No. 625,288. Patented May 16, 1899.

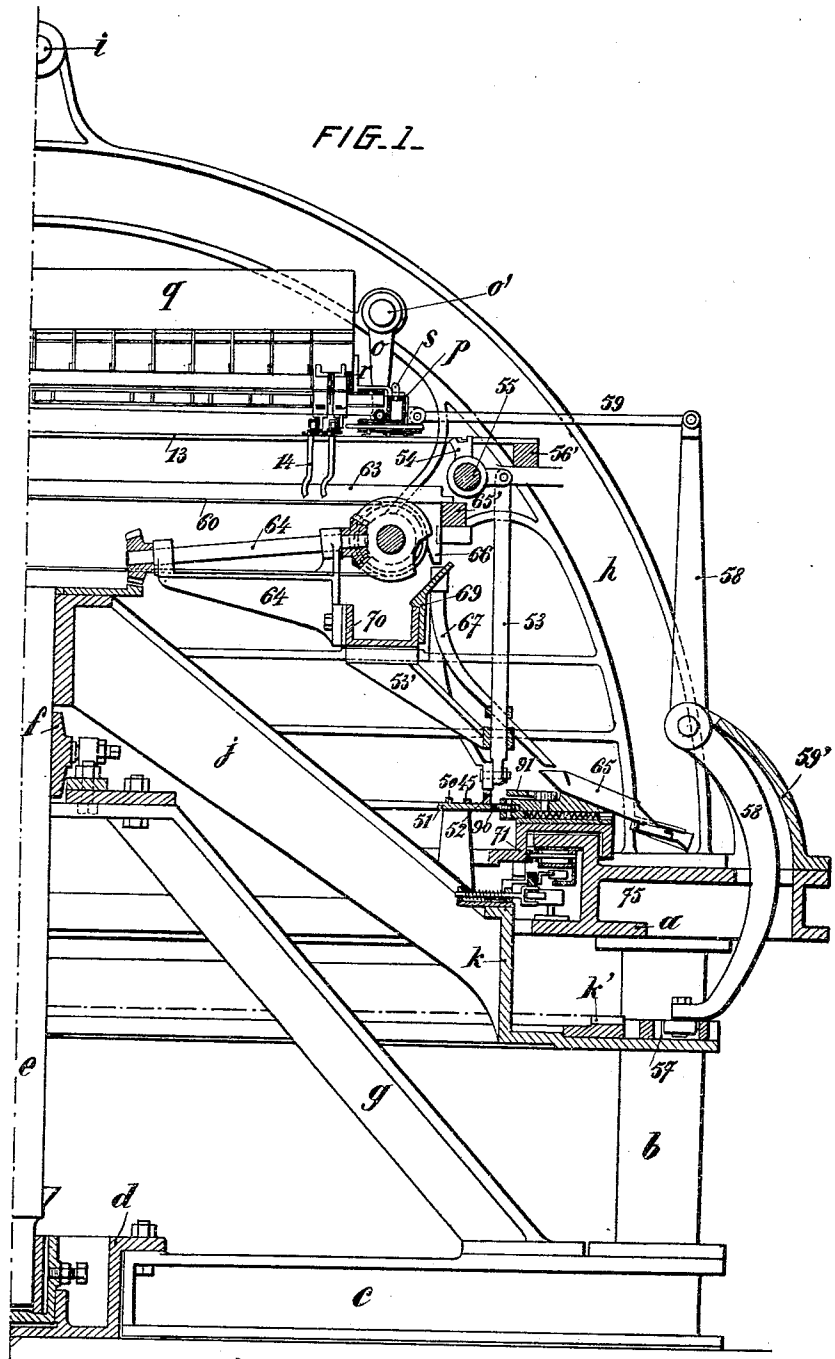
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 1.

FIG. 1.



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No. 625,288. Patented May 16, 1899.

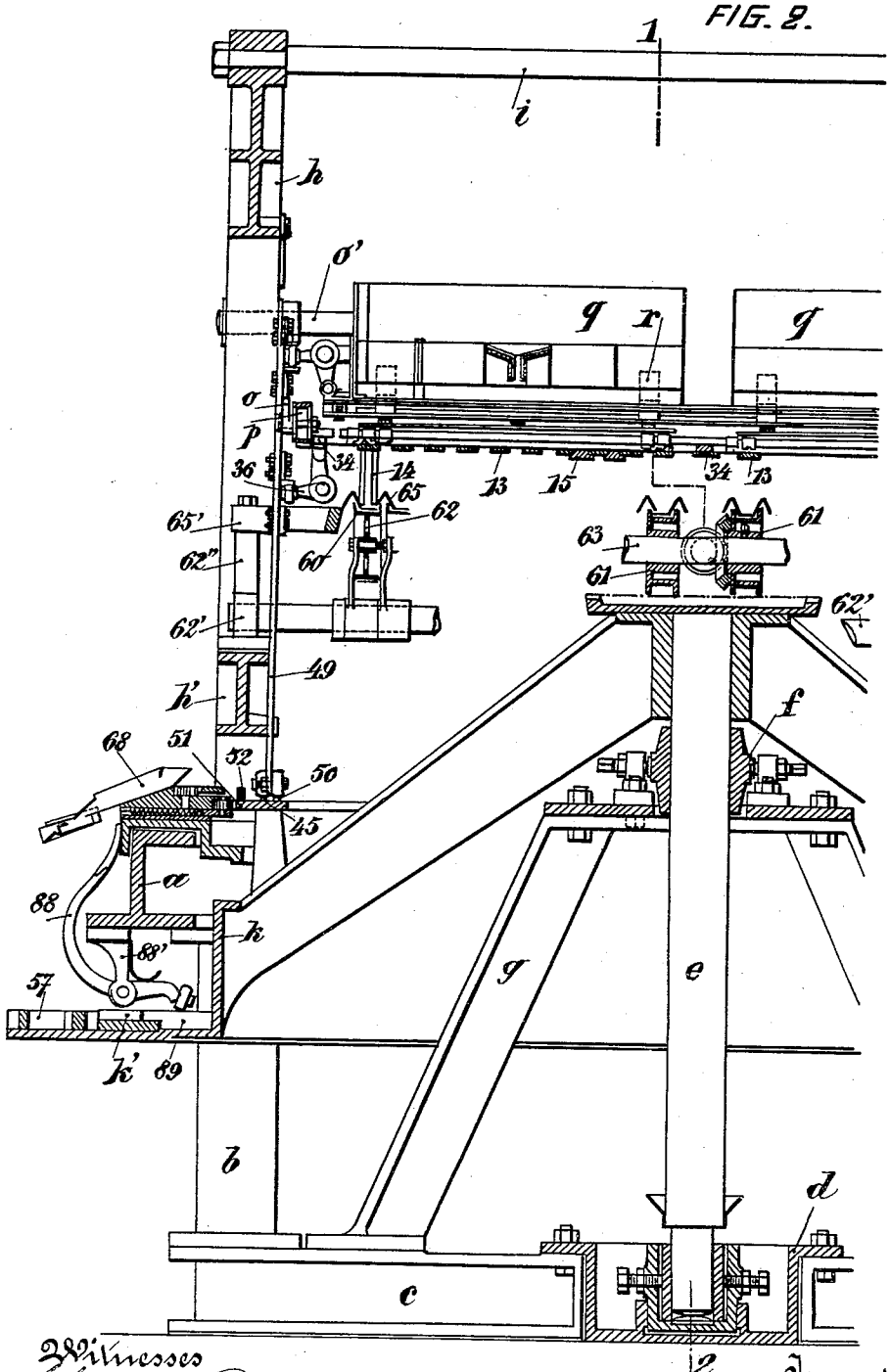
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 2.

FIG. 2.



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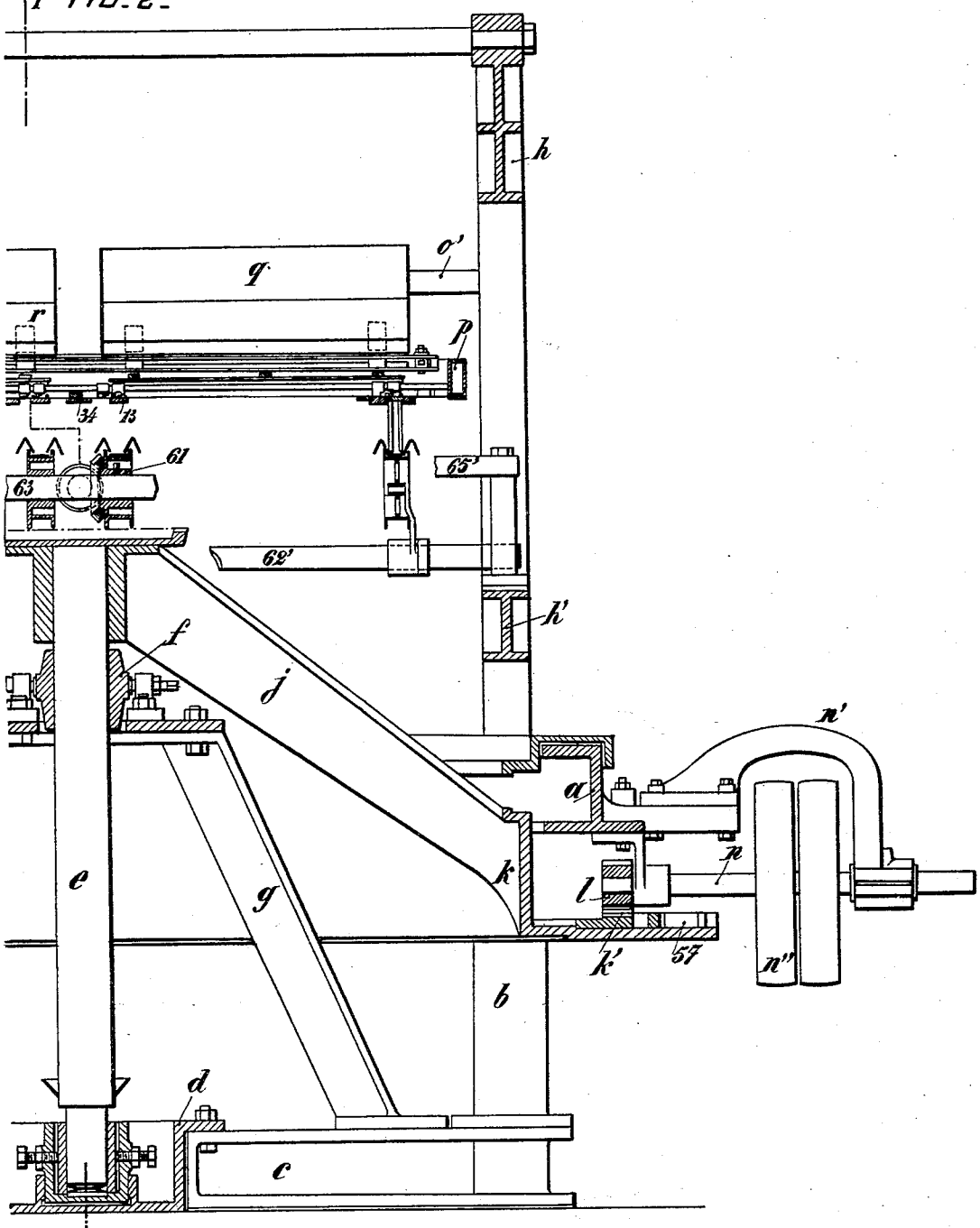
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 3.

