July 21, 1953 J. G. GAMBLE 2,646,226

COP HANDLING MECHANISM

Filed Sept. 28, 1949 7 Sheets-Sheet 1

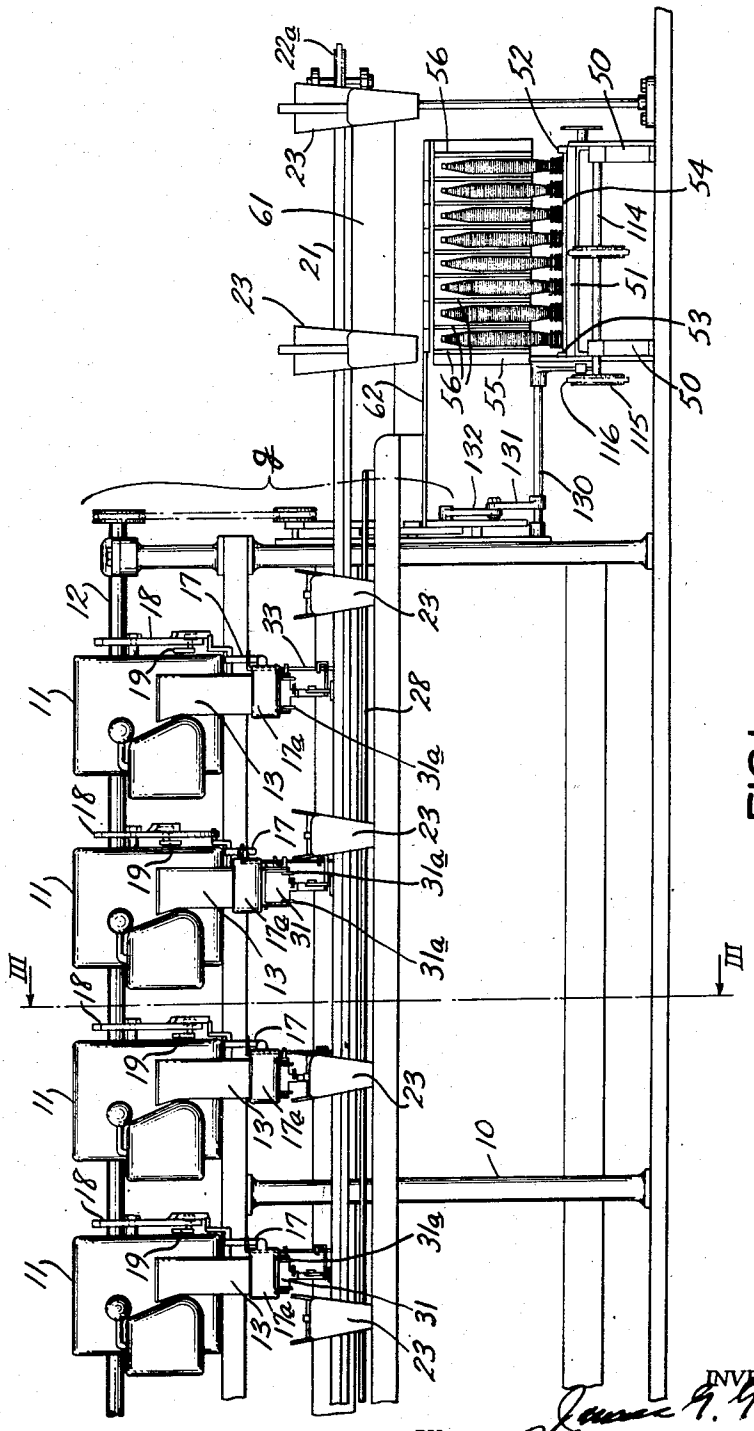

FIG. I.

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COP HANDLING MECHANISM

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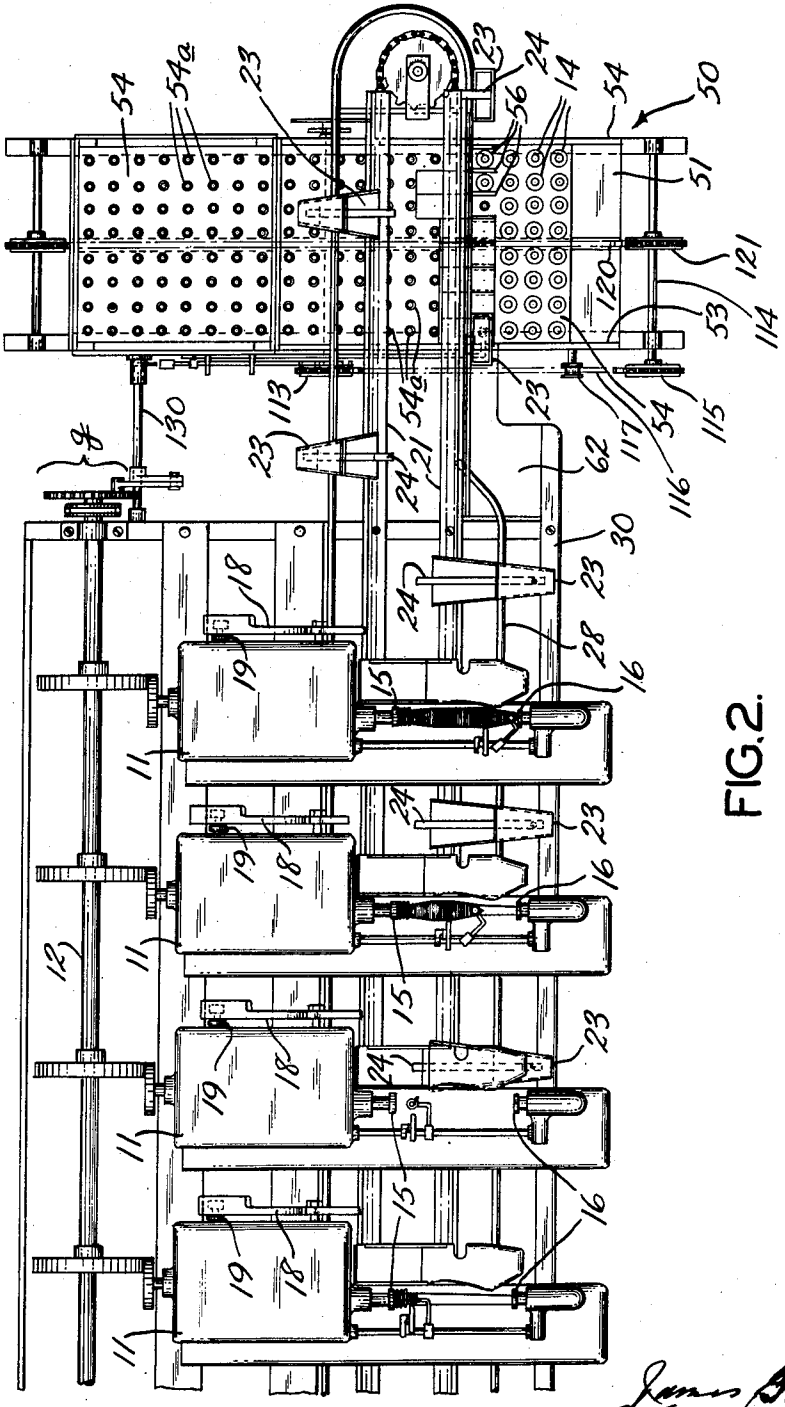

FIG.2.

