Oct. 14, 1958 H. RICHTER 2,856,109

SETTING APPARATUS FOR TEXTILE FABRICS

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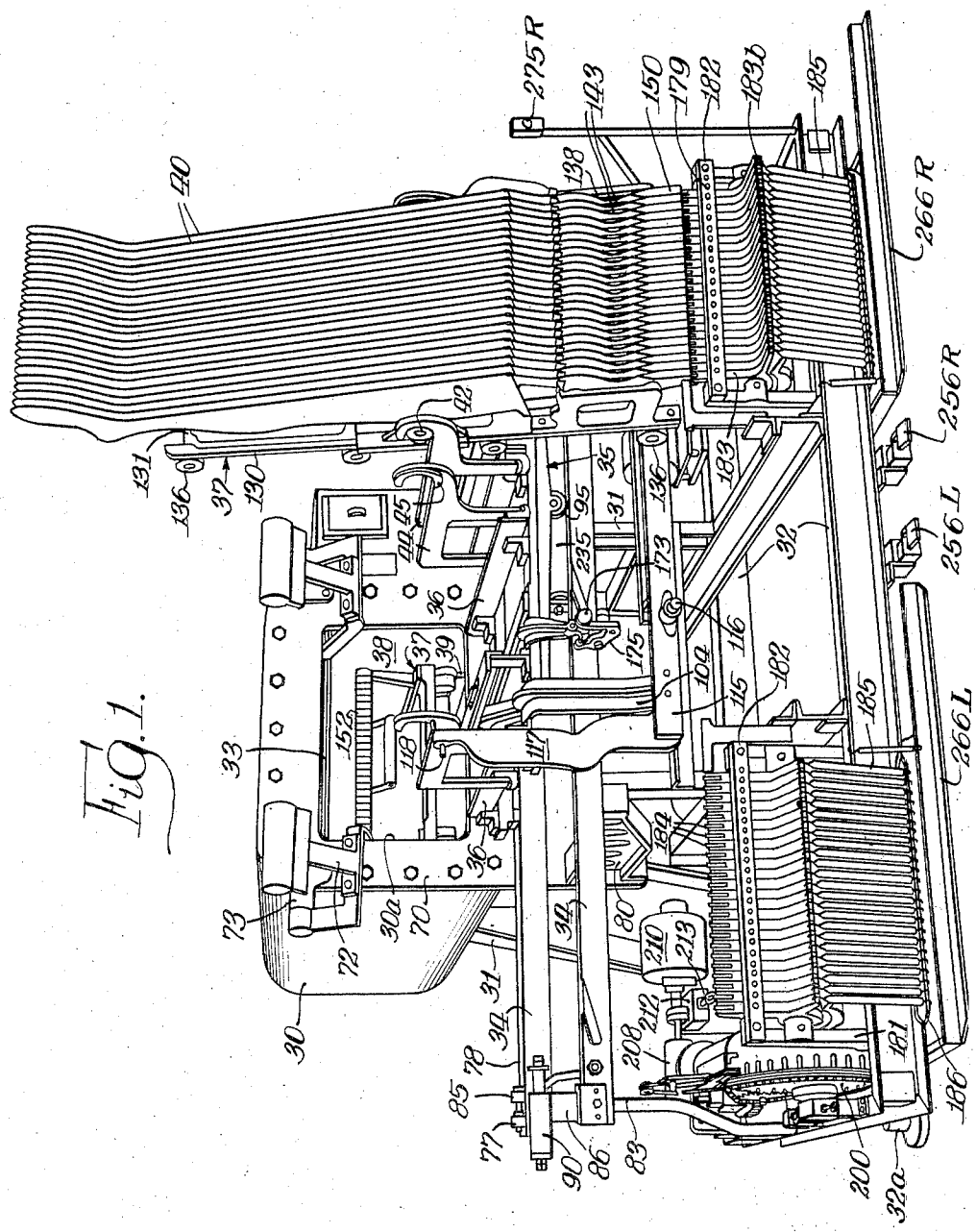


Fig. 1.

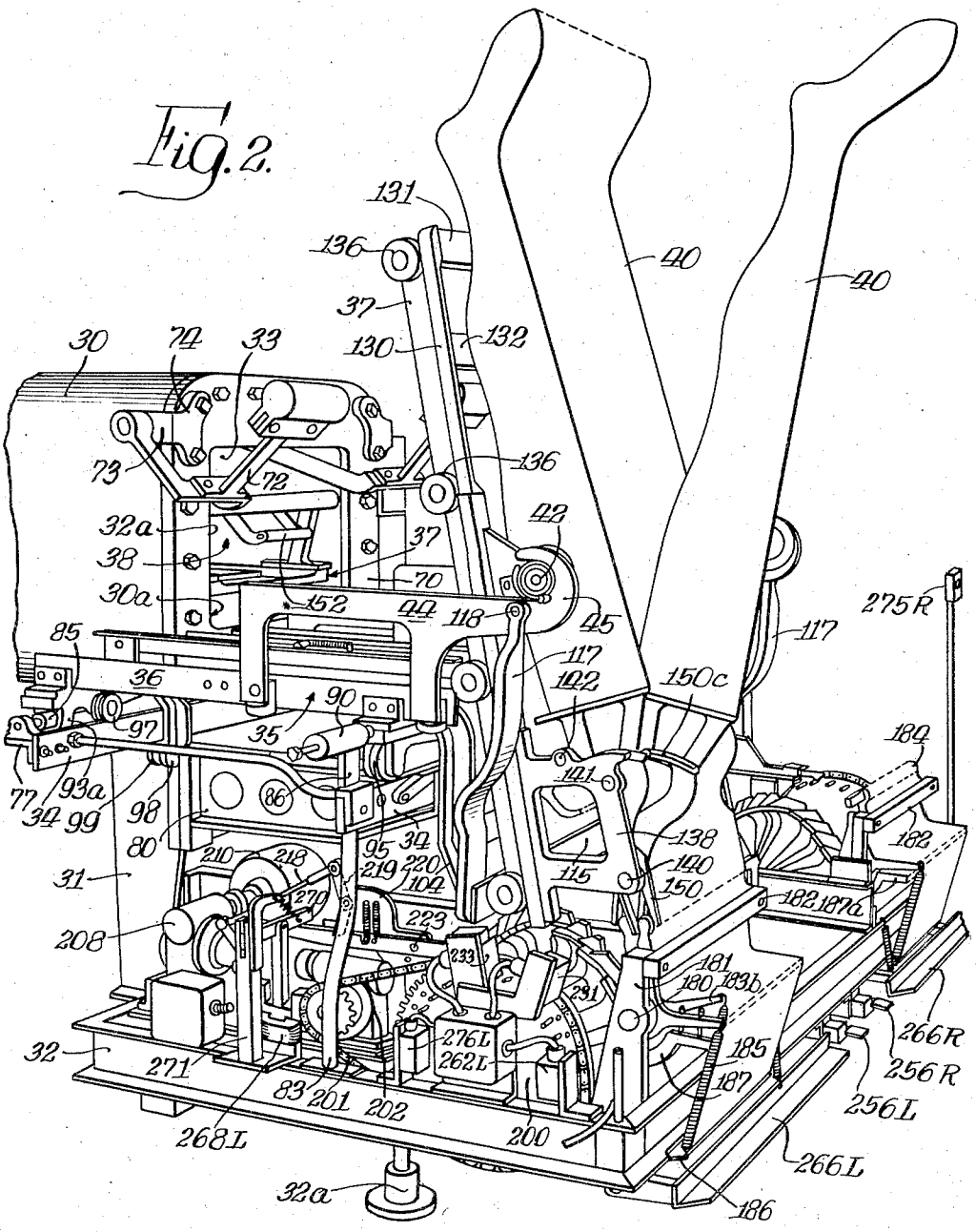
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SETTING APPARATUS FOR TEXTILE FABRICS

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Fig. 2.



