Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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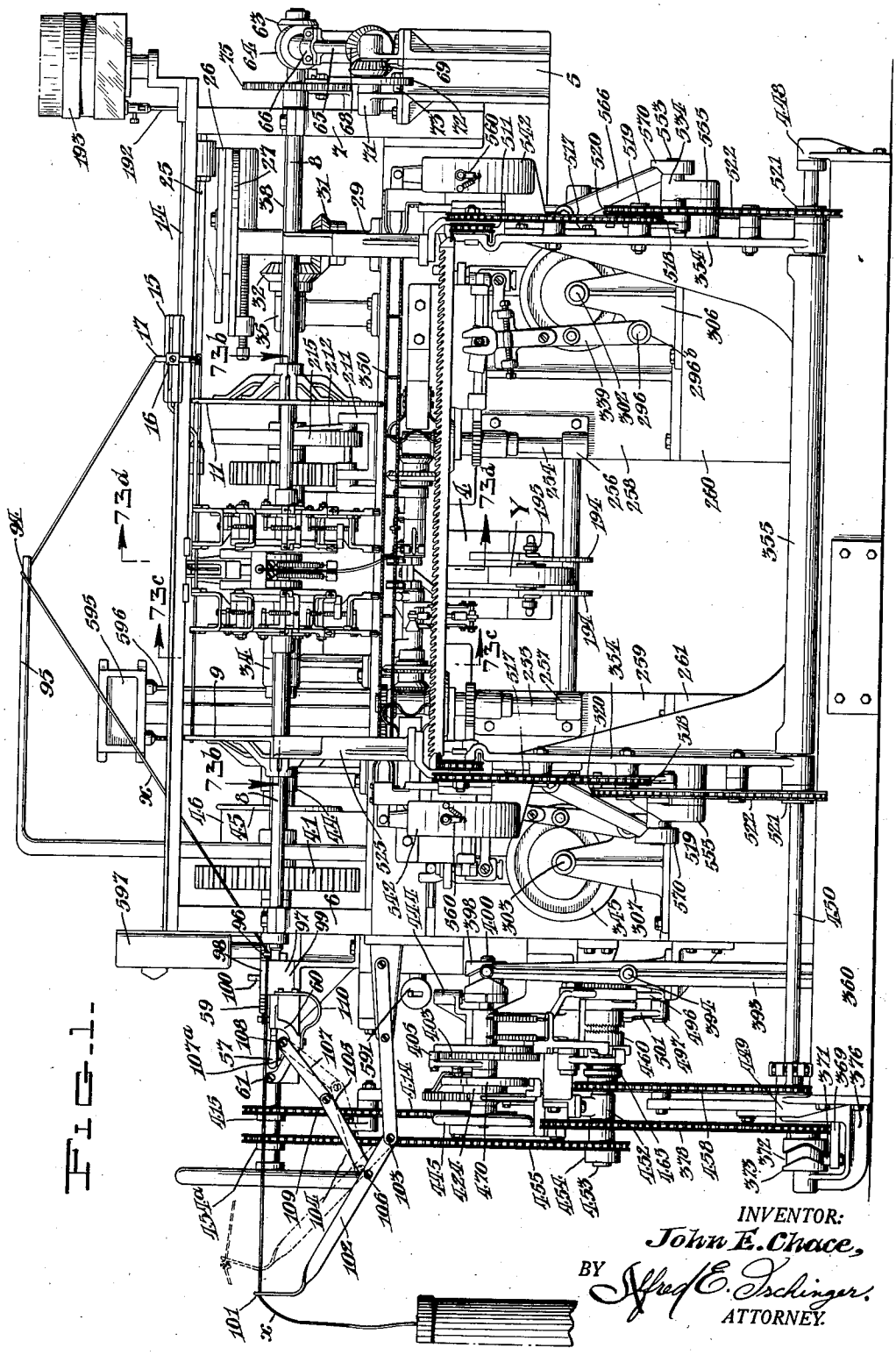


FIG. 1.

INVENTOR:
John E. Chace,
BY Alfred E. Ischinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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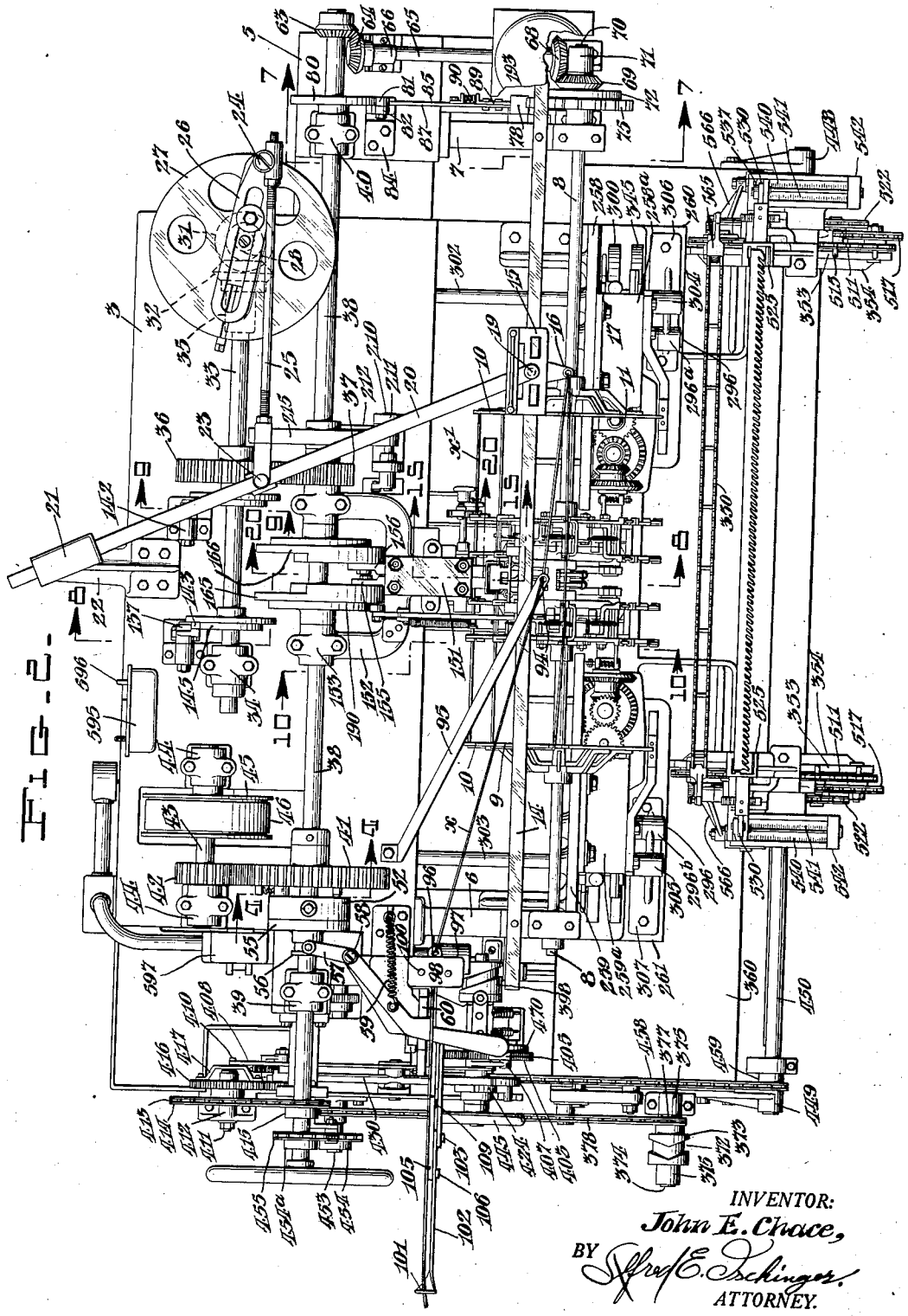


Fig. 2.

INVENTOR:
John E. Chace,
BY Alfred E. Tschinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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FIG. 3.

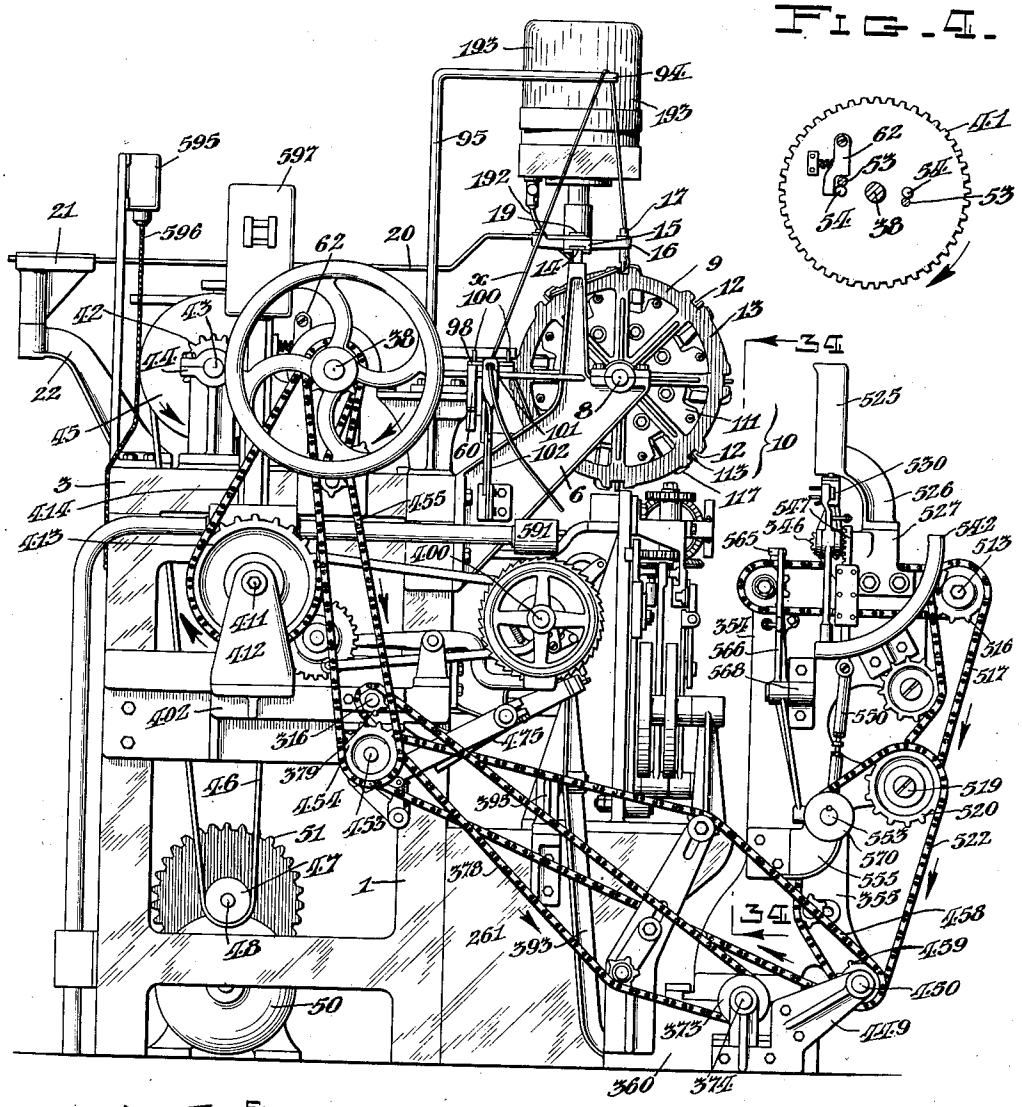
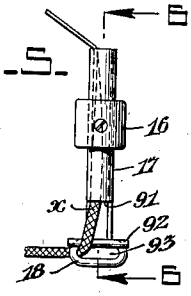


FIG. 4.

FIG. 5.



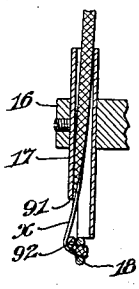


FIG. 6.