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COP HANDLING MECHANISM

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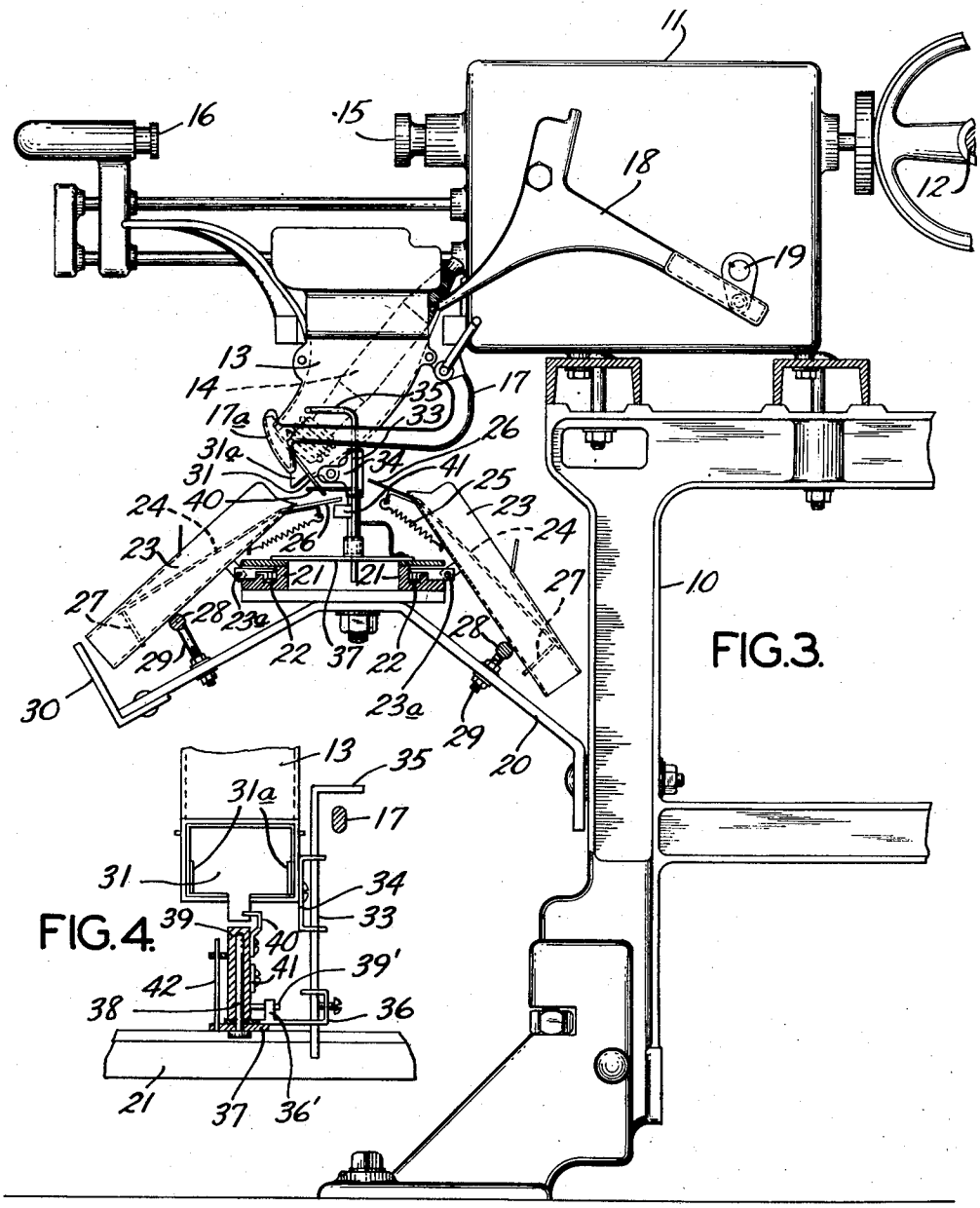

FIG.3.

FIG.4.

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COP HANDLING MECHANISM

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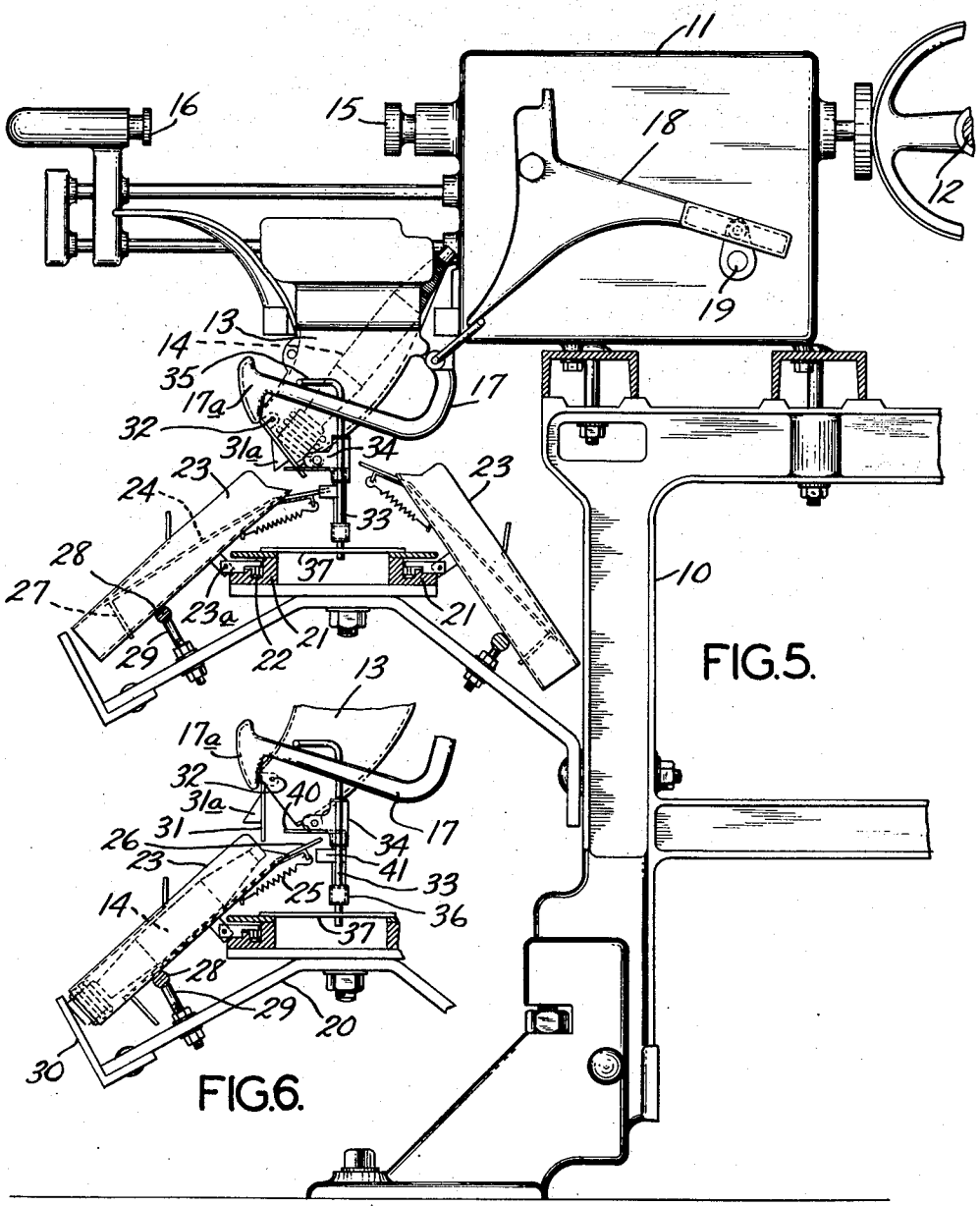

FIG.5.

FIG.6.

