Nov. 17, 1953 G. GIORI 2,659,305

MULTICOLOR ROTARY INTAGLIO, LETTERPRESS, AND OFFSET PRINTING PRESS

Filed Jan. 23, 1950

5 Sheets-Sheet 1

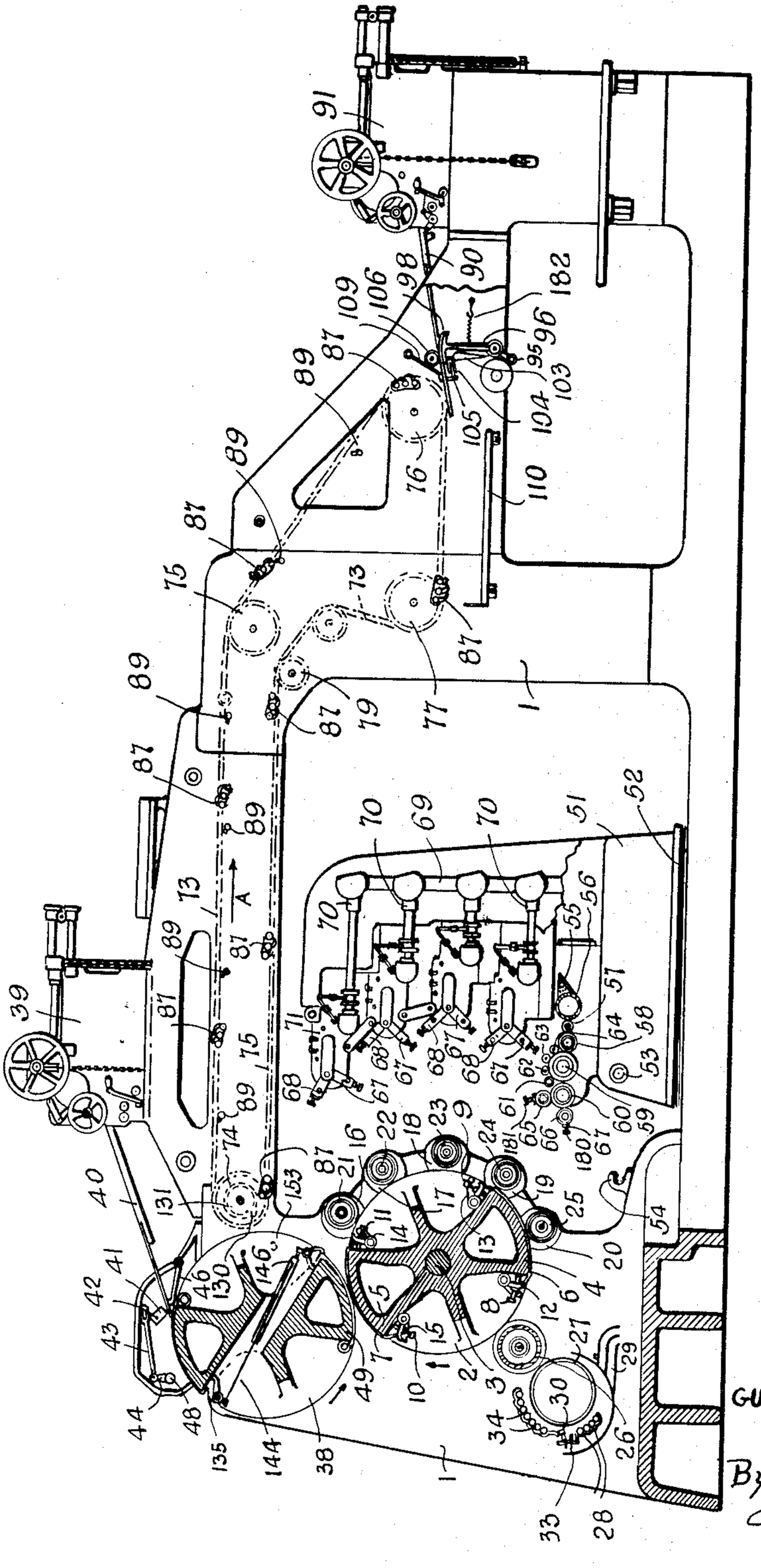

FIG. 1

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MULTICOLOR ROTARY INTAGLIO, LETTERPRESS, AND OFFSET PRINTING PRESS

