventional example, the Europena gravure plate maker is equipped with an apparatus to automatically mount the gravure roller onto the pretreatment apparatus, plating apparatus, and after-treatment apparatus or to dismount the roller from each of them respectively as well as to rotate the roller. However, such a structure has certain disadvantages as is described below. Firstly, the cost is high because an automatic mounting apparatus is required for each pretreatment, plating and after-treatment apparatus. In addition, the mounting must be done on each apparatus and therefore the time required for the process increases. In addition, since there are required a great number of mountings and dismountings of the roller, the chance of a leak into the inside of the roller in increased. Furthermore, because the roller is directly lifted onto and off of each one of the apparatuses, there is a substantial possibility that the roller surface will be scratched and to avoid such scratching the rollers must be handled carefully and with a soft material such as a cloth.

Accordingly, it is the general object of the present invention to provide an apparatus wherein the printing roller

can be mounted automatically and exactly, to be provide an apparatus wherein the roller can be carried easily, quickly, and safely to a plurality of specified processing apparatuses without manually handling the roller, to provide an apparatus wherein each of the processing apparatuses is not required to have a mounting apparatus, to provide a method and apparatus for plating a roller wherein the cost is reduced, and in keeping with the principles of the present invention, the above-mentioned features and objects of the present invention are accomplished by a unique plating method for plating only the outer circumferential surface of a hollow roller.

DISCLOSURE OF THE INVENTION

The automatic cassette type hollow roll removal device of the invention has a pair of opposing spindles, at least one of which is axially movable, on a suspension frame, and conducting a pair of charge-supporters at the spindle ends, with leak proof caps movable on the outside of the spindle. By this constitution, the hollow roll may be carried at either ends by a pair of charge-supporters in a conducting state, and the spindle is driven for rotating the hollow roll while the means for preventing the leakage of the process solution to be inside of the hollow roll by leak proof caps is arranged as cassette, and removal for hollow roll is automated.

The plating method for the periphery of the hollow roll of the present invention uses the automatic removal system arranged as cassette and having the above function to support the roll at both ends for transit through plural apparatus

devices and necessary treatment and to finally dismount the roll. By this method, the automatic removal means need not be provided to each apparatus device thus shortening the process.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a sectional view of a mounting apparatus and plating apparatus in accordance with the teachings of the present invention; and

FIGURE 2 is a schematic view of a plating process line utilizing the plating method in accordance with the teachings of the present invention.

BEST EMBODIMENTS OF THE INVENTION

Referring more particularly to the drawings, the plating line of the photogravure roll makeup device will be explained. Figure 1 is a mounting apparatus represented by the symbol X and a copper plating apparatus represented by a symbol Y. The mounting apparatus X and the copper plating apparatus Y, operate together to perform the required function.

Firstly, an explanation will be given of the construction and operation of the copper plating apparatus Y. The apparatus Y includes a pair of right and left frames 2A and 2B which are provided with guide plates 1 at their upper ends in order to mount the apparatus X on to the specified position. Between the frames 2A and 2B is provided a process tank 3 and at both sides of the tank 3 is provided leakage collector tanks 4A and 4B. Any process solution in the collector tanks 4A and 4B whick has leaked from process tank 3 is sent back to the

process tank 3 through a circulator 5 composed of circulation pipes 5A and 5B, circulation pump 5C and circulation pipe 5D. On top of the four side panels 6A, 6B, 6C, and 6D, which constitute the above-described tanks 3, 4A and 4B, notches 7 are provided so that the apparatus X can be mounted thereon by fitting into the notches 7. In addition, leak prevention plates 8A, 8B, 8C, and 8D are provided. The lower ends of leak prevention plates 8A through 8D are pivoted and can close in order to prevent the porcess solution from leaking from the tank 3. However, the upper portions of the prevention plates 8A through 8D can be split in two. On an accessory board 9 attached to the right frame 2B, a motor 10 is installed. The motor 10 is designed to drive an appropriate chain drive which is not shown in the drawings. A drip trap 11 is provided under the process tank 3.

In the following paragraphs the mounting apparatus will be explained. The mounting apparatus X includes right and left vertical frames 12A and 12B which face each other and which cooperates with the right and left frames 2A and 2B of the apparatus Y. The frames 12A and 12B are designed to be placed on top of the frames 2A and 2B and are installed at both ends of the high pressure tank 13. The high pressure tank 13 also serves as the transverse frame member. As a whole, all of these components form a hoasting frame. The pressure in the high pressure tank 13 can be detected by means of a pressure gage, not shown. Also, the tank 13 can regularly supply high pressure air through an air inlet attached to it, but not shown in the drawings. Furthermore, on upper sides of

both ends of the tank 13 is provided suspension metal fittings 14A and 14B.