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COP HANDLING MECHANISM

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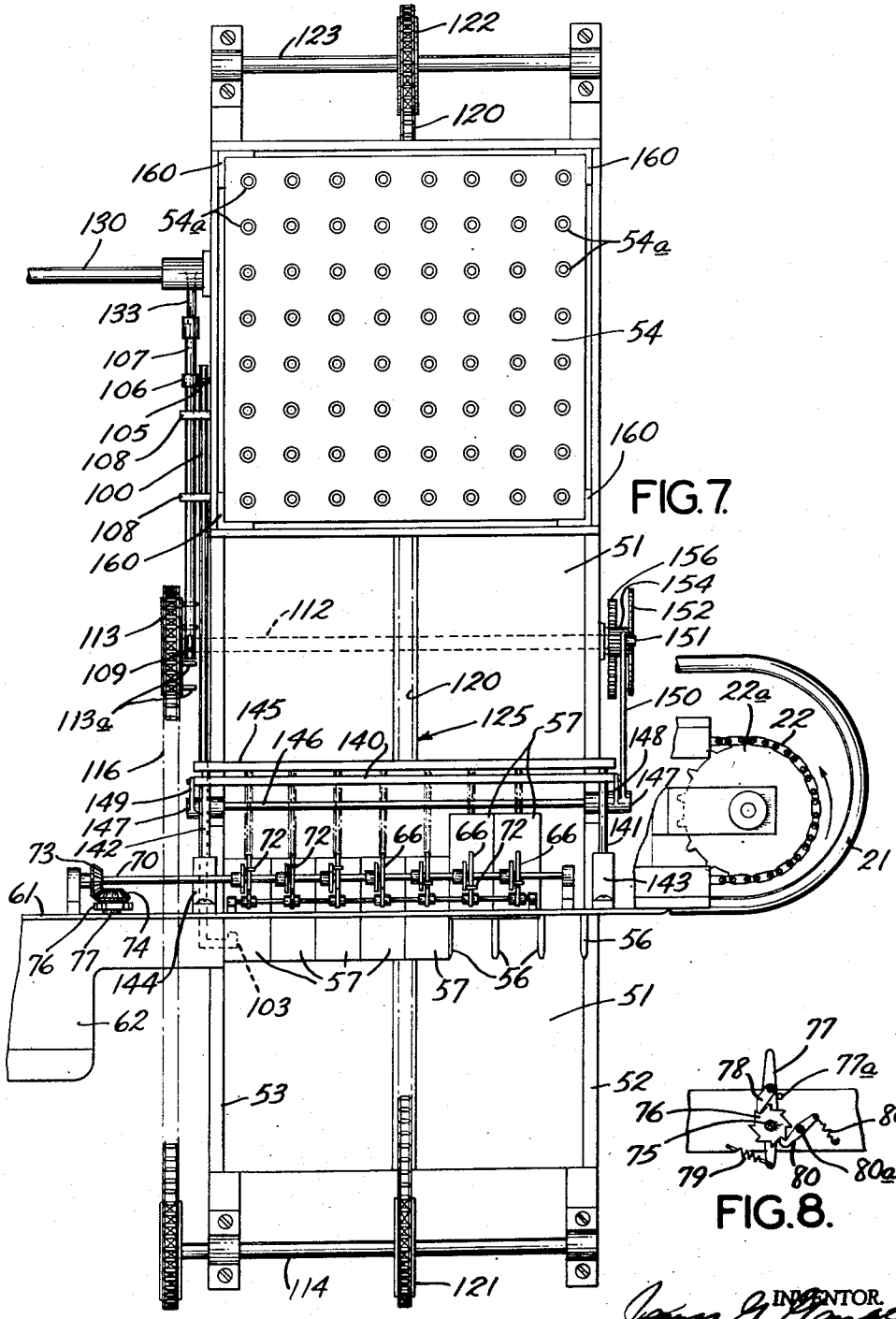

FIG. 7.

FIG. 8.

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July 21, 1953 J. G. GAMBLE 2,646,226

COP HANDLING MECHANISM

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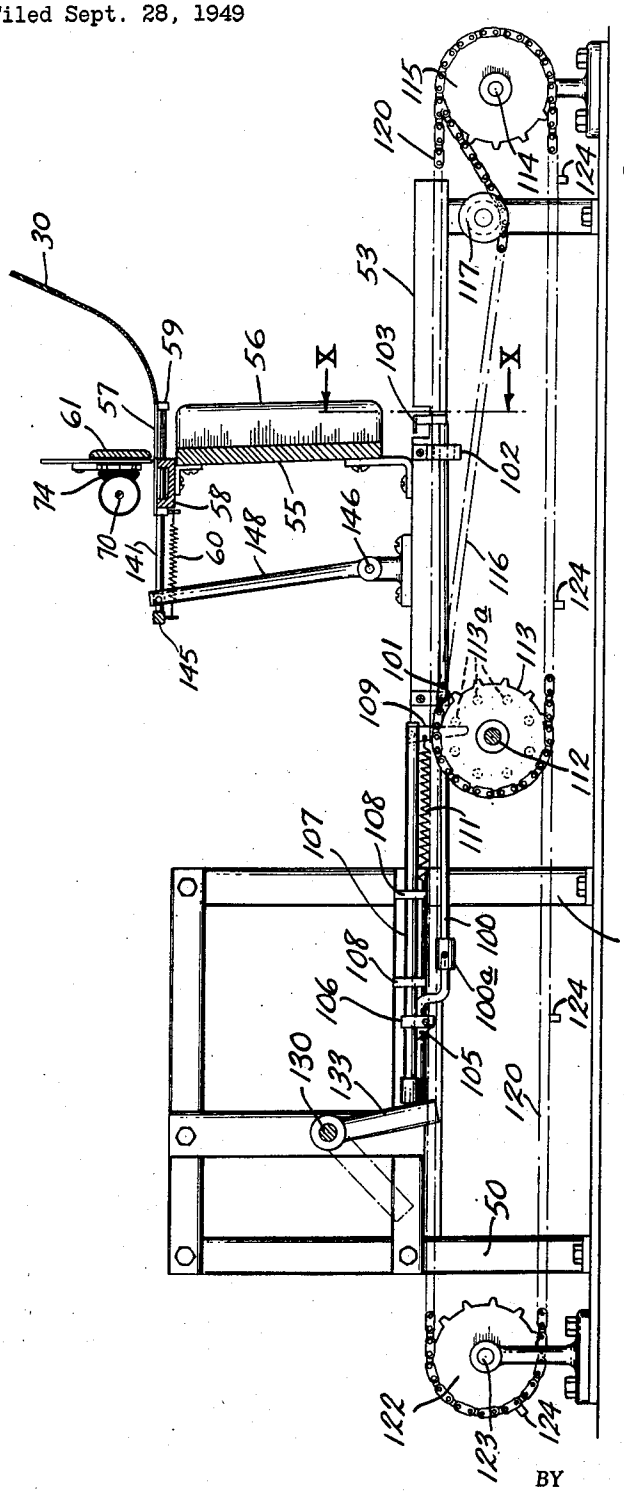

FIG.9.

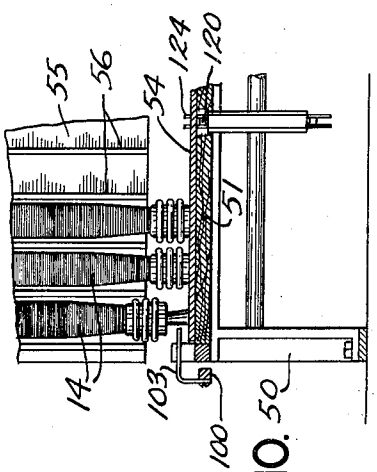

FIG.10.

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COP HANDLING MECHANISM

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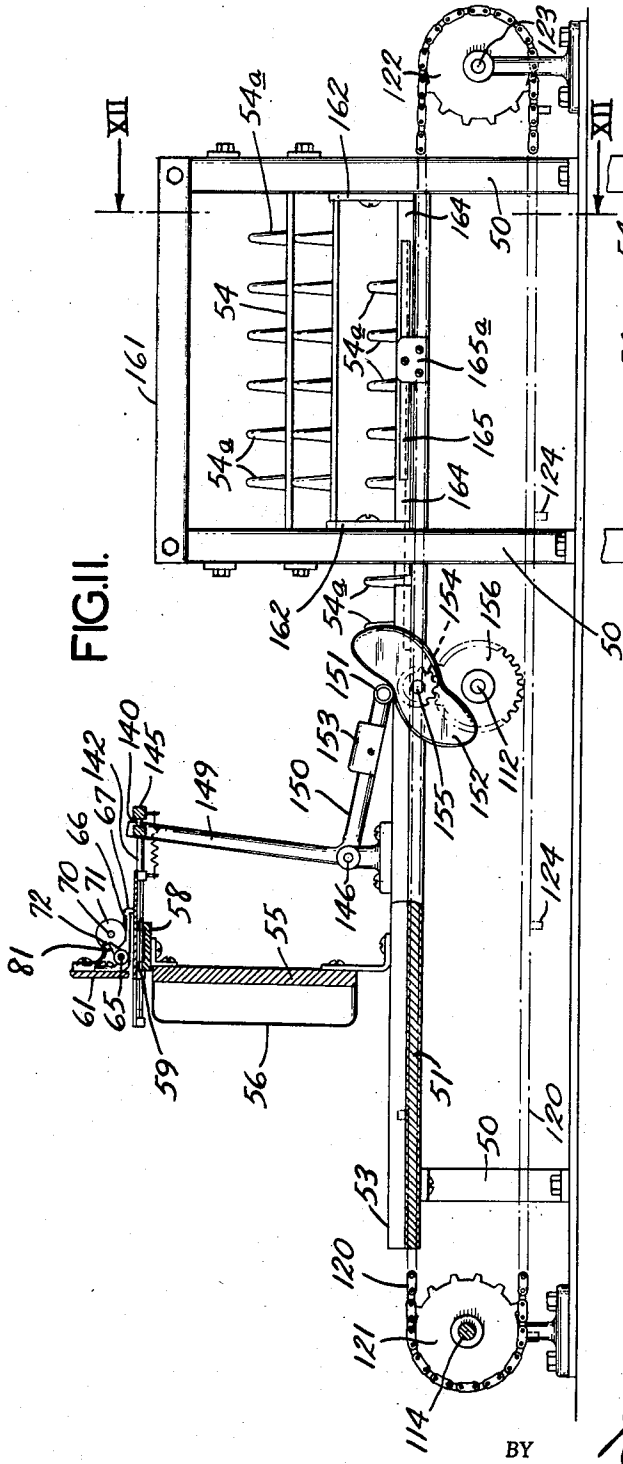

FIG. 11.