Filed Jan. 23, 1950 5 Sheets-Sheet 2

FIG. 2

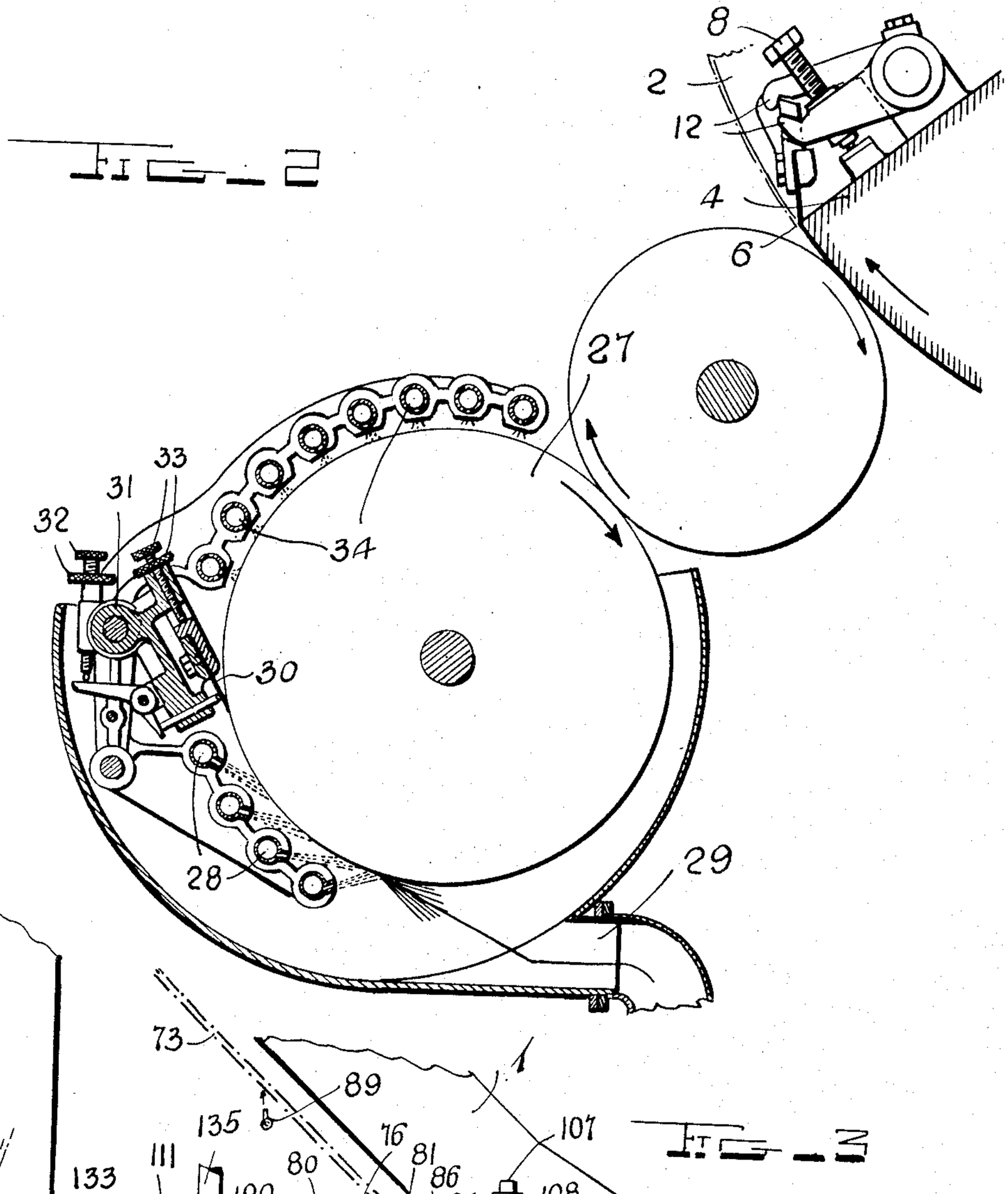

FIG. 3

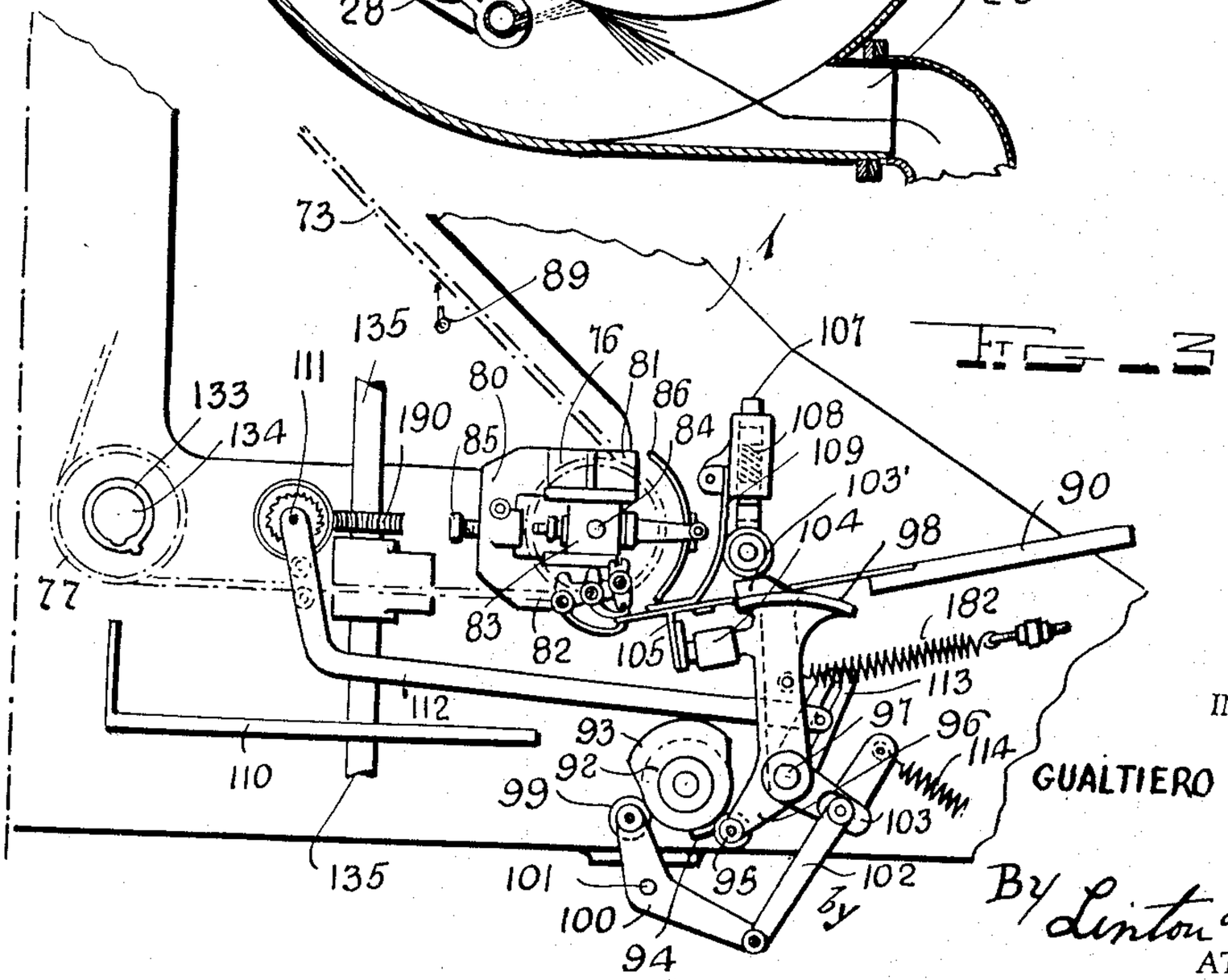

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FIG. 4

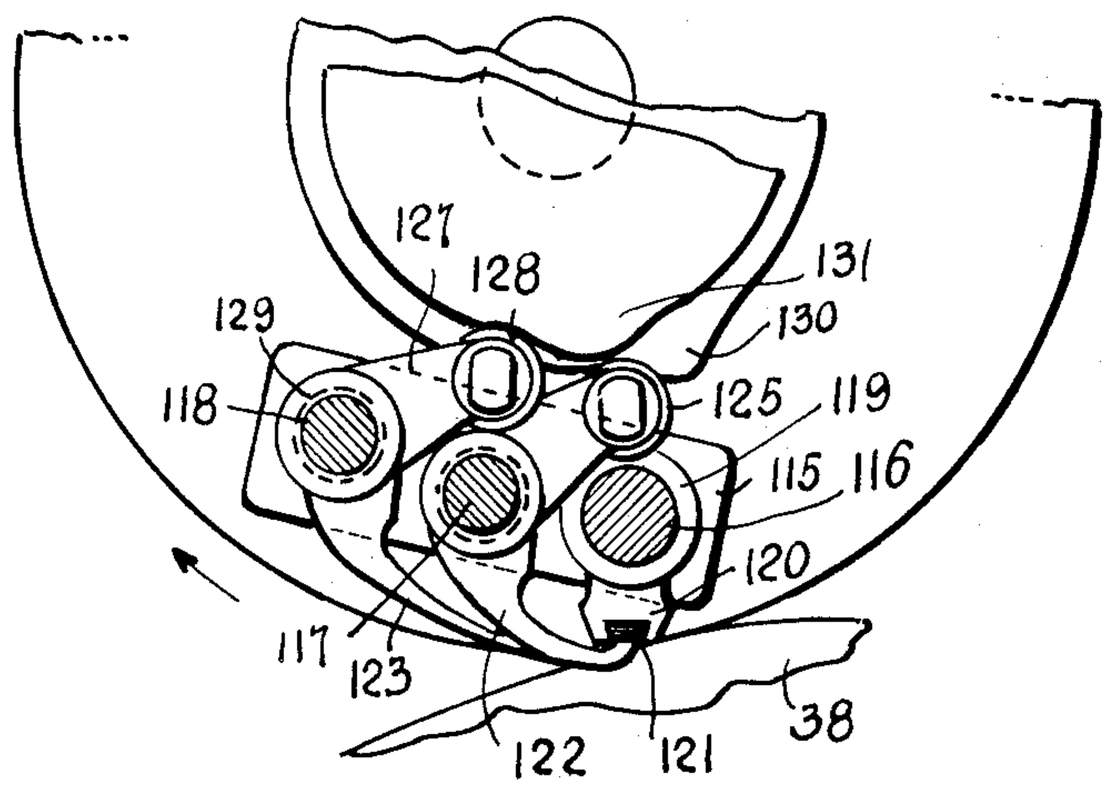


FIG. 5

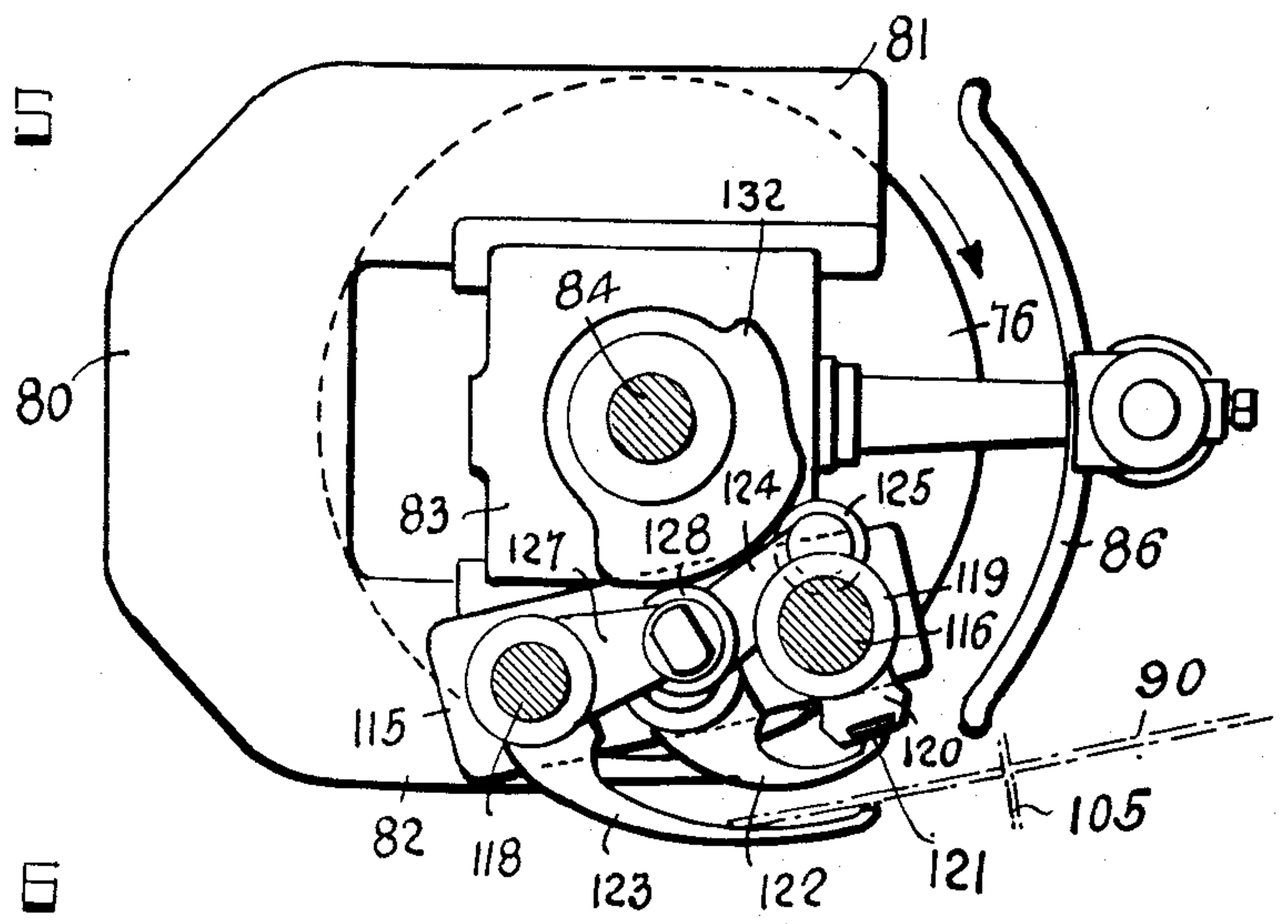
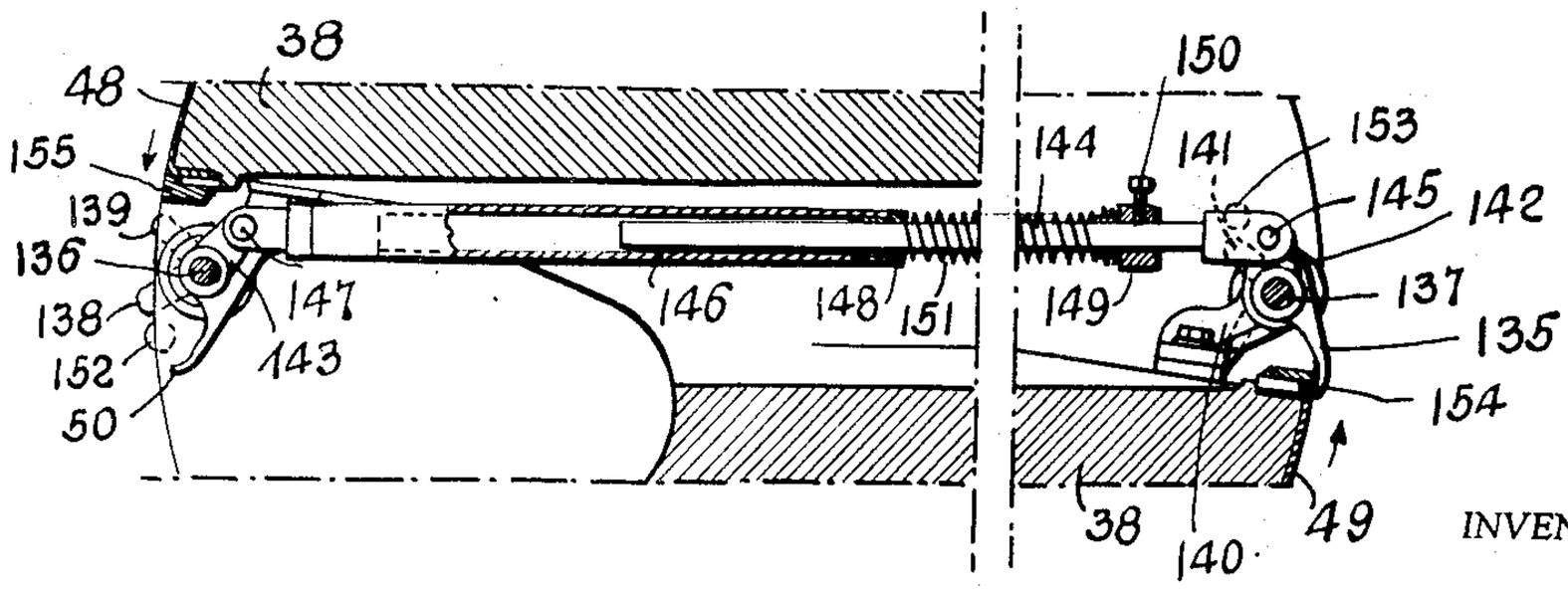