INVENTOR:
John E. Chace,
BY Alfred E. Zehlinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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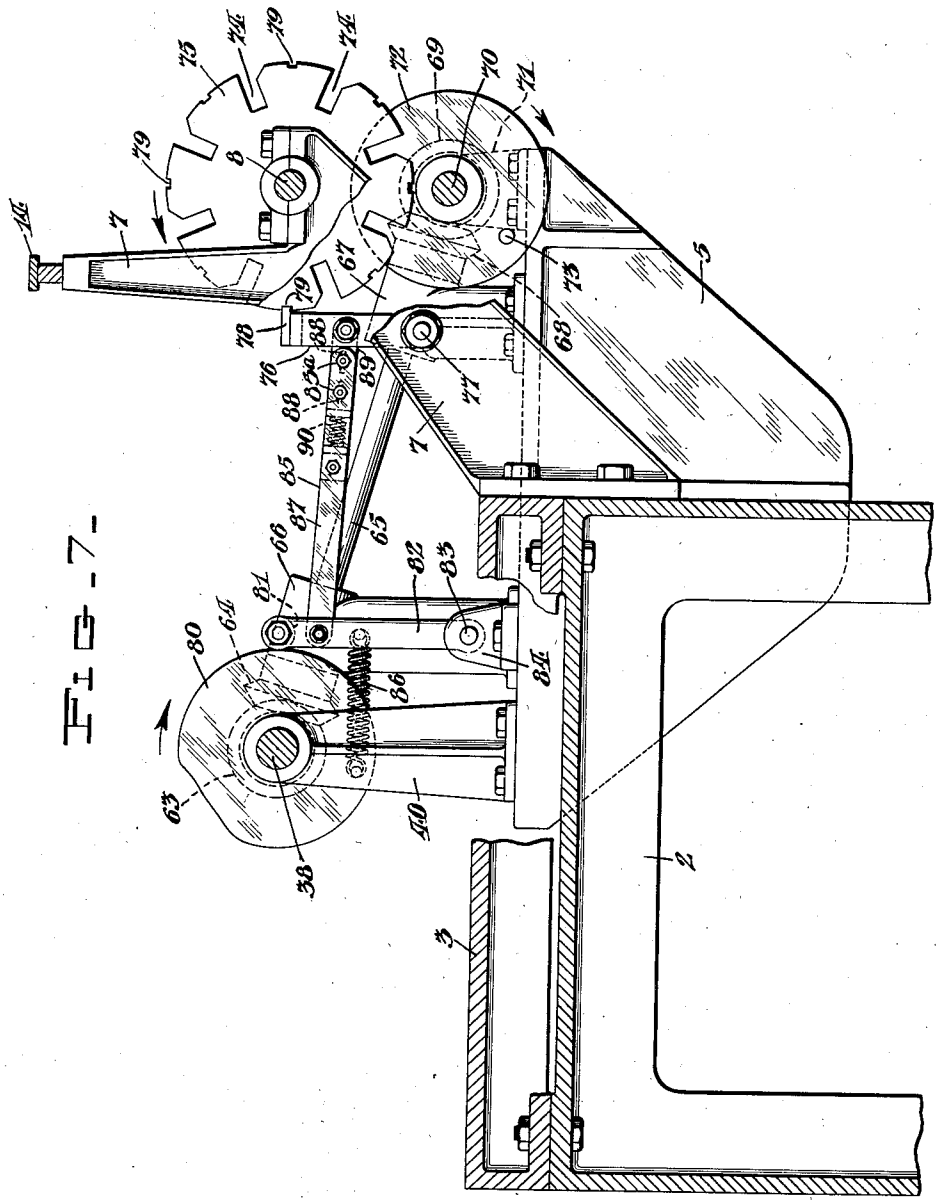


Fig. 7.

INVENTOR:
John E. Chace,
BY Alfred E. Tschinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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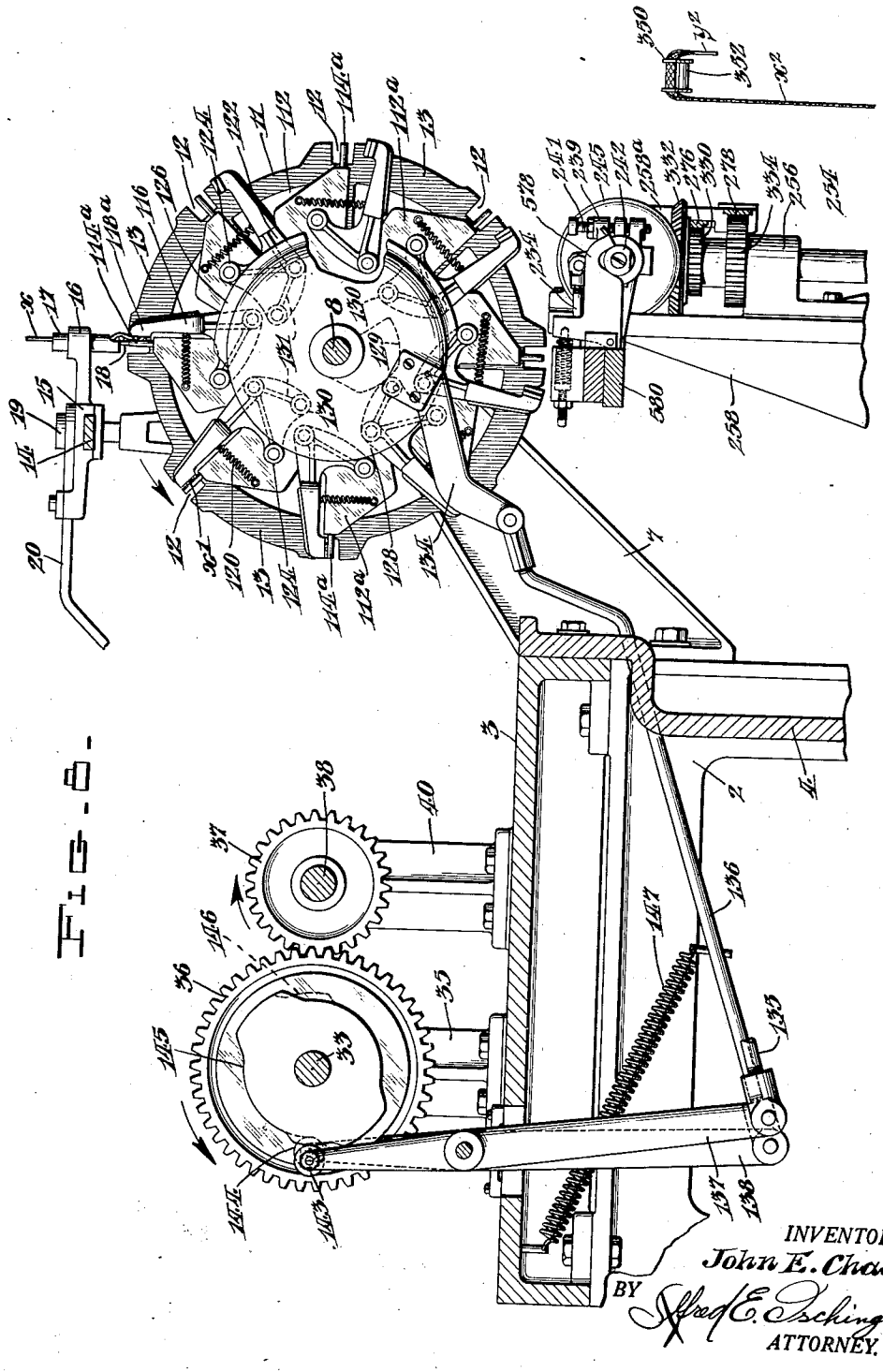


Fig. 8.

INVENTOR:
John E. Chace,
BY Alfred E. Tschinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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Fig. 25.

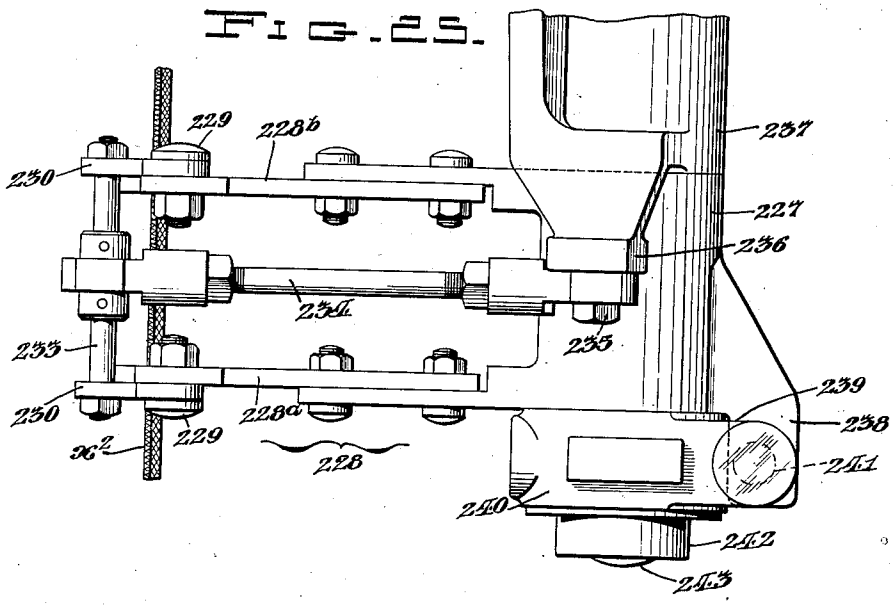
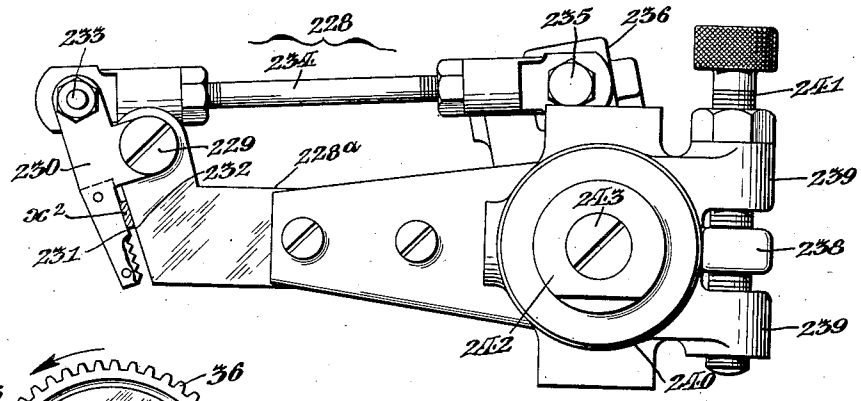


Fig. 26.



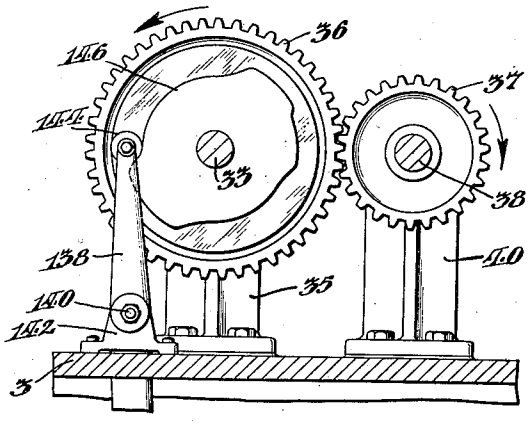


Fig. 9.

INVENTOR:
John E. Chace,
BY Alfred E. Schinger,
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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FIG. 20.

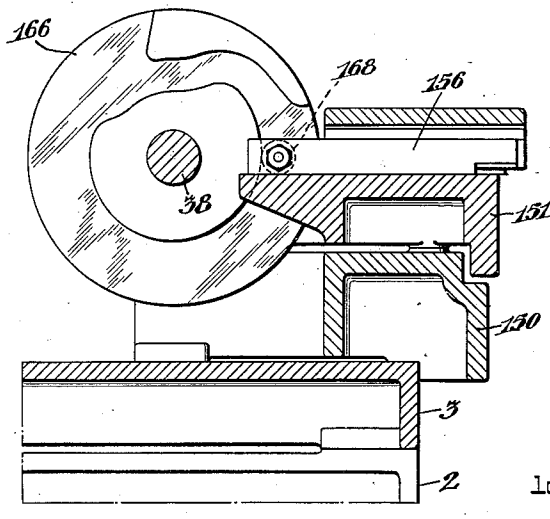


FIG. 10.