1 FIG. 2ª



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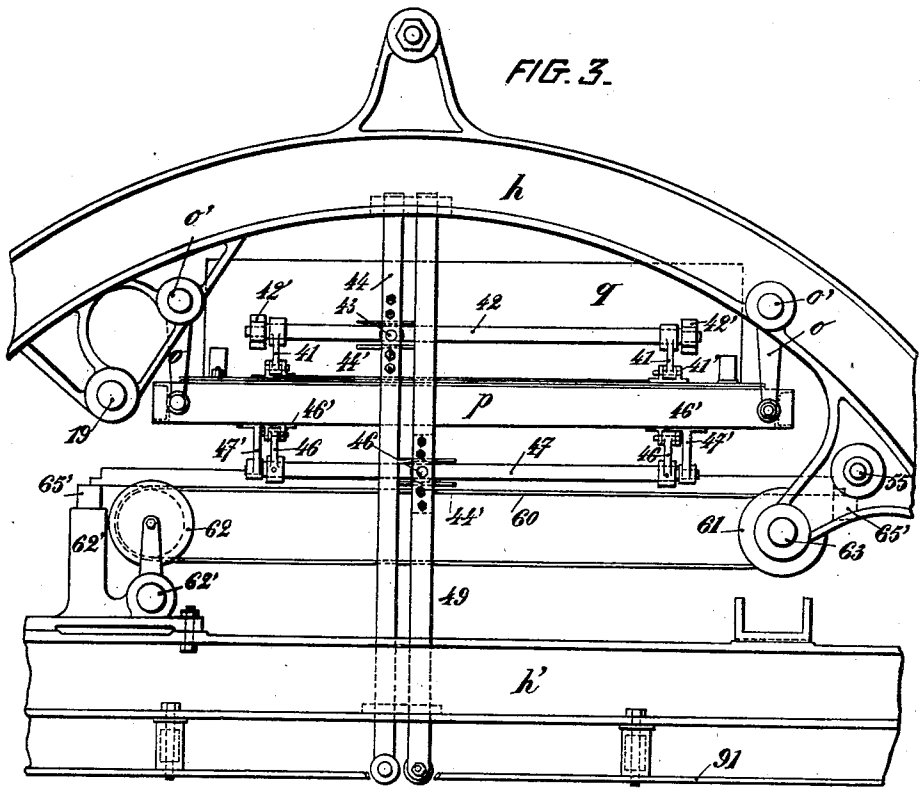
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 4.

FIG. 3.



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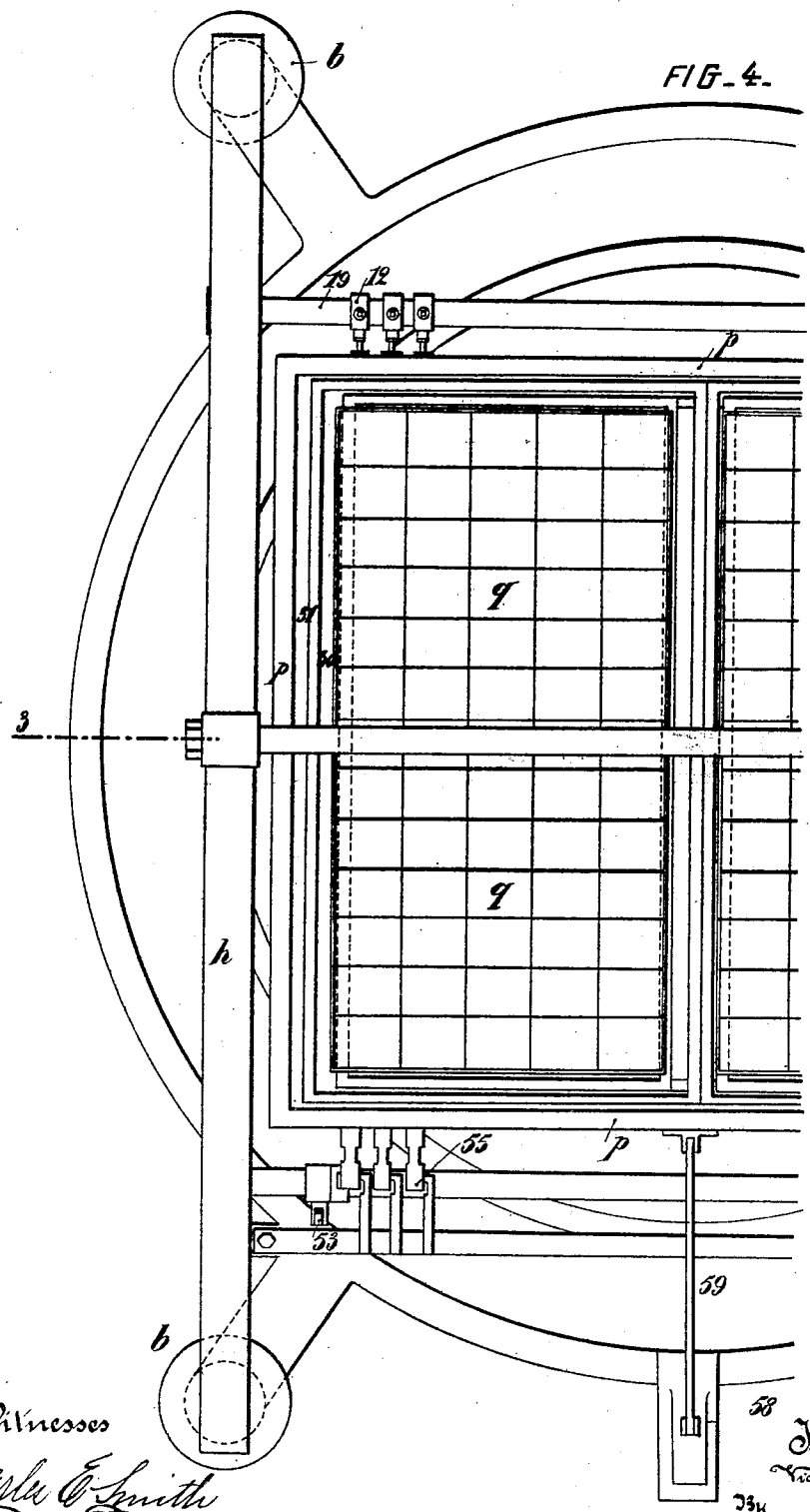
No. 625,288. Patented May 16, 1899.

V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 5.



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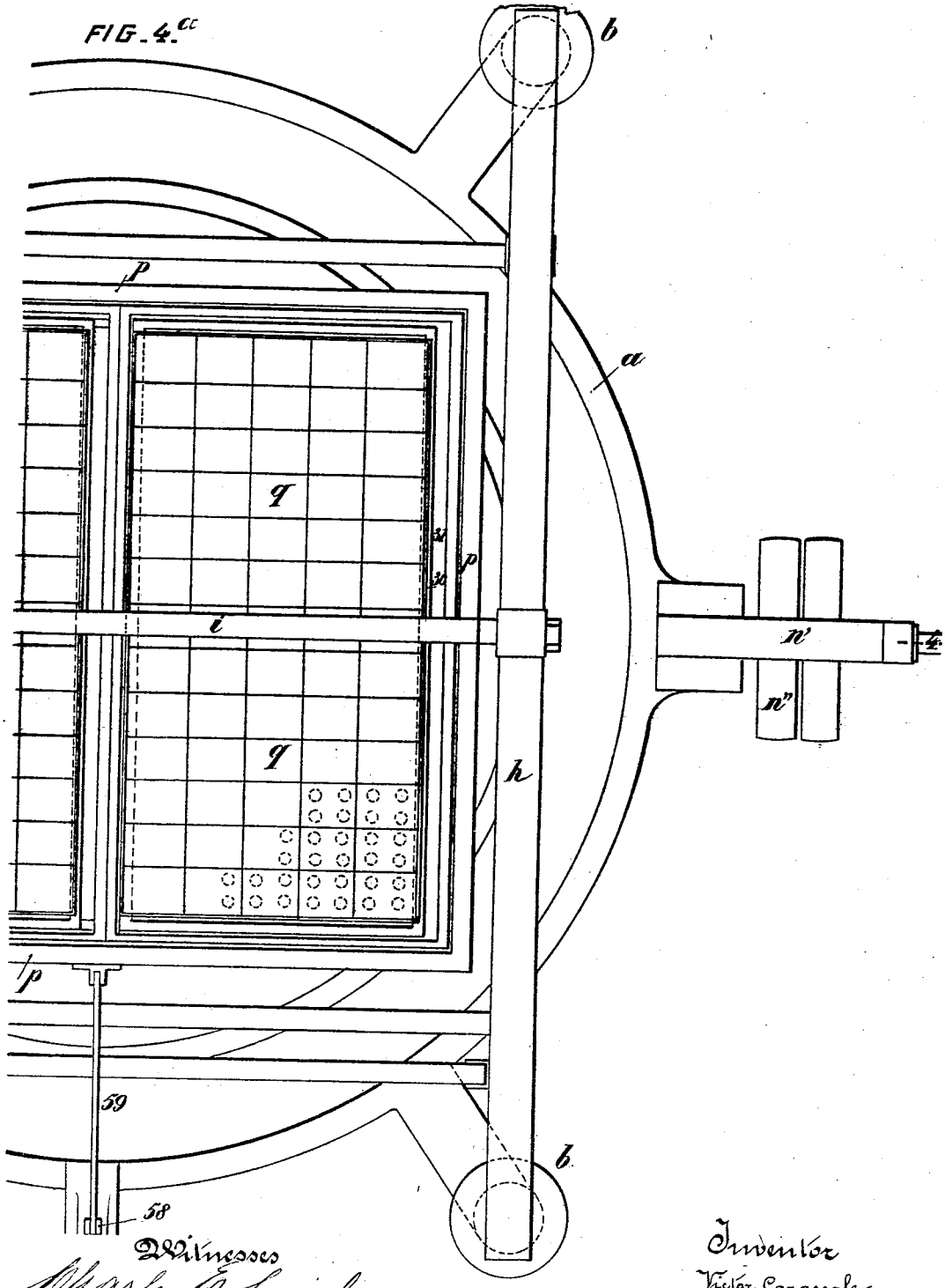
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 6.