FIG. 6



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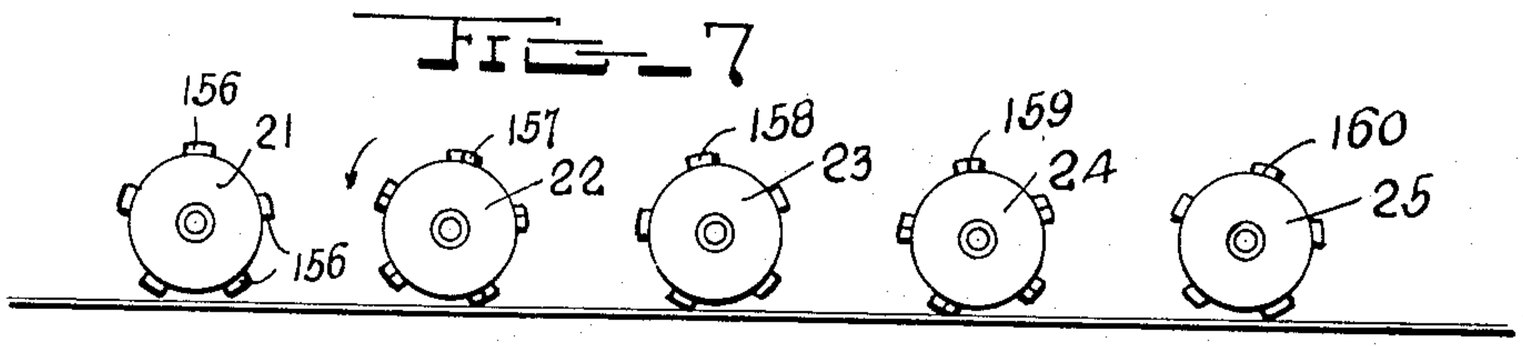
5 Sheets-Sheet 4