FIG. 12.

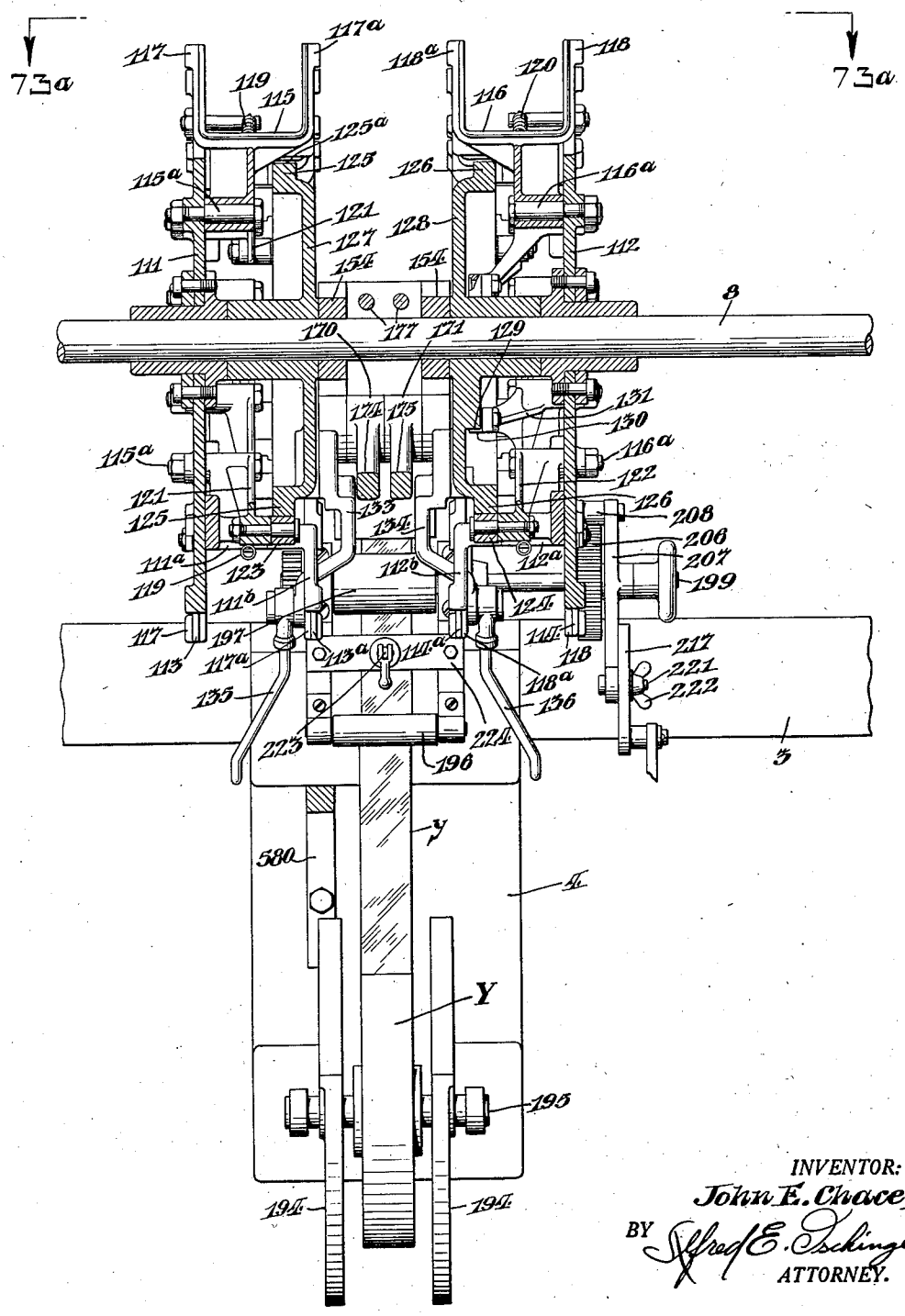
INVENTOR:
John E. Chace,
BY Alfred E. Jochinger,
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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Fig. 11.



INVENTOR:
John E. Chace,
BY Alfred E. Eschinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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Fig. 13.

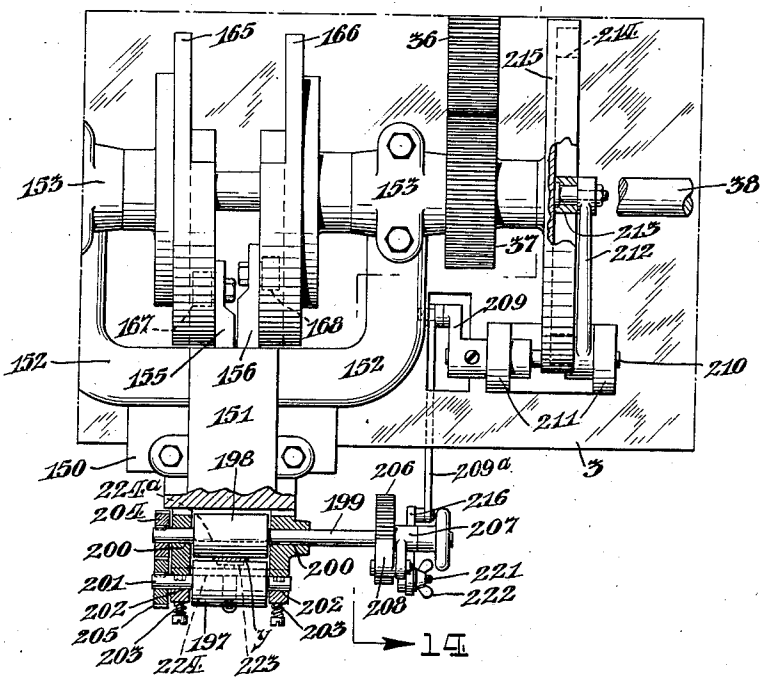
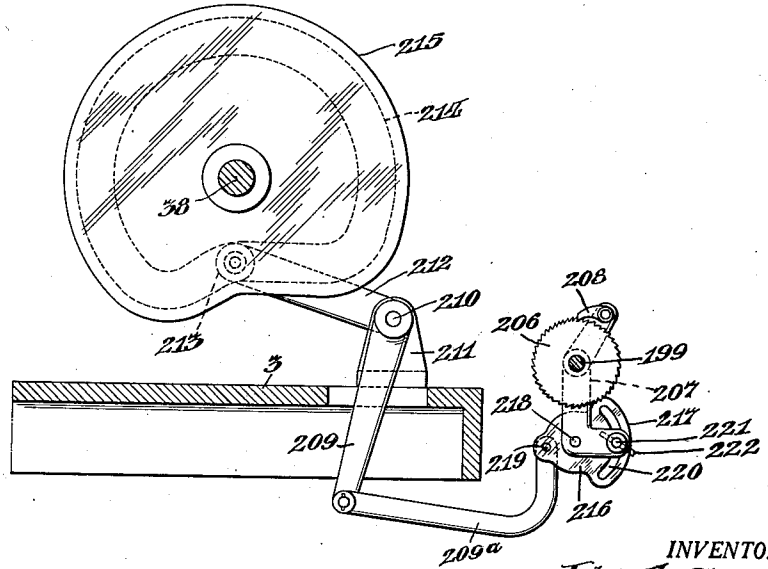


Fig. 14.



INVENTOR:
John E. Chace,
BY Alfred E. Zschinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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Fig. 15.

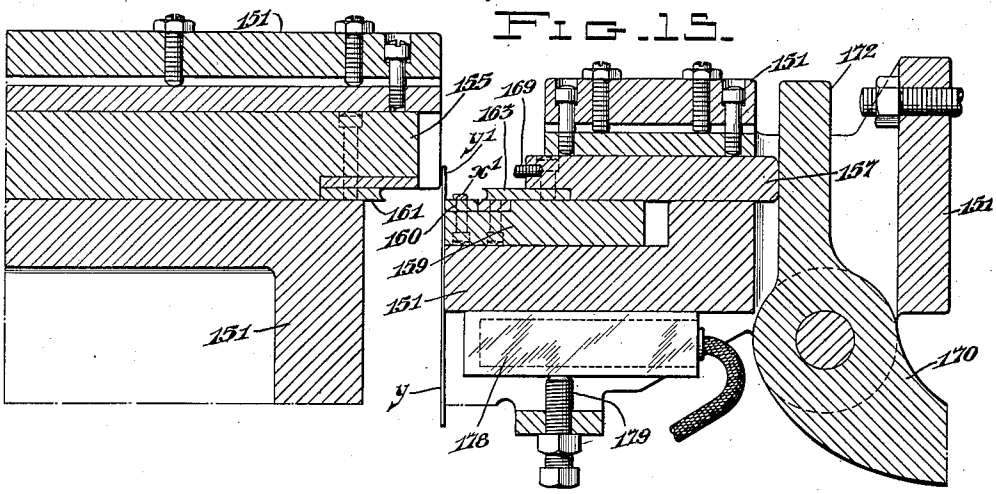


Fig. 16.

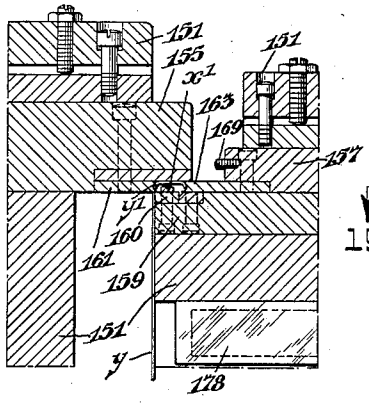


Fig. 17.

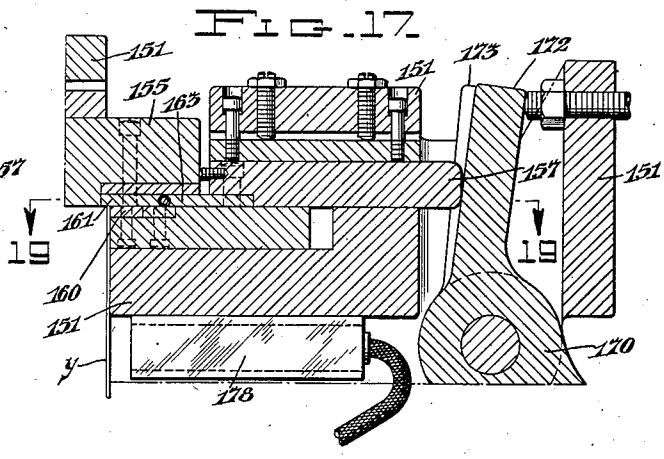


Fig. 19.

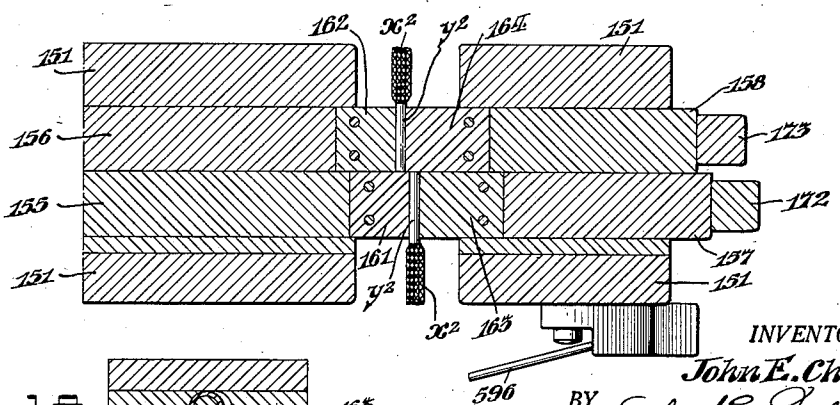
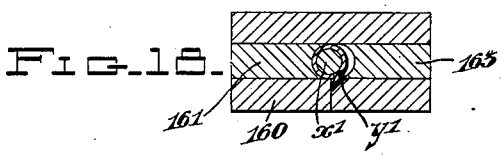


Fig. 18.