FIG. 4.cc



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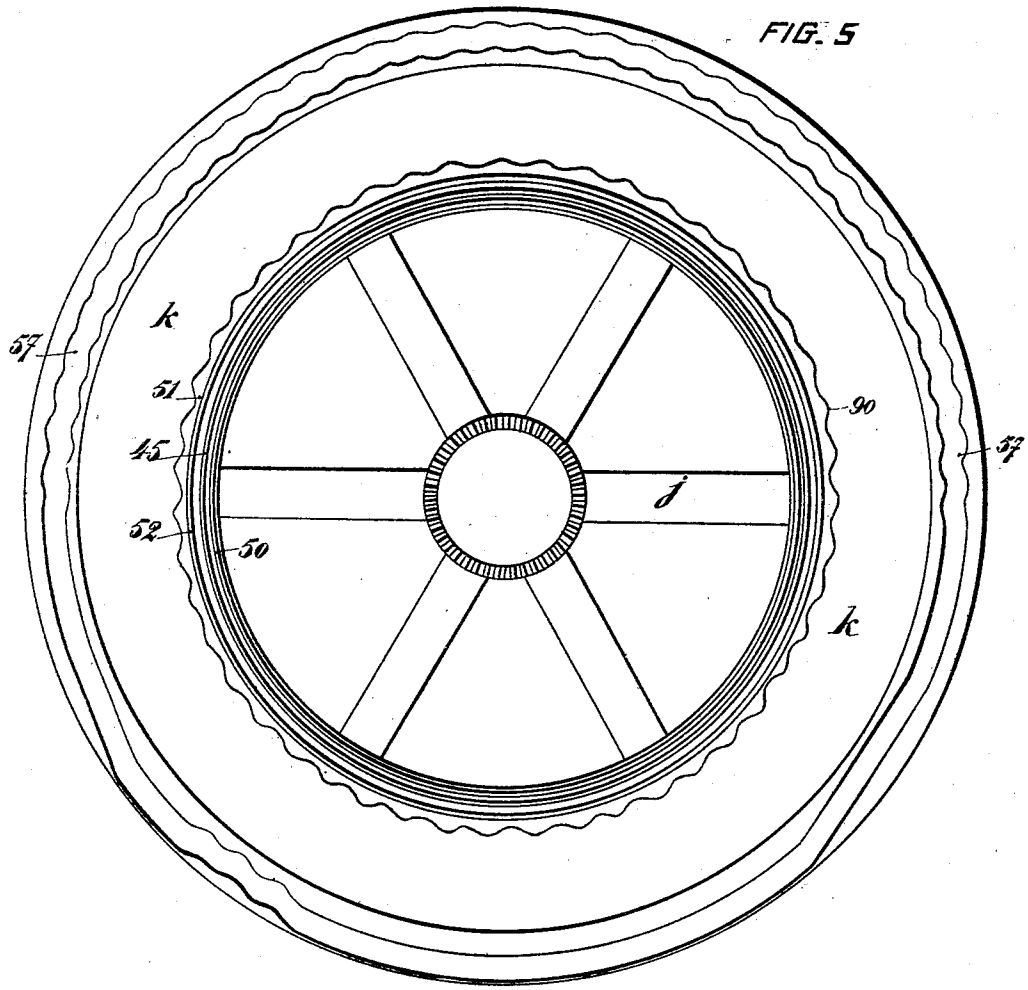
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 7.

FIG. 5



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BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 8.

FIG. 6.

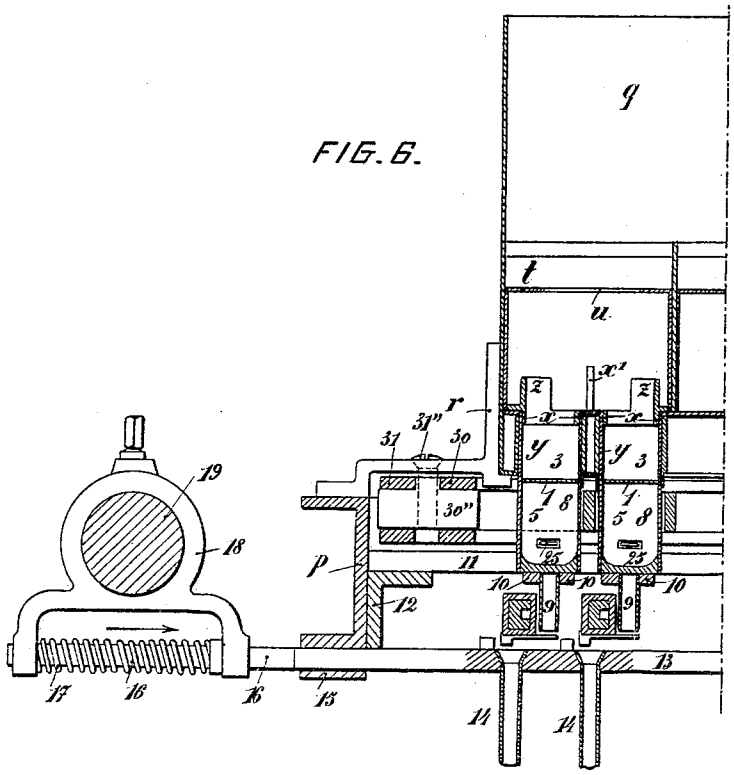


FIG. 9.

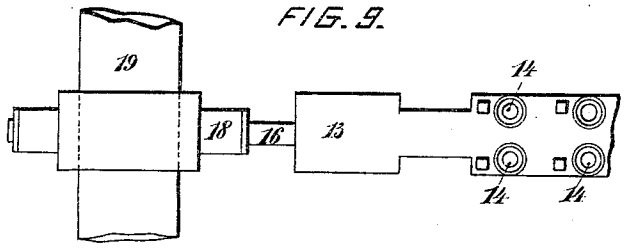
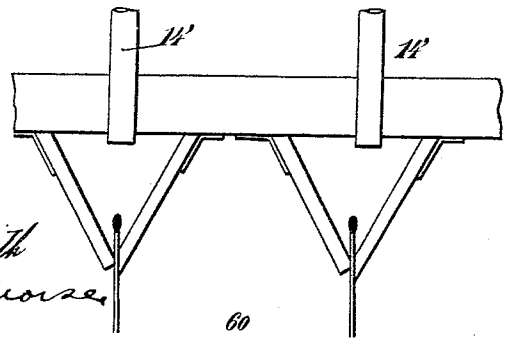


FIG. 22.



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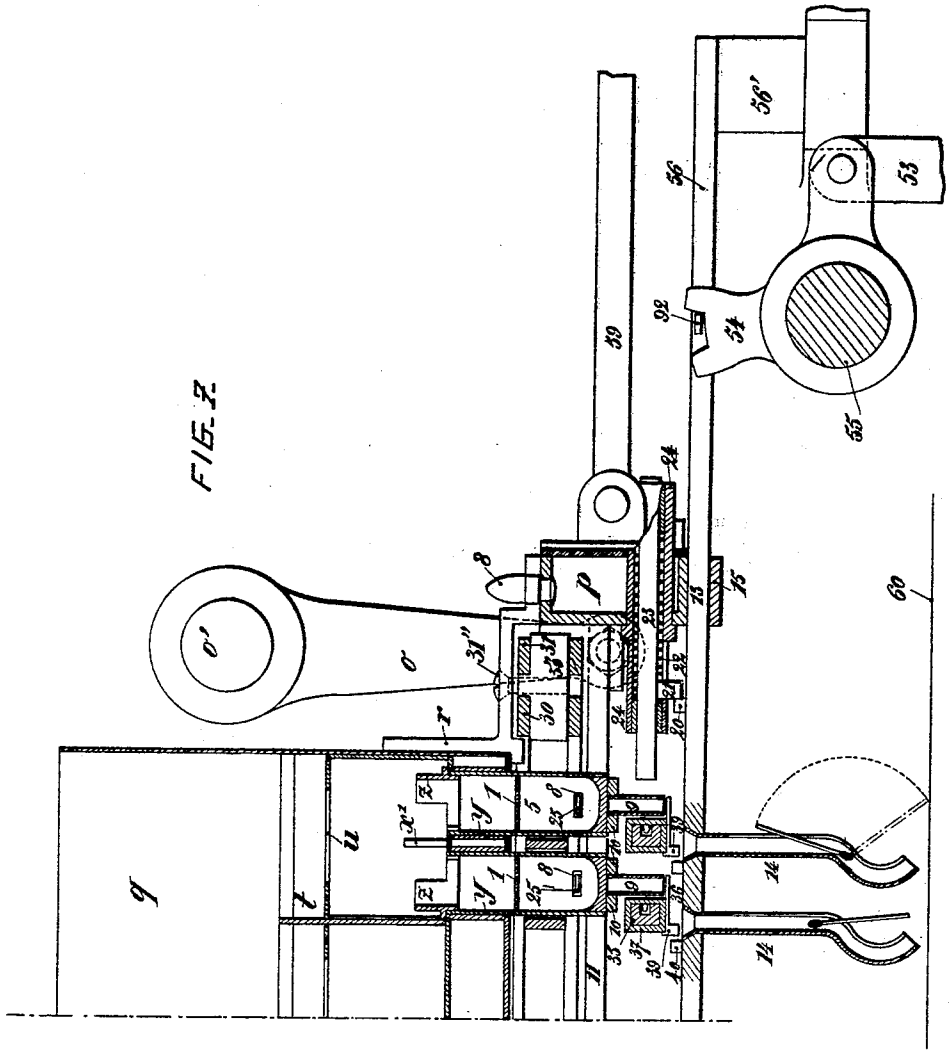
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 9.

FIG. 2.