Fig. 7



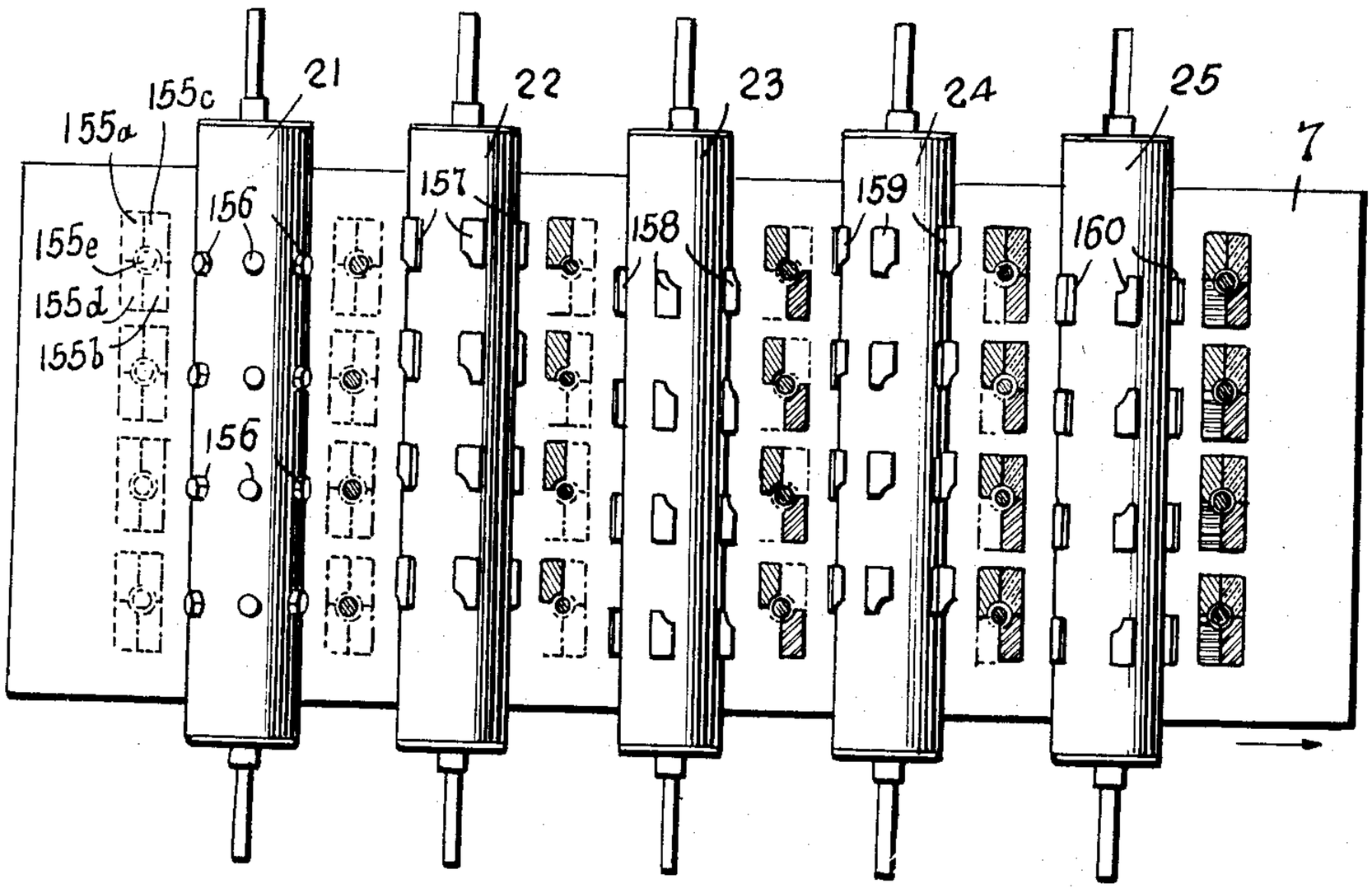


Fig. 8

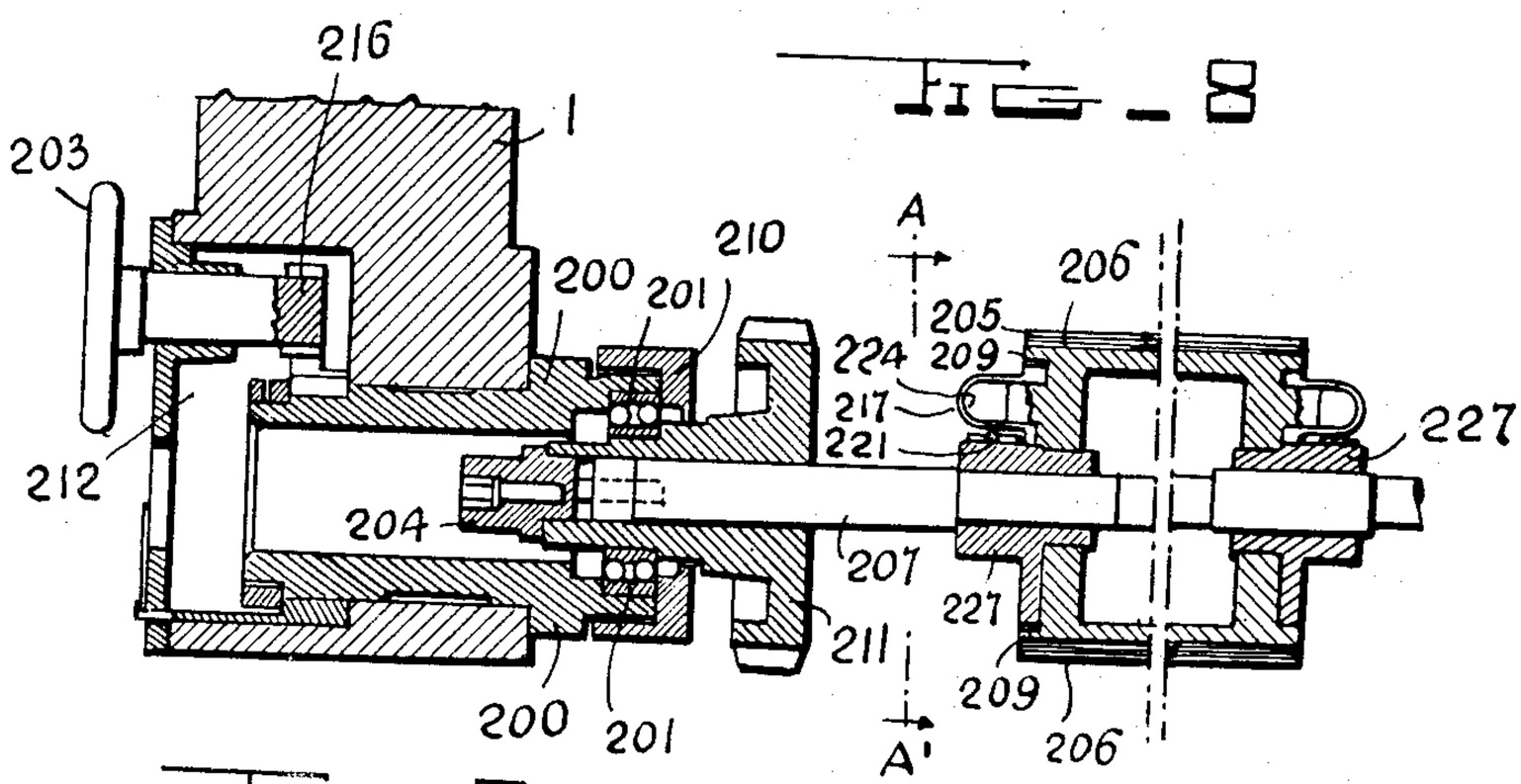


Fig. 9

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MULTICOLOR ROTARY INTAGLIO, LETTERPRESS, AND OFFSET PRINTING PRESS

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FIG. 10

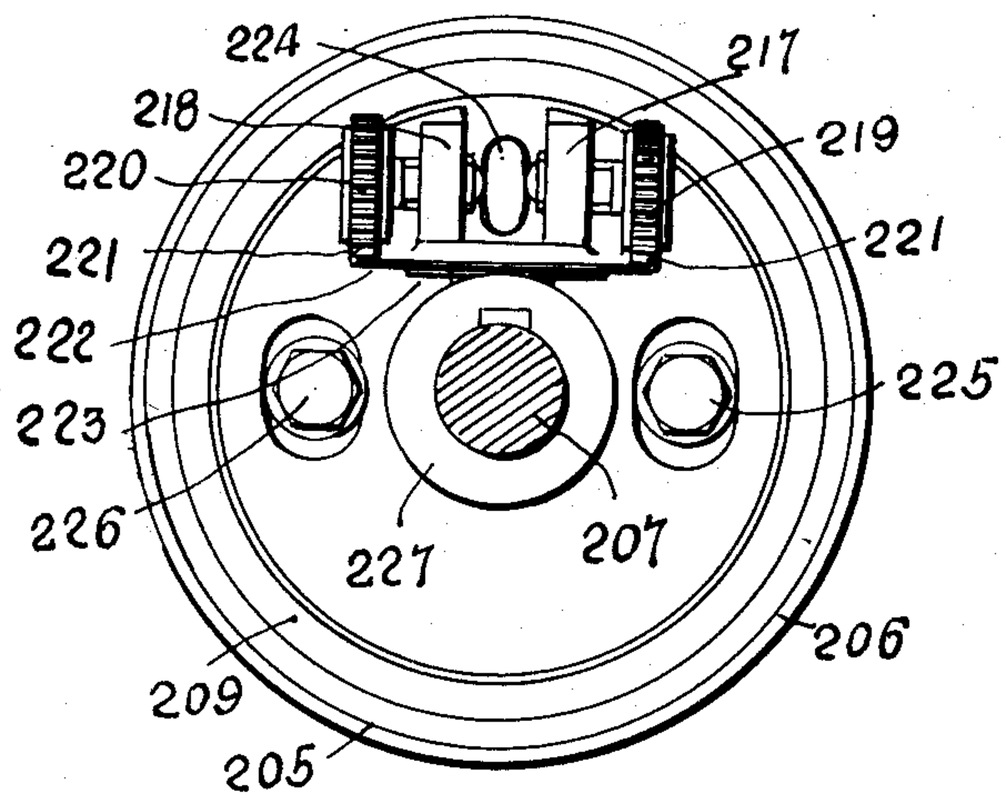
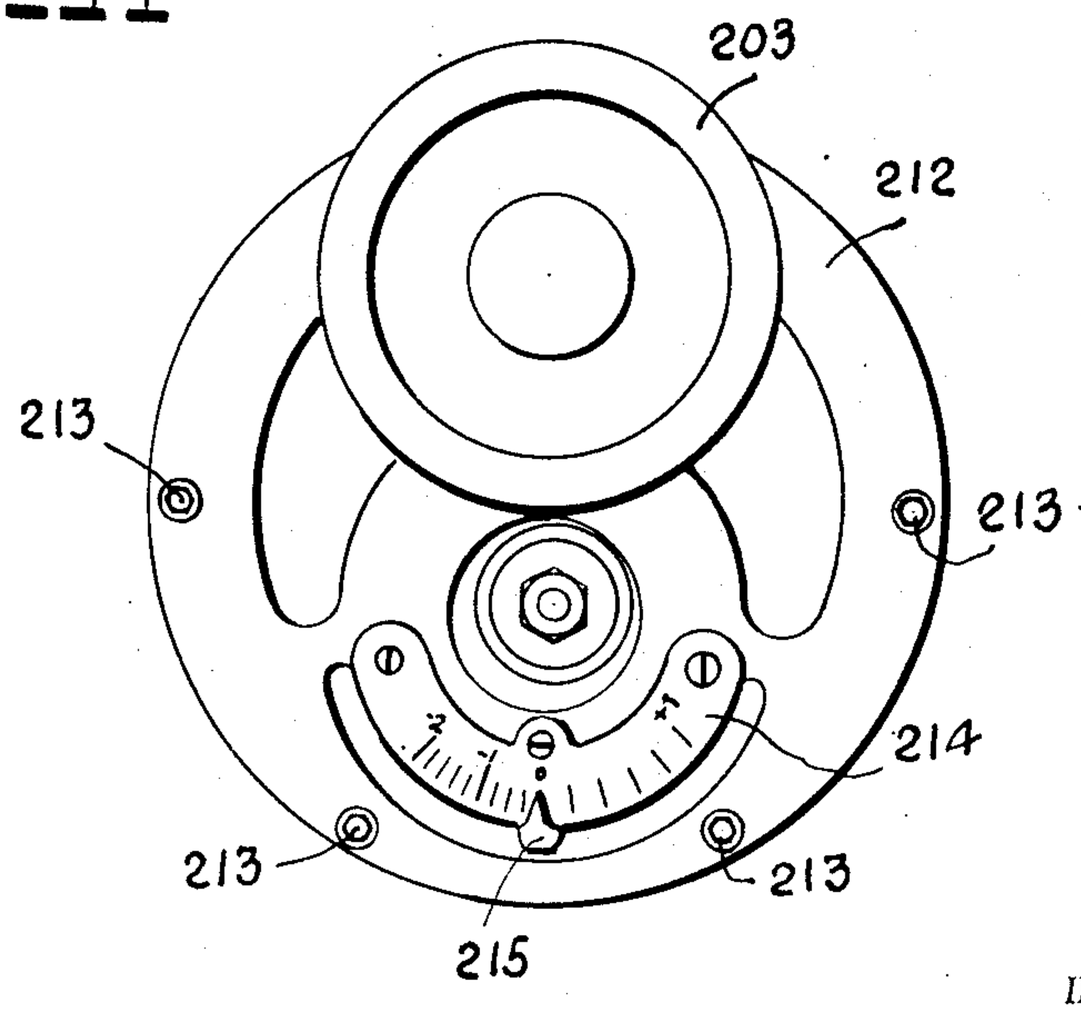


FIG. 11



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Patented Nov. 17, 1953

2,659,305

UNITED STATES PATENT OFFICE

2,659,305

MULTICOLOR ROTARY, INTAGLIO, LETTERPRESS, AND OFFSET PRINTING PRESS

Gualtiero Giori, Buenos Aires, Argentina

Application January 23, 1950, Serial No. 140,029

2 Claims. (Cl. 101—175)

1

This invention relates to printing presses, and more particularly to a multicolour printing press, specially fit for printing securities by letterpress, intaglio or indirect printing.