INVENTOR:
John E. Chace,
BY Alfred E. Tschinger,
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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FIG. 21.

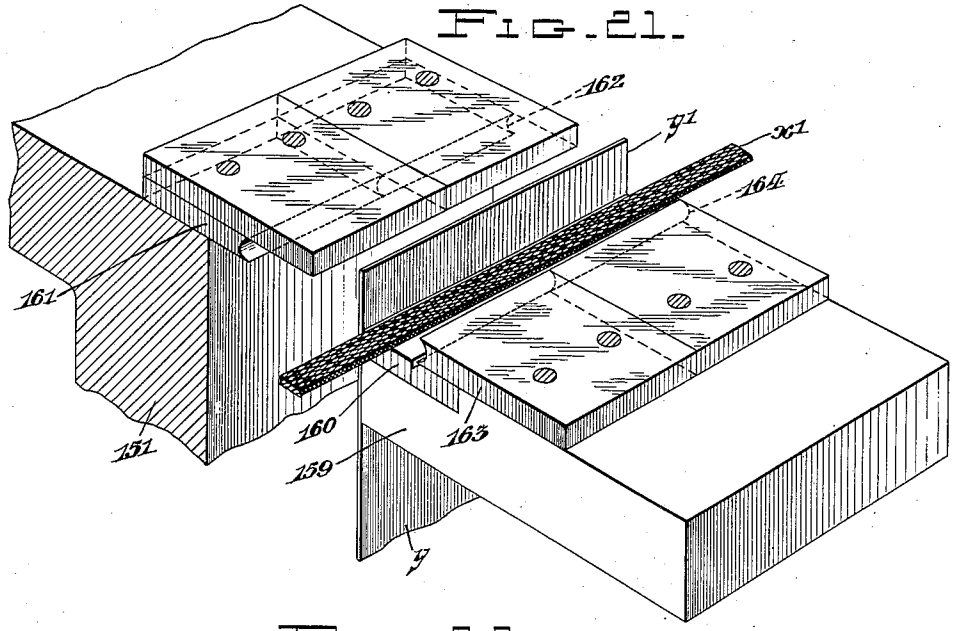
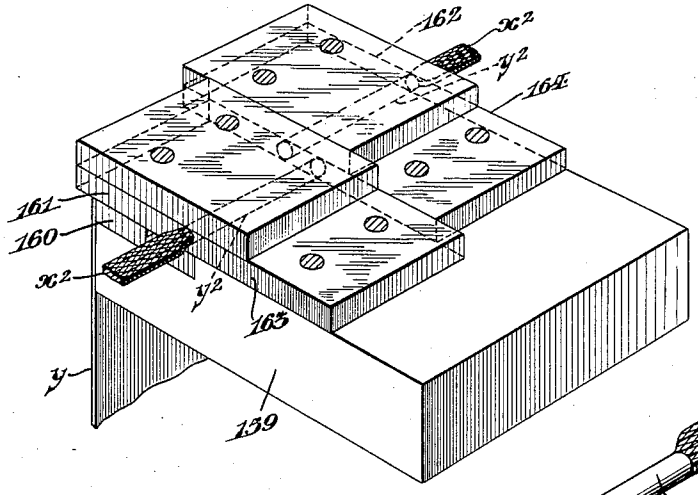


FIG. 22.



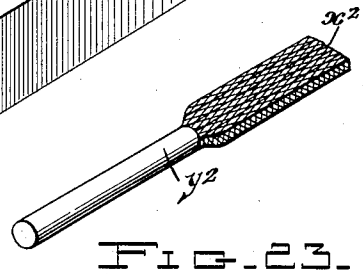
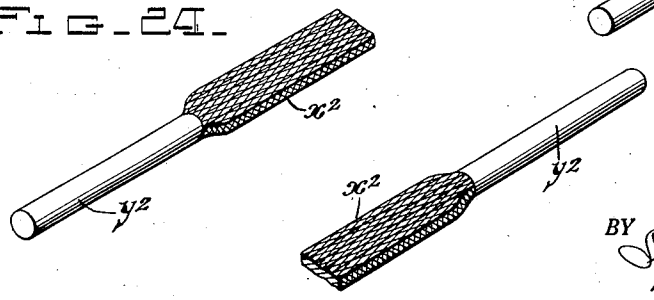


FIG. 23.

FIG. 24.



INVENTOR:
John E. Chace,
BY Alfred E. Tschinger,
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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FIG. 27.

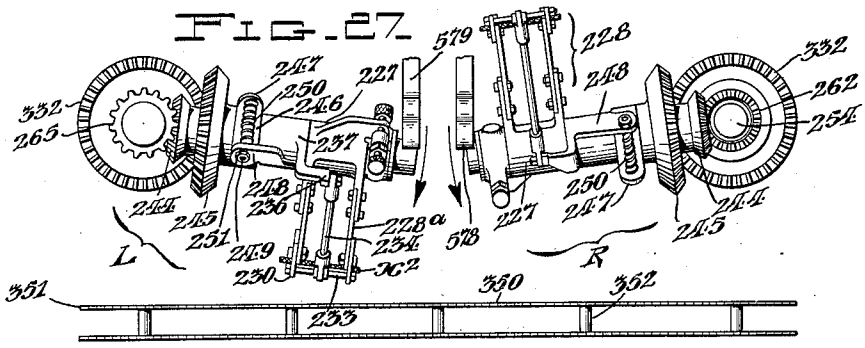


FIG. 28.

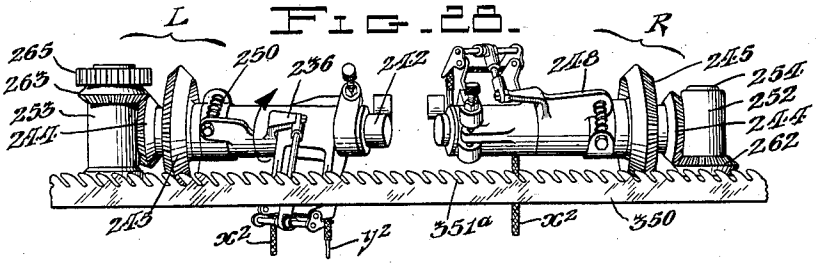


FIG. 29.

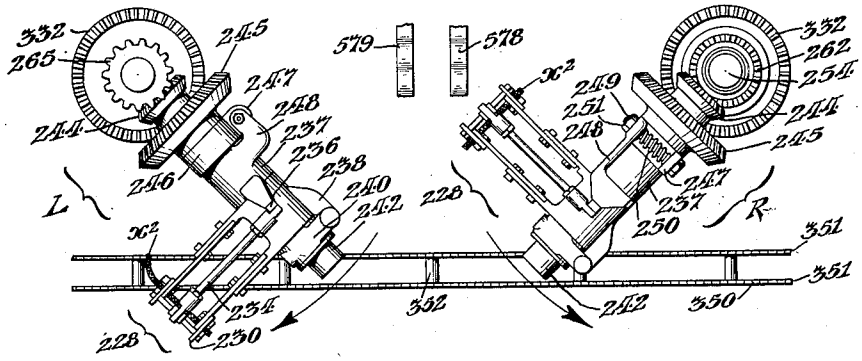
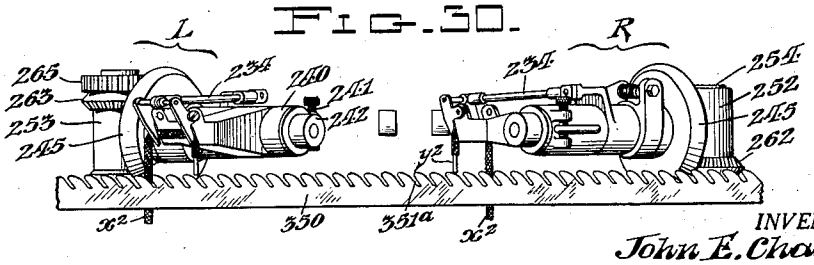


FIG. 30.



INVENTOR:
John E. Chace,
BY Alfred E. Ischinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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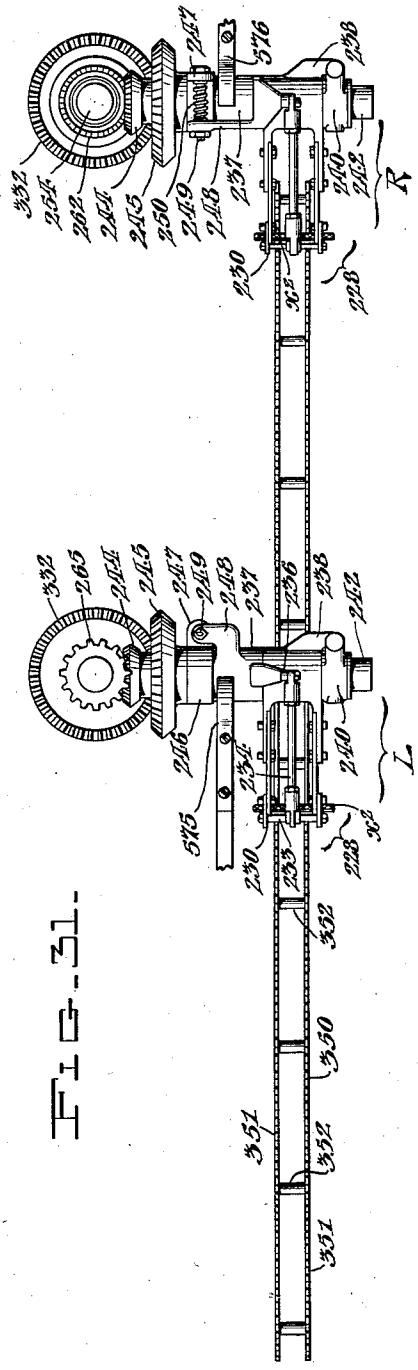


Fig. 31.

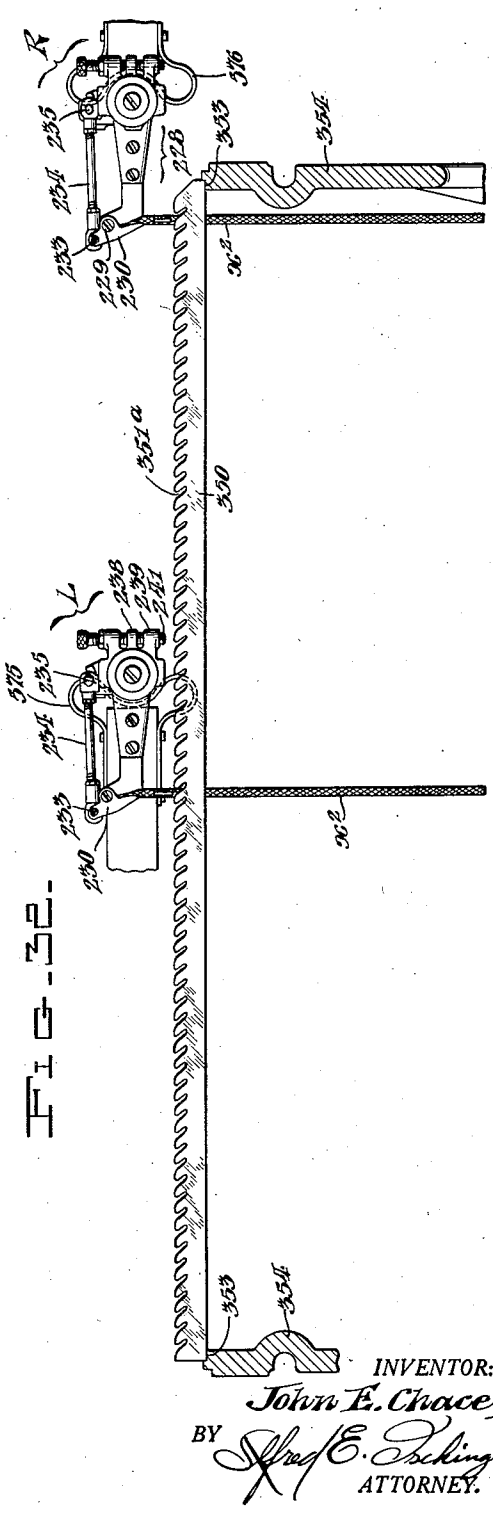


Fig. 32.