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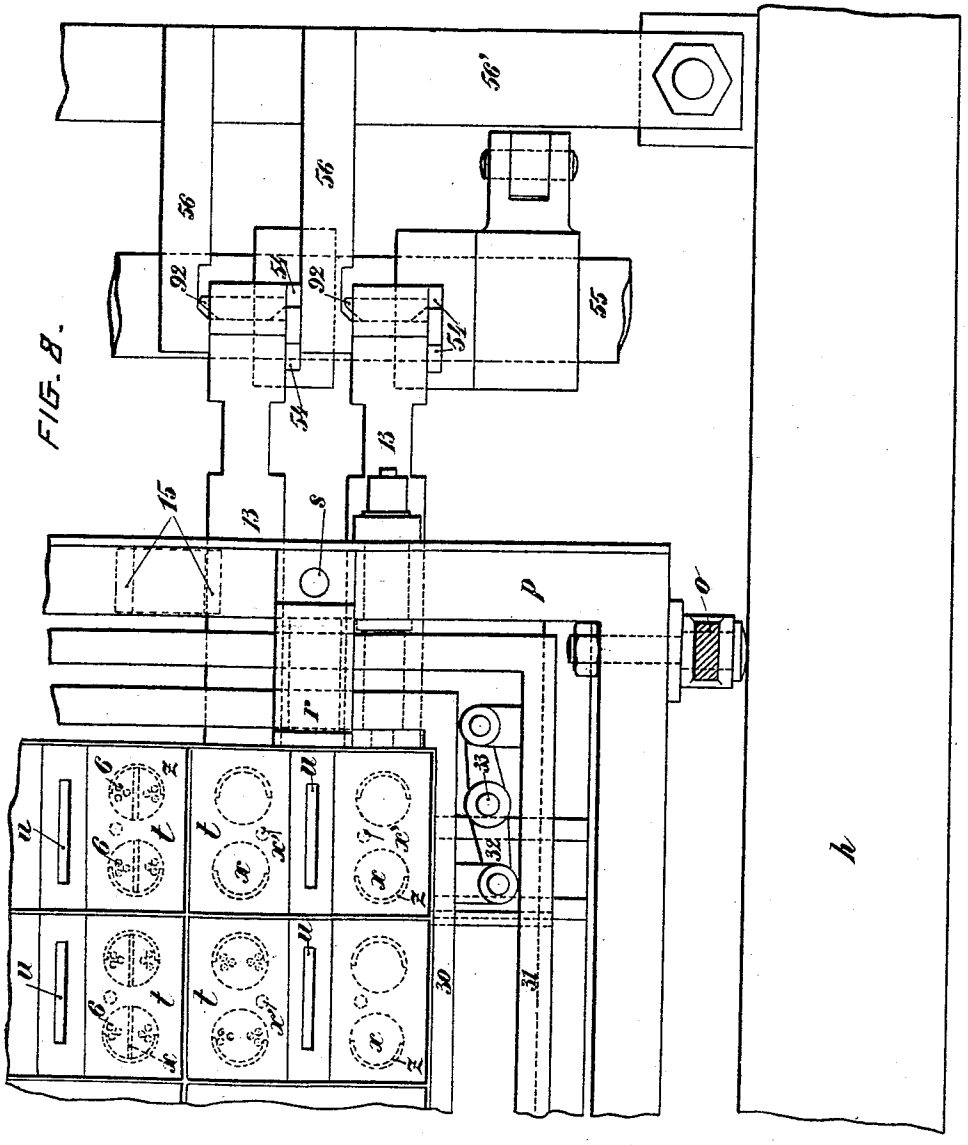
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 10.

FIG. 8.



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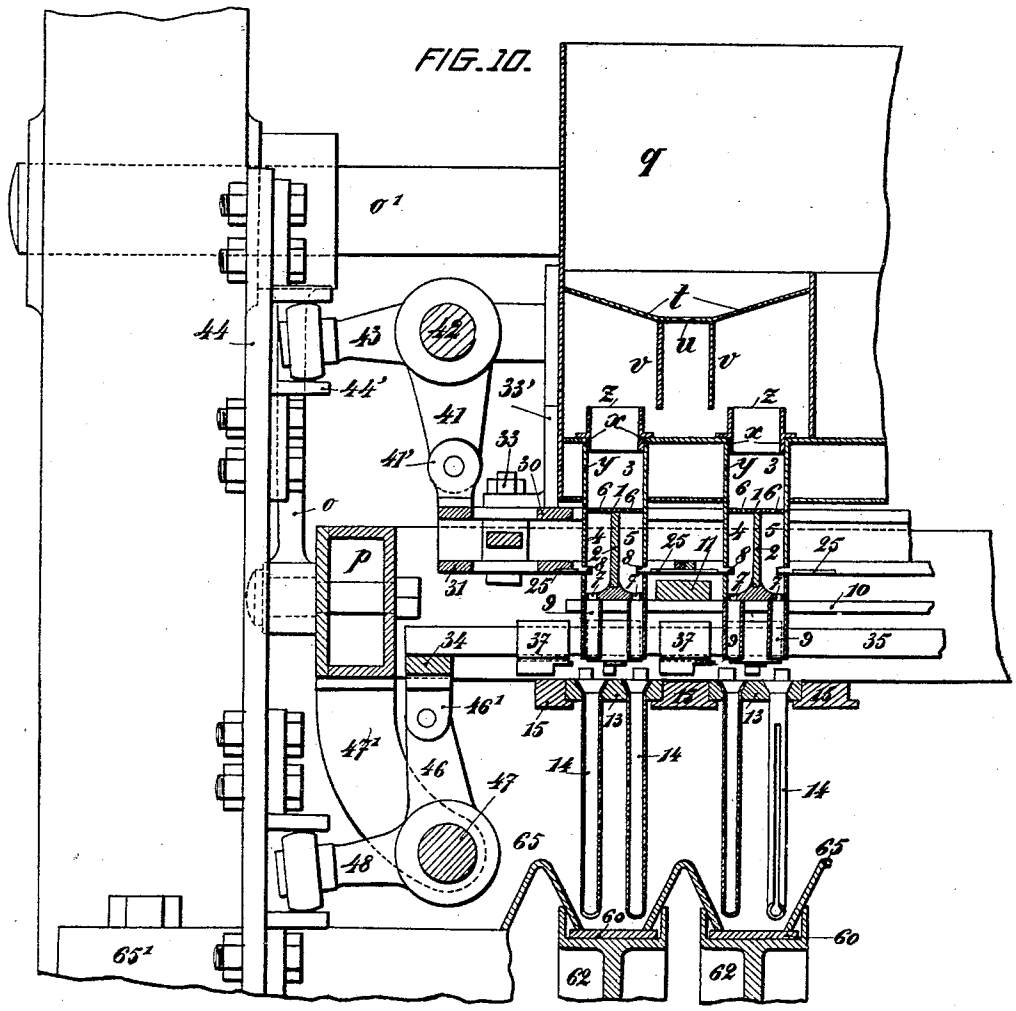
V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 11.

FIG. 10.



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BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 12.

FIG. 12.

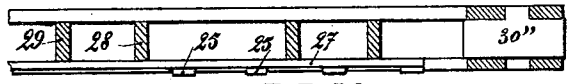
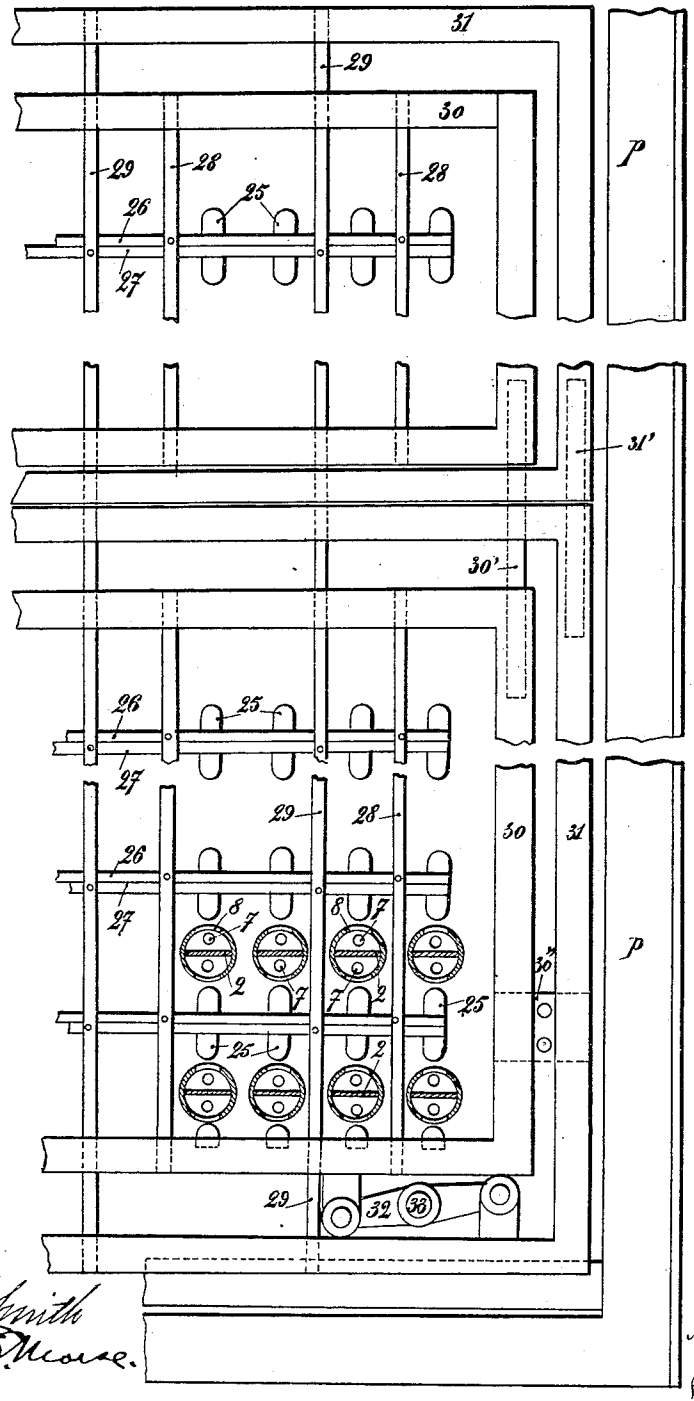


FIG. 11.



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No. 625,288. Patented May 16, 1899.

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BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 13.

FIG. 14.