One object of this invention is to provide a new printing press which executes the multicolour indirect printing with superimposed impressions or the multicolour intaglio or letterpress printing with adjacent colours from a single engraved plate and in a single operation.

A further object of the invention is to provide a multicolour printing press having means for inking printing plates with one or more colours, or means for printing rubber blankets with one or more designs and colours, means to obtain a perfect registration of the colours to be deposited on the printing plate or on the transferring rubber blanket, means for taking out any surplus of ink from the intaglio printing plate, and means to repeat the printing operation in a continuous way.

Still a further object of the invention is to provide a printing press having means for carrying the printed sheets from the printing means to a receiving table in such a way that they do not enter into contact with any part of the machine that could blur or soil the fresh printing.

Still a further object of the invention is to provide means for cleaning the intaglio plate inked with one or more colours.

Still further objects of the invention will appear from the description given hereinafter.

Securities and banknotes are usually printed by superimposing several impressions which are obtained through different processes.

Some zones, called "protection plains or backgrounds," are printed by letterpress printing or by offset, with a view to make their counterfeiting almost impossible because of the difficulty to select, by photography, the elements which, in several colours, compose said backgrounds, and because of the perfect register with which they have to be printed. Other impressions, superposed on said backgrounds, constitute the main part of the printed security and are usually made through the intaglio printing, which, beginning from originals engraved by tool on copper or steel, allow the attainment of a high technical and artistic degree of perfection, as well as a good protection from counterfeiters.

The printing of securities may be also obtained through a single kind of printing but they evidently, for safety reasons, have generally backgrounds printed by letterpress printing or by offset with superposed colours and designs, and the main part by intaglio printing with a single colour.

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It is well known that letterpress and intaglio printing are based on the following principle: an inking device inks a printing element (cylinder, plate or other) and this executes the printing when put in contact with the paper.

The indirect printing, on the contrary, is based on the following principle: an inking device inks an engraved element (plate, cylinder or other), and this transfers the design on a sheet made from rubber or any other suitable material, which sheet, on its turn, executes the printing when put into contact with the paper.

Now, processes for multicolour printing have been known for many years. One of the most common, consists in printing on a sheet of paper, or any suitable material, a number of superposed coloured images by means of as many engraved cuts or plates as are the colours to be printed. In all of the processes of this kind the principal difficulty to deal with is the correct registration of the several superimposed designs, each one of which is generally printed with a different colour.

Another known process for multicolour printing consists in inking a single engraved plate or cut with several inks of different colours, distributed in separate areas on the plate, and then printing on the paper or any other suitable material, in a single operation, all the adjacent colours with which the plate is inked. This process was first described in P. Bonnier's U. S. Patent No. 1,108,063, of August 18th, 1914. Said printing processes, completely different one from the other, were in need of different presses for their performance.

In intaglio printing the superposition of two or more colours printed by two or more printing elements of the same press is impossible. This is due to the fact that the print of the first design and colour still fresh, contacts another printing element, and therefore not only gets dirty, as a consequence of the great amount of ink necessary for intaglio printing, but also dirties the printing element (plate, cylinder or other) causing a blurring of colours and designs.

Actually, while for letterpress and indirect printing there are multicolour presses with many printing elements; for multicolour intaglio printing there are no presses with more than one printing element.

It is well known that the intaglio printing is generally executed with paper previously dampened. This is due to the fact that in intaglio

printing the paper has to be depressed into the grooves of the plate to cause the paper to take up the ink therein. This operation requires a high degree of pressure between the pressure cylinder, known as "D" roller, and the printing plate through which the paper passes during the printing operation. When dry paper is used, and since the paper for printing securities must have a high degree of resistance which gives it great hardness, the pressure required from the intaglio printing press is enormous. Aside from the fact that presses which may afford sufficient pressure are very few, the paper, when submitted to this high pressure, alters its size: this does not permit a great number of intaglio printings with dry paper.

Manifold intaglio printings with dampened paper require logically successive dampening and drying operations on the paper. It is well known that dampening and drying operations alter the size of the paper in such a way that there is a difference between the sheets. Consequently it is not possible to obtain a perfect register among the several superimposed designs and colours.

It follows, therefore, that when dampened paper is used, the intaglio printing with superimposed designs and colours may be obtained for a restricted number of them, while the multicolour printing by means of a single plate inked with adjacent inks of several colours may be obtained. The printing plate executes the printing in only one operation.

It is well known that during the intaglio printing the plate surface is cleaned by wiping and polishing prior to taking of each impression in order to eliminate the ink laid by the inking and not compressed in the engravings.

Said cleaning so far, has been executed by successive rubbing of blades, cloths, paper, rollers, or other material on the printing plate, some of which could be united. These polishing devices did not permit the multicolour printing with several adjacent colours from only one engraved plate because they, by force, as a consequence of their rubbing action and of their having to execute manifold passages, caused a mixing of the several colours retained in the engraving of the plate.

The cleaning operation, executed by means of a single wiping cylinder rotating at the same relative velocity of the printing element (as in other known processes), cannot be done because the wiping cylinder must have a velocity greater than that of the printing element.

In fact, as the inks for the intaglio security printing have to be very dense, it is difficult to remove them from the printing plate and, therefore, a rubbing of the wiping cylinder against the printing element is necessary so that, along the ideal contacting line, the removal of the excessive ink laid on the intaglio plate, inked with several colours may be executed.

It is obvious that the greater velocity of the wiping cylinder in comparison with that of the printing element is the factor which determines the perfect cleaning of the intaglio plate inked with several colours.

Furthermore, it is well known that the sheets, printed by the intaglio printing process, contain an amount of ink, determined by the depth of the engraving, as this amount of ink requires a certain period of time to dry, it is necessary to interpose a sheet between one printed sheet and another. The interleaving operation has always been done by hand with the constant risk that

the interleaving sheet might scrape the printed sheet and ruin the print.

So far no press could execute the multicolour intaglio, letterpress or indirect printing changing no mechanical part; this press executing a multicolour direct print from a single intaglio or letterpress plate and an indirect print with superimposed designs and colours from more plates or other printing elements.

In the field of securities so far no press could execute the multicolour printing of backgrounds by letterpress or indirect printing and the multicolour printing of the main part by intaglio printing. Therefore the paper had to be printed by successive printings in different presses.

Now I have invented a press, particularly apt to print securities, and which eliminates all the above mentioned inconveniences.

The printing press I have invented, and to which this patent refers, essentially consists of a paper feeder device for feeding the sheets to be printed; a first drum of great diameter upon which printing plates for direct printing (or rubber blankets in substitution thereof for indirect printing) may be fixed; a pressing cylinder or drum (commonly known as "D roller"), having the same diameter as the first one but rotating in contrary direction; a number of inking rollers for inking the printing plates (or a number of engraved rollers for printing the rubber blankets for indirect printing); a wiping cleaning device for taking off ink in excess from the surface of the printing plates; an interleaving device; an endless conveyor to carry the printed sheets from the D roller to the interleaving device and cöoperating with the latter for interleaving paper sheets between the printed sheets; air blower, ejecting air blasts in the path of the printed sheets carried by the endless conveyor; a delivery table to receive the printed sheets and the interleaving sheets; and a number of inking groups, mounted on a cart, to ink the inking rollers.

For the better understanding of my invention a preferred embodiment of my press is shown in the accompanying drawings. In these drawings for clarity sake, gearings and shafts interconnecting different parts of the press, and some other parts, have been omitted; but all of them will be obvious to those persons skilled in the art.