At the lower end of the left of the tank 13 vertical frame 12A and air cylinder unit 15 is provided. At the lower end of the right tank 13, vertical frame 12B and cylinder bearing box 16 is provided. The air cylinder unit 15 is designed to conduct the pressurized air in the high pressure tank 13 into the outlet side of the cylinder chamber 15A through the pipe 17, switching valve 18, and pipe 19 to push the piston 15B made of insulated material towards the right frame 12B. Also, the air cylinder unit 15 is designed that by switching the switching valve 18 from (a) to (b), the pressurized air in the high pressure tank 13 is led to the retreating side cylinder camber 15C through the pipe 20 and the piston 15B is pulled back. The piston 15B is made in a cylindrical shape. To the piston 15B, the bearing box 16, spindles 21A and 21B are rotatably coupled and the pair of spindles 21A and 21B face each other. Charge-supporters 22A and 22B are fastened to respective ends of the spindles 21A and 21B. These charge-supporters 22A and 22B have tapered cylinders capable of anchoring the printing roller R.

At the outside of the spindles 21A and 21B, leakproof caps 23A and 23B are fitted in a manner as to be able to slide. At the end surfaces of the leakproof caps 23A and 23B, ring shaped packings 24A and 24B are provided. In order to enable a pair of right and left leakproof caps 23A and 23B to approach each other by moving their positions respectively, the cylinder chambers 25A and 25B are provided between a notched portion of

an inner surface of the leakproof caps and a notched portion of the spindles 21A and 21B, respectively. Into the left cylinder chamber 25A, highly pressurized air from the high pressure tank 13 is provided via the pipe 26, the switching valve 27, the pipe 28A, the flexible pipe 29 installed on the cylinder 15A, the rotary joint 39A, and the air inlet 31 provided in the spindle 21A. Also, into the right cylinder chamber 25B, the highly pressurized air is provided via the pipe 28, rotary joint 30B, and air inlet 31B provided through the spindle 21B.

Between the respective leakproof caps 23A and 23B, and the small diameter portions of the spindles 21A and 21B, springs 32A and 32B are inserted and by switching the switching value 27 from (c) to (d), the respective leakproof caps are carried back to the original position by the springs 32A and 32B. At the outside of the respective leakproof caps 23A and 23B, hand guard shaped drainboards 33A and 33B are installed in such a position that they are provided between the side panel 6A and 6B and 6C and 6D, respectively. Between the leakproof cap 23A and the vertical frame 12A and between the leakproof caps 23B and the vertical frame 12B, the bellows shaped cylinders 34A and 34B are provided. Current feeding to the charger-supporters 22A and 22B is accomplished by feeding the current to bearing portions of the respectivespindles 21A and 21B. In addition, at the base of the right spindle 21B, is provided a sprocket 35.

In operation to mount the roller R in the apparatus X one must first place the roller R on a supporting roll for mounting, not shown in the drawings. Then, after placing the

apparatus X on the roller R, fit the tapered hole at the right end of the roller R over the tapered cylinder of the charger-supporter 22B on the right side by moving the roller R towards the right. Next, switch the lever of the switching valve 18 from (b) to (a). By doing so the piston 15A is pushed out and the charger-supporter 22A at the end of the left spindle 21A fits into the tapered hole at the left end of the roller R. Thereafter, when the lever of the switching valve is shifted from (b) to (c), high pressure air in the high pressure tank 13 flows into the right and left cylinder chambers 25A and 25B and the right and left leakproof caps 23A and 23B support the ends of the roller R as well as preventing the leakage of the process solution to be inside of the roller R.

To remove the roller R, it only required that the switching valve 27 be returned to the (d) position and then the switching valve 18 returns to the (b) position. The above-described mounting and dismounting of the roller R by the apparatus X is carried on a specified mounting or dismounting board and the roller is mounted onto the apparatus Y after being held by the apparatus X. Upon mounting the apparatus X with the roller R onto the apparatus Y, the four leak prevention plates 8A, 8B, 8C and 8D are split in two, respectively, by the action of the springs which are not shown in the drawings and are closed when the leakproof caps 23A and 23B are dropped into a setting position. Also, by merely mounting the apparatus X on the apparatus Y, the sprocket 35 of the apparatus X is linked to a chain drive gear (not shown) of the apparatus Y and the right spindle 21B is caused to

rotate by the motor 10. Then, when the motor 10 and circulation pump 5C of the apparatus Y are started to operate automatically or manually, the roller R held at both ends with the right and left spindles 21A and 21B is immersed, while rotating, in the process solution in the processing tank 13 to be copper plated.