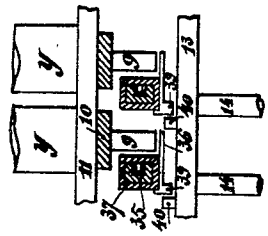


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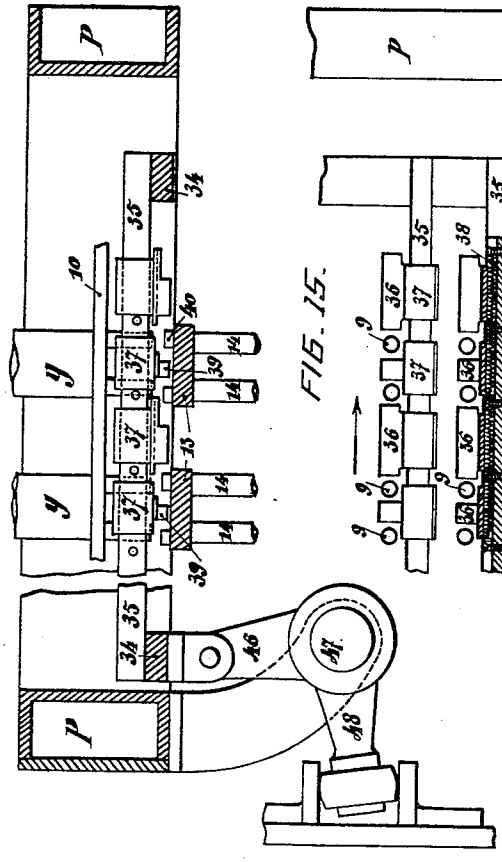
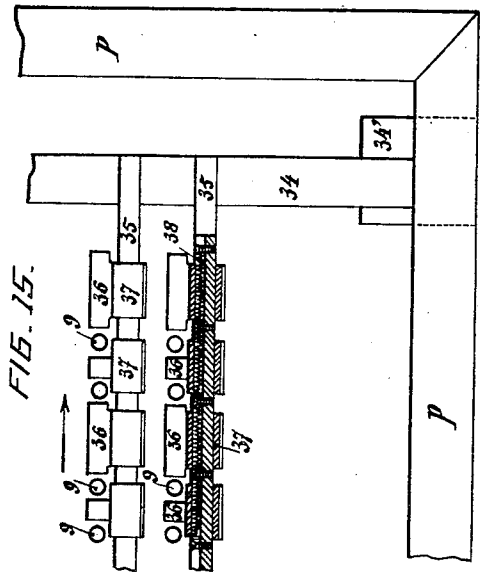


FIG. 15.



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No. 625,288.

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BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.)

16 Sheets—Sheet 14.

FIG. 16.

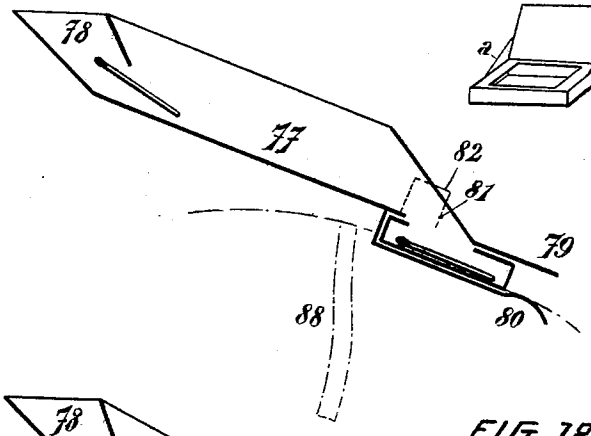


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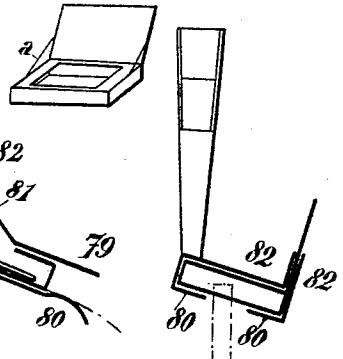
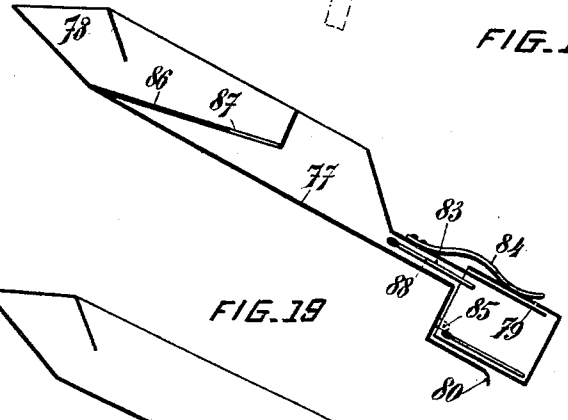


FIG. 18.



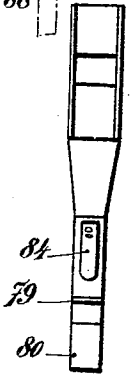
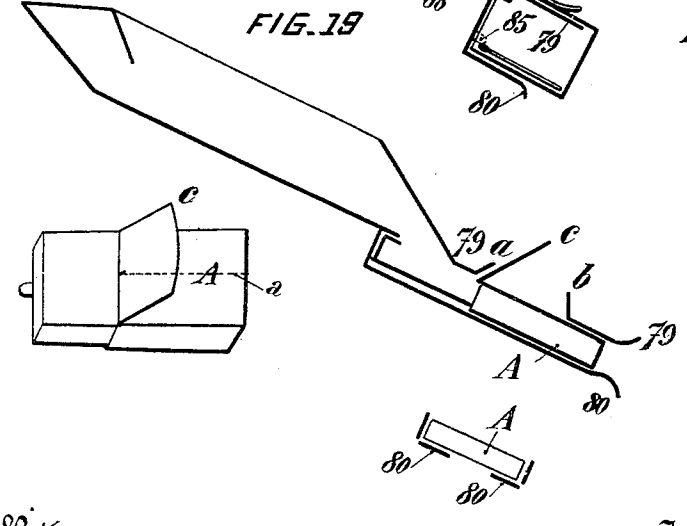


FIG. 19.



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No. 625,288. Patented May 16, 1899.

V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 15.

FIG. 80.

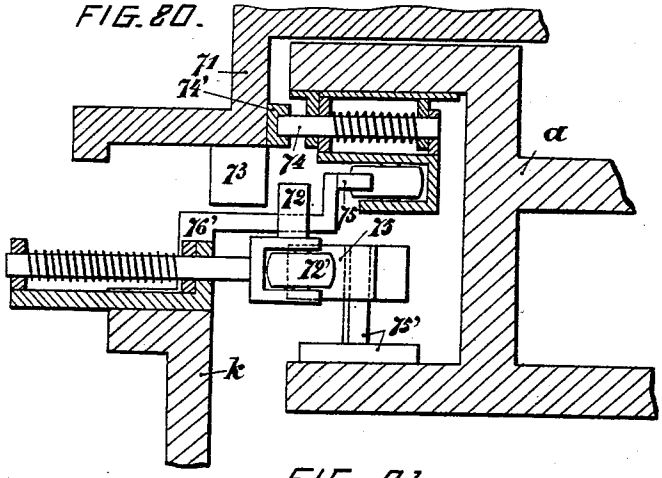
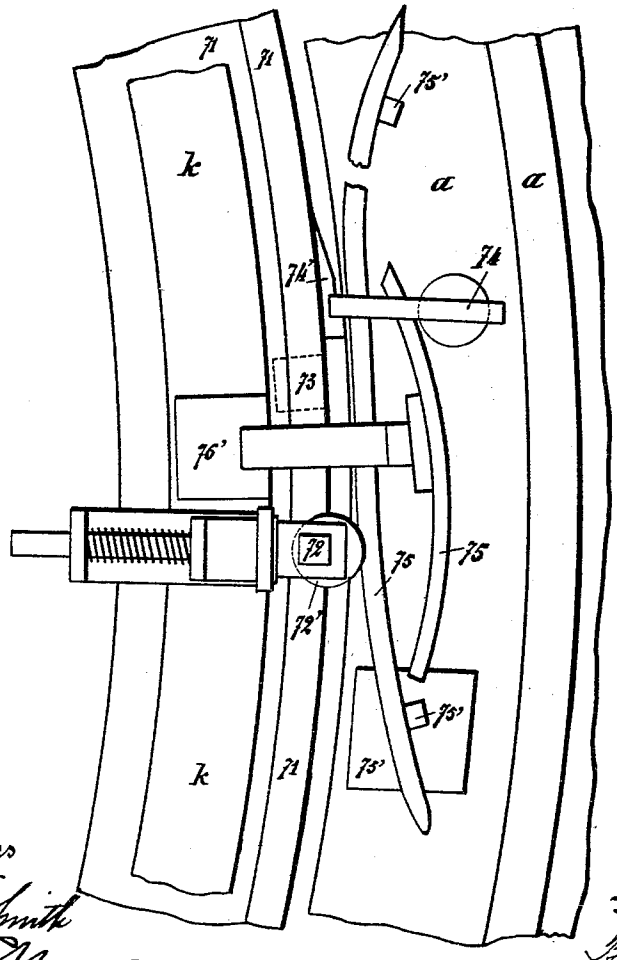


FIG. 81.



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No. 625,288. Patented May 16, 1899.

V. CARASSALE.

BOX FILLING MACHINE.

(Application filed Dec. 30, 1897.)

(No Model.) 16 Sheets—Sheet 16.

FIG. 23.

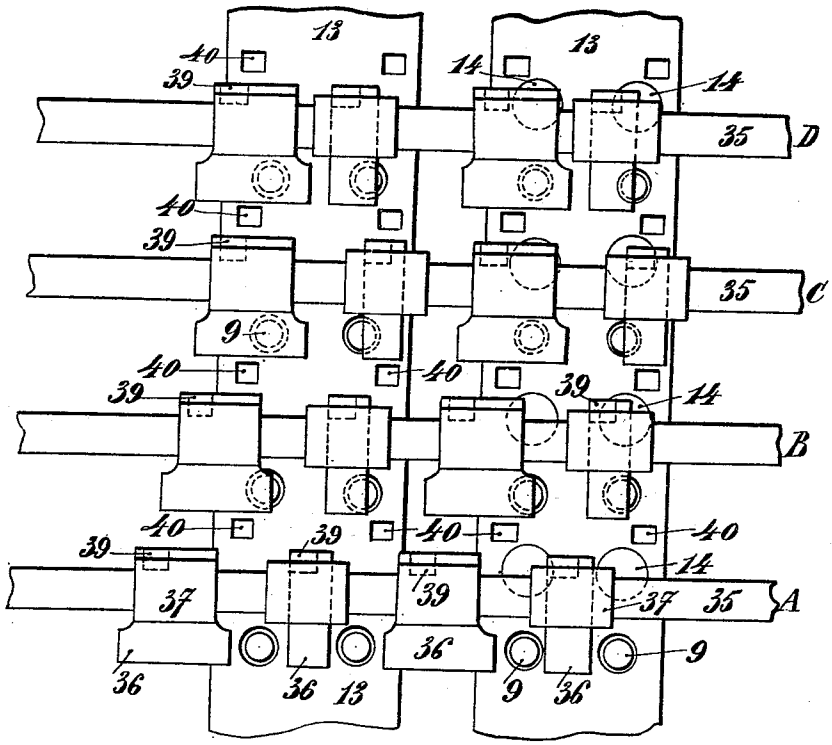
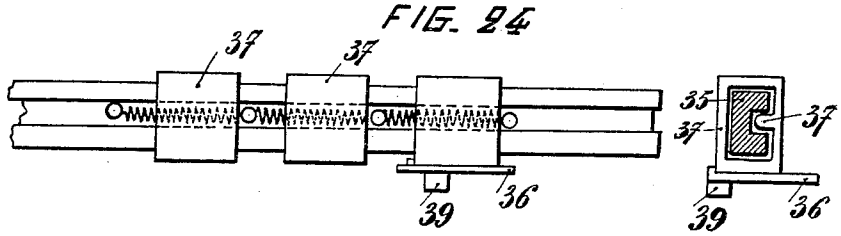


FIG. 24.