In these drawings, Figure 1 shows a lateral view of the printing press partly in cross section; Figure 2 is a cross section of the cleaning and wiping device; Figure 3 is a lateral view of the interleaving device, partly in section; Figure 4 shows one of the pincers of the endless conveyor when it passes near the "D roller" for taking the printed sheet; Figure 5 shows one of the pincers of the endless conveyor when it takes the interleaving sheet; Figure 6 is a section of the part of the pressure cylinder with the mechanism for taking the sheet from the feeder and for giving same to the pincers of the endless conveyor; Figures 7 and 8 show the way in which the inking rollers ink a plate (the length of the plate has been somewhat exaggerated); Figure 9 is the section of an inking roller mounted on an eccentric support; Figure 10 is the section of the line A—A' of Figure 9; Figure 11 is a lateral view of the cover of the eccentric support mounted on the frame of the press and provided with handwheel, graduation and index for the regulation of the pressure.

As it will be seen in the drawings the press comprises a frame 1 on which a plate bearing cylinder 2 (Fig. 1) is rotatably mounted on shaft

3. This cylinder has two opposite seats 4 and 5 on which printing elements 6 and 7 may be fixed. Screws 8, 9, 10 and 11 acting on clamps 12, 13, 14 and 15, securing printing or transferring elements 6 and 7, allow the registering of their position on cylinder 2. To this purpose a millimetric rule is engraved on the borders of the sectors of cylinder 2. Shaft 3 is connected to the shaft of the motor of the press by means of a suitable shafting, both not shown in the drawing because it is obvious.

On frame 1 five supports 16, 17, 18, 19 and 20 are mounted. When the press prints multicolour printing from a single printing plate inked by inking rollers, then the inking rollers 21, 22, 23, 24 and 25 are rotatably and removably mounted on said supports. The same inking rollers may be used for letterpress or intaglio printing. For printing in indirect printing, instead of mounting inking rollers on supports 16, 17, 18, 19 and 20, engraved cylinders for indirect printing are mounted.

A wiping and cleaning device is mounted on frame 1 in the position shown in Fig. 1. It substantially consists of (see Fig. 2) a wiping cylinder 26 coated with, or made from, resilient material, rotatably mounted in the framework of the press. This cylinder 26 rotates in the same direction as cylinder 2 and it is connected by means of suitable shafting to the motor of the press. Furthermore it has a seesaw movement not in phase with its rotation and rotates at a predetermined peripheral speed greater than that of plate bearing cylinder 2. The wiping cylinder executes a rubbing action on the surface of the plates every time it has to clean the plates. The contact between cylinder 26 and the plate on cylinder 2 is virtually a line and, therefore, the wiping operation takes place without taking away and without mixing the several colours compressed in the engravings of the plate by the inking rollers. The regulation of the pressure of cylinder 26 against the printing plate on cylinder 2 is obtained by means of an eccentric support in which the shaft of cylinder 26 rotates. A metal cylinder 27, mounted on frame 1 of the press is in the position shown in Fig. 1. The diameter of cylinder 27 (Fig. 2) is greater than that of cylinder 26 so as to have a greater surface wiping cylinder 26; this, and the greater speed of cylinder 27 make the ink, taken away from cylinder 26, adhere in a very thin layer on the surface of cylinder 27. The regulation of the pressure of cylinder 27 against cylinder 26 is obtained by means of an eccentric support in which the shaft of cylinder 27 rotates. This cylinder 27 rotates in the same direction of cylinder 26 but a determined peripheral speed greater than that of cylinder 26.

Cylinder 27 has not a seesaw movement because it profits by the seesaw movement of cylinder 26. Its rotation is obtained through cylinder 26 by means of suitable gears. The wiping of cylinder 26 is executed by cylinder 27 based on the same principle which causes the cleaning of the printing plate by means of cylinder 26.

A set of nozzles 28 located along all the width of cylinder 27 in the position shown in Fig. 2. These nozzles throw a violent liquid jet on cylinder 27 so that the direction of them is lightly secant to the periphery of cylinder 27 and in contrary direction to the peripheral speed of cylinder 27. This liquid jets take away the ink from cylinder 27 in consequence of the mechanical action caused by the violence, pressure and direction of the jets.

A screen having an exhaust pipe 29 collects all the liquid, and all the ink, taken away from cylinder 27 by liquid jets, to carry them into exhaust pipe 29.

A scraper 30 which has a seesaw movement is placed in tangent contact with cylinder 27 in the position shown in Fig. 2 and is mounted on a support 31 having adjusting screws 32 and 33. This scraper prevents a possible ink veil to return on cylinder 26 should it have remained on cylinder 27 notwithstanding the cleaning operation.

A set of nozzles 34 is placed between scraper 30 and the contact point of cylinder 26 with cylinder 27 (Fig. 2). These nozzles have to throw a plurality of warm air jets to eliminate the moisture possibly still on the surface of cylinder 27.

Therefore the wiping operation is as follows: cylinder 26 cleans the plate placed on cylinder 2; cylinder 27 cleans cylinder 26; the liquid jets thrown by nozzles 28 clean cylinder 27; scraper 30 ends the cleaning of cylinder 27; the warm air jets thrown by nozzles 34 dry cylinder 27.

By means of this wiping and polishing device the operation takes place uninterruptedly.

A pressure cylinder 38 (Fig. 1) having the same diameter as cylinder 2, is rotatably mounted on frame 1 in such a way as to exercise a regulable pressure against cylinder 2. This cylinder 38 has at one end a toothed rim which comes into engagement with the toothed wheel of cylinder 2 so as to be rotated by this latter and, logically, in a contrary direction. On cylinder 38 there are some pincers which take the paper sheet from the feeder and hold it on its surface until said sheet, after the printing operation, passes to the pincers, mounted on chains, which carry it to the delivery table.

Automatic feeders 39 and 91 (Fig. 1) of the paper to be printed and of the interleaving sheet are of the sheet by sheet reloading type with suckers to forward the sheet. They work with dry or dampened paper and feed the press in case of printing with one or two plates. These feeders are provided with mechanisms to forward the sheet in perfect register and square. Incline 40 leads the paper sheet to the upper part of "D roller" 38. There is a bar 41 rotatably mounted on an axle 42. Bar 41 is controlled by a rod 43 articulated at the end of lever 44 which is fixed on shaft 45. On shaft 45 another lever, which is not shown in the drawing, is mounted: said lever contacting an eccentric sector mounted on cylinder 38 rotates, and consequently lever 44 rotates, and rod 43 moves, and bar 41 is rotated. In this way a paper sheet, which had been stopped by bar 41, is free to pass when bar 41 rotates.

On a cart 51, running on rollers 52 upon tracks made in frame 1 (Fig. 1), five inking groups are mounted. This cart may be anchored in working position by means of pins 53 (one on each side of the cart) engaging hooks 54. Fig. 1 shows four inking groups in lateral view and one in cross section. Each group consists of an upsetting ink container 55, which feeds ink to roller 56; and a set of rollers 57, 58, 59, 60, 61, 62, 63 and 64, which transfer the ink from roller 56 to rollers 65 and 66. Rollers 58, 59 and 60 are mounted so to be given also an alternative lateral motion, in order to uniformly distribute and grind the ink. Rollers 61, 62, 63 and 64 serve to carry the ink from roller 58 to roller 60.

Rollers 65 and 66 are rotatably mounted on regulable swinging supports so as to obtain a perfect contact between rollers 65 and 66 and inking rollers 21, 22, 23, 24 and 25, furthermore they have a micrometrical regulation of the ink passage.

When cart 51 is hooked to hook 54, one or more of the inking groups may be put out of motion simply by opening the corresponding support 67 and 68 or declutching those groups by means of insertion 70.

These gears and shafts driving rollers are closed in crankcases 69 and 71. These gearings are connected to a transmission endless screw, parallel to the track of cart 51, and connected to the motor of the press.

It is to be noted that the inking groups may work when the cart is put in its working position as well as when it is removed from the inking rollers which permits the automatic washing of the inking groups and the first regulation thereof.

The inking groups of this press allow the perfect inking for letterpresses, intaglio or indirect printing. They have a considerable adjustability as it is required for letterpress and indirect printing being able, also, to feed the inking roller with the amount of ink necessary to fill the hollows of the engraved plate (intaglio printing). Moreover, in said groups the ink passage may be micrometrically regulated, which guarantees for ever the identity of the inking and, consequently, of the printing. Therefore, this possibility allows any work to be printed in five colours by letterpress, intaglio or indirect printing with the same press, and without changing mechanical parts.

On opposite sides of cylinder 38 (see Fig. 6) two axles 136 and 137 are mounted. Along these axles a set of pincers is mounted, Fig. 6 shows one pincer 50 mounted on shaft 136 and another 135 on shaft 137.

On shaft 136 two arms 138 and 139 are fixed in different planes. Similar arms 140 and 141 are fixed, in the same way, on shaft 137. Furthermore, arms 142 and 143 are fixed to shafts 137 and 136. Arms 142 and 143 are connected together by means of a device exercising opposite forces on arms 142 and 143. This device consists of a rod 144 articulated by one end to arm 142 by means of an axle 145; the other end enters tube 146, which is connected to arm 143 by means of an axle 147. In this way rod 144 may slide into tube 146. Tube 146 has a seat 148, and a flange 149 is fixed on rod 144 by means of a screw 150. Between seats 148 and flange 149, and surrounding rod 144, an expansion spring 151 is placed. Two pins 152 and 153 are fixed to frame 1 of the printing press; pin 152 is located next to the lower end of incline 40 of feeding device 39; and pin 153 is placed next to the border of conveyor 73 (Fig. 1). As may be seen in Fig. 6, when arm 141, during the rotation of cylinder 38, hits pin 153, shaft 137 is rotated and pincer 135 takes the position the drawing 6 shows for pincer 50. Simultaneously, arm 138, hitting pin 152, makes pincer 50 press its seat 155 taking the position the drawing 6 shows for pincer 135. A similar seat 154 is in correspondence of pincer 135.