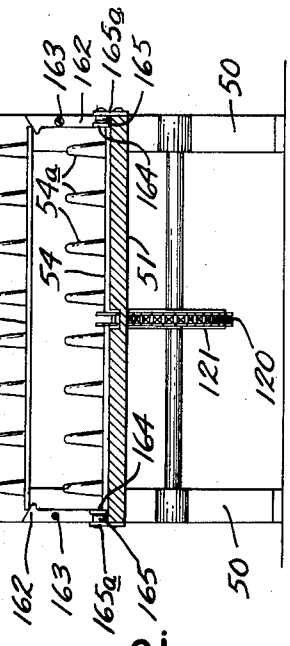

FIG. 12.

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Patented July 21, 1953 2,646,226

UNITED STATES PATENT OFFICE

2,646,226

COP HANDLING MECHANISM

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Application September 28, 1949, Serial No. 118,259

9 Claims. (Cl. 242—35.5)

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This invention relates to mechanism for handling cops discharged from winders. The term "cop" is used herein in a generic sense, i. e. as including cops, cones, bobbins, etc., in general all kinds of yarn packages. Also for conciseness the word "winder" is used herein in a generic sense.

It is common practice to collect cops discharged from winders in boxes placed below the winder heads, and by hand transfer the cops from the boxes to racks on which they are held out of contact with each other and carried to the next operating station. The haphazard falling of the cops onto each other in the boxes however, entails a material amount of damage, especially when they are filled with a delicate yarn such as rayon or glass for example. This not only causes waste of material, but also both the handing of the cops between the boxes and the racks and the separating of the damaged material from the good consumes considerable of the operative's time. Various expedients have been proposed to avoid these faults. The present invention avoids them by providing for the direct transfer of the cops from the winders to the racks, and in such a manner that damage during the transfer is substantially eliminated.

To this end, in its most complete form, the invention provides, briefly, a conveyor to take the cops at the point or points where they are delivered and transport them to a station or stations where at least one rack is located, mechanism to direct each cop as it arrives at this station to an empty space on the rack (i. e. to an empty pin or an empty pocket, depending on the nature of the rack), a magazine for empty racks, and mechanism to replace filled racks by empty racks taken from the magazine. Preferably the conveyor is of the endless chain type, say, extending along and receiving cops from a whole bank of winding heads, and has individual carriers for the cops. Preferably these carriers have the form of pockets. The pockets may have either open bottoms, in which case stationary rails against which the, say, butt ends of the cops slide, can be employed to prevent premature escape of the cops from the pockets, or have movable bottoms which open to release the cops at the proper times. Preferably the conveyor runs above the rack so that the cops can be carried from the conveyor to the rack by gravity. Especially in such cases the mechanism which directs the cops from the conveyor to the rack and thus assures that a cop from the conveyor will pass to only a vacant space of the rack, may comprise, and preferably is, a set of shutters disposed above the cop-holding spaces of the rack, or above a group of those spaces, and arranged initially to prevent the passage of cops from the conveyor to the rack, but which open one at a time to permit the passage of cops to successive cop-spaces

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of the rack. However the reverse of this shutter operation is an alternative, and also the transfer of the shutters from the rack station to the cop carriers on the conveyor as it were (e. g. providing each carrier with a removable bottom) is another alternative. The arrangement may be such that the delivery of cops is restricted to the spaces of a single row of the cop-spaces of a rack as it were, and the rack advanced to bring a new row to this delivery position each time the filling of a row is completed, thereby bringing the rows of the rack to delivery position successively. The magazine may carry the stock of empty racks superposed one above another, and above the carrier of that rack which, at the moment, is at or passing through the delivery position, so that the replacement of a filled rack by an empty one is accomplished readily.

The foregoing and other matters of the invention are illustrated by the preferred form of the invention which is shown in the accompanying drawings. Fig. 1 is a front elevation of a portion of a multiple-head cop winder and of a corresponding part of the cop handling mechanism of the present invention which serves this winder. Fig. 2 is a plan view of the mechanism of Fig. 1. Fig. 3 is a vertical section about on the line III—III of Fig. 1, drawn to a larger scale. Fig. 4, drawn to a still larger scale, is an elevation, partly in section, of certain details of the mechanism of Fig. 3. Fig. 5 is a view similar to that of Fig. 3 but with the movable parts in the positions which they occupy just about as a cop is to escape to the conveyor from the delivery part of a winding head. Fig. 6 shows some of the parts of Fig. 5 just about as the cop has entered the conveyor. Fig. 7 is a plan view of the rack carrier, the mechanism for directing cops from the conveyor to empty spaces on the receiving rack, and of the rack magazine. Fig. 8 is a detail of certain parts of the mechanism shown in Fig. 7. Fig. 9 is a side elevation of the mechanism of Fig. 7, the load of racks being omitted from the magazine. Fig. 10 is a partial vertical section on the line X—X of Fig. 9, but showing a rack and some filled cops at the receiving station. Fig. 11 is an elevation of the mechanism of Fig. 7 showing the side opposite that shown in Fig. 9. Fig. 12 is a vertical section about on the line XII—XII of Fig. 11, showing additional parts of the rack replenishing mechanism. Various parts of the machine have been omitted from the drawings for clarity of illustration as will be understood, some not important to the invention and some not important to the particular figures from which omitted.

The cop winder shown in the drawing is conventional. It has a frame 10 which supports a number of winding heads 11. These winding heads are dirven by a power shaft 12, common to them all, through pairs of frictionally engaged

driving wheels, Fig. 2. Each winding head has a chute 13 into which each cop 14 wound by it falls at the conclusion of the winding operation and upon its release from the centers 15 and 16 between which it is held during the winding operation. At each winding head a lever 17 having a downwardly projecting end piece or head 17a prevents cops from leaving the chute of the respective winding head when the lever is in its Fig. 3 position, while a lever 18, which is connected by an eccentric pin and slot to a control shaft 19 of the winding head, serves to raise the lever 17 to remove its restraint on the discharge of cops, Fig. 5, at appropriate times as determined by the control shaft.

Inasmuch as winders like that shown are well known, including their internal mechanisms, the foregoing will suffice for the present purposes.

Several brackets 20, fastened to the frame 10, Fig. 3, support a pair of rails 21 which extend lengthwise of the winder below the heads and carry an endless chain 22; at one end of the rails, the chain is mounted on a sprocket 22a, Fig. 7, and at the opposite end on a similar sprocket, not shown; both sprockets are mounted on vertically extending axes and one of them is driven by power shaft 12. The manner in which the chain 22 is driven can be explained better later on in this specification. A plurality of cop carriers 23, Fig. 1, are pivotally secured at spaced intervals to the chain 22 by horizontally extending pivots 23a, Fig. 3. Each of these cop carriers may have substantially the form of a tube, or upwardly open trough, or part one and part the other, and may be open at both its upper and its lower end. Inside each carrier a tongue 24 extends lengthwise of the carrier and is pivoted at its upper end to the carrier, Fig. 3, to serve as a feeler and register the presence or absence of a cop on the carrier. A spring 25 maintains each feeler tongue 24 projecting well into its carrier, as it were, when there is no cop in the carrier, Fig. 3 (cf. Fig. 6), in which position an upper end or extension piece 26 of the tongue is held in lowered position and its lower end or projecting part 27 is held in a raised position, Fig. 3. On the other hand, when a carrier receives a cop from one of the winder chutes, the cop comes to rest on its feeler 24 and overcomes the pull of its spring 25, and thereby the feeler is swung to its operative position, Fig. 6, i. e. to a position where its upper end or extension piece 26 is held raised and its lower end or projection 27 is held depressed. Preferably a rail 28 is secured by longitudinally adjustable bolts 29 to the brackets 20 parallel to each of the chain rails 21, and in such relation to the rails that the outer portions of the hinged carriers rest thereon and thereby are held at an angle to the vertical except adjacent the rack station, Fig. 3 and Fig. 1. At least when the lower ends of the carriers are open, a stop rail 30 also is fastened to brackets 20; it extends along the front of the machine to prevent the cops from falling out of the cop carriers through their open bottom ends until they approach the receiving position of the racks, Fig. 1.