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UNITED STATES PATENT OFFICE.

VICTOR CARASSALE, OF PARIS, FRANCE.

BOX-FILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 625,288, dated May 16, 1899.

Application filed December 30, 1897. Serial No. 664,683. (No model.)

To all whom it may concern:

Be it known that I, VICTOR CARASSALE, of the city of Paris, France, have invented an Apparatus for Automatically Filling Boxes with Matches or the Like, (for which I have obtained Letters Patent in France for fifteen years, dated July 3, 1897, No. 268,423; in Belgium for fifteen years, dated July 3, 1897, No. 129,240, and in Austria for fifteen years, dated September 24, 1897, No. 3,561,) of which the following is a full, clear, and exact description.

This invention relates to improvements in apparatus for automatically filling boxes with matches, and particularly with wax matches.

My apparatus is characterized by the combination and special arrangement of a series of devices for effecting the filling of the matches into boxes in the same order in predetermined quantities and constructed so as to successively drop said matches for the purpose of preventing any obstruction during this operation of filling.

My improved apparatus is illustrated, by way of example, in the accompanying drawings, wherein—

Figure 1 represents a half-horizontal section of the apparatus, taken on line 1 2, Fig. 2. Figs. 2 and 2^a are cross-sections of the same, taken on line 3 4, Figs. 4 and 4^a, the boxes being shown in elevation. Fig. 3 is an elevation of the upper part of the apparatus. Figs. 4 and 4^a are fragmentary plan views of the apparatus. Fig. 5 is a detail plan view of the several driving-cams. Figs. 6 to 10 are detail views of the boxes with the devices for regulating the feed and arranging the match-heads all one way, Figs. 6 and 7 showing the two ends of the boxes in longitudinal section, and Fig. 8 a plan corresponding to Fig. 7; Fig. 9, a plan of one of the bars carrying the rectifying-tubes by which the matches are laid with their heads all one way, and Fig. 10 a vertical section of the mechanism for operating the feed regulating and parceling out. Figs. 11 and 12 represent a plan and transverse section of the frames carrying the devices for parceling out the matches. Figs. 13, 14, and 15 show, respectively, an elevation, end view, and plan of the controlling or feed-regulating mechanism. Fig. 16 is a longitudinal section, and Fig. 17 an end view, of one of the box-filling devices with a box shown in perspective. Figs. 18 and 19 are like views showing modifications of the same. Figs. 20 and 21 represent a vertical section and plan of the mechanism for operating the ring which carries the box-filling devices. Fig. 22 shows a modification of the device for arranging the matches all in one direction. Figs. 23 and 24 show the position of tappets of the feelers with regard to those of the bars carrying tubes in the several cases and the way in which said feelers are mounted.

The same letters and figures of reference indicate the same parts in all the views.

My improved apparatus is constructed mainly as follows: The operating mechanism is mounted upon a stationary ring *a*, Figs. 1, 2, and 4, supported upon four pillars *b*, braced together at bottom by four radial arms *c*, bolted to the support *d* of a footstep-bearing in which revolves a central shaft *e*, turning at its upper part in a collar *f*, carried by the four inclined legs *g*. Upon the four pillars *b* are supported two arched frames *h*, which are braced together at their upper part by a tie-rod *i* and are each provided with a cross-bar *h'*. Upon the upper end of the central shaft *e* is mounted a cam-wheel *k*, connected to said shaft by six downwardly-extending arms *j*, by means of which wheel the principal movements of the operative mechanism are effected. The wheel *k* carries a ring of teeth *k'*, which gears with a pinion *l*, keyed on the driving-shaft *n*, which is mounted in a bracket *n'*, bolted to ring *a*, and is driven from any suitable source of power by means of pulleys *n''*.

In order to better understand the order in which the several movements of the machine are executed, I will suppose the shaft *n* to impart a speed of one revolution in twelve seconds to wheel *k*. The arched frames *h* carry two shafts *o'*, from which are hung four links *o*, to which is suspended a frame *p*, supporting two hoppers *q*, Figs. 1, 2, 3, 7, and 10, which for the sake of strength are made with double bottoms and are connected by means of angle-iron brackets *r* and tenons *s* to frame *p*. (See Figs. 1, 2, 6, and 7.) The said frame at every revolution of wheel *k* receives an oscillatory motion during six seconds, imparted through a connecting-rod 59 and lever 58, Fig. 1, by means of the sinuous groove formed

in one-half the circumference of cam 57, Figs. 1 and 5, a vibration which is equal to about thirteen millimeters being produced, which moves hopper q to the right, Fig. 1. At the commencement of the eighth second, or after traversing an arc of two hundred and ten degrees, the cam-groove 57 in receding from the center of the machine moves the frame p fourteen millimeters in the reverse direction. On the cam attaining the two hundred and eighty-fifth degree, or in about nine and one-half seconds, the small sinuosities of the cam produce slight vibrations of frame p, while between the three hundredth and three hundred and thirtieth degree, or during the eleventh second, the frame p is moved back fourteen millimeters to its original position, Fig. 5. The effect of these movements will be afterward described. The lever 58 is pivoted in a bracket 59′, carried on ring a, Figs. 1 and 5.

Each box q is divided into a certain number of compartments, Figs. 4, 6, 7, 8, and 10, each provided with a double incline t, forming a chute, and with a rectangular aperture u, Figs. 8 and 10, through which the matches fall, they being guided in their descent by the two vertical sides v and the aperture u being small enough to prevent the whole mass of matches from passing through it. The bottom of the box q, Figs. 8 and 10, is provided with a number of holes x—four, for example, for each compartment—which communicate with vertical tubes y of a diameter less than the length of a match. x', Figs. 7 and 8, are small stems which extend upward in proximity to the holes x and are also partially surrounded by semicircular collars z. The vertical tubes y, which extend up through the double bottom of the box q, are divided by a horizontal partition 1 and a vertical partition 2, Figs. 6, 7, and 10, into three compartments—an upper one, 3, and two lower ones, 4 and 5. The partition 1 has a number of small holes 6—six, for example—three for each lower compartment. (See Figs. 6 and 8.) The height of the compartments 3 4 5 is less than the length of a match. The bottom of the compartments 4 5 is made concave and provided with a hole 7 at its lowest point near the wall of tube y. The holes 6 7, Figs. 8 and 10, are made of such diameter as to permit of one match only passing at a time. Apertures 8 8, Figs. 6 and 10, are made in the walls of tubes y y for the introduction of separating-slides 25, Figs. 8, 10, and 11, into compartments 4 5. Each exit-aperture 7 communicates with a small tube 9, Figs. 10 and 6, said tubes being carried by bars 10, Figs. 6 and 10, fixed to cross-bars 11, connected to frame p by means of angle-irons 12. The separating-slides 25 are carried by four frames 31 30, Figs. 12, 8, 6, 7, 10, and 11, two outer and two inner, and each constituted of two superposed frames which carry, Figs. 11 and 12, the frame 31, the cross-bars 29, the frame 30, and the cross-bars 28, which latter in turn carry small bars 26, and the cross-bars 29 carry the small bars 27, the separating-slides 25, which are respectively disposed opposite the openings 8 of tubes y, being fixed to said bars 26 and 27. There is a frame 30 and 31 to each box q, and the frames 31 are connected together on each side by bars 31′, and, similarly, the two inner frames 30 are connected together by bars 30′. The frames 30 and 31 are supported and guided by blocks 30″, secured by screws 31″ to brackets r, Figs. 6, 7, and 12. The frames 30 and 31 are also connected together at one side by a rock-lever 32, pivoted at 33 upon a bracket 33′, fixed to box q, Figs. 8 and 10, said rock-lever by its oscillation on axis 33 producing a movement of about eight millimeters in opposite directions of the frames 30 and 31, and consequently of the series of bars 26 and 27, for causing the separating slides to enter the compartments 4 5 about six millimeters and to withdraw them therefrom, Figs. 11 and 10. This to-and-fro movement of the frames 30 31 is obtained with the aid of the connecting-rod 44, Figs. 3 and 10, the vertical movement of which is produced by the cam 45, Figs. 2 and 5. The rod 44 carries a horizontal guide 44′, Figs. 10 and 3, in which is received a friction-roller mounted on the end of a lever 43, keyed at about the middle of a shaft 42, turning freely in bearings 42′, fixed on box q. (See Fig. 3.) Upon shaft 42 are keyed two lever-arms 41, jointed to lugs 41′ on frame 31. In this manner when the rod 44 is raised by cam 45 the arm 41 will thrust the frame 31 toward the left, and when the rod 44 descends the frame 31 is moved toward the right, so as to produce a movement of a few millimeters in extent in opposite directions of the two frames 30 and 31. The guide 44′, Figs. 10 and 3, serves to enable the lever 43 to partake in the oscillatory movements of box q. The movement of frame 31 toward the left and its retention in this position, and consequently the remaining of the separating-slides 25 within the tubes y, is produced while wheel k describes an arc of one hundred and sixty-five degrees, or from about the commencement of the seventh to the end of the twelfth second, which movement corresponds to a slight superelevation of one hundred and sixty-five degrees of length of the cam 45. The box q, tubes y and 9, and separating-slides 25 constitute the mechanism which serves to parcel out or separate the matches into given quantities in the manner hereinafter described. The number of matches to be separated is determined by the number of small tubes 9, Figs. 7 and 10, which each receive one match at a time and where they are momentarily retained by a bar 13, placed beneath at a distance from hole 7 of tube y less than the length of the match.