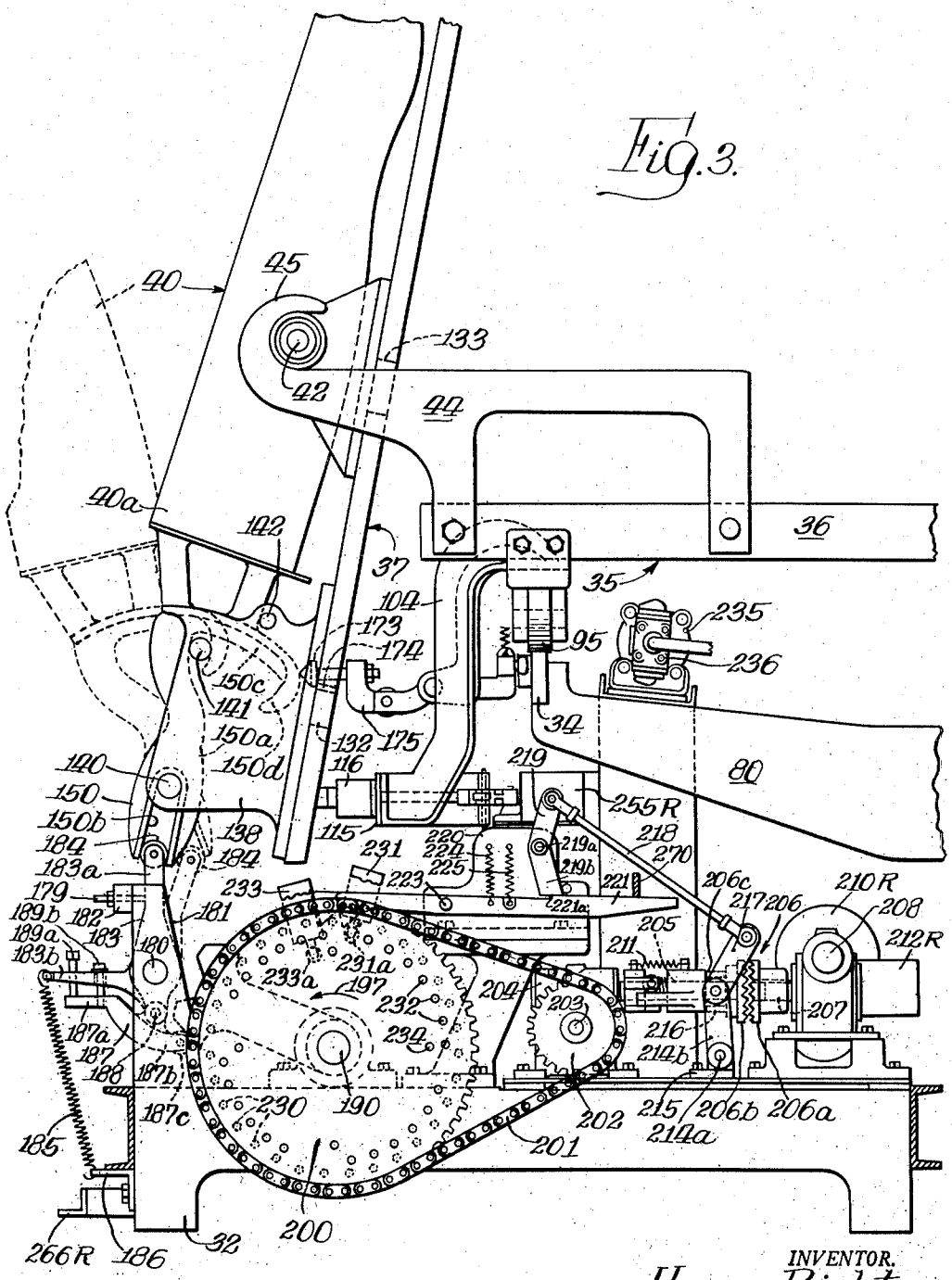
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SETTING APPARATUS FOR TEXTILE FABRICS

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Fig. 3.



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SETTING APPARATUS FOR TEXTILE FABRICS

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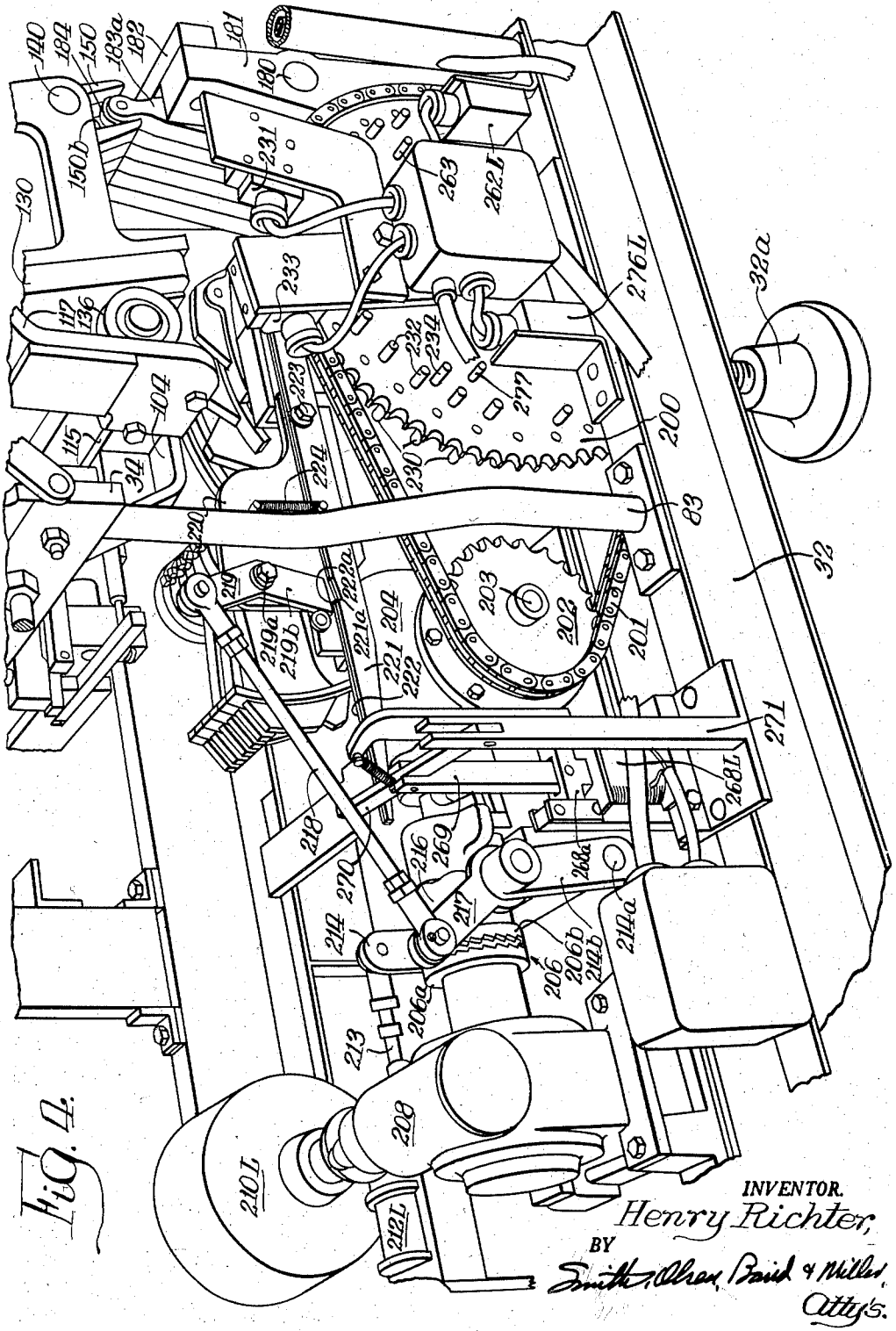


Fig. 4.

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SETTING APPARATUS FOR TEXTILE FABRICS

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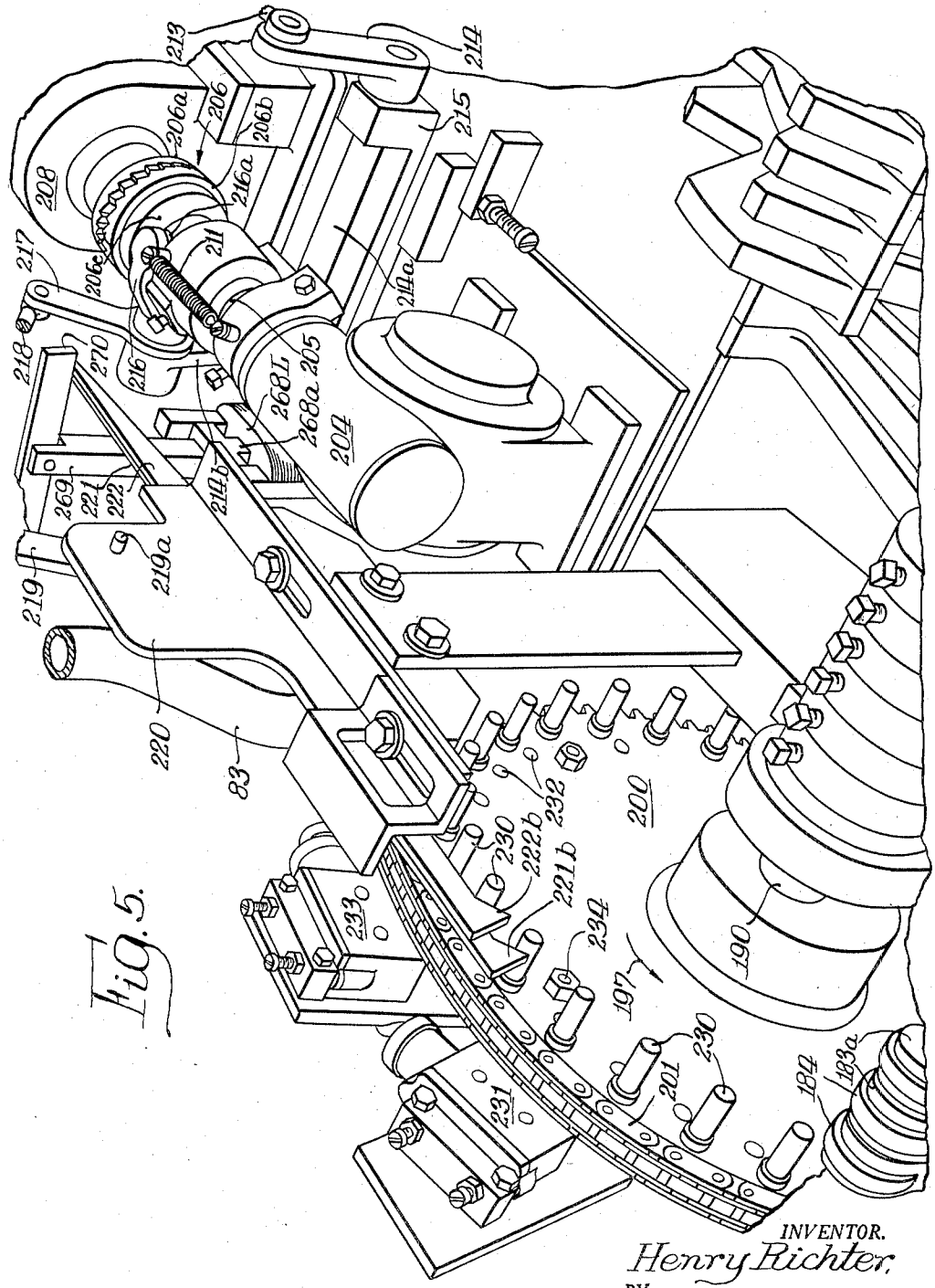


Fig. 5.