Referring now to Figure 2, shown therein is a method for plating the roller in a copper plating process line utilizing the mounting apparatus X described above. The roller R is mounted on two supporting rollers 37 provided on a mounting board 36 and to the roller R1 the apparatus X is fitted as is described above. Then, the apparatus X, which holds the roller R, is held by an automatic carrier 38 which is controlled by a computer and carried to the stop board 39 to be stored. Next, the rollers R2 assembled with the apparatus X and placed on the stop board 39 are carried to the pretreatment apparatus 40 by the carrier 38, after being divided into two groups of rollers and mounted on the apparatus 40. Then, the rollers are nickel plated and are subjected to treatment. When the pretreatment is completed, the rollers R3 assembled with the apparatus X are carried by the carrier of conveyor 38 to a double copper plating apparatus 41 and 42 wherein both of the rollers are mounted on the double copper plating apparatus 41 and 42 and copper plated. Next, the rollers R4 assembled with the apparatus X are carried separately to the after-treatment apparatus 43 and mounted on the after-treatment apparatus 43. When after-treatment is finished, the rollers R5 assembled with the apparatus X are carried by the carrier 38 to the stop board 44

and mounted thereon. Finally, the rollers are carried to buffing machine 45 to be fuffed and when the buffing is finished, the rollers are removed from the apparatus X.

It should be apparent that the process described above is in terms of copper plating. If chromium plating is utilized, buffing is not done. It should be apparent that the construction of the above-described apparatus could be varied without departing from the scope of the present invention. In particular, in the apparatus X the means to move the spindle in the axial direction is not limited to an air cylinder unit and various other methods such as a motor with pinion and rack, hydraulic motor and screw, and the combination of an air cylinder unit and linking device could be utilized. Furthermore, it is not necessary that the driving devices be provided on the apparatus X and could be provided on the apparatus Y. To the present invention it is only essential that the spindle be mounted in the mounting apparatus only essential that tne spindle be mounting apparatus or cassette so that the spindle can move in the axial direction and so that the spindle can be driven by one of the above-described driving methods. Also, it is not necessary that the drive source for rotating the spindle be provided on the apparatus X and other driving means for rotating the spindle than those specifically described above could be utilized.

It should be apparent to those skilled in the art that the above described embodiment is merely illustrative of but one of the many possible specific embodiments which represent the applications and principles of the present invention.

Numerous and various other arrangements can be readily devised by those skilled in the art without departing from the spirit and scope of the invention.

INDUSTRIAL EXPLOITABILITY

The plating method for the periphery of a hollow roll and the automatic removal system for the cassette type hollow roll according to the present invention may be adopted to all plating lines adapted for copper or chrome plating only on the periphery of the hollow roll and convenient especially for plating treatment of photogravure rolls.

X ... Mounting apparatus, Y ... Copper plating apparatus, R ... Printing roller, 1 ... Guide plates, 2A, 2B ... Frames, 3 ... Process tanks, 4A, 4B ... Collector tanks, 5 ... Circulator, 5A, 5B ... Circulation pipes, 5C ... Circulation pump, 50 ... Circulation pipe, 6A, 6B, 6C, 6D ... Side panels, 7 ... Notchs, 8A, 8B, 8C, 8D ... Leak prevention plates, 9 ... Accessory board, 10 ... Motor, 11 ... Drip trap, 12A, 12B ... Vertical frames, 13 ... High pressure tank (Transverse frame), 14A, 14B ... Suspension metal fittings, 15 ... Air cylinder unit, 16 ... Cylinder bearing box, 17 ... Pipe, 18 ... Switching valve, 19 ... Pipe, 20 ... Pipe, 21A, 21B ... Spindles, 22A, 22B ... Charge-supporters, 23A, 23B ... Leak proof caps, 24A, 24B ... Packings, 25A, 25B ... Cylinder chamber, 26 ... Pipe, 27 ... Switching valve, 28A, 28B ... Pipe, 29 ... Flexible pipe, 30A, 30B ... Rotary joint, 31A, 31B ... Air inlet, 32A, 32B ... Springs, 33A, 33B ... Drainboards, 34A, 34B ... Bellows shaped cylinders, 35 ... Sprocket, 36 ... Mounting board, 37 ... Supporting rollers, 38 ... Automatic carrier, 39 ... Stop board, 40 ... Pretreatment apparatus, 41, 42 ... Copper plating apparatus, 43 ... Aftertreat apparatus, 44 ... Stop board, 45 ... Buffing machine.