An endless conveyor 73 (Fig. 1) formed from two parallel chains is mounted on wheels 74, 75, 76, 77, 78 and 79. Wheel 76 is provided with means for tensioning the chains. These tensioning means consists (Fig. 3) of a frame 80, fixed on frame 1 of the press, and having arms 81 and 82 which embrace a block 83. In this

block shaft 84 of wheel 76 is mounted. A screw 85 may push block 83. Screen 86, fixed by means of a rod to block 83, prevents sheets from striking the interleaving device. On the chains of the endless conveyor pincers 87 are mounted. These pincers are spaced apart at a distance equal to the peripheral distance separating pincers 50 and 135 of cylinder 38 (Fig. 1). The endless conveyor moves in the direction shown by arrow A in Fig. 1 at a speed equal to the peripheral speed of cylinder 38. A suitable gearing connecting cylinder 38 with driving wheel 74 insure that speed. Below endless conveyor 73, a number of air blower nozzles is placed. These nozzles point their air blasts in an upward direction, contrary to that of the conveyor motion. A tank of air under pressure, not shown in the drawings, provides the necessary air. The endless conveyor carries the printed sheet to an interleaving device disposed as shown in Fig. 1 and illustrated in Fig. 3. This device comprises an incline 90, connected to an automatic feeder 91 (Fig. 1) that may be of any known type. In the drawing, the feeder is of the same kind as feeder 39. A shaft 92 is mounted in frame 1 below incline 90 and is connected by means of a suitable gear to the motor of the press in such a way that whilst cylinder 2 performs a complete revolution, shaft 92 performs two. Two opposite cams 93 and 94 are fixed on shaft 92. Said cams are not in the same plain. Cam 93 acts on a roller 95 rotatably mounted on one end of lever 96 rotating around the axle 97 (Fig. 3). The other end of lever 96 has an arched surface 98 on the same lever with incline 90 and a projection 104 holding a plate 105 for retaining the paper sheets. A spring 182, acting on lever 96 forces roller 95 towards shaft 92. Cam 94 acts on a roller 99 mounted on one end of lever 100 rotating on axle 101. The other end of lever 100 is connected, through rod 102, with lever 103, having a curved part 103' to raise up the roller 106. Said roller 106 is mounted on a rod 107 which is mounted in a casing 108 fixed to frame 1. A spring placed into casing forces rod 107 downwards. A spring 114 acts upon lever 103 and forces roller 95 towards shaft 92. Roller 106 extends across the path of the sheet on incline 90. In the position shown in Fig. 3, a sheet of paper coming on incline 90 may pass between roller 106 and incline 90; it is stopped by plate 105. When shaft 92 rotates, cam 94 raises roller 99 and, consequently, lever 103 also rotates with the consequence that roller 106 gets in contact with arched part 98 of lever 96 pressing, thus, the paper sheet. As the revolution of shaft 92 goes on, cam 93 raises roller 95 and then lever 96 rotates on axle 97.

Simultaneously, plate 105 descends and the paper sheet is driven forwards by arched part 98 and by roller 106. The sheet is then taken by pincers 87 in the way it will be explained later.

Pincers 87 are more clearly shown in Figs. 4 and 5. They are mounted, in series, on shafts carried by two chains so as to be fixed on a same transversal line to the conveyor. These pincers consist of a frame or body 115 on which shafts 116, 117 and 118 are fixed. Said shafts are common to the other pincers located between the two chains on the same line of that shown in Fig. 4. On shaft 116 a ring 119 is fixed and it has a projection 120 which presents a rubber or the like seat 121, on which the ends of fingers 122 and 123 rest. Finger 122 is fixed to shaft 117, which is rotatably mounted on frame 115.

An arm 124 is also fixed to a shaft 117 and has a roller 125 mounted at its end. A spring 126 forces shaft 117, and consequently finger 122, against seat 121. Finger 123 is fixed to shaft 118, which is rotatably mounted on frame 115. An arm 127 is also fixed to shaft 118 and has a roller 128 mounted at its end. A corresponding spring 129 forces finger 123 against seat 121. Arms 124 and 127 are not in a same plain, although they are parallel. It may be seen that when arms 127 and 124 are pressed downwards, fingers 122 and 123 separate from seat 121. The working of these pincers is as follows: around the shaft of driving wheel 74 (see Fig. 4) two parallel cams 130 and 131 are placed in such a way that when each group of pincers 87 arrives to pressure cylinder 38, said cams push simultaneously rollers 125 and 128, thus separating fingers 122 and 123 from their common seat 121.

At this moment the device on cylinder 38 deposits a printed sheet in the space comprised between seat 121 and fingers 122 and 123. As soon as the action of cams 130 and 131 ceases, fingers 122 and 123 close and hold the sheet against seat 121.

The group of pincers 87 works, at the interleaving device, as shown in Fig. 5. Around shaft 84 of wheel 76 a cam 132 is fixed. This cam is in the path of arm and roller 128, but not in the path of roller 125. When a group of pincers arrives at the interleaving device, arm 127 is pushed down through roller 128 and finger 123 opens, while finger 122 continues holding the printed sheet of paper. At this moment, as explained above, plate 105 descends and allows an interleaving sheet to glide on incline 90 and to enter the space comprised between finger 123 and seat 121. As soon as the action of cam 132 ceases, finger 123 closes and retains the interleaving sheet. Same is carried by finger 123 together with a printed sheet carried by finger 122. Around the shaft of wheel 77 two cams 133 and 134, of a same shape as cams 130 and 131, are fixed. When rollers 125 and 128 are pushed down by said cams, they open the fingers of the pincers and, thus, the printed sheet and the interleaving sheet are freed and may fall upon table 110.

Delivery table 110 (Fig. 1) is located in such a way that it can receive the interleaved and printed sheets, laid by pincers 87 when they arrive at wheel 77.

The delivery table must descend as the sheet piles up upon it, in order to keep the top of pile on a level lower than that of incline 90 (see Fig. 3). To this purpose delivery table 110 is fixed to a ratchet mechanism 111 acted by lever 112 connected to an arm 113 fixed to lever 96. When lever 96 rotates, letting in an interleaving sheet, lever 113 also rotates and transmits a rotation to shaft 135 through lever 112. The rotation of shaft 135 lowers delivery table 110.

The inking rollers (or the engraved rollers) are mounted as shown in Fig. 9, where a section of an inking roller (or an engraved cylinder) with all the make shifts securing its radial, circular and axial movements, is shown.

Shaft 207 (Fig. 9) of the inking roller is mounted in support 200 of which ball bearing 201 is shown. Flange 210 serves to block ball-bearing 201 on support 200.

A gear 211 is fixed on shaft 207. This gear comes into engagement with the toothed wheel

of cylinder 2 so as the inking roller is rotated by this latter and, logically, in contrary direction.

Bearing 200 is mounted on frame 1 of the press and has a cover 212. A hand-wheel 203 is located on cover 212. Said hand-wheel is integral with a gear 216 lowered by toothed sector 217 placed on eccentric bearing 200.

As a consequence of this speed-lowering between the gears of hand-wheel 216 and toothed sector 217, a rotation of the hand-wheel causes a micrometrical movement of the eccentric support and, thus, a micrometrical approaching or removal of the inking roller from the bearing plate cylinder.

Cover 212 with hand-wheel 203 are shown in Figure 11. This cover is fixed to the frame of the press by means of nuts 213, furthermore a graduation 214 and an index 215 are on this cover to measure the pressure of the inking roller against the printing plate.

In Fig. 9 it is possible to see that shaft 207 of the roller is blocked in support 200 by means of a screw 204. This screw 204, which is also on the other side not shown in the design as obvious, may be screwed or unscrewed determining the micrometrical axial movement of shaft 207 and hence of the inking roller with regard to cylinder 2.

In Figure 9 a section of the inking roller with its main parts is also shown. As it will be seen it comprises a tubular section, which hereinafter will be called tube 209, and is the main part of the roller; a resilient material coating 205 and 206 in accordance with the printing kind; two flanges 227, on the border of tube 209, which permit the blocking up of tube 209 on shaft 207.

These two flanges 227 have two rods 217 and 218 which are better shown in Fig. 10. These two rods 217 and 218 have two micrometrical and indented screws 219 and 220 which press on a protruding bolt 224 which makes with flange 227 one sole body. When screw 219 is screwed and screw 220 is unscrewed or vice versa, flange 227 is micrometrically rotated. As flange 227 blocks tube 209, same causes the micrometrical rotation of the whole roller on shaft 207 and, thus, the perfect positioning of the roller coating is possible with regard to the engraving of the plate.

Two pointed teeth 221, pressed by springs 222 and 223 against the teeth of screws 219 and 220 avoid the unscrewing of same during the motion of the press.

When the perfect positioning of the resilient material coating the inking roller has been obtained, two screws 226 and 225 block the whole that forms the roller.