INVENTOR:
John E. Chace,
BY Alfred E. Ischinger,
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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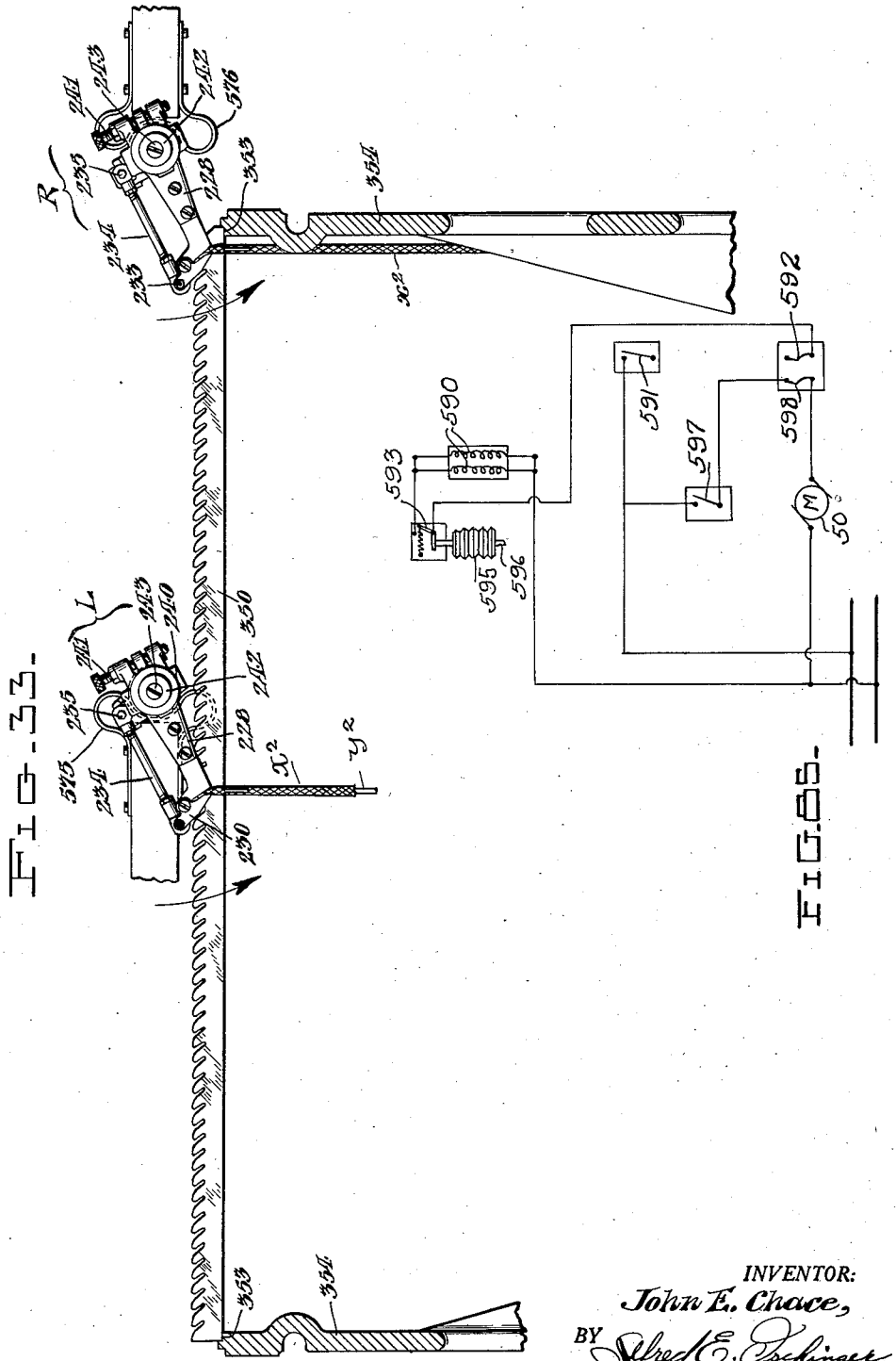


FIG. 33.

FIG. 65.

INVENTOR:
John E. Chace,
BY Alfred E. Eschinger,
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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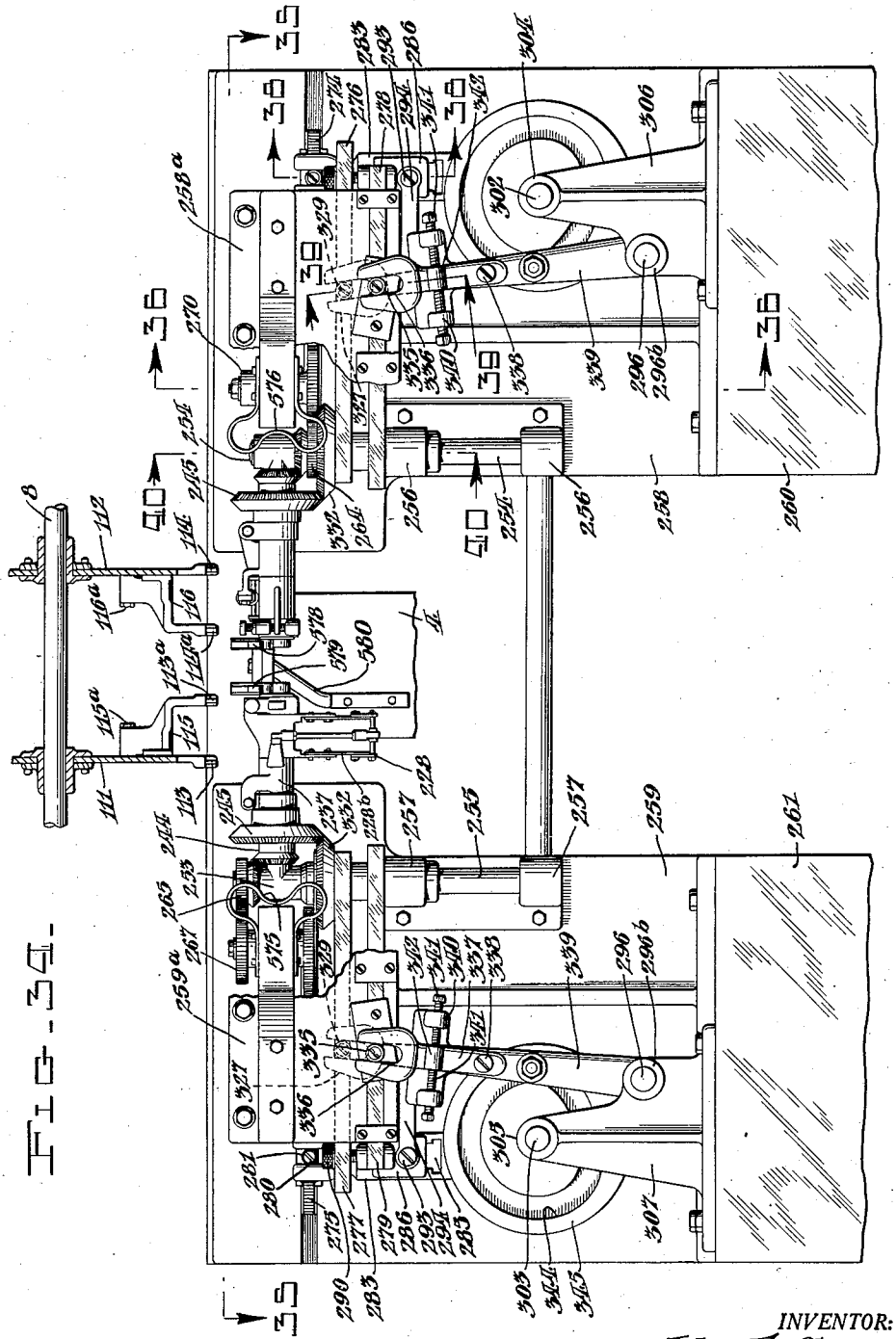


FIG. 35.

INVENTOR:
John E. Chace,
BY Alfred E. Ostlinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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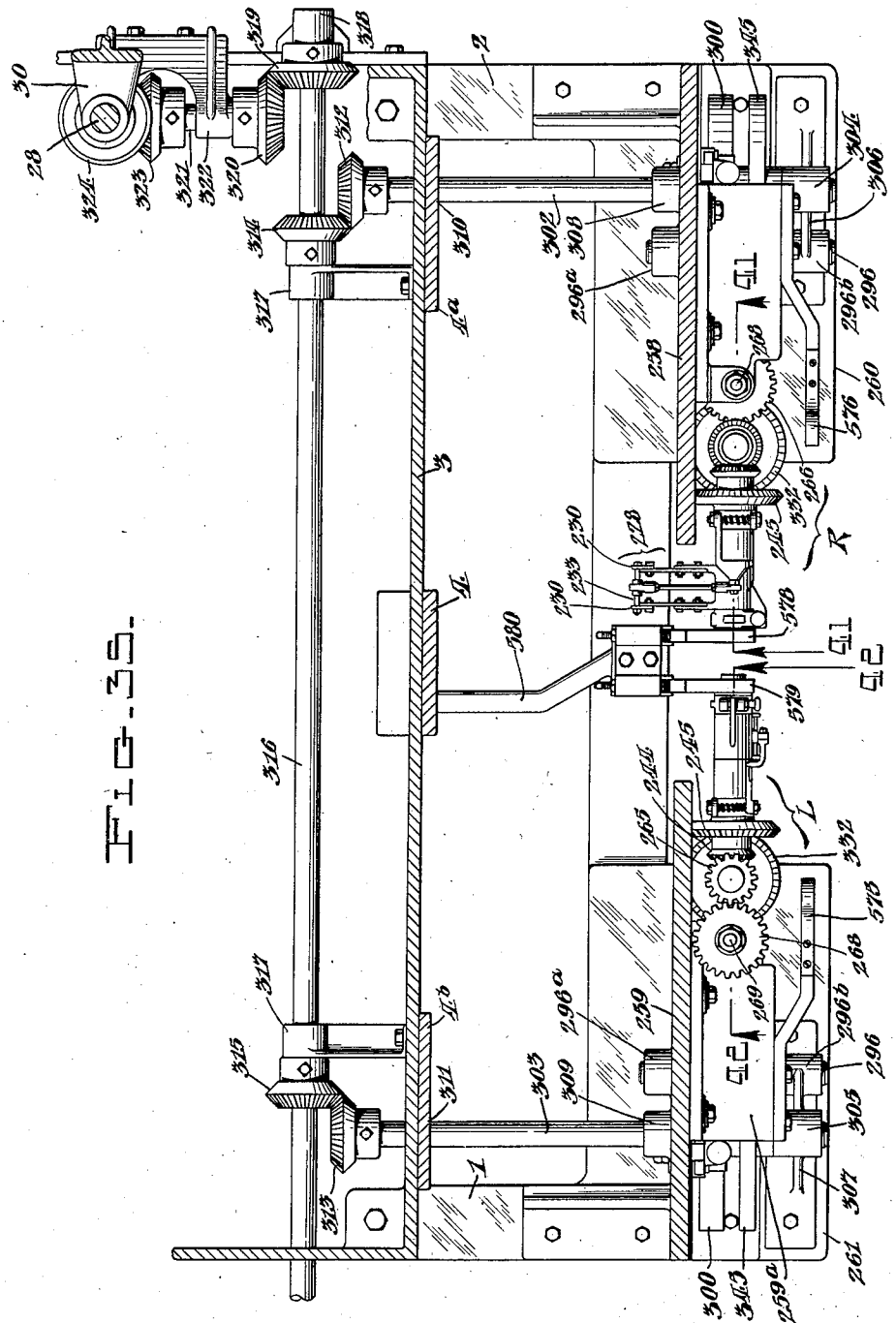


FIG. 35.