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SETTING APPARATUS FOR TEXTILE FABRICS

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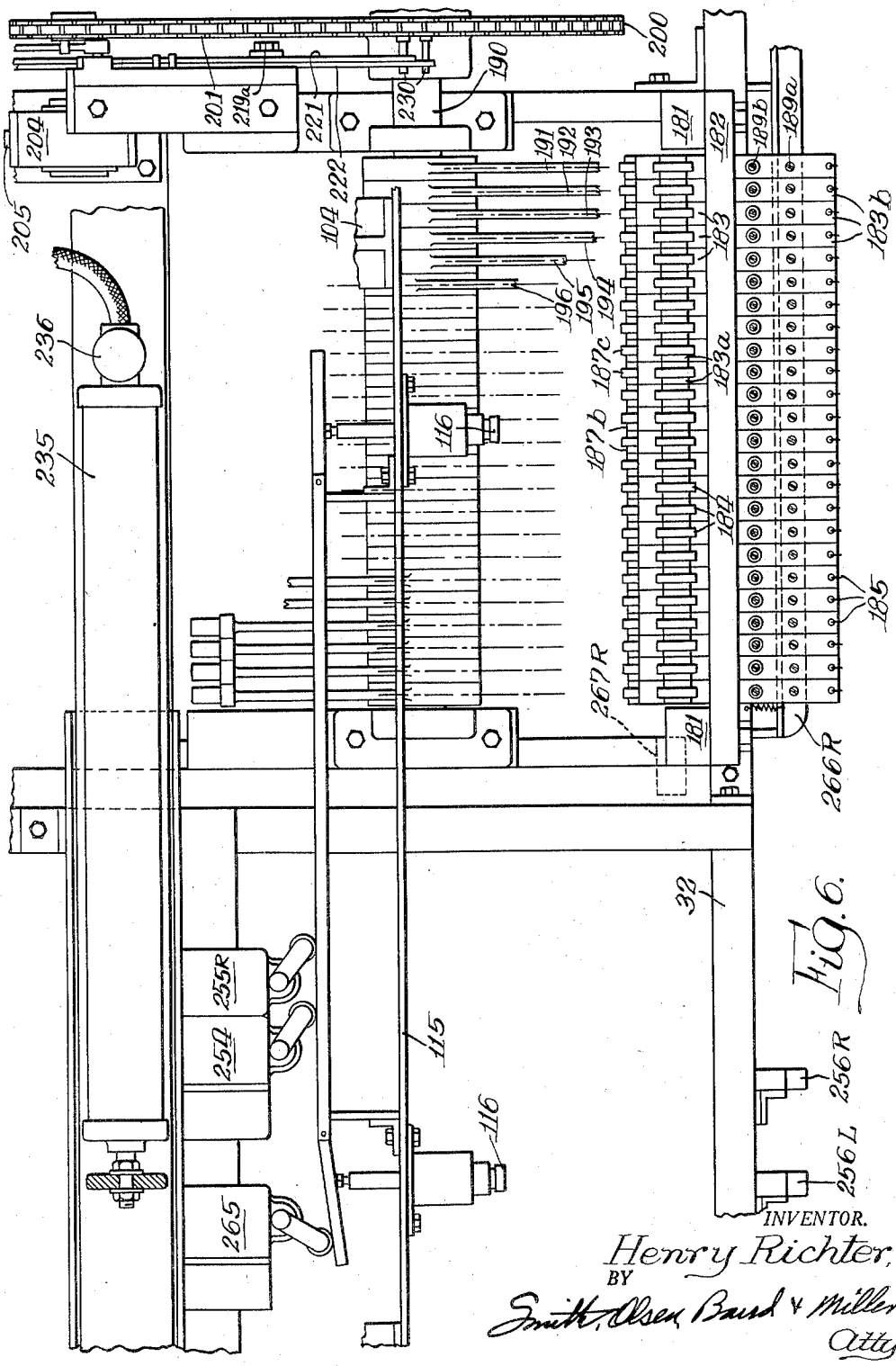


Fig. 6.

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Oct. 14, 1958 H. RICHTER 2,856,109

SETTING APPARATUS FOR TEXTILE FABRICS

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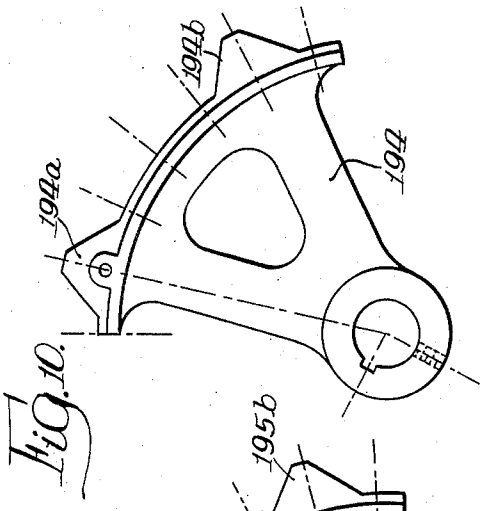


Fig. 10.

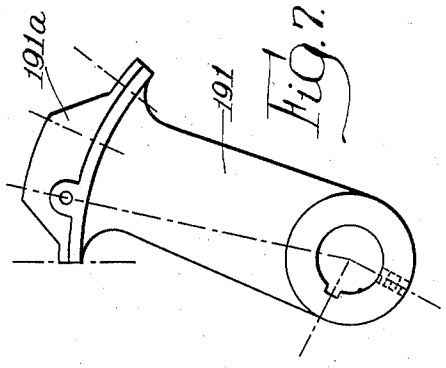


Fig. 7.

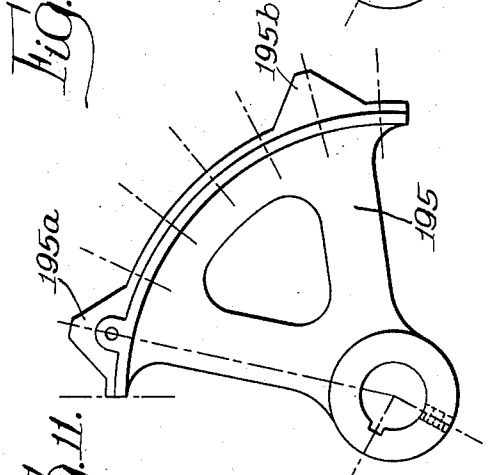


Fig. 11.

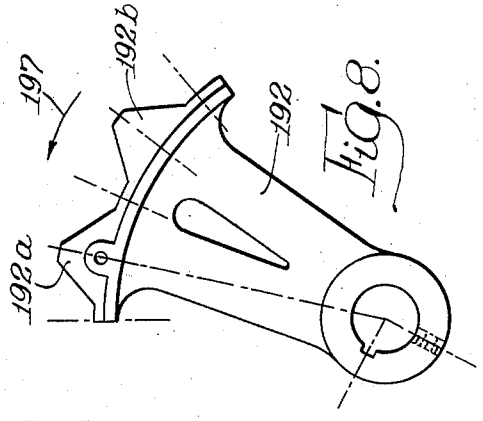


Fig. 8.

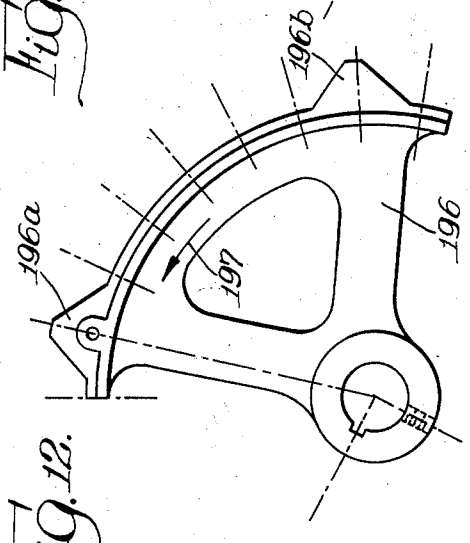


Fig. 12.

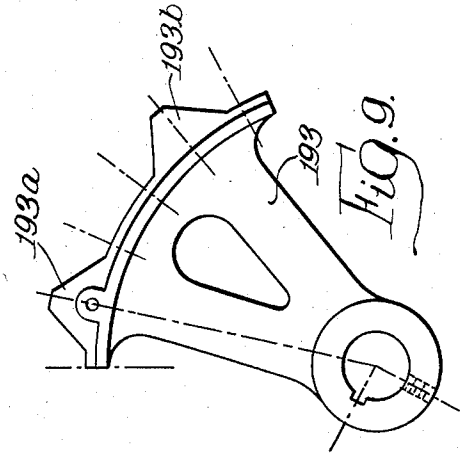


Fig. 9.