CLAIMS;

1. A method of plating outer peripheral surface of a hollow roller comprizing the steps of:

preparing an automatic roller mounting and demounting device capable of holding said hollow roller at both ends of said roller in such a manner as to permit said roller to rotate and to be supplied with electric current, said roller mounting and demounting device being adapted to prevent a treating liquid from coming into the inside of said hollow roller;

making said automatic roller mounting and demounting device hold said hollow roller thereby to form a transferable cassette;

transferring said cassette by a transfer device to a predetermined treating station;

effecting a predetermined treatment on said hollow roller in said treating station while rotating said roller;

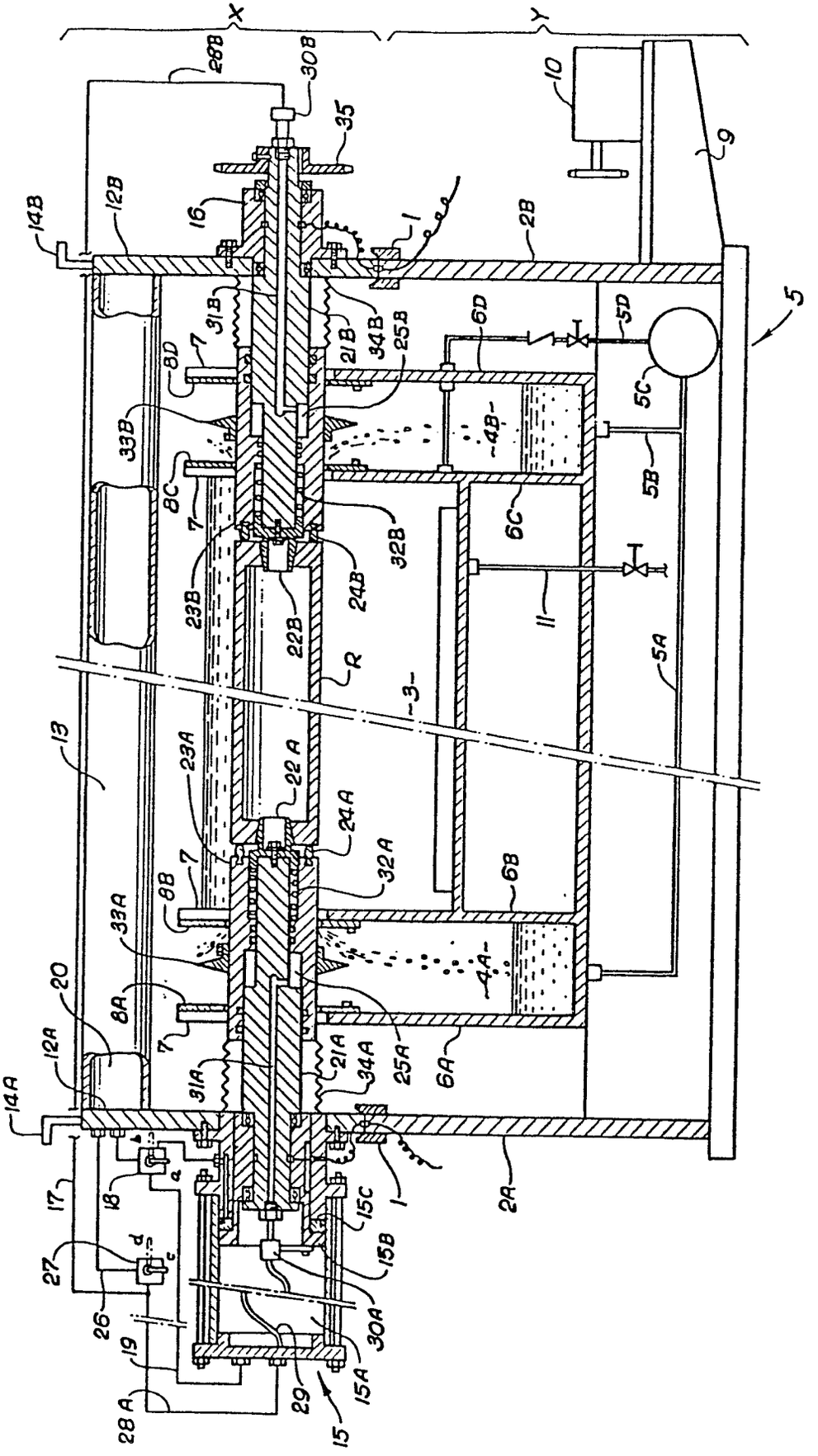
transferring said cassette to successive treating stations to effect desired treatments; and