INVENTOR:
John E. Chace,
BY Alfred E. Eschinger,
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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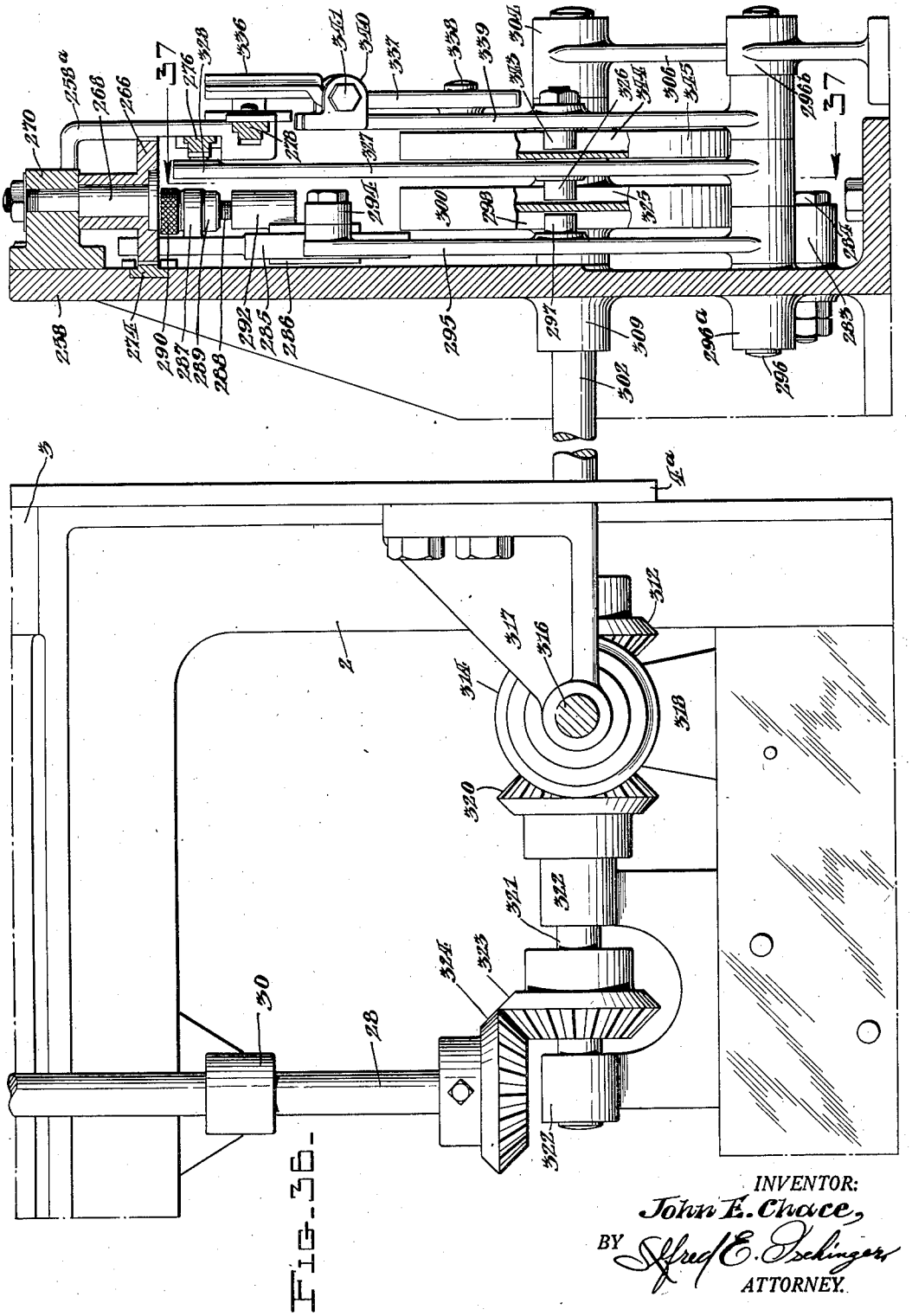


Fig. 36.

INVENTOR:
John E. Chace,
BY Alfred E. Ackinger
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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FIG-40.

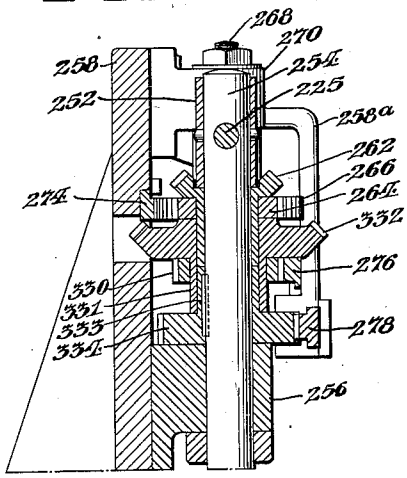


FIG-38.

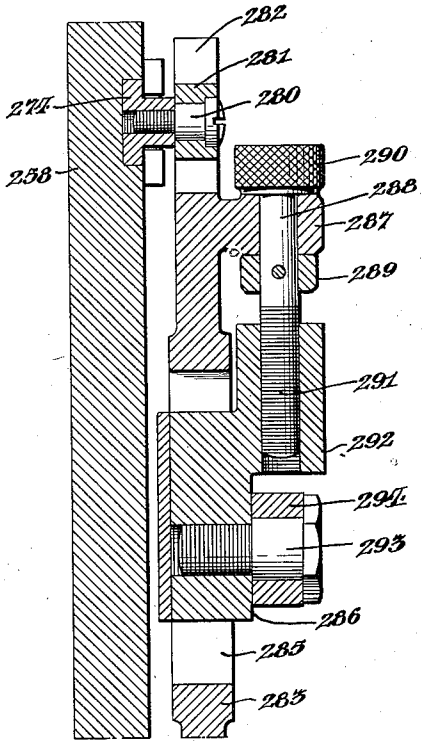


FIG-37.

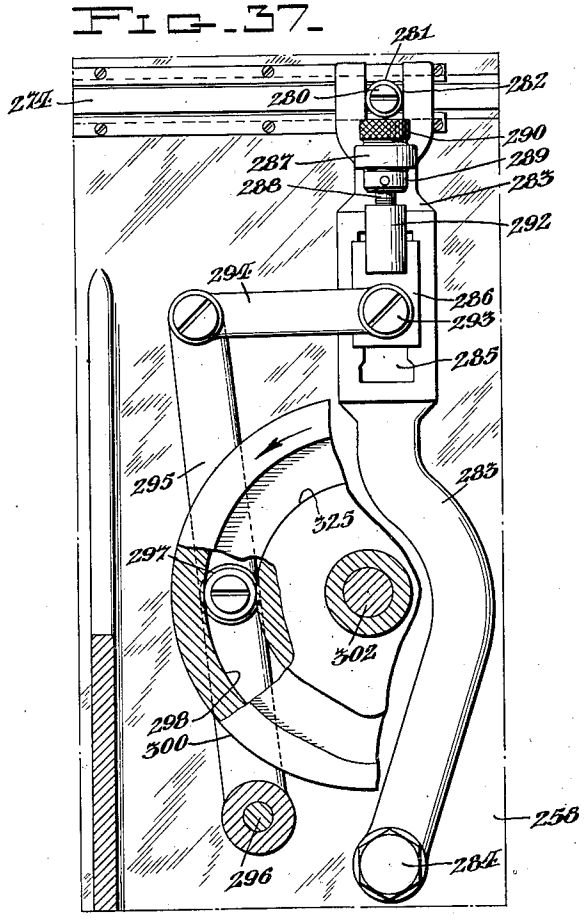
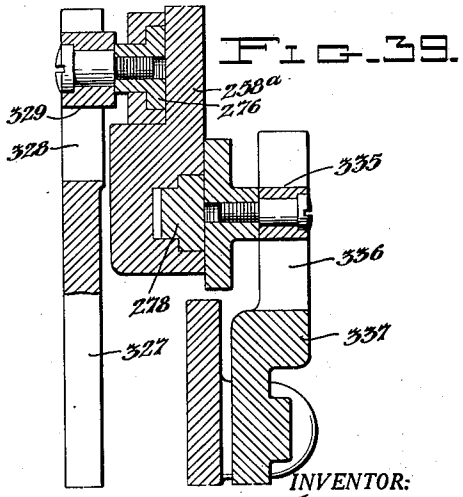


FIG-39.



INVENTOR:
John E. Chace,
BY Alfred E. Dechinger,
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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Fig. 41.

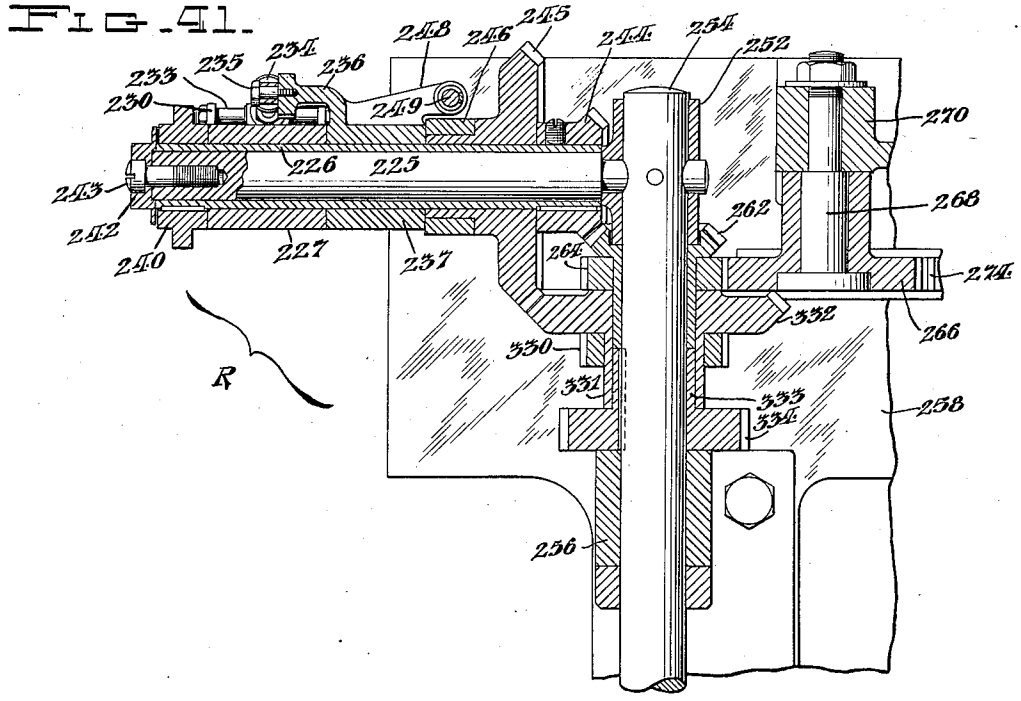
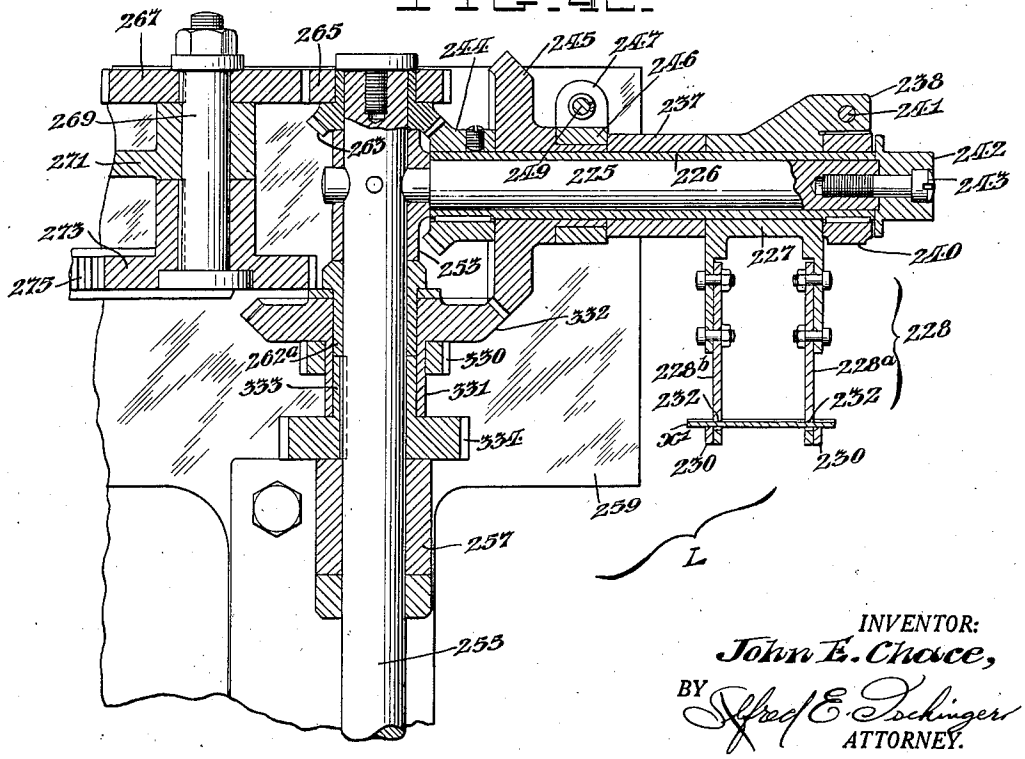


Fig. 42.