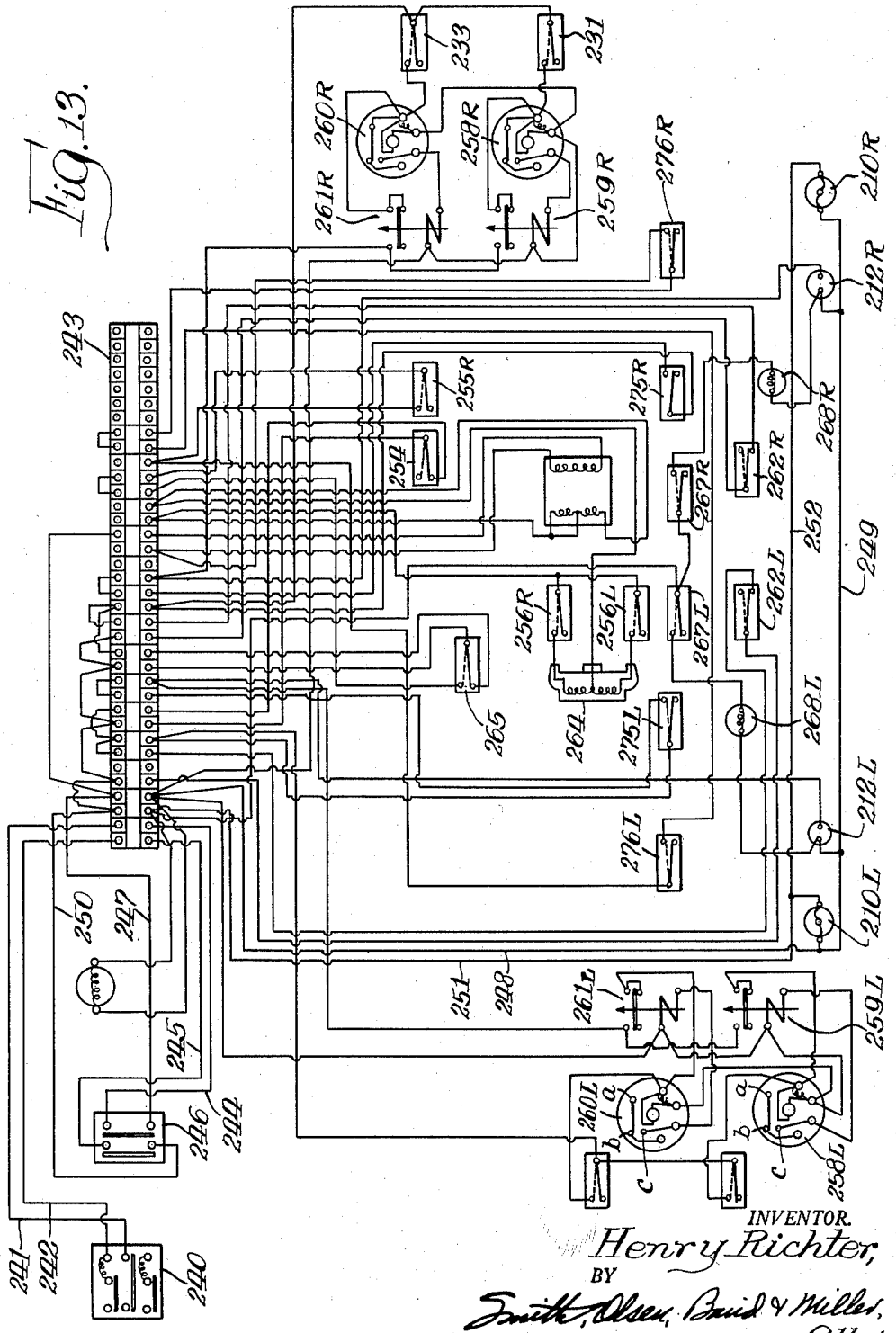
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SETTING APPARATUS FOR TEXTILE FABRICS

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Fig. 13.



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United States Patent Office 2,856,109 Patented Oct. 14, 1958

2,856,109

SETTING APPARATUS FOR TEXTILE FABRICS

Henry Richter, Kankakee, Ill., assignor to Paramount Textile Machinery Co., Kankakee, Ill., a corporation of Illinois

Application December 2, 1955, Serial No. 550,682

18 Claims. (Cl. 223—76)

This invention relates to improvements in setting apparatus for textile fabrics and its purpose is to provide improved means for setting and shaping stockings and other fabric forms by knitting linear condensation polyamide fibers such as those known as "nylon." The present invention is directed to apparatus of the type which is disclosed in United States Letters Patent No. 2,351,063, granted June 13, 1944, on an application of Leslie H. Oswald et al. and in my prior Letters Patent No. 2,470,265, issued on May 17, 1949, and No. 2,520,062, issued on August 22, 1950.

As explained in said Letters Patent, it is desirable to treat shaped textile articles, such as hosiery, formed of nylon yarn by a setting operation on forms of the desired shapes in the presence of saturated steam for the purpose of reducing the resiliency of the knitted loops and removing the natural wrinkles of the loose fabric, thereby causing the articles to retain the shapes of the forms during subsequent use and while being laundered. The treatment is carried on at a high temperature, preferably between 240° Fahrenheit and 260° F., for a short period and at a pressure above that of the atmosphere, thus requiring the use of a closed chamber for containing the articles.

The present invention is preferably employed as a part of, or as an attachment to, the type of setting apparatus described and claimed in said Letters Patent, wherein the forms carrying the articles are mounted in groups on carriages which are movable in succession into a chamber or retort, thus permitting the heat treatment of articles on one group of forms during the time that articles are being changed on other forms outside of the chamber. In said Letters Patent there is disclosed a steam receiving retort having an opening, a door for closing said opening, a main carriage movable transversely to said opening, and a plurality of form carriages mounted on parallel tracks on said main carriage for movement alternately or successively into said retort through said opening, each form carriage having mounted thereon a plurality of forms for supporting the textile articles to be treated whereby the articles may be changed on the forms of one form carriage while another form carriage and its article carrying forms are in the retort. The forms are capable of relative pivotal movement on each form carriage and each form carriage is tiltable upwardly when withdrawn from the retort for the purpose of locating the forms in positions to permit the articles thereon to be conveniently changed.

In said Letters Patent there is also disclosed a combination of apparatus wherein the operations of opening the door, admitting steam to the chamber of the retort, exhausting the steam, opening the door and causing a form carriage to be ejected from the chamber, are all actuated or controlled electrically in proper timed relation. Said Letters Patent further disclose the features of locking the main carriage in positions wherein one of the form carriages is in registry with the opening of the retort and for locking the form carriages in their horizontal positions so that they may not be tilted while either form carriage is being moved to or from the retort.

The principal object of the present invention is to increase the production of setting apparatus for textile fabrics by providing means for automatically moving the forms to and from a stripping and boarding position after the articles on the forms have been treated. Another object of the present invention is to provide textile setting apparatus of the type referred to in which the forms, after being removed from the retort following a steam treatment, and after being tilted upwardly as above described, are selectively and automatically moved forwardly to an upright stripping and boarding position and thereafter moved rearwardly to said inclined position.

According to the preferred practice, the forms carrying articles which have been treated are automatically moved forwardly from the inclined position to the upright position in groups and, after the operator has stripped the treated articles from all of the forms of that group, all but one of the forms of that group are automatically withdrawn to the inclined position, leaving one form to be boarded with a new article to be treated and as the boarding of that one form is completed the next form of that group is advanced to the upright position to be boarded to be followed by the successive advance of the other forms until all of the forms of that group have been boarded, whereupon all of the forms which have thus been boarded are simultaneously retracted to the inclined position and a second group of forms bearing articles which have been treated are moved to the upright stripping and boarding position. This operation is repeated for the other groups of forms until all of the forms carried by one form carriage have been stripped and boarded.

A further object of the invention is to provide form actuating mechanism capable of being applied as an attachment to the setting apparatus disclosed in said Letters Patent to effect automatically the movement of the article carrying forms to and from the stripping and boarding position. Still another object of the invention is to provide automatic actuating mechanism for moving the article carrying forms to and from a stripping and boarding position in combination with an electric control circuit comprising parts for effecting and controlling the operation of said mechanism and for insuring the operation of the various parts only at the proper times in the cycle. Other objects relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which one embodiment is illustrated. In the drawings,

Figure 1 is a perspective view of one form of setting apparatus embodying the present invention, looking in a diagonal direction toward the front end of the apparatus, with one form carriage in the retort and another form carriage tilted upwardly to an inclined position;

Fig. 2 shows a perspective view of the front portion of the apparatus illustrated in Fig. 1, illustrating the left-hand unit of the form operating mechanism and showing one form tilted forwardly from the inclined position to the upright stripping and boarding position;

Fig. 3 shows an enlarged side elevation of the front end of the righthand portion of the apparatus illustrated in Fig. 1, showing the mechanism by which the forms are moved forwardly from the upwardly inclined position and returned to that position;

Fig. 4 is a perspective view of the form operating mechanism on the right side of the apparatus shown in Fig. 1, looking in a diagonal direction toward the front of the apparatus;

Fig. 5 is a perspective view of a portion of the form

operating mechanism illustrated in Fig. 4, looking outwardly and rearwardly from the inner part of the mechanism;

Fig. 6 shows a top plan view of the form operating mechanism for the righthand portion of the machine as received in Fig. 1, with the forms removed;

Fig. 7 shows an enlarged side elevation of the first cam of a series of cams arranged side by side and adapted to effect the tilting of the forms of one group from the upwardly inclined position to the forward upright position for stripping and boarding and for retaining one form in the forward position after the other forms of that group are retracted;

Fig. 8 shows an enlarged side elevation of the second cam of the series which moves the second form of the group to its forward position to be stripped, then retracts that form while the first form is being boarded and then moves the second form forwardly again to be boarded;

Fig. 9 shows an enlarged side elevation of the third cam of the series which moves the third form of the group to its forward position to be stripped, then retracts that form while the second form is being boarded and then moves the third form forwardly again to be boarded;

Fig. 10 shows an enlarged side elevation of the fourth cam of the series which moves the fourth form of the group to its forward position to be stripped, then retracts that form while the third form is being boarded and then oves the fourth form forwardly again to be boarded;

Fig. 11 shows an enlarged side elevation of the fifth cam of the series which moves the fifth form of the group to its forward position to be stripped, then retracts that form while the fourth form is being boarded and then moves the fifth form forwardly again to be boarded;

Fig. 12 shows an enlarged side elevation of the sixth cam of the series which moves the sixth form of the group to its forward position to be stripped, then retracts that form while the fifth form is being boarded and then moves the sixth form forwardly ag in to be boarded; and

Fig. 13 is a schematic circuit diagram showing the electrical connections of the timing device and other pieces of apparatus by which the sequential movements of the forms mounted on the carriages are actuated and controlled in proper timed rel tion.