finally disassembling said cassette.

2. A cassette type automatic hollow roller mounting and demounting device comprising: a lifting frame; a pair of opposing spindles pivotally secured to said lifting frame, at least one of said spindles being axially movable; a pair of electrically conductive support members provided on free ends of said pair of spindles and capable of supporting both ends of said hollow roll in contact with the latter; and a pair of

leak proof caps slidably mounted at the outside of respective spindles and movable to the outside of respective electrically conductive supporting members into contact with said end surfaces of said hollow roller thereby to prevent a treating liquid from coming into the inside of said hollow roller.

FIG. 1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32A
6B
8B
33A
4A
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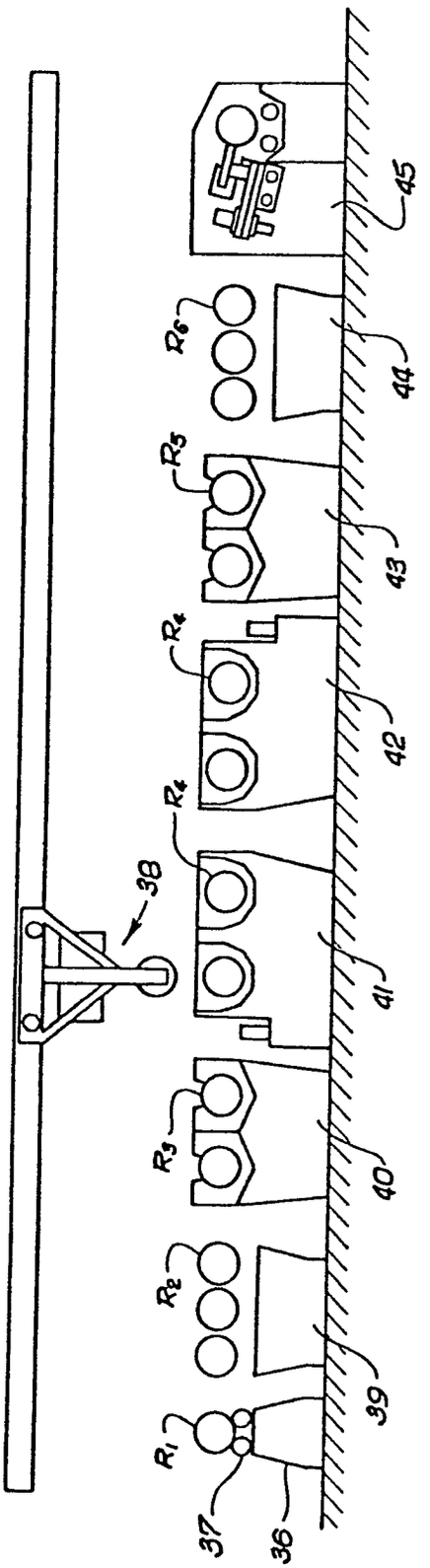
FIG. 2



INTERNATIONAL SEARCH REPORT

0032954

International Application No PCT/JP80/00123

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

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

Int. Cl.[3] C25D 17/06, C25D 7/04

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
I P C	C25D 17/06, C25D 7/04

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

Jitsuyo Shinan Koho 1926 - 1980

Kokai Jitsuyo Shinan Koho 1971 - 1980

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	JP, B1, 47-42020 1972-10-24 See column 2, lines 17 to 19, Fig. 3 Suzuki Shoji	1
X	JP, Y1, 40-21302 1965-7-23 Kitagawa Takashi	1

* Special categories of cited documents: [15]

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"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention

"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [3]
August 26, 1980 (26.08.80)	September 1, 1980 (01.09.80)
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Japanese Patent Office	