INVENTOR:
John E. Chace,
BY Alfred E. Tschinger
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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Fig. 43.

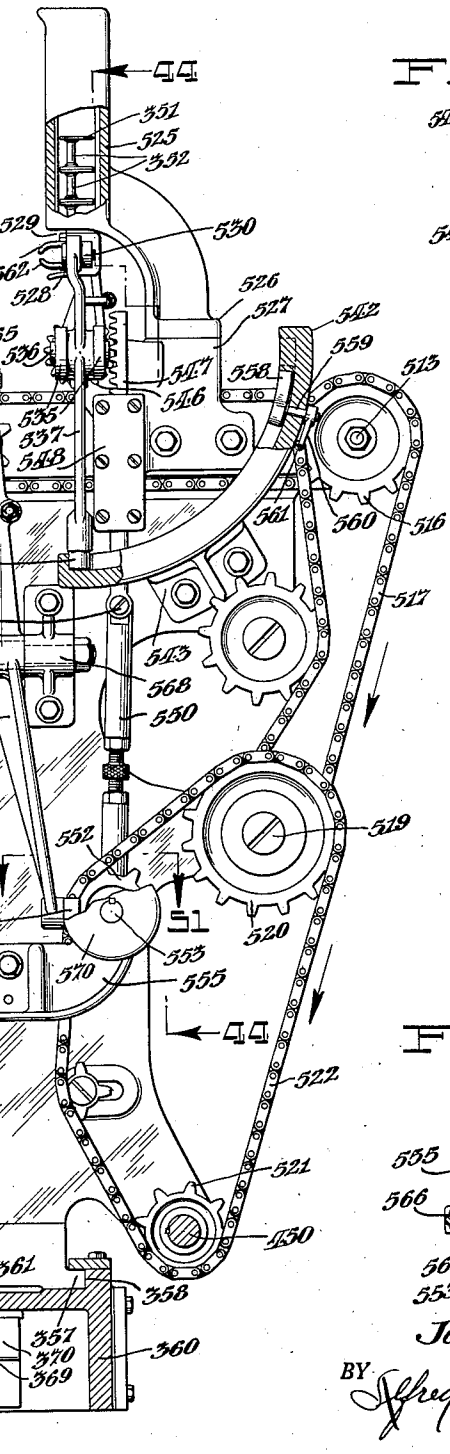


Fig. 46.

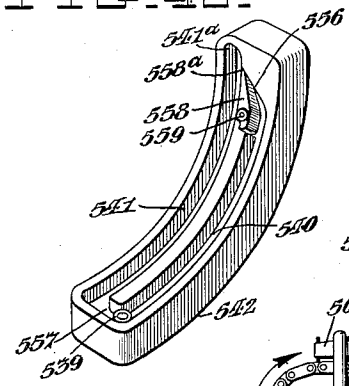


Fig. 47.

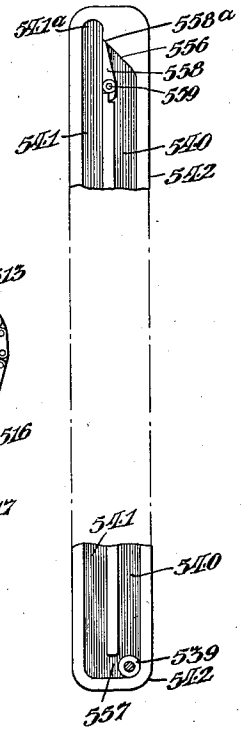
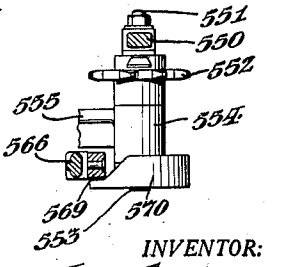


Fig. 51.



INVENTOR:
John E. Chace,
BY Alfred E. Tschinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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Fig. 49.

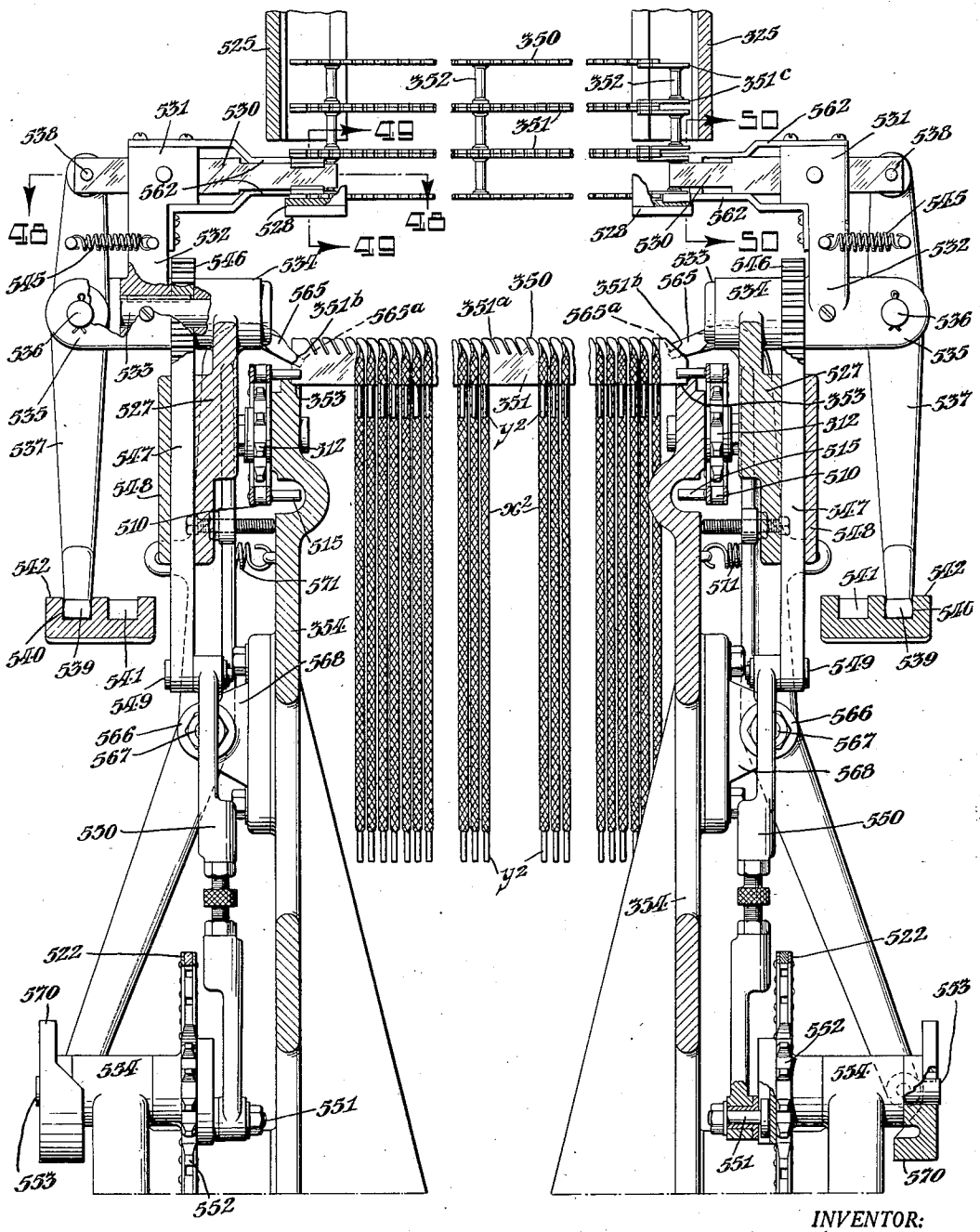
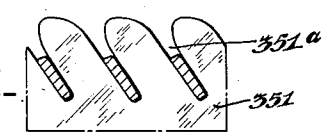


Fig. 54.



INVENTOR:
John E. Chace,
BY Alfred E. Schinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

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FIG. 48.

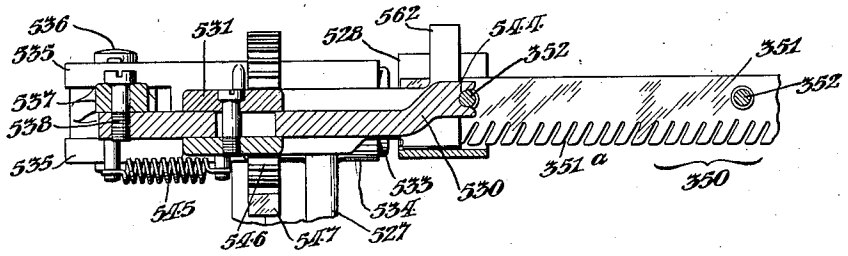


FIG. 49.

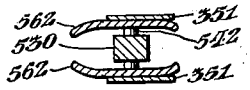


FIG. 45.

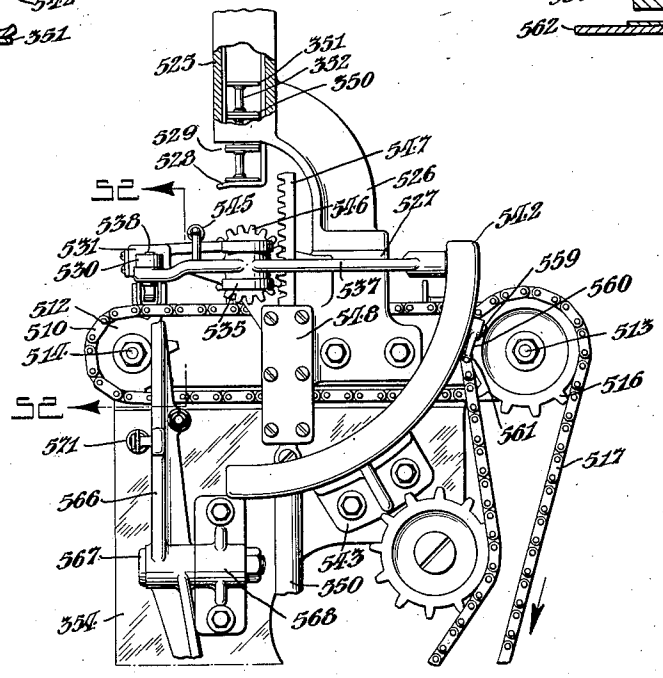


FIG. 50.

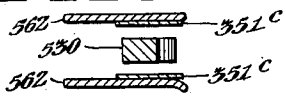


FIG. 52.