Referring particularly to Figs. 1, 2 and 3 of the drawings, the principal features of the setting apparatus and their mode of operation will be briefly described before proceeding with a more detailed description of their structural features and of the improvements of the present invention. The apparatus comprises a horizontal retort **30** carried by legs **31** which are adapted to rest partly upon the floor and partly upon a horizontal rectangular frame **32** which is supported from the floor by pedestals **32***a*. The retort **30** is provided at one end with a rectangular opening **30***a* which is normally closed by a hinged door **33**. In front of the retort and extending transversely to the longitudinal axis thereof is a pair of main tracks **34** on which a main carriage **35** is mounted to travel. This main carriage has mounted thereon two pairs of form carriage track members **36** which extend parallel to each other and parallel to the longitudinal axis of the retort **30**. These track members **36** support two form carriages **37** which are identical in construction and the upper edges of these track members are located substantially flush with, but slightly above, the lower horizontal edge of the door opening **30***a* so that, when a pair of track members **36** are properly positioned with respect to that opening, by the transverse movement of the main carriage **35**, a form carriage **37** on that pair of track members may be moved therefrom into the chamber **38** of the retort where it is supported on the horizontal retort tracks **39**.

Each form carriage **37** has mounted thereon a group of setting forms **40** which, in this instance, are shown as being of the proper shape for the setting of ladies' nylon hosiery. These forms are mounted so that they normally extend substantially parallel to the body of the form carriage **37** by which they are carried but they are capable of limited pivotal movement away from the carriage and away from other forms of the series on the same carriage, for permitting the ready removal and replacement of articles of hosiery or the like located thereon. When a form carriage **37** has been withdrawn from the retort **30**, a pair of roller bearing trunnions **42** mounted on opposite sides thereof are adapted to travel on auxiliary horizontal track members **44** which are mounted on the main carriage **35**. Each of the auxiliary track members **44** is mounted adjacent to, but at a substantially higher level than, one of the track members **36**. When a form carriage **37** is discharged from the retort and reaches the limit of its outward movement on its track members **36**, the trunnions **42** mounted on that form carriage engage open hook shaped bearing members **45** which are located at the outer ends of the auxiliary track members **44** and the form carriage then tilts upwardly due to its own momentum until it reaches the upwardly inclined position which is shown at the right of Figs. 1 and 2. The forms are then readily accessible to the operator standing on the floor at the front of the machine so that the forms may then be tilted forwardly about their pivots for the purpose of separating them from the remaining forms on the same carriage and permitting the previously treated hosiery to be removed therefrom preliminary to placing upon these forms other hosiery which is to be treated in a succeeding operation.

While a form carriage **37** is being moved into and out of the retort **30**, the main carriage is latched in a position which locates the track members **36** for that form carriage in alignment with the retort tracks **39**, as described particularly in said Letters Patent No. 2,470,265. When that form carriage is moved outwardly and tilted upwardly and forwardly as described above, the main carriage **35** retains its fixed position until it is intentionally moved by the operator through the manipulation of a foot operated switch which controls an air cylinder by which the main carriage is moved. When thus released, the main carriage **35** may be shifted by the air cylinder under the control of the operator to bring either form carriage into alignment with the retort, whereupon the main carriage is latched in the new position and another form carriage carrying hosiery to be treated is pushed into the retort and the operator is then enabled to work upon the forms which have just been withdrawn from the retort, first stripping from these forms the hosiery which has just been treated and then boarding them with other hosiery to be treated in a succeeding operation. When the forms on a form carriage outside of a retort have been boarded with hosiery to be treated, that form carriage is tilted downwardly from its upwardly inclined position and it is then automatically locked in its horizontal position and remains so secured while it is moved into the retort, as described in said Letters Patent. When that form carriage is again removed from the retort it is automatically released as it approaches its outer position on its track members **36** so that it will again tilt upwardly due to the balanced condition of the form carriage and the forms with respect to the pivots of the rollers **42** about which the tilting movement takes place.

When a form carriage **37** after being tilted downwardly and latched in its horizontal position is located opposite the mouth of the retort, it is pushed by the operator into the retort with sufficient momentum to cause it to operate the latch mechanism and compress the spring of the ejecting mechanism (described in said Letters Patent) whereupon the door of the retort is automatically closed, the steam is automatically turned on and the heat treatment of the hosiery on the forms continues for a predetermined period, at the conclusion of which the steam is exhausted from the retort, the door is automatically opened, and the latch holding the form carriage in the retort is released to permit the actuation of the spring pressed plunger

which ejects the carriage from the retort with sufficient momentum to cause it to move to the forward ends of the aligning track members 44 and to tilt upwardly upon engagement of the trunnions 42 with the hook shaped bearing members 45. These successive operations are automatically controlled by an electric circuit, which is described in said Letters Patent, but not disclosed herein because it does not form a part of the present invention.

The door 33 is located entirely on the inside of the retort and, when it is closed, its outer margin seats against the inner surface of the end plate 70, being preferably provided around its margin with a strip of resilient compressible material which engages the plate 70 to form a fluid-tight seal. The door is carried by hinged brackets 72 of irregular form which are pivotally mounted on bearing members 73 carried by the brackets 74 fixed on the end plates 70 adjacent the upper corners thereof.

The tracks 34 which support the main carriage 35 are in the form of flat bars located in vertical planes and extending parallel to each other at the front of the retort transversely to the longitudinal axis of the retort. The rear track 34 is secured by intervening brackets 77 to a parallel rail 78 which is bolted or otherwise secured to the end plate 70. This end plate extends downwardly below the body of the retort and has secured to the lower part thereof two forwardly projecting heavy brackets 80 which are provided at their forward ends with upturned flanges to which the forward track 34 is secured. In addition, the ends of the forward track 34 are supported by vertical rods or struts 83 which extend upwardly from the horizontal frame 32. The brackets 77 at the ends of the rear track 34 carry yielding stop members 85 which are adapted to be engaged by lugs 93*a* carried by the main carriage 35 when this carriage is at either end of its path of travel. The forward track 34 is also provided at its ends with resiliently mounted stop members 90 carried by brackets 86 and adapted to yield when they are engaged by the ends of the forward portion of the main carriage. In this way the main carriage is cushioned and brought to rest at each end of its movement on the track members 34.

The forward portion of the main carriage 35 is provided with depending ears in which are rotatably mounted the cylindrical rollers or wheels 95 by which the carriage is supported on the forward track member 34. The rear portion of the track member is supported by other depending ears on which are mounted the grooved rollers 97 arranged to embrace and travel upon the upper edge of the rear track 34 thus holding the main carriage against displacement transversely to its track members. The rear frame member of the main carriage 35 carries depending brackets 98 on which are mounted rollers 99 arranged to underlie the rear track 34, thus holding the rear part of the main carriage 35 against displacement upwardly from the rear track 34.

At the forward ends of the tracks 36 there are mounted two hanger brackets 104 which have their lower ends secured to a flat bar 115 located in a vertical plane and arranged to carry a pair of resiliently mounted stop members 116 which cushion the downward movement of the forward portion of a form carriage 37 when this carriage is tilted to its inclined position. The flat bar 115 has secured to each end thereof an angular shaped arm 117 which extends upwardly and forwardly with its upper extremity attached to one of the outermost auxiliary track members 44 through an adjusting screw 118. The two arms 117, taken with the bar 115, form a yoke which supports the two outermost auxiliary track members 44 against lateral separation under the influence of the momentum of the form carriages when the main carriage is shifted laterally and brought to a stop.

Each of the form carriages 37 comprises a pair of side frame members 130, a pair of end frame members 131, a central transverse frame member 133 and two intermediate transverse frame members 132. These frame members are preferably cast as one integral construction, being formed preferably of aluminum or the like which is light in weight and capable of withstanding high temperatures in the retort chamber without corrosion or distortion. The side frame members of each form carriage have formed thereon depending lugs on which are mounted grooved rollers 136 adapted to travel on the track members 36 and upon the retort tracks 39.

Each form carriage 37 is adapted to support a plurality of forms 40 which are arranged parallel to each other and which are adapted to be tilted about their pivotal axes 140 in moving from the horizontal position to the upwardly inclined position and any form may be tilted out of alignment with the others for permitting the convenient removal or replacement of an article of hosiery or the like which is to be treated or which has been treated in the retort.

When the form carriages 37 are tilted upwardly to permit access to the forms 40 mounted thereon, they are latched in the inclined position by the latch members 173 which engage hard metal plates 174 carried by the forward transverse frame members 132 of the carriage, thus holding the form carriage in its upwardly tilted position while the forms are being worked upon. Each latch member 173 is spring actuated to interlock with a form carriage 37 to hold the carriage in the upwardly tilted position and when the forms 40 on a carriage have been boarded and the main carriage is moved to position this form carriage in registry with the retort, that latch member 173 is actuated by a lever 175 which is then engaged by a cam on the forward track 34 so that the form carriage then swings to its horizontal position in readiness to be pushed into the retort by the operator who grasps the handle 152 of the form carriage for that purpose.

Each form carriage 37 is adapted to support a plurality of forms 40 which are arranged parallel to each other and these forms are mounted between two brackets or hangers 138 which are secured to the forward portions of the side frame members 130 of the form carriage. Each hanger 138 extends upwardly in a plane at right angles to the upper surface of the carriage 37 and the two hangers at opposite sides of the same carriage are connected by tie rods 140, 141 and 142. A series of sheet metal dividers 143, which are apertured for engagement by the tie rods 140, 141 and 142, are mounted between adjacent hangers 138 and the space between adjacent dividers on each of the rods is occupied by space sleeves or collars. These sleeves on the rod 140 serve as auxiliary portions of this rod about which the forms 40 are adapted to pivot when they are moved toward and from a position which is located forwardly of the inclined position of the forms shown at the right of Fig. 1 to facilitate the operations of stripping and boarding the forms.