In addition to the lever 17 and lever head 17a, each chute 13 is provided with a gate 31, pivoted at 32, between its open lower end and the head 17a of its adjacent lever 17, Figs. 3, 5 and 6. In order for a cop to escape from a chute therefore, its lever head 17a must be raised, Fig. 5, and also the gate 31 free to open, Fig. 6. As before pointed out the position of the head 17a

is controlled by its control shaft 19 and accordingly is controlled in relation to the operations of its winding head. When lowered each lever head 17a holds the adjacent gate closed, acting on cams 31a on the gates (Figs. 6 and 3), and when its head 17a is raised, each gate 31 is freed to open to permit the escape of a cop in its chute by the action of the feeler 24 of the next empty cop carrier to come to it. To this end a vertically extending rod 33 is mounted slidably in a bracket 34 attached to the lower end of each chute 13, Figs. 4 and 6. The upper end of each of these rods 33 is formed as a hook 35 which projects above and across the adjacent lever 17. Also a plate 37 carrying a vertical post 38 is secured to the rails 21 below each chute 13 and a sleeve 39 is mounted both slidably and rotatably on each post 38. Member 36, fastened to adjacent rods 33 and extending below each sleeve, serves to slide the sleeves 39 upwardly on their posts whenever their respective rods 33 are raised by the respective levers 17. A finger 40 is mounted on each sleeve 39 in position for engagement with the adjacent gate 31 to hold this gate in closed position normally (Figs. 3 and 4). Also an arm 41 is mounted on each sleeve 39 in such a position as to be below the path of the feeler extensions 26 when the latter are in their low positions and its sleeve is lowered (Fig. 3), but to be in the path of the lowered extensions 26 (Fig. 5) but still below the path of raised extensions (Fig. 6) when its sleeve is raised. Each sleeve 39, its finger 40 and arm 41 thus constitutes a latch for the adjacent gate 31. Accordingly whenever an empty cop carrier comes to a chute 13 whereat the lever 17 is raised, as it will be whenever there is a cop in the chute, the tongue extension piece 26 of that carrier engages the adjacent arm 41 and swings this arm and thereby its sleeve 39 with the latch 40, thereby removing latch 40 from engagement with gate 31. The cop in the chute, by its weight then forces the gate 31 open and slides into the empty cop carrier. As the cop enters the carrier it depresses the lower end of tongue 24 of that carrier. Depression of the tongue 24 raises its extension piece 26 to its inoperative position where it passes above any other arms 41 it may come to, regardless of whether these are in their raised or lowered positions, Fig. 6. Sometime before another cop is delivered to the chute 13 from which a cop has thus been taken, the related lever 17 is returned to its original operative position by its control shaft 19, and thereby the head or finger 17a is caused to close the gate 31, for this purpose running onto a cam 31a, Fig. 6, attached to the gate. Just as the raising of the lever 17 raised the adjacent arm 41 into the path of lowered feeler extensions 26, just so the lowering of each lever 17 permits its adjacent arm 41 to fall again below the path of these extensions. Accordingly lowering a lever 17 permits a leaf spring 42 to rotate the related latch 40 and arm 41 to their original positions wherein the latch 40 again holds its gate 31 closed. The backward rotation is stopped at the proper point by an arm 39' on sleeve 39 engaging a stop member 36' on the sleeve lifter 36. As an incident to the depression of a tongue or feeler 24, its pin 27 is moved downwardly also of course. The purpose of this is described later.

At the cop-delivery position or station, i. e. the station at which the containers 23 of the conveyor deliver their cops to the racks, a frame 50 having a platform 51 and side rails 52 and

53 to guide and center the racks on the platform, serves as a support for the receiving racks, one by one. In the present instance the cops 14 have longitudinal holes or recesses at their bases whereby they can be set onto pins, and accordingly each of the racks consists primarily of a flat member 54 such as a board, and a number of pins 54a projecting from this base member, arranged in rows lengthwise and transversely of the base member 54, and each is adapted to receive a cop and hold it out of contact with its neighbors. The conveyor rails 21 and the conveyor extend not only along the array of winding heads 11 but also to one end of the array and across the rack carrier, Figs. 1 and 7, at a higher level than the tops of the cop-pins 54a, and adjacent one run of the conveyor, a bracket 55 is fixed to and spans the space between the guide rails 52 and 53 and suspends a partition 56 at each side of each cop-pin 54a at the cop-receiving position. The partitions 56 guide the cops in their descent from the conveyor containers to the pins 54a. Above each guideway, formed by the partitions 56, except the one at the extreme right, (the movement of the carriers is from left to right as viewed in Figs. 1, 2 and 7) is a flat plate-like shutter 57 slidable horizontally on guides in a transverse member 58 of bracket 55 from a position where the shutter covers its guideway to a position where its guideway is uncovered, Figs. 2 and 7. In effect, these shutters especially select particular cops in the cop-carriers of the conveyor for particular empty spaces on the racks and direct the cops to empty spaces. A bumper 59 at the forward end of each shutter 57 limits the backward movement of of the shutter by striking the bracket member 58. Springs 60, one for each shutter 57, urge the shutters to their rearward or guideway-uncovered position. Latches 66, independently hinged on a cross bar 65 (Figs. 7 and 11), have hooked ends 67 to engage the rear ends of the shutters to hold the shutters against the pull of the springs. Also each latch 66 has a projecting arm 81 so placed that lifting its arm 81 lifts the hooked end 67 of the latch and thereby frees its shutter 57 for movement by the shutter spring 60 to guideway-uncovering position, Fig. 11. To thus release the latches 66 at the proper times, a shaft 70 is provided, and keyed to this a number of discs 71, one for each latch 66, and each having an eccentrically positioned pin 72 so set as to strike and lift one of the arms 81 of the latches as the shaft 70 is rotated (e. g. rotated clockwise in Fig. 11). In Fig. 11, one of the pins 72 has raised its latch 66 recently, and its associated shutter has been pulled to its position where its guideway between two partitions 56 is uncovered, and further rotation of the shaft 70 has carried this pin 72 beyond its arm 81 so that the latch has fallen back onto the shutter. Successively the pins 72 are displaced from each other angularly around the shaft 70 so as to release the latches 66 successively; to this end, since there are eight guideways formed by the partitions 56 and the filling of each row of cop pins begins at the right in Fig. 7 in the instance illustrated, each pin 72, beginning with the second from the right in Fig. 7, is set back of the pin ahead of it one-eighth of a circumference; e. g. in the present instance where the shaft 70 rotates clockwise in Fig. 11, each pin 72 is displaced 45° in the counterclockwise direction from the pin 72 to the right of it. To rotate the shaft 70 a bevel gear 73 is fixed to shaft 70 and meshed with another bevel gear 74 which is loose on a stub shaft 75 (Fig. 7). A ratchet wheel 76 is secured to the gear 74 (Fig. 7), and on shaft 75 is provided a lever 77 carrying a pawl 78 to turn the ratchet wheel 76 and therewith the bevel gear 73. A spring 79 attached at one end to the lower end of lever 77 and its opposite end secured to frame 50, urges the lever 77 in clockwise direction as viewed in Fig. 8, or its top end to the right in Fig. 7. A stop member 77a, Fig. 8, prevents the lever from movement in this direction beyond the position which it occupies in Fig. 8. A pawl 80, pivoted at 80a and urged to swing against the ratchet by the spring 80b, prevents backward or clockwise rotation of the ratchet 76 and bevel 74. This latter mechanism is located at the side of the rack position opposite that at which the first cop of each row is delivered (e. g. at the right, Fig. 7), and is so disposed that the top end of the lever 77 projects into the path of the feeler pins 27 of such of those cop carriers 23 as may be carrying cops at any time, and thereby each carrier 23 carrying a cop that passes the lever 77 turns shaft 70 one-eighth of a full rotation while empty carriers do not turn the shaft at all. Further, initially the shaft 70 is so set angularly that when a new row of cop-pins on a rack is brought to cop-receiving position, i. e. to the guideways between 56, the pin 72 of the first shutter 57 at the right of Fig. 7 is displaced one-eighth of a circumference (45°) from its lever arm 81. Still further, the lever 77 is so placed that the distance between it and the first cop-pin of any row (the one at the right in Fig. 7) is at least equal to the distance between two adjacent cop carriers 23 of the conveyor. As a result of this construction and arrangement, when a new row of cop pins is brought to cop-receiving position, the first carrier 23 containing a cop that passes lever 77, makes shaft 70 ready to release the first shutter when the second cop-containing carrier 23 passes the lever, but all the shutters remain in guideway-covering position until the first cop-containing carrier reaches the first guideway (at the right in Fig. 7), and perhaps a little longer. Somewhat similarly, the second cop opens the first shutter for itself, the third cop opens the second shutter, and so on.