A special device prevents the separation of the matches which are not in the determined member. This device consists of a movable frame formed of bars 35, united by three cross-

bars 34, supported by plates 34′, fixed to frame *p*. (See Figs. 10, 13, 14, and 15.) The bars 35 carry contact-pieces or feelers 36, Fig. 23, each corresponding to a tube 9. Each of said feelers is provided with a lug 39 and is carried by a socket 37, capable of sliding on the bars 35, a small spring 38, placed in the groove of bar 35, Figs. 15 and 24, fixed at one end to said bar and at the other end to the socket, constantly tending to return the latter to its initial position. On the feeler-frame being pushed toward the right at a given moment a distance of from ten to twelve millimeters the feelers are brought beneath the tubes 9, and should they meet with a match the spring yields to this obstacle and the lug 39, Fig. 23, is held out of line with tappets 40 on the bars 13. When the tube 9 does not contain any match, the feeler continues its movement, and its lug is arrested in line with the studs, Fig. 23, the effect produced in each case being as hereinafter described. A single feeler-frame extends beneath both boxes *q*.

Fig. 23 shows the different positions which the feelers and their lugs 39 can take with regard to the tappets 40 of the bars 13 and the cases where it would be possible to bring the tubes 9 above the tubes 14. The bar A shows the feelers in their primitive position. In the bar B they have met with a match. In such case the bringing together of the tubes 9 and 14 can be effected freely. In the bar C the tubes have not met with a match in the tubes 9. In the bar D they have met with a match in two tubes and not in two others. In the case of bars C and D the superposition of the tubes 9 and 14 is not possible, as the tappets 40, and consequently the bars 13, would be carried away by tappets 39. The movement of said frame, like that of the separating-slides, is controlled by a vertical rod 49, actuated by a cam 50, Figs. 2, 3, 5, and 10. A lever-arm 48 is keyed near the middle of a shaft 47, turning in bearings 47′, fixed to frame *p*, and two lever-arms 46 on the opposite ends of said shaft are jointed to lugs 46′, Figs. 3 and 10, fixed to the cross-bar 34 of the feeler-frame. In this manner when rod 49 is raised by the cam 50, Figs. 2 and 10, the levers 46 advance the frame of separating-slides 25 a distance of from ten to twelve millimeters toward the right, and when the rod 49 descends the frame returns to its original position. This movement is effected once for every revolution of wheel *k* from the commencement of the seventh to the commencement of the ninth second, which corresponds to a slight superelevation of cam 50, extending through an arc of sixty degrees. The cams 45 50 are carried by a ring 51 on the large wheel *k*, Figs. 1, 2, and 5.

The device employed for separating the matches with their heads all one way consists of a cylindrical tube 14, Figs. 6, 7, and 10, which is slotted for a certain distance and slightly curved or bent at an angle at its lower end, said slot extending in a longitudinal direction on the concave side of the curve and being made of a width slightly greater than the diameter of the stem of the match, but of less width than the head. The object of the curve or bend of the tube is to cause the match-stem to drop out through the slot before it has traversed the entire length of the tube. The diameter of each of the tubes 14 is such that a match will pass lengthwise therethrough until the bent end is reached, when the stem of the match will drop through the slit and the matches will be discharged with all their heads extending in the same direction. The tubes 14, which are in number equal to that of tubes 9, are carried by the bars 13, which slide in guides 15 on the two sides of frame *p*. The guides 15 have only a few centimeters in length, just the width of frame *p*, Figs. 10, 7, and 8. In their normal position the tubes 14 do not coincide with tubes 9, Figs. 6 and 7. Each tube 14 corresponds to a tappet 40, carried by the bar 13, Figs. 6 and 9, one end of which latter bears against a sliding rod 16, acted on by a spring 17 and supported in stirrup-pieces 18, carried on a shaft 19, mounted at its opposite ends in the arched frames *h*, Figs. 3, 6, 7, and 10. The bars 13 are provided toward their right-hand end with a tappet 20, Fig. 7, which bears against a lug 21 on a rod 23, acted on by a spiral spring 22 of less force than the spring 17, contained in a socket 24 on frame *p*. In the position shown the bar 13 is not subject to the thrust of either of the springs 17 or 22, which are retained by their supports. Each bar 13 is also provided with a cross-slot to receive a tappet or bolt 92, Figs. 8 and 7, capable of sliding from one side to the other of said slot and placed between a notched frame 56, carried by a bar 56′, bolted to the arched frames *h*, Fig. 1, and a lever 54, keyed on shaft 55, also carried by the frames *h*. The levers 54 are operated by a connecting-rod 53, actuated by a cam 52 in such manner that said levers are at a given moment forced to turn toward the left. The connecting-rod 53 is guided at its lower part in a bracket 53′, Fig. 1, carried by the trough 70, and it is operated by a slight superelevation of cam 52, Figs. 1 and 5, extending through an arc of about one hundred and fifteen degrees, this movement being performed in almost the same time as the holder 9 moves fourteen millimeters to the left, or from the commencement of the eighth second and during a period of rather more than three seconds. Under these conditions when the box *q* effects its six seconds of oscillatory movement thirteen millimeters to the right the bar 13, Figs. 6 and 7, carried by the frame *p*, moves away from rod 16 and partakes in the same oscillations, and when box *q* moves fourteen millimeters to the left if no one lug 39 of the feelers is arrested in the line of the tappets 40, Fig. 23, the bar 13 is held in place by the rod 16 through its spring 17, which is stronger than spring 22,

which is thus forced to yield. While the bars 13 remain stationary the tubes 9 are brought by the movement of the box *q* opposite the tubes 14 to allow matches to fall on the endless web 60. On the box *q* moving back toward the right the spring 22 gradually expands and holds bar 13 in position. On the other hand, should one of the lugs 39 of the feelers be arrested in the line of the tappets 40, Fig. 23, on the feeler-frame moving toward the right and failing the presence of a match in either of the tubes 9 the lug 39 will carry the corresponding bar 13 with it in its movement of fourteen millimeters, and the tube 9 cannot be brought opposite to the tube 14. The tappet or bolt 92, Figs. 7 and 8, will also at same time be forced to slide from the other side between the teeth of segment 54, which in rotating toward the left will move the bar two millimeters farther, or to an extent of sixteen millimeters, allowing the feelers to retire, the bar 13 under the action of spring 17 returning to position, together with segment 54, whose left-hand tooth will force the tappet 92 back to the other side. Beneath each bar 13 is disposed an endless web 60, Figs. 1, 3, and 10, which passes around pulleys 61 and 62, the former of which are keyed on a same shaft 63, mounted in the arched frames *h* and driven from the central shaft *e* by means of bevel-gearing on an intermediate shaft 64, mounted in a bracket 64′, bolted to the trough 70, Fig. 1. The pulleys 62, Figs. 2 and 3, are mounted on independent adjustable supports, so as to permit of regulating the tension of each web, said supports being carried on a single shaft 62′, mounted in bearings 62″ on cross-bars *h*′. The endless webs receive continuous motion at a speed which is calculated at a speed such that a given point will move from one extremity to the other in eight seconds. 65, Figs. 2, 3, and 10, are fences carried by bars 65′ for retaining the matches upon the endless webs. At the end of each endless web 60, Fig. 1, is a funnel 66, placed above a distributing-spout leading to a box-filling device 68. The funnels 66 are carried by the bar 65′, which is supported from the arched frame *h*, Figs. 1 and 3. The spouts 67 are carried by a part 69, capable of sliding on a trough 70, supported on cross-bars *h*′ and serving to receive the matches which from any cause it is not desired to be supplied to the fillers.

The mechanism for boxing the matches comprises the box-filling devices 68, Fig. 1, carried on a ring 71, which may run on and be guided by friction-rollers upon the stationary ring *a*. The revolving ring 71 carries one hundred fillers, corresponding to five times the number (twenty) of the distributing-spouts 67. It consequently receives periodically at every twelve seconds a movement equal to one-fifth of a revolution, which is transmitted from wheel *k* in the following manner, (see Figs. 20 and 21:) The wheel *k* carries a tappet 72, mounted on a spring-pressed rod provided with a friction-roller 72′ and a cam-surface 76, mounted on an arm 76′. The stationary ring *a* carries a spring-pressed bolt 74, also provided with a friction-roller and a cam 75, extending around about one-fifth of its circumference and supported upon posts 75′. The ring 71 is provided with five catches 74′ for successively engaging with the bolt 74 and with five stops 73, placed equidistant from each other. In the position of rest the ring 71 is held stationary by bolt 74, and the tappet 72 under the pressure of its spring will be outside the circle of stops 73. At each revolution, however, of wheel *k* the cam 76 strikes the friction-roller of spring-bolt 74 and moves it backward, while cam 75 presses back roller 72′ and tappet 72, so as to cause the latter to strike the stop 73 and carry with it in its rotation the ring 71 for a period of a fifth of a revolution. At this moment the cam 75 causes the tappet 72 to release the stop 73 and allows the bolt 74 to enter the next catch presented to it. One-fifth of a revolution is thus performed in 2.4 seconds and the stoppage of ring 71 in 9.6 seconds for every revolution of wheel *k*. The motion is thus sufficiently slow to prevent any appreciable shock, the more so as ring 71 constantly receives a certain impulse from a studded ring 51, hereinafter described. Shocks may also be entirely prevented by providing the stops 73 with springs.

The box-filling devices 68, whose external form may be varied as regards the part which receives the boxes to suit the form of the latter, consist, essentially, of an inclined channel 77, Figs. 16 and 18, provided at its upper part with a funnel-mouth 78, through which the matches enter, and terminated at bottom by spring-jaws 79 80, between which the boxes to be filled are placed in an inclined position, as shown in Fig. 17. The channel 77 is provided at its lower end with an aperture 81, through which the matches fall into the box. The jaws 80 of the filler, Fig. 16, are separated (see Fig. 17) to admit, as hereinafter described, of the insertion between them of an ejector 88, Figs. 2, 16, and 17, for discharging the full boxes, as hereinafter described. The fillers 68, Fig. 1, are mounted on independent supports, fitted to slide upon the ring 71, by which they are carried, and are each spring-pressed in the direction of the center of the machine. Each support is provided with a lower roller in constant contact with a cam-ring 51, Figs. 1, 5, and 2, carried by the arms of the large wheel *k*, which ring when the motion of ring 71 is arrested imparts a to-and-fro motion to the fillers.

The filled boxes may be removed by hand or by means of a series of twenty extractors 88, (see Fig. 2,) which may be placed, for example, in the third arc of seventy-two degrees. The extractors are mounted on brackets 88′, fixed to ring *a*, and are held in position by springs, and a short cam 89 is provided on wheel *k*, which on passing at each revolution

beneath the roller carried by the extractor raises the latter sufficiently to cause the point of the extractor to pass between the two jaws 80 of the filler 68, Figs. 16 and 17, and eject the filled box, the extractor being then returned to its initial position by a spring.