Each form 40 comprises a sheet metal hollow portion 40*a* which is shaped to conform to the configuration of a lady's nylon stocking and each of these shaped portions 40*a* is mounted upon a rocker arm 150 having a depending arm 150*a* which is bifurcated at its lower end to form an elongated U-shaped bearing slot 150*b* adapted to rock on the sleeves of the rod 140. Each rocker arm also comprises a curved arm 150*c* terminating in a hook shaped portion 150*d*. When a form 40 is in its upwardly inclined position shown by full lines in Fig. 3, the upper end of the arm 150*a* of the rocker arm engages the sleeves of the rod 141 to position the form in proper relationship to the frame of the form carriage and this relationship exists when the carriage is in its horizontal position for movement into the chamber of the retort. When a form 40 has been moved outwardly to the stripping and boarding position shown by dotted lines in Fig. 3, the hook shaped extremity 150*d* of the rocker arm engages the sleeves of the rod 141 to locate the form in its forward upright position.

The present invention is directed primarily to the means for moving the forms 40 about the sleeves of the shafts

141 of the carriage by automatically operated mechanism which causes the forms to be actuated in proper timed relation to permit the operator to strip and board the forms while they are in the upright forward position indicated by dotted lines in Fig. 3. For this purpose the forms on a single carriage are preferably operated in groups, since it is possible to strip the hosiery from a number of adjacent forms in one operation. However, the forms must be separately boarded and means are therefore provided for moving a group of forms forwardly from the upwardly inclined position shown in Figs. 1, 2 and 3 to permit the stripping of the forms of this group, after which all of the forms of that group except one are returned to the upwardly inclined position and after the one form which has been retained in the forward position has been boarded, it is automatically returned to the upwardly inclined position and the other forms of the same group are moved forwardly in succession and in proper timed relation to be boarded, the form being returned to its retracted position as soon as it has been boarded. In the embodiment illustrated there are 24 forms 40 mounted on each form carriage 37 and the actuating mechanism is arranged to operate the forms in groups of six. As soon as all of the forms of one group have been stripped and boarded, the next adjacent group of six forms is moved forwardly and actuated in the same manner to permit the stripping and boarding by the operator.

The automatic actuation of the forms 40 in the manner which has just been referred to is effected by two units of actuating mechanism which are carried by the frame 32, one unit of this mechanism being provided at each side of the frame 32 for actuating and controlling the forms which are mounted upon one of the two form carriages 37. Each unit comprises a shaft 180 journalled in upwardly extending brackets 181 which are carried by the frame 32 and connected at their upper ends by transverse bars 182. Each shaft 180 has mounted thereon a series of bell-crank levers 183, each of which has an upwardly extending arm 183*a* provided with a roller 184 which is adapted to engage the bearing slot 150*b* of one of the rocker arms 150 carrying a form 40. Thus, when the lever 183 is rocked about the shaft 180, the form is pivoted about the rod 140 and moved toward or from the position shown by dotted lines in Fig. 3. Each bell-crank lever 183 has a forwardly extending arm 183*b* to which there is connected a coil spring 185 having its lower end attached to a bracket 186 carried by the frame 32. These springs 185, therefore, serve to move the forms 40 normally to the upwardly inclined retracted positions, such as that shown by full lines in Fig. 3. The forward positions of the lever arms 183*a* are limited by the engagement of these arms with stop screws 179 adjustably mounted in the bars 182.

The bell-crank levers 183 are adapted to be actuated, through the cams hereinafter described, by auxiliary levers 187, each of which is pivoted at 188 on a depending ear of a lever 183 and provided with a forwardly extending arm 187*a* which is located beneath the arm 183*b* of the connected lever 183 so that the relative positions of the arms 183*b* and 187*a* may be regulated by two adjusting screws 189*a* and 189*b*, one of which extends through an aperture in the arm 183*b* and threadedly engages the arm 187*a*, while the other has a threaded engagement with the arm 183*b* and bears upon the upper face of the arm 187*a*. Each lever 187*a* has a rearwardly extending arm 187*b* upon which there is mounted a roller 187*c* adapted to engage the cam by which the associated form 40 is to be actuated. By adjusting the screws 189*a* and 189*b* with the roller 187*c* in its retracted position, the rollers 184 on the upwardly extending arms of the bell-crank levers 183 may be caused to align with each other for engagement by the bearing slots 150*b* of the rocker arms 150 when the form carriage 37 is moved laterally by the corresponding movement of the main carriage 35. In this way, the rollers 184 may be accurately aligned with each other and with the aligning bearing slots 150*b*.

The lever mechanism which has just been described, including the levers 183 which actuate the forms 40, is the same for both the lefthand carriage 37 and the righthand carriage 37 and this is also true of the mechanism for actuating the rollers 187*c* for both units of the apparatus. Each unit comprises a horizontal shaft 190 journalled in bearings carried by the frame 32 and having keyed thereon four groups of cams, each group comprising six cams 191, 192, 193, 194, 195 and 196 which are shown in side elevation in Figs. 7, 8, 9, 10, 11 and 12, respectively. The shaft 190 is adapted to be intermittently rotated in the direction of the arrow 197 by mechanism hereinafter described to cause the cams to effect the individual and group actuation of the levers 183 of each group and four other groups of similar cams are mounted on the shaft 190 in different angular positions so that there is a successive actuation of other levers 183 by the cams of the several groups of the same set in the same manner as that in which the levers of the first group are actuated.

Assuming that a carriage 37 has been tilted to the upwardly inclined position and that all of the forms 40 are occupied by treated hosiery and are retracted, the control mechanism is operated at the proper time to cause the partial rotation of the shaft 190 to the extent necessary to cause the cam 191 (Fig. 7) to move the first form 40 of the first group to the position shown by dotted lines in Fig. 3 by the engagement of the projection 191*a* of this cam with the roller 187*c* which actuates the levers 183 associated with the first form. At the same time the five next adjacent forms 40 are moved forwardly by the projections 192*a*, 193*a*, 194*a*, 195*a* and 196*a* of the cams 192, 193, 194, 195 and 196, respectively, so that all six forms of the first group occupy simultaneously the forward positions represented by dotted lines in Fig. 3. The operator then seizes the toe and welt portions of all six stockings on these forms and strips all of them from the forms in one operation.

By the time the stripping of the six forms has been completed, the rotary motion of the shaft 190 will have continued to the point where the rollers 187*c* for the second, third, fourth, fifth and sixth forms will have passed out of engagement with the projections 192*a*, 193*a*, 194*a*, 195*a* and 196*a*, respectively, and will be in engagement with the arcuate surfaces of these cams which are concentric with the axis of the shaft 190 under the influence of the springs 185. The projection 191*a* on the first cam, however, has an outer surface which is longer than the outer surfaces of the aforesaid projections on the other cams of the group, so that the first form is retained in its forward position, after the others have been retracted, for a sufficient length of time to permit this first form to be boarded with a new stocking, whereupon that form is retracted to the inclined position. At the same time the roller 187*c* for the second form is engaged by another projection 192*b* on the cam 192, with the result that the second form is again moved forwardly to the boarding position. When the boarding of the second form is completed, the projection 192*b* passes out of engagement with its roller 187*c* with the result that the second form is then retracted. By that time the projection 193*b* on the cam 193 engages its roller 187*c* to move the third form forwardly to its boarding position where it remains until the boarding is completed when it is returned to the retracted position. In the same manner, the fourth, fifth and sixth forms of the group are moved successively and temporarily to the boarding position by the cam projections 194*b*, 195*b* and 196*b* on the cams 194, 195 and 196, respectively.

When all of the forms of this group have been boarded, they are all in their retracted positions and the shaft 190 is then rotated to bring a second group of six cams of the same form into operative relationship with the rollers

187c which actuate the levers 183 of a second group of forms 40 and the stripping and boarding operation is repeated with this second group. The stripping and boarding of the forms for the third and fourth group are then brought about successively by two other groups mounted on the shaft 190 in the proper angular relation so that one group of cams begins to operate as soon as the next preceding group has performed its function.

When all of the twenty-four forms on one form carriage 37 have been stripped and boarded, and the other form carriage 37 has been withdrawn from the retort and locked in its upwardly tilted position, the main carriage 35 is then moved laterally by the air cylinder 235 on the tracks 34 to position opposite the retort the form carriage 37 carrying the forms which have just been boarded and to bring into engagement with the levers 183 of the other unit of actuating mechanism the forms on the form carriage which has just been removed from the retort. The main carriage is then held in this new position by the other latch operated by a rod 100. Also, the form carriage which has just been removed from the retort is then latched in its upwardly inclined position by the other latch pin 173. As the form carriage which has just been boarded moves laterally with the main carriage 35, the bearing slots 150b of the rocker arms of that form carriage move sidewise out of engagement with the rollers 184 mounted on the levers 183 of the unit of actuating mechanism by which the forms on this carriage have been actuated during the preceding stripping and boarding operation. At the same time the bearing slots 150b of the rocker arms of the form carriage which has just been removed from the retort move sidewise into engagement with the rollers 184 on the levers 183 which are part of the other unit of actuating mechanism.