At the winding heads the cop carriers 23 are held in an angular position by the front rail 28 in order to be well positioned to receive cops from the chutes 13, Fig. 3, and also by a rail 28, at the rear, say for constructional reasons. Between the end of the bank of winding heads and the position for the cop-receiving racks, the front rail 28 is bent, as it were, to a position beneath the adjacent conveyor track 21, Fig. 2, and in such relation to this track may be continued across the rack position or be replaced by another wall 61 substantially below this track, Figs. 1, 2 and 11. This change in the rail 28 allows the cop carriers 23 to swing from their angular positions at the chutes to vertical positions, and in the vertical positions the carriers 23 are carried across the receiving rack. About at the place where the carriers become vertical, the stop rail 30 ends, and is replaced by a horizontal shelf 62 which extends to and is disposed at the same level as the row of shutters 57. This shelf therefore retains the cops in those carriers 23 that have cops, until the row of shutters is reached. As the carriers pass above

the shutters 57 these shutters (speaking generally) act as a wall to confine the cop in any carrier that has a cop until that carrier reaches a guideway between two of the partitions 56 that is not covered by a shutter 57. When this occurs the cop in that carrier slides out of the carrier by gravity, passes down the guideway and comes to rest on one of the cop-carrying pins 54*a* of the rack which happens to be in cop receiving position at the time.

As each row of pins 54*a* of a rack is filled in the present instance, the rack is moved forward to bring the next row of pins to cop-receiving position, e. g. underneath the row of shutters. Such filling of a rack, i. e. one row at a time and advancing the rack to bring successive rows to the apparatus delivering the cops to the racks, is the preferred form of operation, but is not wholly essential as will be apparent. The advancement of a rack row by row is brought about by a feeler that is located at or adjacent the position occupied by the last pin 54*a* of each row to receive a cop, so that this feeler will be encountered by those cops that complete the filling of the rows. In the machine illustrated a latch rod 100, pivoted horizontally at 101 and movable in a vertical plane in guide 102, carries a finger 103 which constitutes the feeler. This finger or feeler 103 is located rather close to the position occupied successively by that cop-receiving pin 54*a* of each row which is the last of its row to receive a cop, e. g. underneath the left-hand shutter 57, Fig. 7, high enough to permit the base members 54 to pass beneath it, and extends thence to one end of the rod 100, Figs. 7 and 9. As the last cop needed to fill a row of the pins 54*a* falls onto its pin, it strikes the feeler 103 and thereby rocks the rod 100 on its pivot, clockwise in Fig. 9. A weight 100*a* or the like can be used if necessary to hold the feeler 103 elevated except when a cop rests on it. The opposite end of rod 100 has a hook 105 which while the feeler 103 is in its upper position, engages a bracket 106 fastened to a plunger 107 which is slidable in bearings 108 on frame 50 and which carries a downwardly extending pawl or lever 109 pivoted at its upper end to the plunger 107. A spring 111 tends to thrust the plunger 107 to the left in Fig. 9. Normally this movement is prevented by the hook 105. The pawl or lever 109 can swing freely in one direction on 107, e. g. counterclockwise in Fig. 9, at least through a substantial arc, but is prevented from moving beyond a certain position in the opposite direction, e. g. beyond the downward position clockwise in Fig. 9. A transverse shaft 112, mounted in bearings on frame 50, has secured to it a pulley or sprocket 113 which has a plurality of equally spaced pins 113*a* projecting sidewardly from the pulley or sprocket and the pulley or sprocket is so placed that one end of the lever or pawl 109 projects into the spaces between adjacent pins. Another shaft 114, at one end of the frame 50, carries a second pulley or sprocket 115, and a belt 116 connects the pulleys or sprockets 113 and 115. An idler 117 holds the belt 116 under tension. A second belt 120 is mounted on another pulley or sprocket 121 fixed to shaft 114, and an additional pulley or sprocket 122 which is fixed to a shaft 123 at the opposite end of the frame 50. The upper run of this belt 120 lies in a recess 125 in platform 51 and a series of fingers 124, secured to this chain 120 at spaced intervals corresponding to the length of a rack, projects upwardly from the upper run so that as the belt 120 is advanced (to the right in Fig. 9, downwardly in Fig. 7), any finger 124 that may be directly back of any rack 54 which at the moment is beneath the row of shutters 57, can engage that rack and advance it with the belt 120. The purpose of the plunger 107 and this apparatus associated with it is to advance belt 120 a distance equal to the distance, center to center, from one transverse row of cop-receiving pins 54*a* to the next, whenever the filling of a row of these pins with cops is completed. The power for this comes from the shaft 130. This shaft 130 is supported in bearings secured to frames 10 and 50 and is oscillated continually by the main power shaft 12 of the machine. To this end it is provided with an arm 131 which is connected by a link 132 to a crank pin on the last of a train of reduction gears *g*, the first of which is on the shaft 12 (Figs. 1 and 2). A downwardly extending arm 133 is secured to the shaft 130 to oscillate therewith, and oscillate in the path of movement of the plunger 107. The range of movement of the oscillating arm 133 will be understood from the description of the operation which follows.

As a row of pins 54*a* is being filled, the feeler 103 stands elevated and the rod hook 105 prevents the plunger 107 being moved, by its spring 111, to the left beyond its position in Fig. 9. Accordingly the oscillating arm 133 oscillates without effect except perhaps to displace the plunger 107 slightly on each stroke. As ultimately a cop falls onto the last pin 54*a* of a row however, this cop strikes and depresses the feeler finger 103, thereby raising hook 105 and permitting the plunger 107 to move to the left until it strikes the oscillating arm 133. As the plunger moves to the left with the oscillating arm 133, the pivoted arm 109 of the plunger moves to the left of the sprocket or pulley pin 113*a* which is to the left of the pin 113*a* with which 109 is shown engaged in Fig. 9, and then as the oscillating arm 133 swings to the right again and thereby thrusts the plunger to the right in Fig. 9, the pivoted plunger arm 109 turns the pulley 113 a part turn, this turns shaft 114 a part turn, and this advances the belt 120 a step (to the right in Fig. 9, downwardly in Fig. 7). The extents of the various movements are such that the belt 120 advances a distance equal to the distance between adjacent transverse rows of the cop pins 54*a*, center to center. Accordingly the block or finger 124 that is back of the rack that is below the shutters 57, advances the rack a similar distance and thus brings a new row of pins to the cop-receiving position. Also this advance of the rack relieves the feeler finger 103 of the cop that was resting on it and thus permits the hook 105 to seize on the bracket 106 of the plunger and thus stop the further advance of the belt and rack until the new row of pins 54*a* is filled. When this happens the rack will be advanced again of course, a similar distance.