Figs. 16 and 17 show the position occupied in the machine by the extractor 88 with regard to the filler 68 and how the same can pass between the two jaws 80 for pushing the box from behind. The boxes of the type represented, Figs. 17 and 19, are self-closed on going out, as they are provided with elastic bands *a*. The boxes are closed first upon the jaw 79 as soon as they have left the flanges 82. A cam 91, Figs. 1 and 3, carried by cross-bar *h'*, holds during the last two-fifths of a revolution the extractors raised off the studs of ring 51 to prevent vibration and permit of the introduction of a fresh supply of empty boxes.

The following is the working of the apparatus: Under the action of the oscillatory motion toward the right communicated to boxes *q*, Figs. 1, 10, and 7, during the first six seconds the matches which have been thrown therein pell-mell gradually fall through the apertures *u* parallel to one another to the bottom of said boxes, whence they pass vertically downward into the tubes *y* and from there pass singly down through the holes 6 7, Figs. 8 and 10, into the tubes 9, where they are momentarily arrested by the bars 13, which at this moment occupy the position shown in Fig. 7, one end of the match being still engaged in hole 7, owing to the distance between said hole and bar 13 being less than the length of the match, the object of this arrangement being to prevent a second match from dropping into tube 9. The height of the compartments 3 4 5, Figs. 10 and 7, being also less than the length of a match, only three matches can penetrate at one time into each compartment 4 5, the upper ends of which matches will be still engaged in the holes 6, while the matches in compartment 3 will stand up above the level of the bottom of box *q*. The arrangement of the latter, together with the semicircular collars *z*, Figs. 8, 10, and 7, and vertical stems *x'*, serve to prevent the descent of too large a number of matches into tubes *y* at one time, so that they may always move freely in compartments 3. A single hole 6 would be sufficient for each compartment 4 and 5, but when there are several there will always be a certainty of having a match in said compartments ready to fall into tube 9. The matches contained in the double row of tubes 9, corresponding to each bar 13, Fig. 10, constitute the charge for each box and should be of the exact prearranged number. It only remains to verify that all the tubes 9 contain a match, to retain those matches which are contained above in compartments 4 and 5, so as to enable the matches contained in tubes 9 to be separated, and prevent their being followed by the others, and to distribute the former matches in complete series, the incomplete series being retained. These different operations are effected during the second half of the revolution of wheel *k*, Figs. 1 and 5—that is to say, during the six last seconds.

It has been before stated that at the commencement of the seventh second the movement of the separating-slide frames 30 31, Fig. 11, causes the separating-slides 25 to enter the apertures 8 of compartments 4 and 5, Fig. 10, so as to shut off the matches from holes 7 and prevent them dropping into the tubes 9, even supposing the same to be empty. Nearly at the same time the feeler-frame 36 is moved toward the right, and, supposing all the tubes 9 contain a match, the whole of the feelers 36 will be arrested in their course and their course and their lugs will remain out of line with the tappets on bars 13, Fig. 23. It is at the commencement of the eighth second that the boxes *q* move fourteen millimeters, Figs. 1, 5, and 6, to the left and the tubes 9 are brought over the tubes 14, while at the commencement of the ninth second the feeler-frame returns to position toward the left and each complete series of matches passes through said tubes 14 and falls upon the endless web 60, assisted by a slight vibratory movement at about the ninth-and-a-half second, Fig. 5. At the eleventh second the box *q* returns to its original position, the tubes 9 and 14 no longer coincide, and during the twelfth second the separating-slides are withdrawn from tubes *y*, so as to allow a fresh series to drop into the tubes 9. Should a match be wanting in a series of tubes 9, the bar 13 will be caused by the lugs 39 to partake in the movement of box *q*, the tubes 9 will not be brought over the tubes 14, and the incomplete series of matches will be retained.

It has been seen that the matches before dropping onto the endless web 60 pass one at a time through the tubes 14, Figs. 1 and 7, which are made of such form and have slits of such width that should a match drop head uppermost into tube 14 its stem will pass out through the slit, as shown in Fig. 7, while its head will be retained until it escapes at the end of the tube, when it falls onto the endless web close beneath, which carries it along to the right with the undipped end foremost. If, on the contrary, the match passes head downward through tube 14, the head will still be retained thereby and the stem will fall through the slit and fall over, so as to bring the head uppermost, as before. Thus the matches are in all cases delivered on the endless web with their heads all one way and remain so until they are introduced into the boxes. The parceling out of the matches or their fall upon the endless web and their arranging all the heads in one way are effected instantaneously and simultaneously.

Each complete charge of matches is delivered in less than eight seconds to the box-fillers 68 by means of the funnels 66 and distributing-spouts 67, Fig. 1. The to-and-fro

movement of the fillers 68, which occupies 9.6 seconds during each stoppage of ring 71, produces the successive introduction of the matches into the boxes (which have been previously placed between the jaws of the fillers) with all the heads one way. The to-and-fro motion of the fillers is arrested when wheel 71 has performed one-fifth of a revolution, as it now revolves at the same speed as the wheel *k* and cam-ring 51. Should the filling of the boxes with matches be not concluded within the first fifth of a revolution, it may be continued during the following periods. During the third fifth of a revolution the filled boxes are pushed out by means of the extractors, as hereinbefore described, this method being more particularly employed for boxes whose lids are provided with rubber springs, as those of the type represented, Figs. 17 and 19. The empty boxes are introduced into the fillers during the two last fifths of the revolution, when the fillers remain stationary.

For boxes of the type represented in Fig. 17 the filler 68 may be provided with a double flange 82 for holding the lid open. For the well-known type of match-box represented at A in Fig. 9 the filler would be the same as that shown in Fig. 16 except that the jaws are longer, the upper jaw 79 being also provided with an opening extending entirely across and the edges *a b* of which are bent up, as shown, so that when the box (which is introduced through the opening) is withdrawn the bent-up edge will force the lid to close. The drawer is instantaneously closed, being drawn by an elastic spring.

It is to be understood that the box-fillers may be modified to adapt them to receive different forms of boxes. Thus in the case of boxes having the mouth at one end the modified form of filler represented in Fig. 8 is employed, the box being clamped between the flat spring 84 and the jaws 79 80, and the filler being provided with a prolongation 83, which forms a channel through which the matches are introduced into the box. The filler may also be provided with a division-plate 86, having a longitudinal slit 87, through which the matches can only pass one by one. This division-plate may also be applied to all the forms of fillers described.

The number of containers *q* and also of tubes *y* may be varied according to the number of matches to be contained in each box and the number of boxes to be filled at a time.

The mechanism for arranging the matches all one way may also be constituted of straight tube 14′, Fig. 22, each mounted above a kind of trough formed with inclined sides, with sufficient space between them for the passage of the stem of the match, but so that the matches will be retained by their heads. One side of the trough may be fixed and the other hinged, so as to allow, on swinging the side upon its hinge, of the matches falling onto the endless web 60, which travels at a distance from the troughs less than the length of the match, so that the heel ends of the matches will be carried forward by the hand before the heads are released from the trough, and thus insure the matches all falling one way. Each row of tubes 14 would correspond to a trough, and all the hinged sides of the troughs would be connected by a rod receiving motion from a lever operated by a cam on the wheel *k*. The matches on dropping into the trough remain suspended by their heads, with their stems inclined to the direction of movement of the endless web, upon which they drop on the sides of the troughs being opened.

It is obvious that my improved machine is applicable not only for boxing all kinds of matches, but also any other objects of circular form, and that various modifications may be made, the accessory parts to suit the nature of each application, without departing from the spirit of my invention.

I claim—

1. An apparatus for automatically filling boxes with an exact predetermined number of matches, comprising a number of match-containers divided into compartments provided at bottom with a number of vertical tubes divided into three match-receiving compartments, the two lower compartments communicating by a single hole with a tube which receives one match at a time, bars disposed beneath each double row of tubes for retaining the matches, rectifying-tubes which co-operate with the match-receiving tube and which serve to deliver the matches with their heads all one way and in complete series, a box-filling device adapted to receive the matches from said rectifying-tube and automatically-operated extractors for displacing the filled boxes.

2. In the apparatus herein specified, the containers *q* divided into hopper-bottomed compartments each having a rectangular aperture *u*, for the delivery of the matches which are guided in their descent by the vertical surfaces *v* and the bottom of said compartments being provided with a number of holes *x* of a diameter less than the length of a match, distributing-tubes into which the holes *x* open and means regulating the delivery of the matches into said delivery-tubes.

3. In the apparatus herein specified, compartments provided with holes *x*, distributing-tubes placed beneath said holes, each tube being divided by a horizontal and a vertical partition into three compartments, an upper one 3, and two lower ones 4, 5, all of a height less than the length of a match, the upper compartments 3 communicating with the lower compartments 4, 5, by means of small holes and the bottoms of the compartments 4, 5, being made concave so as to direct the matches toward the hole 7 which as well as the holes 6, is of such diameter as to allow of only one match passing at a time, the hole 7 opening into a tube 9 of less length

than a match, a bar 13 on which the matches are adapted to rest, so that the matches resting on the bars 13 may remain still in engagement with holes 7 and those in compartments 4, 5, remain for the same reason engaged in holes 6 and separating-slides for shutting off the holes 7 to prevent the matches from dropping into tubes 9 before the proper moment, as specified.

4. In the apparatus herein specified, tubes 9, and 14, means for alining the same, feeler mechanism for verifying the completion of the charge, said feeler mechanism comprising spring-pressed feelers mounted on the cross-bars of a frame, springs being adapted to yield on the feelers meeting matches contained in tubes 9, said feelers having lugs which, should a match be absent, will become interposed in the line of the engaging abutments so as to prevent the tubes 9 from coinciding with tubes 14, as specified.

5. In a match-making machine, a cylindrical tube for arranging the matches with their heads all one way, said tube being curved or bent at its lower end and provided with a longitudinal slot at the concave side of the curve and being made of a width sufficient to give passage to the stem, but not to the head, of the match, the diameter of the tube being sufficient to allow of a match passing therethrough lengthwise but not crosswise and to allow the head of a match to turn therein and the extent of the bend of said tube being such that a match cannot pass therethrough unless the stem protrudes through the slot, as specified.

The foregoing specification of my apparatus for automatically filling boxes with matches or the like signed by me this 8th day of December, 1897.

VICTOR CARASSALE.

Witnesses:
EDWARD P. MACLEAN,
MAURICE HENRI PIGNET.