Each shaft 190 is driven by a sprocket wheel 200 fixed thereon and meshing with a sprocket chain 201 which also meshes with a sprocket pinion 202 fixed on the shaft 203 of a power transmission unit 204. This unit is driven by a horizontal shaft 205 arranged to be connected by a clutch 206 with the horizontal aligning shaft 207 of a speed reducer 208 which, in turn is driven by an electric motor 210. The clutch 206 comprises a clutch member 206a fixed on the shaft 207 and a complementary clutch member 206b splined on the shaft 205 and normally held in its retracted position by coil springs 211. The clutch member 206b is adapted to be moved into engagement with the teeth of the clutch member 206 by the energization of a solenoid 212 which is connected in the control circuit hereinafter described and which is adapted to move the clutch member against the tension of the springs 211.

The solenoid 212 has its movable core connected to a rod 213 which extends forwardly and is loosely connected with an arm 214 fixed on a shaft 214a journalled in a bracket 215 fixed on the frame 32. The other end of this shaft has mounted thereon an upwardly extending arm 214b which is connected to a yoke 216 having two inwardly extending rollers 216a which engage an annular groove 206c in the clutch member 206b so that when the solenoid 212 is energized the arm 214 is actuated to move the clutch member 206b into locking engagement with the clutch member 206a against the tension of the springs 211.

Thus, the clutch members are momentarily engaged by the energization of the solenoid 212 and, in order to retain this engagement of the clutch members with a consequent actuation of the sprocket wheel 200 and the shaft 190, the upper end of the arm 214b is connected to an arm 217 which extends upwardly with its upper end pivotally connected to a rod 218. This rod extends upwardly and forwardly and has its forward end connected to a latch lever 219 which is pivoted at 219a upon a stationary plate 220 carried by the frame 32. The latch lever 219 extends downwardly from its pivot and its lower end 219b is adapted to engage the notches 221a and 222a which are formed in two trip levers 221 and 222 which are pivoted at 223 on the plate 220. These levers 221 and 222 are connected, at the right of the pivot 223 as viewed in Fig. 3, to two coil springs 224 and 225, respectively, which serve normally to move these levers upwardly against the latch lever 219 while at the same time forcing downwardly the forward ends of the trip levers which are provided with downwardly extending teeth 221b and 222b. These teeth are adapted to be actuated, as hereinafter described, to cause movement of the trip levers 221 and 222 so that the trip lever 219 will engage one or the other of the notches 221a and 222a, thus holding the clutch members 206a and 206b in engagement with each other by the action of the rod 218. In this way, the shaft 190 may be caused to be actuated through any desired interval depending upon the period during which the clutch members are retained in engagement by the trip levers 221 and 222.

The intermittent rotation of the shaft 190, which brings about the sequential operation of the cams 191, 192, 193, 194, 195 and 196, previously described, is controlled by the ratchet wheel 200 which is in the form of a flat disk having pins mounted on the opposite sides thereof to extend parallel to the axis of the disk. On the inner side of the wheel or disk 200, which is shown particularly in Figure 5, a series of pins 230 are mounted to extend laterally from the disk and to engage the teeth 221b and 222b of the trip levers. These pins are arranged in a circle and are equally spaced from each other adjacent the outer margin of the disk and the teeth 221b and 222b are spaced apart longitudinally of the trip levers so that if the disk 200 is stopped with one of the teeth 221b resting upon the outermost surface of a pin 230, the other tooth 222b will be in a position to be actuated by the next adjacent pin 230 so that one of the levers 221 or 222 is certain to be actuated by a pin 230 to cause one of the notches 221a or 222a to interlock with the lower end of the latch lever 219, and thereby holding the clutch members 206a and 206b in engagement with each other. When the trip levers have thus been actuated to cause the clutch members to be held in engagement with each other, the shaft 190 and the cams mounted thereon continue to rotate for an interval of a few seconds which is terminated by certain switches connected in the electric control circuit illustrated in Fig. 13. These switches include a switch 231 connected in the circuit and having a radially extending actuating member 231a which is adapted to be operated by a pin 232 which projects axially from the face of the disk 200 on the side thereof opposite the pins 230. Also, there is connected in the electric control circuit a switch 233 having an inwardly extending actuating member 233a which is adapted to be operated by one of a series of widely spaced pins 234 which project laterally from the disk 200 on the same side thereof as the pins 232.

There is also connected in the control circuit shown in Fig. 13 an air pressure device for effecting lateral movement of the main carriage 35 after the forms on a form carriage 37 have been boarded and the parts are in readiness for the main carriage to move laterally to position the form carriage and the boarded forms opposite the retort. This apparatus comprises an air cylinder 235 which is mounted on the brackets 80 at the rear of the forward track 34 and which comprises a piston rod connected to the main carriage so that when compressed air is admitted through an air motor 236, the compressed air acting in the cylinder will force the main carriage in either direction depending upon admission of air by the air motor to the ends of the cylinder.

The electric control circuit for actuating the forms 40 is shown in Fig. 13 where the parts associated with the right and left form carriages 37, as viewed in Fig. 1, are designated by the same numbers. To distinguish the circuit parts which are associated particularly with the lefthand actuating unit from those particularly associated

with the righthand unit, the letter "L" follows the numbers identifying the circuit parts of the lefthand unit and the letter "R" follows the numbers identifying the circuit parts of the right hand unit. This circuit includes a main switch **240** which connects the supply conductors of an alternating current circuit with the line conductors **241** and **242** leading to a panel of connecting blocks **243** through which connections are made to various conductors leading to different units of apparatus, including the conductors **244** and **245** which lead to the switch **246** which is normally closed but which is held open by the form carriage until the carriage is tilted upwardly. When the switch **246** is closed, upon upward tilting of the form carriage, current is supplied through the conductors **247**, **248** and **249** to one terminal of each of the electric motors **210**, by which the form actuating cams are driven, and through conductors **250**, **251** and **252** to the other terminals of these motors so that these motors operate continuously when the switch **246** is closed.

Assuming that the lefthand form carriage **37** has been moved outwardly onto the main carriage **35** from its position in the retort shown in Fig. 1 and that both form carriages are in their upwardly inclined positions on the main carriage which is then in its extreme righthand position, the main carriage is moved toward the left to move the left form carriage into registry with the lefthand actuating unit. As this takes place the bearing sockets **150***b* of the forms on this carriage are engaged by the rollers **184** of the left actuating unit and as the main carriage approaches the limit of its travel to the left, the righthand form carriage is unlatched, thereby causing a switch **254** to close to permit the clutch solenoid **212** of the right unit to be energized and also causing a switch **255R** to open so that the main carriage cannot be moved transversely even though a foot pedal switch **256R** for controlling the circuit of the air motor **236** is closed by the operator. When the push button switch **275L** is then actuated, the left clutch solenoid **212** is energized, causing the engagement of the clutch members **206***a* and **206***b* so that the shaft **190** of the left unit rotates to cause the cams **191** to **196**, of that unit to move forwardly to the stripping and boarding position six of the forms on the left carriage.

When the six forms reach their forward position, the index pins **230** actuate the trip levers **221** and **222** to release the latch lever **219** and permit the clutch members to disengage, leaving all six forms in their forward positions. As the clutch is disengaged by the action of one of the pins **230**, the switch **231** is closed by the engagement with its actuating member **231***a* of one of the index pins **232** mounted on the disk **200** which closes the circuit of a time delay relay **258L**, hereinafter referred to as a "timer," which is set for a predetermined period, usually about thirty seconds. At the end of that period the contacts *a* and *b* of the timer are opened and the contacts *a* and *c* are closed, thereby energizing the solenoid switch **259L** and reestablishing the circuit of the clutch solenoid **212** so that the shaft **190** is again rotated sufficiently to cause the cams **192**, **193**, **194**, **195** and **196** to permit the retraction of five of the forms under the influence of the springs **185**.

The length of time the one form remains in the forward position for boarding is determined by a timer **260L** which is set to run for a predetermined period, for example, about fifteen seconds. At the end of that period the contact *a* of this timer is disengaged from the contact *b* and connected to a contact *c*, thereby energizing a solenoid switch **261** which again establishes the circuit of the clutch solenoid **212** so that the cam **191** is actuated to permit the retraction of the form which has been boarded during the interval while at the same time the cam **192** is actuated to move the next form to boarding position. The timer **260L** is brought into action by the actuation of the switch **233** which is engaged by one of the pins **234** on the disk **200**. When the second form has been boarded, it is retracted by the cam **192** and at the same time the cam **193** moves the third form to boarding position. This action continues for the several forms with successive operations of the cams and repeated operations of the cams and repeated operations of the timer **260L** until all six forms have been boarded. Thereupon, the next six forms on the lefthand carriage are actuated by a second group of cams and so on until all twenty-four forms on that carriage **37** have been stripped of the treated hosiery and boarded with new hosiery to be treated.

While the forms **40** on the lefthand form carriage have been stripped and boarded as just described, the righthand form carriage will have been moved into the retort for the treatment of the hosiery boarded thereon. The timing of the operations is preferably such that the righthand carriage will be ejected from the retort and tilted to its upwardly inclined position before the stripping and boarding of the forms on the left-hand carriage is entirely completed. Then, when the lefthand carriage is fully boarded, the main carriage **35** is shifted to the right through the actuation of the air motor **236** which is effected by closing the foot pedal switch **256L** which is located adjacent the left unit of the carriage actuating mechanism. A similar switch **256R** is located adjacent the righthand unit. The air motor is actuated by the foot pedal switches through a transformer **264** which reduces the voltage of the supply line from 220 to 8 volts at the intake of the air motor. When the main carriage has been shifted by the cylinder **235** to its righthand position, the lefthand form carriage **37** is tilted downwardly to its horizontal position and moved into the retort and the forms of the righthand form carriage **37**, which have been moved into operating connection with the righthand unit of actuating mechanism, are then stripped and boarded sequentially in the manner which has been described in connection with the lefthand form carriage. Before the main carriage can be moved to the righthand position as just described, the switch **265** is closed by the release of the lefthand form carriage which normally holds this switch open to prevent movement of the main carriage.