As a rack is advanced to bring a new row of pins 54*a* to cop-receiving position, the shutters 57 are returned to their positions above the guideways formed by the partitions 56. The mechanism presently used for this purpose is shown best in Figs. 7, 9 and 11. It includes a cross bar 140 which is slidably mounted on two rods 141 and 142 in such a position that when moved forwardly (to the left in Fig. 11) it will strike the sliding shutters 57 and shove them to their positions above the guideways where they will be held by the hooks or latches 66 as before described. The rods 141 and 142 are carried in brackets 143 and 144 fastened to the bracket 55 and their rear ends are connected by

a stationary cross bar 145 for rigidity. At a lower level a shaft 146 is rotatably supported in brackets 147 which are mounted on the frame 50, and carries two arms 148 and 149 which are pivotally connected to the ends of bar 140 (loosely if necessary, as will be apparent), and also has an arm 150 which is provided with a cam follower 151 to bear on a cam 152; a weight 153 for example can be put on the arm 150 if necessary to hold the follower 151 in contact with the cam 152. Primarily this cam is so shaped that when rotated, and acting through the follower 151 and its arm 150, it will shift the cross bar 140 to replace the shutters 57 as described, and then permit the, say, weight 153 to return the cross bar to its initial position, Fig. 11. In the machine illustrated, the cam 152 is so made, for convenience, that a single rotation of it causes the cross bar 140 to act twice. To rotate it, the cam is fixed to a pinion 154, the two are mounted on a stub shaft 155 on the frame, and the pinion is meshed with a gear 156 fixed on the shaft 112 so that the return of the shutters is in a fixed time relation with the advance of the racks. The ratio between the gear and the pinion is such that each movement of shaft 112 to advance a rack to bring a new row of pins 54*a* below the shutters, turns the cam 152 sufficiently (180 degrees with the cam illustrated) to swing the cross bar 140 to the left once and permit it to return to its initial position again, and the timing is such that the cross bar 140 thus swings forward and back during such an advance of the shaft 112.

When a rack has been filled with cops, an empty rack can be substituted for it on the rack carrier or support 51 by hand. In the alternative a magazine of empty racks may be provided and the substitution made automatically as suggested above. In the present instance a magazine is provided (see Figs. 7, 11 and 12 especially) by four uprights 160 fastened to or forming parts of the frame 50 and tied at their upper ends by braces 161. This is of a size to easily hold a number of the racks 54 one above another. The lowermost of these racks rests upon the top or platform 51 of the frame 50. At the four corners of the frame four vertical levers 162 are provided, hinged at 163, and the next rack of the magazine above the lowest, or the second rack of the magazine, rests on the upper ends of these levers (Fig. 12). Each of the empty racks above the second rests on the pins of the rack below it (Fig. 11). At each of the two sides of the magazine, a horizontal bar 164 is connected to the lower ends of the two levers 162 of the respective side, to act as feelers, and each is provided with a spring 165 (flat springs are illustrated), mounted on brackets 165*a*, which tend to thrust the bars inwardly thereby rocking the levers 162 so as to move their upper ends outwardly and release the racks above them. However the bars 164 are so placed that they engage any rack 54 resting on the platform 51 between them and thereby are held outwardly to such an extent that the tops of the levers 162 support whatever racks there may be above them, Fig. 12. Also the bars 164 extend so far above the top or platform 51 of the frame 50, that a rack 54 falling from the tops of the levers 162 strikes and passes between the bars 164, and thus spreads them apart and returns the upper ends of the levers 162 to rack-holding position, before that rack which is above the rack falling onto the top or platform 51 reaches the tops of the levers. Accordingly, when the bottom rack 54 of the magazine is moved to the left on the top or platform 51 and thus taken from the magazine, the second rack or rack immediately above it, of the magazine, will fall to the top or platform 51, but the rack immediately above this second rack will be caught and come to rest on the upper ends of the levers 162, and also will support all the racks 54 there may be above it, Fig. 11. By locating the rack feelers 164 at, or extending them to, the outlet side of the magazine as illustrated in Fig. 11, the racks that are above the bottom rack do not fall until this bottom rack has passed completely from the magazine.

A magazine from which the racks are deliverable by such sidewise movement is especially well adapted for the present purposes, because then the mechanism employed to advance a rack row by row at the receiving station can be used to bring up empty racks to replace filled racks also. Thus as will be seen from Figs. 7 and 11, both the top or platform 51 on which each rack at the cop-receiving position rests, and the rack-advancing belt 120 with its fingers 124, may extend to below the magazine also. With such an arrangement the advancing of the belt 120 to advance a rack at the receiving station below the shutters 57 row by row, will advance the bottom rack of the magazine similarly and at the same time, and by making the bases 54 of the racks, the fingers 124 and the spacings between adjacent fingers of such dimensions that the distance from the last row of pins 54*a* of a rack at the cop-receiving station to the first row of pins 54*a* of the rack that is advancing behind it, equal to the distance between adjacent rows of pins of the same rack, empty racks will be substituted for filled racks without interrupting the operations.

Speaking generally the chain or conveyor 22 with its cop containers 23 can be driven intermittently step by step providing the steps are such that, say, each container comes to rest underneath each chute 13 of the winding heads and comes to rest on each shutter 57 at the cop-delivering station, and providing the dwells of the conveyor with the containers at such places are of sufficient length to permit cops to pass from the chutes 13 to the containers 23, and from the containers 23 into the guideways between the partitions 56. On the other hand, the conveyor or chain with its cop containers or carriers can be driven continuously providing the speed of the conveyor is slow enough to permit a cop to pass from a chute to a container in passing, and to pass from a container to a guideway between partitions 56 in passing. Also the conveyor or chain 22 can be driven from any source of power. Preferably however I drive the conveyor 22 continuously, and by the main power shaft 12 of the winder, and by connecting one end of the power shaft 12 to one of the sprockets 22*a* which carry the conveyor or chain, interposing a speed reducing gear in the connection between the shaft 12 and the sprocket 22*a* so that the conveyor will move sufficiently slowly.

For the most part at least the operation of the mechanism described will be understood from the foregoing. To recapitulate however: The winder heads operate, say, as heretofore, and from time to time drop cops into their respective chutes 13 and thereafter raise their respective levers 17 with their heads 17*a*, all as heretofore. The raising of a lever head 17*a* does

not free the cop in its chute however, but leaves the cop still confined in the chute by the related gate 31. The raising of the lever 17 leaves this gate 31 held closed only by its finger 40 however, and also raises the arm 41 associated with this finger 40 into the path of extension pieces 26 of those cop feelers 24, the containers 23 of which do not contain cops. The movement of the conveyor or chain 22 moves cop containers or carriers 23 across the end of the chute of course. If the first carrier 23 to come to a chute 13, the lever 17 of which has been raised, has a cop within it, the extension piece 26 of its feeler 24 will be raised and will pass the associated arm 40 without striking it, Fig. 6, and accordingly the gate 31 of the chute will be held closed. The same is true as other carriers 23 holding cops may come to the chute 13 that contains a cop. Ultimately however a carrier or container 23 without a cop within it will arrive at the chute 13 which has a cop, and its extension piece 26 will be in depressed position, and hence will strike the arm 41 associated with this chute 13, Fig. 5. As the carrier moves a little further piece 26, acting on the arm 41, will turn the associated finger 40 away from the gate 31, and thereupon the cop in that chute will slide into the carrier or container 23 at its end, Fig. 6. As the conveyor or chain 22 continues to advance it moves this carrier or container, now with a cop, away from this chute and ultimately to the delivery station at the shutters 57. Some time after the cop is discharged from the chute 13, and before the next cop is dropped into the same chute, the mechanism of the associated winder drops the lever 17 again. This drops the carrier of the arm 40 down again (cf. Figs. 5 and 3), so that 40 again is out of the path of feeler extension 26, Fig. 3, and also the head 17*a* of this lever, acting on the cam 31*a* of the associated gate 31, closes this gate again. Also the leaf spring 42, Fig. 4, swings the finger 40 back to gate-holding position. This restores the apparatus at this particular winder head to its initial state of course, and the same action of delivering cops to carriers 23 takes place at each winder head as cops are dropped into their chutes respectively.