In a few words, the inking rollers for the letterpress or intaglio printing or the engraved cylinders for the indirect printing, have a radial movement by means of the eccentric support, this permits the variation of their pressure against the printing plate or the transferring element. The inking rollers or the engraved cylinder have also an axial and a circular movement for their exact positioning with regard to the printing plate, as it will be explained later on.

During the letterpress or intaglio printing operation the resilient material, coating the five inking rollers of the press, is left only on the parts which have to take ink and give it again to the corresponding parts of the printing plate. Consequently, it is possible to print securities in a single operation and from a single engraved plate, thus obtaining the continuation of the thread of the engraving (design) and changing

the colours at the desired spots. Furthermore, during the printing operation, it is possible to obtain the desired degrees of pressure of the inking roller against the printing plate. This causes the always identical crushing of the resilient material with which the roller is coated and, consequently, an always identical colouring of securities printed by intaglio or letterpress printing. The perfect registry of the indirect printing with superimposed designs and colours is always guaranteed because five engraved cylinders **21**, **22**, **23**, **24** and **25** are rotated by a single gearing mounted on cylinder **2**. This determines that the engraved parts on cylinders **21**, **22**, **23**, **24** and **25** always contact the same identical points of common transferring elements **6** and **7**, which transfer to the paper the composite image at a single operation.

The operation of my press in intaglio printing is as follows: intaglio printing plates **6** and **7** (Fig. 1), are mounted on cylinder **2** in the desired position employing, the millimetric rules, marked on the borders of bearing plate sectors **4** and **5**, and the reference lines engraved on the plates, which are then fixed to sectors **4** and **5** by means of clamps **12**, **13**, **14** and **15**. Inking rollers **21**, **22**, **23**, **24** and **25**, prepared following a process which is an object of another application of patent, are mounted in their supports **16**, **17**, **18**, **19** and **20**, and their regulation is executed by means of eccentric supports **16**, **17**, **18**, **19** and **20** by means of the proper mechanisms which allow the micrometrical axial and circular movements of the inking rollers.

After, the first regulation of the inking groups, mounted on cart **51**, is executed so as to have on rollers **65** and **66** the amount of ink which is necessary for intaglio printing.

Cart **51**, carrying the inking groups, is approached to the inking rollers and it is hooked at hook **54** by means of pivot **53**.

Then the final regulation of the inking is executed until inking rollers **21**, **22**, **23**, **24** and **25** have the amount of ink necessary to fill the grooves of the intaglio plates.

When the perfection of inking is assured, the regulation of the cleaning of plates is executed. This regulation is obtained varying the pressure of cylinder **26** against the plates until the wiping cylinder executes perfectly its function. After the above mentioned operations the printing is begun.

A paper sheet (dry or dampened) fed by feeder **39**, slips down on incline **40** and is detained by bar **41**. When said bar, connected with a suitable shafting, rotates on its axle **42**, the sheet is free to pass and it is taken by the set of pincers **135** which close and carry it on cylinder **38**. It is clear that this operation is preceded by the perfect putting in register and square of the sheet: this operation is obtained by means of suitable mechanisms.

Simultaneously to the above mentioned operation, cylinder **2** rotates, and printing plate **7**, fixed on it, contacts inking rollers **21**, **22**, **23**, **24** and **25** in succession. Each of these inking rollers deposits a different ink on printing plate **7**. As it may be seen in Figs. 7 and 8, each inking roller has its surface worked off so as to provide protruding and inking zones **156**, **157**, **158**, **159** and **140** corresponding in shape exactly to the zones to be inked on the printing plate (**155***e*, **155***a*, **155***b*, **155***c* and **155***d*). As the printing plate advances, the inking rollers roll upon it and deposit the inks in the proper places. Of course, these inking rollers may be formed in accordance with any known method but the best effects are obtained, through my press, if they are made in accordance with a process of my invention, which is object of another application.

Coming back to Fig. 1, printing plate **7**, thus inked with the several inks, goes in contact with wiping cylinder **26**, which removes from plate surface the surplus of ink not compressed in the engraving of the plate: this without taking away and without mixing the inks contained in the engraving. Yet more, the wiping cylinder, in consequence of its working as above described, besides the cleaning of the plate surface, compress more the inks contained in the engraving.

Printing plate **7**, so inked and cleaned, meets then the paper sheet carried and pressed by cylinder **38**, and makes a print on it.

The result will be an intaglio printing with five adjacent colours distributed on the desired areas.

The paper sheet is still held by pincers **135** until their arm **141** hits pin **153** opening the pincers (see Figs. 1 and 6). At this moment a group of pincers **87** rotates around wheel **74**, its arms **124** and **127** (see Fig. 4) have contacted cams **130** and **131** and have momentarily open fingers **122** and **123**. So they take, by pressing it against seat **121**, the printed sheet. The group of pincers **87** carries the sheet following the course shown by arrow A in Fig. 1 until it arrives to wheel **76**. At this moment as above described, finger **123** of pincer **87** (Fig. 5) opens to take the interleaving sheet forwarded by feeder **91** so that the printed sheet and the interleaving one are carried by the same group of pincers until wheel **77**. Then pincers **87** open and contemporaneously leave both sheets which, so freed, lie down upon delivery table **110**.

It is to be noted that the printed sheet follows the course shown by arrow A with the printed side turned down, it overturns on wheel **76** so that the interleaving sheet comes to be on the back (not printed) of the sheet. When both sheets lie down upon the delivery table, they place upon the previously deposited sheets exactly in pile and, thus, scraping is avoided.

While the sheet is carried by the conveyor, it is held by air jets blown from nozzles **89**.

The operation repeats indefinitely and two sheets are printed by plates **6** and **7** during every revolution of cylinder **2**. It is clear that the press can work with one plate too.

During the letterpress printing the press works in the identical manner as above described the following changes excepted:

(1) Feeder **91** is put off;

(2) The wiping device is eliminated;

(3) Intaglio plates are substituted by letterpress plates.

During the indirect printing the press works in the identical manner as an intaglio printing, the following changes excepted:

(1) Elimination of feeder **91**;

(2) Elimination of the wiping device;

(3) Application of two rubber blankets or of any other suitable transferring material able to execute the indirect printing, in the place of intaglio plates **6** and **7**;

(4) Assembling of five cylinders (these may be of copper, zinc, brass or of any other suitable material) previously engraved in accordance with one of the many known processes for the indirect printing, in the place of the inking rollers.

During the indirect printing, the inking groups ink the engraved cylinders, these cylinders print

on the rubber blankets, fixed on sectors 4 and 5 of cylinder 2, their own design and colour in succession, and the rubber blankets transfer the ink design to the paper obtaining, thus, a print in five colours which may be superimposed or adjacent.

During the printing operation, sectors 48 and 49 of cylinder 38 (see Fig. 1) which carry the making-ready, are prepared in accordance with the known art for the different printing kinds because it is possible the making-ready of each rubber.

From the operation of the press as above described it is clear the simplicity and velocity with which it is possible to pass from one to another printing process without changes of mechanical parts.

The press and all the above described make shifts have been studied by me particularly for printing securities but it is obvious that they may be utilised for prints of different kinds, e. g. maps or others, as well as for printing on other materials as cloths, plastics, etc.

Of course, a number of modifications, alterations and mechanical improvements may be made to my printing press, always within the province of the invention.

Having described and specified the printing press I invented, what I claim as being my invention and exclusive property is:

1. A printing press for printing multicolor intaglio, letterpress impressions from a single intaglio plate, letterpress cut inked with several adjacent colors, off-set printing from a single rubber blanket or transfer element provided with several superimposed or adjacent designs and colors by a plurality of engraved cylinders, comprising in combination a rotatably supported drum, means positioned on said drum capable of holding either an intaglio printing plate, a letter-press cut, a rubber blanket or transfer element on the same supporting surface of said drum, a second rotatably supported drum of the same diameter as said first mentioned drum being in pressure contact therewith for rotating at the same speed but in an opposite direction thereto, a sheet feeder positioned above said second drum, means on said second drum for taking from and holding on its surface sheets fed by

said sheet feeder, an arcuate support positioned adjacent said first drum, a plurality of equally spaced roller holding members mounted on said support capable of interchangeably holding a series of inking rollers to apply each a different ink to the intaglio printing plate or the letterpress cut on said first drum and a series of printing rollers to print each a different color in the blanket on said first drum while circumferentially spaced with respect to said first drum, a movably mounted carriage, a series of inkers arcuately mounted on said carriage in such a manner that one inker will be placed in cooperating relation with a corresponding inking roller or printing roller when on said arcuate support upon the moving of said carriage adjacent said holding members, a cleaning cylinder being positioned adjacent the periphery of said first drum for cooperating therewith for taking off the excess ink from the intaglio plate when on said first drum, a rotatably mounted cylinder for taking the ink off said cleaning cylinder, the said second drum, roller holding members and cleaning cylinder being positioned around the periphery of said first drum in that order.

2. A printing press as claimed in claim 1, wherein conveyor means are provided for taking printed sheets from said second drum and a second sheet feeder is mounted for feeding interleaving sheets to said conveyor whereby said conveyor can deposit printed sheets with said interleaving sheets on a delivery table.

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