In order to allow the operator to obtain additional time for the stripping or boarding of a particular form beyond that which is automatically fixed by the cams **191** to **196** and by the timers **260L** and **260R**, means are provided for instantly stopping the automatic return of a form from the forward stripping and boarding position to the retracted upwardly inclined position. This is accomplished by the operator stepping on one of the bars **266L** or **266R** which are located in front of the actuating units and which are adapted to close the switches **267L** and **267R**, respectively. The closing of these switches energizes the solenoids **268L** and **268R**, respectively. As shown in Figs. 4 and 5, the core **268***a* of the solenoid **268L** is connected to a link **269** which has its upper end pivoted to an intermediate point of a lever **270** which is pivotally mounted on a post **271** extending upwardly from the frame **32**. The free end of the lever **270** overlies the trip levers **221** and **222** so that, when the solenoid **268L** is energized by the depression of the foot bar **266L**, the trip levers are depressed so that the notches **221***a* and **222***a* of the trip levers are not engaged by the latch lever **219** thereby preventing the rotation of the disk **200** and leaving the selected form in its forward position. When the operator desires to restore the selected form to its retracted position, a push button switch **275L** or **275R** is actuated to deenergize the solenoid **268L** or **268R** and thereby permit the trip levers **221** and **222** to perform in the normal manner.

There are also provided in the operating circuit two safety switches **276L** and **276R** which are normally open. When one of these switches is closed by a pin **277** on the sprocket disk **200**, it completes the circuit of the associ-

ated air motor 236 so that when the associated foot pedal switch 256L or 256R is closed, the main carriage is moved transversely of the retort. In this way the movement of the carriage at improper times is prevented. When all of the forms 40 on the lefthand carriage are stripped and reboarded and the shaft 190 and the cams have completed the cycle, a safety switch 262L is engaged by a pin 263 on the sprocket disk 200, thereby opening the circuit to the timers 258L and 260L so that the clutch 212L cannot be engaged.

The circuit shown in Fig. 13 is designed for the control of the operation of apparatus comprising two form carriages mounted on a single main carriage. It will be understood that one of the actuating mechanisms for operating the forms could be omitted with a modification of the control circuit to omit those parts which relate only to the operation of the omitted actuating mechanism.

One form of the improved setting apparatus has been shown and described by way of illustration, but it will be understood that the invention may be constructed in various other forms within the scope of the appended claims.

I claim:

1. The combination in setting apparatus of the class described, of a retort having an opening, a main carriage movable outside of said retort transversely to said opening, a pair of form carriages mounted on said main carriage for movement into and out of said retort, a plurality of forms pivotally mounted on each of said form carriages, each of said form carriages being tiltable with its forms to an upwardly inclined position outside of said retort, said forms being selectively tiltable from said inclined position to a forward upright position for stripping and boarding, two units of actuating mechanism each adapted to effect said movements of said forms on one form carriage, and means actuated by said movement of said main carriage transversely to said opening for forming a driving connection between one of said units and the forms on one of said form carriages.

2. The combination in setting apparatus of the class described, of a retort having an opening, a main carriage movable outside of said retort transversely to said opening, a pair of form carriages mounted on said main carriage for movement into and out of said retort, a plurality of forms pivotally mounted on each of said form carriages, each of said form carriages being tiltable with its forms to an upwardly inclined position outside of said retort, said forms being selectively tiltable from said inclined position to a forward upright position for stripping and boarding, two units of actuating mechanism each adapted to effect said movements of said forms on one form carriage, means actuated by said movement of said main carriage in one direction transversely to said opening for forming a driving connection between one of said units and the forms on one of said form carriages, and means actuated by said movement of said main carriage in the opposite direction transversely to said opening for forming a driving connection between the other of said units and the forms on the other of said form carriages.

3. The combination in setting apparatus of the class described, of a retort having an opening, a main carriage movable outside of said retort transversely to said opening, a pair of form carriages mounted on said main carriage for movement into and out of said retort, a plurality of forms pivotally mounted on each of said form carriages, each of said form carriages being tiltable with its forms to an upwardly inclined position outside of said retort, said forms being selectively tiltable from said inclined position to a forward upright position for stripping and boarding, two units of actuating mechanism each adapted to effect said movements of said forms on one form carriage, means actuated by said movement of said main carriage in one direction transversely to said opening for forming a driving connection between one of said units and the forms on one of said form carriages, means actuated by said movement of said main carriage in the opposite direction transversely to said opening for forming a driving connection between the other of said units and the forms on the other of said form carriages, and means for locking said main carriage in either of two positions wherein one of said units has a driving connection with all of the forms on one of said form carriages.

4. The combination in setting apparatus of the class described, of a retort having an opening, a main carriage movable transversely to said opening, a form carriage mounted on said main carriage for movement into and out of said retort, said form carriage being tiltable to an upwardly inclined position on said main carriage, a plurality of forms mounted on said form carriage, a bearing rod on said form carriage, each of said forms having a bearing socket engaging said rod, and actuating mechanism having parts engageable by said bearing sockets upon transverse movement of said main carriage for then effecting tilting movements of said forms about said rod.

5. The combination in setting apparatus of the class described, of a retort having an opening, a main carriage movable transversely to said opening, a form carriage mounted on said main carriage for movement into and out of said retort, said form carriage being tiltable to an upwardly inclined position on said main carriage, a plurality of forms mounted on said form carriage, a bearing rod on said form carriage, each of said forms having a bearing socket engaging said rod, and actuating mechanism comprising levers engageable by said bearing sockets upon transverse movement of said carriage, and having means for actuating said levers to tilt said forms about said rod.

6. The combination in setting apparatus of the class described, of a retort having an opening, a main carriage movable transversely to said opening, a form carriage mounted on said main carriage for movement into and out of said retort, said form carriage being tiltable to an upwardly inclined position on said main carriage, a plurality of forms mounted on said form carriage, a bearing rod on said form carriage, each of said forms having a bearing socket engaging said rod, and actuating mechanism comprising levers engageable by said bearing sockets upon transverse movement of said carriage, and having means for actuating said levers to tilt said forms about said rod, and means for adjusting the normal positions of said levers to register with said bearing slots upon movement of said main carriage.

7. The combination in setting apparatus of the class described, of a retort having an opening, a main carriage movable transversely to said opening, a form carriage mounted on said main carriage for movement into and out of said retort, said form carriage being tiltable to an upwardly inclined position on said main carriage, a plurality of forms mounted on said form carriage, a bearing rod on said form carriage, each of said forms having a bearing socket engaging said rod, and actuating mechanism comprising levers engageable by said bearing sockets upon transverse movement of said carriage, and having means for actuating said levers to tilt said forms about said rod, and adjustable means for limiting the movement of said forms.

8. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, actuating means engaging said forms for effecting said movements, and means including cams for operating said actuating means to effect said movements of said forms individually and in groups.

9. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position,

actuating means engaging said forms for effecting said movements, means including rotary cams for operating said actuating means, and means for intermittently rotating said cams.

10. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, actuating means engaging said forms for effecting said movements, means including rotary cams for operating said actuating means, a driving motor, and means for connecting said motor to rotate said cams intermittently to effect a predetermined sequential tilting movement of said forms.

11. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, actuating means engaging said forms for effecting said movements, means including rotary cams for operating said actuating means, a driving motor, means including a clutch for connecting said motor to rotate said cams intermittently, and means including timing devices for determining the duration of each movement of said cams.

12. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, actuating means engaging said forms for effecting said movements, a rotary cam shaft, a series of cams secured on said shaft, there being one cam for each of said forms, a driving motor, means including a clutch and a rotary member for rotating said shaft, means for engaging said clutch and means including parts mounted on said rotary member for determining the duration of the engagement of said clutch.

13. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, actuating means engaging said forms for effecting said movements, a rotary cam shaft, a series of cams secured on said shaft, there being one cam for each of said forms, a driving motor, means including a clutch and a rotary member for rotating said shaft, means for engaging said clutch and means including parts mounted on said rotary member for determining the duration of the engagement of said clutch and means including timing devices for controlling the operation of said last named means.

14. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, and actuating mechanism for said forms arranged to move a group of said forms simultaneously to said forward position, then to retract all but one of said group of forms, then to retract said one form and move another form of said group to said forward position, then to retract said last mentioned form and move still another form of said group to said forward position, and then to retract said last named form.

15. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, a series of actuating devices each adapted to move one of said forms, resilient means for actuating said devices to move said forms to said retracted position, a cam shaft, a plurality of groups of cams mounted on said shaft to move said forms to said forward position in groups and individually, and means for imparting an intermittent rotary motion to said shaft.

16. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, a series of actuating devices each adapted to move one of said forms, resilient means for actuating said devices to move said forms to said retracted position, a cam shaft, a plurality of groups of cams mounted on said shaft to move said forms to said forward position in groups and individually, means for imparting an intermittent rotary motion to said shaft, and means including timing devices for determining the intervals between successive movements of said forms.

17. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, actuating means engaging said forms for effecting said movements, means including rotary cams for operating said actuating means, a driving motor, means including a clutch for connecting said motor to rotate said cams, and means including a solenoid for engaging the parts of said clutch.

18. The combination in setting apparatus of the class described, of a plurality of forms arranged side by side in an upwardly extending retracted position, said forms being pivotally mounted for movement from said retracted position toward and from a forward position, actuating means engaging said forms for effecting said movements, means including rotary cams for operating said actuating means, a driving motor, means including a clutch for connecting said motor to rotate said cams, and means including a solenoid for engaging the parts of said clutch, latch mechanism for holding the parts of said clutch engaged, and means for determining the duration of the operation of said latch mechanism.

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