It is evident therefore that one by one all filled cops are brought to the cop-delivering station or position at the shutters 57. Assume for the moment that all the (seven) shutters 57 are covering their guideways (position of five shutters in Fig. 7) and that a wholly empty row of cop-carrying pins 54*a* stands below the guideways formed by the partitions 56. If an empty carrier 23 now is passing the lever 77 at the approach to the shutters, nothing happens because its feeler finger or projecting part 27 stands too high to strike the lever 77, and the same is true for each container or carrier 23 that may come to this place without a cop within it. However, as a carrier or container 23 having a cop within it arrives at this place, its feeler finger or part 27, now depressed, strikes the lever 77 and, in moving along with the conveyor or chain 22, swings this lever (to the right in Fig. 7, and to the left in Fig. 8) so as to turn the shaft 70 one step (one-eighth of a rotation since there are eight guideways in the present instance). This has no effect on the shutters since the last guideway (to the right in Fig. 7) has no shutter (although one may be provided for it, if desired). As the conveyor or chain 22 continues to move, this filled carrier passes along the shutters 57. It now is held vertical, and the shutters 57 have supplanted the rail 30 and shelf 62 in closing the bottom of the container or carrier and preventing the cop from escaping from it. The cop passes over all seven shutters 57 therefore, but drops into the eighth or last guideway and onto the first pin of the row of cop pins 54*a* that is below the shutters. About as this container or carrier 23 arrived at this last guideway, or sometime later, another container or carrier 23 arrived at the lever 77. If this has no cop within it, nothing happened as before mentioned, and this carrier merely passes on over the shutters and back to the winder heads. If however this next container or carrier 23 has a cop within it, or whenever next a container or carrier 23 with a cop within it passes over the lever 77, its projecting feeler finger 27 rocks the lever 77 again, and thus turns the shaft 70 another step (45 degrees). This motion of the shaft 70, acting on the catch 66, Fig. 11, of the first shutter 57 to the right, Fig. 7, releases this shutter and allows its spring 60 to draw it to the rear, thus opening the second guideway. As the conveyor or chain 22 continues to move, it passes this filled carrier 23 over the shutters until it reaches this second guideway, and then its cop falls through this guideway to its pin 54*a* on the rack 54 below the shutters. In a similar manner the third filled carrier 23 releases the second shutter and its cop drops to the third pin of the row, and so on until the eighth cop drops onto the last pin 54*a* of the row. As each carrier or container 23 looses its cop, it passes on to return to the winder heads of course, along with the other empty carriers, as will be understood from Fig. 2.

As the last (or, here, eighth) cop of a row drops onto its pin as above described, it depresses the finger 103 of the cop feeler 100 as before described, and this in turn causes the plunger 107 to act on the combined pin and sprocket wheel 113 to advance the belt 120 with its rack-engaging fingers 124 one step, and this advances the rack that is below the shutters a distance equal to the distance between two adjacent rows of the cop pins 54*a*, center to center, thereby substituting an empty row of pins for the newly filled row. The action also causes the simultaneous semi-rotation of the cam 152, thus restoring all the shutters 57 to their guideway-closed positions, and also frees the cop feeler 103 of the cop resting on it, and this brings the rack advancing mechanism to rest until a cop is delivered to the last pin of the new row and when this happens the rack is advanced to bring a third row of pins to the cop-receiving position. The whole of this rack-advancing and shutter-restoring action occurs while the carrier which supplies the last cop of a row is passing from one side of the rack to the other. Also as the belt 120 advances the rack that is below the shutters 57 at the moment, it also withdraws the bottom rack of the magazine, step by step, and as the filling of the last row of pins 54*a* of one rack is completed, the first row of pins of the new rack is brought to cop receiving position, and as the bottom rack of the magazine ultimately is removed from the magazine, its place is taken by the rack initially above it, all as before described. Filled racks pushed from the cop-receiving position may be taken from the platform 51 by hand, or mechanically as desired, as will be understood.

It follows therefore that each cop is delivered

to its rack wholly automatically, entirely without engaging with another cop, and under such conditions that little damage to the filling is likely. Further, this operation may be a continuous one, even to the extent of substituting empty racks for filled racks.

It will be understood that the invention is not limited to the details of construction and operation described and illustrated except as appears hereafter in the claims, and the claims are intended to include not only the elements mentioned in them specifically, but the equivalents of those elements also.

I claim:

1. The combination with a cop winder having a plurality of winding heads, of an endless belt conveyor disposed to pass along the array of winding heads, and to one end of the array, cop carriers on said conveyor to receive cops from said heads, a support at said end of the array of winding heads for a cop-receiving rack, said conveyor crossing said support, at least one guide to guide cops from said carriers to empty spaces on said rack, and a cop selector mechanism to select cops individually directly from said carriers for empty spaces on said rack.

2. The combination with a cop winder having a plurality of winding heads, of an endless belt conveyor disposed to pass along the array of winding heads, and to one end of the array, cop carriers on said conveyor to receive cops from said heads, a support at said end of the array of winding heads for a cop-receiving rack, said conveyor crossing said support and the distance between said carriers on said conveyor and a cop-receiving rack on said support being at least the length of a cop, at least one guide to guide cops from said carriers of the conveyor to cop-receiving spaces of a rack on said support, and a selector mechanism to direct cops to empty spaces on said rack.

3. The subject matter of claim 2, characterized by the fact that said selector mechanism includes movable shutters to prevent the escape of cops from carriers of the conveyor, at least at said guides, and a trip is provided to move shutters to release cops from carriers to guides leading to empty cop-receiving spaces of a rack on the support.

4. The subject matter of claim 3, characterized by the fact that the said movable shutters are located at at least some of said guides to close the entrance ends thereof, the bottoms of the cop carriers are open, and stationary stops are provided to prevent escape of cops through the open ends of the carriers until the carriers reach said shutters.

5. The combination with a cop winder having a plurality of winding heads, of an endless belt conveyor disposed to pass along the array of winding heads, a support at one end of said array of winding heads for a cop-receiving rack, cop carriers on said conveyor to receive cops from said heads, said conveyor extending across said rack support, a row of guides extending crosswise of said support to direct cops from said carriers to cop-receiving spaces of a rack on said support, a cop feeler disposed adjacent said row of guides to be engaged by cops passing to said row of guides, and mechanism, controlled by said feeler, to advance a rack on said support intermittently distances equal to the distance between adjacent rows of cop-receiving spaces, centre to centre, to bring empty rows of such spaces to said row of guides.

6. The combination of a multiple head winder, a support for a cop-receiving rack, and a belt-type conveyor to take cops from the various heads of the winders and carry them to said support, said conveyor having individual carriers for the cops, characterized by the fact that there is provided a row of shutters extending transversely of the rack support to confine cops in said carriers, a guide for each shutter on which the shutters are independently movable from cop-confining position, a cop-feeler in each carrier, a trip operatable by said cop-feelers to control the movements of the shutters individually from cop-confining positions, a shutter replacer to return the shutters as a group to cop-confining position, and mechanism to advance a rack step by step to bring empty rows of cop-receiving spaces to the shutters and to actuate said shutter replacer substantially simultaneously.

7. The combination of a multiple head winder and a belt-type conveyor to take cops from the various heads of a winder, said conveyor having individual carriers for the cops, characterized by the fact that a gate is provided for the outlet port of each winder head, each cop carrier is provided with a cop feeler, and a latch is provided to hold each gate closed, the operators for said latches being disposed adjacent the paths of said cop feelers for operation thereby.

8. The combination of a multiple head winder each of which has a cop delivery port, and a belt type conveyor to take cops from said delivery ports, the conveyor having individual carriers for the cops, characterized by the fact that a gate is provided for each of said outlet ports, a latch is provided to hold each of said gates closed, and a cop feeler is provided at each of said cop carriers to actuate said latches, said latches being so placed as to be out of the path of such of said feelers as are actuated by cops and within the path of such of said feelers as are not actuated by cops, and are engageable by such latter feelers when the respective cop carriers are in cop-receiving positions at the delivery ports, thereby each latch being actuated to open its gate only when an empty cop carrier is in position to receive cops from the respective delivery port.

9. The combination of a multiple head winder, a support for a cop-receiving rack, a conveyor to take cops from the various heads and carry them to a rack on the support, and a magazine for empty racks, characterized by the fact that said magazine is arranged to contain racks resting one on another, said support extends underneath the magazine, latches are provided to support a rack in the magazine some distance above the support, at least one feeler is provided to feel a rack resting on the support to control the release of said latches and their return to latching rack-holding position.

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