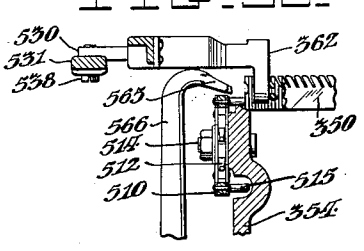
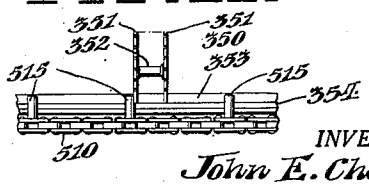


FIG. 53.

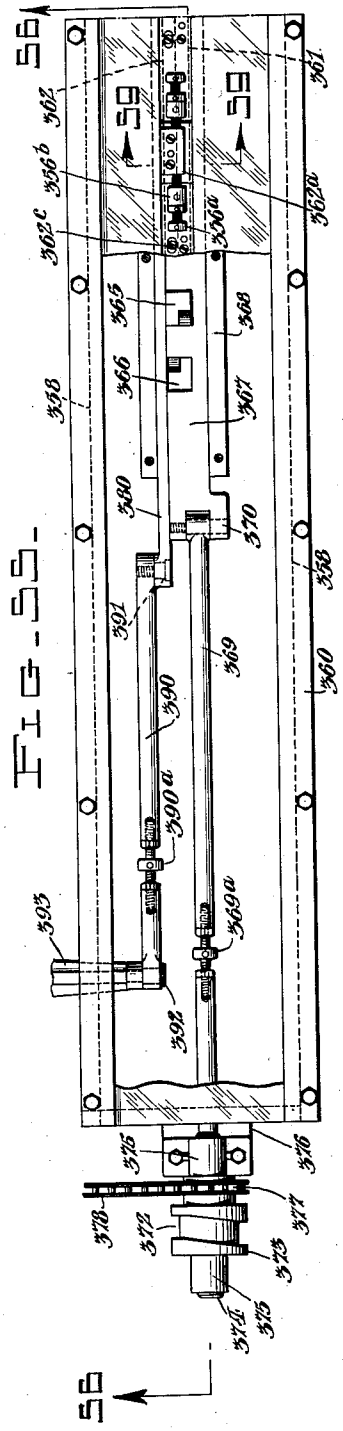


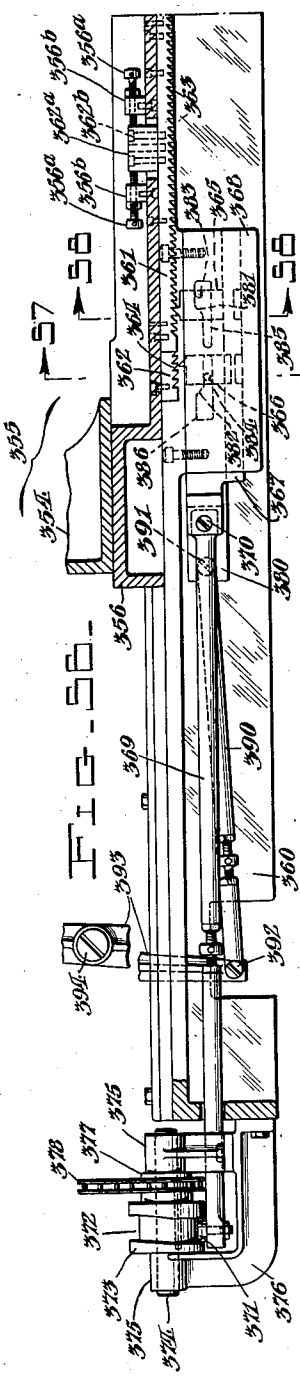
INVENTOR:
John E. Chace,
BY Fred E. Ischinger.
ATTORNEY.

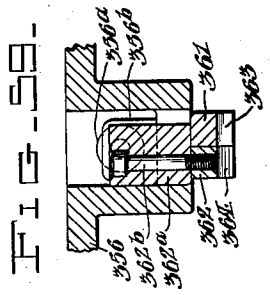
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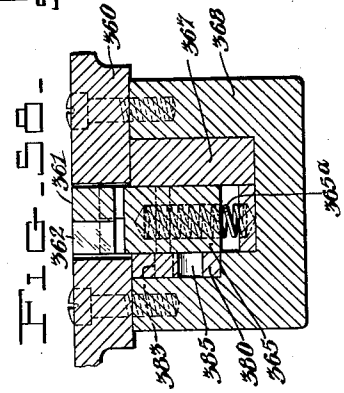
LACE TIPPING MACHINE

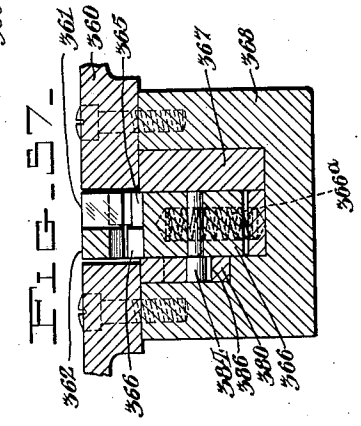
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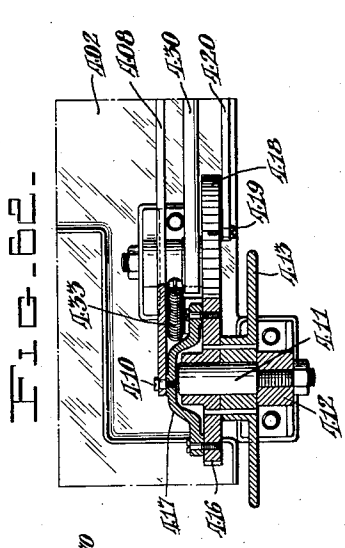


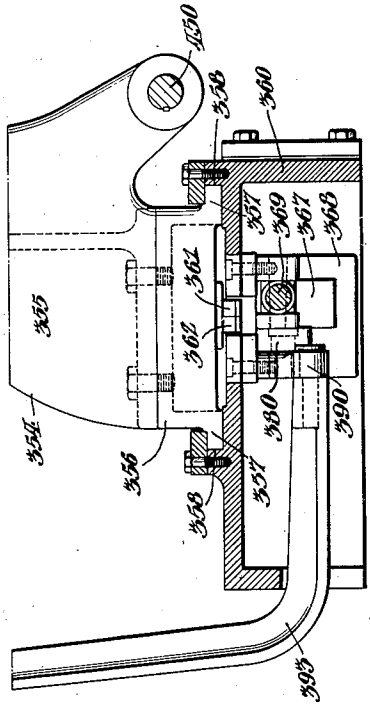
INVENTOR:
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BY Alfred E. Zschinger,
ATTORNEY.

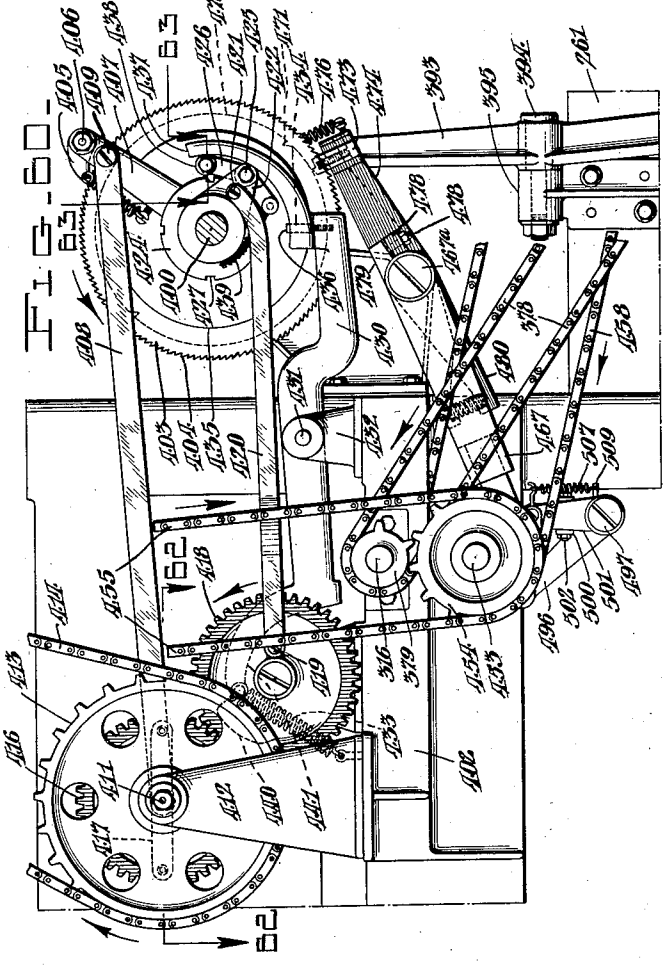
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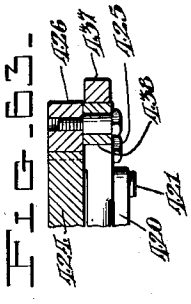
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Fig. 61.

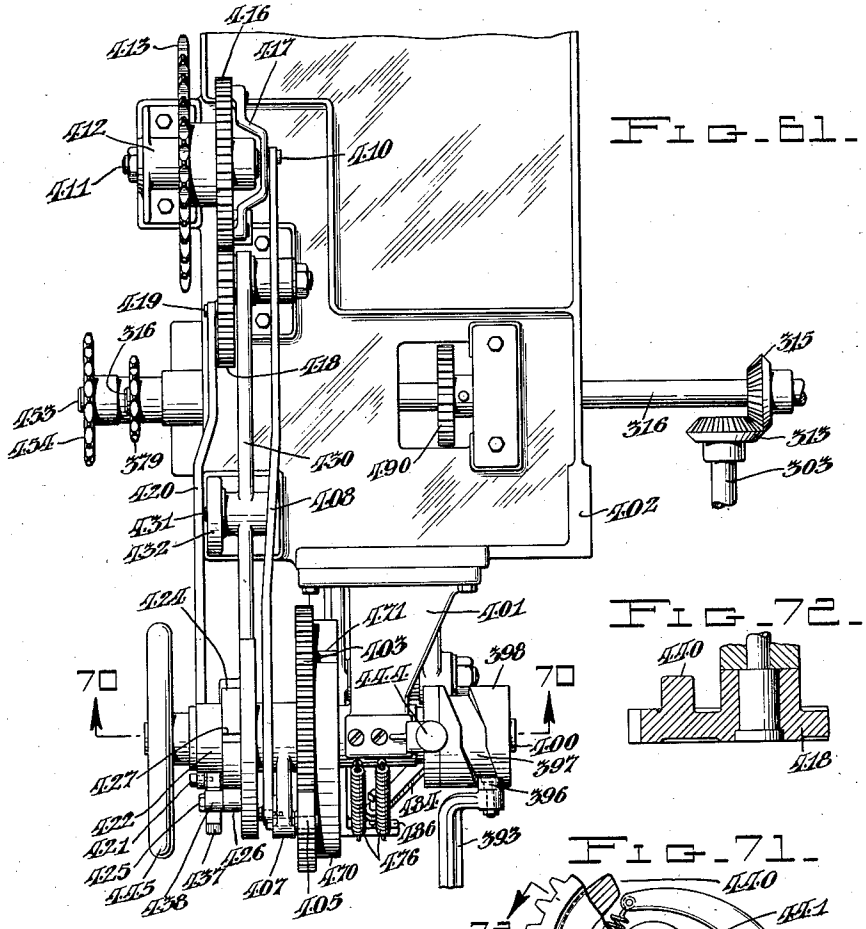


Fig. 72.

Fig. 71.

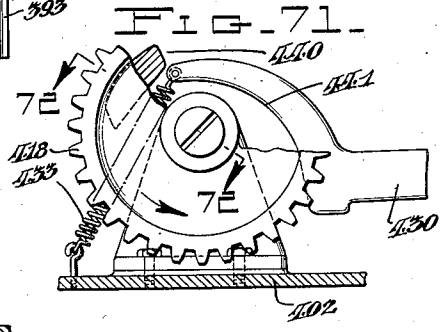
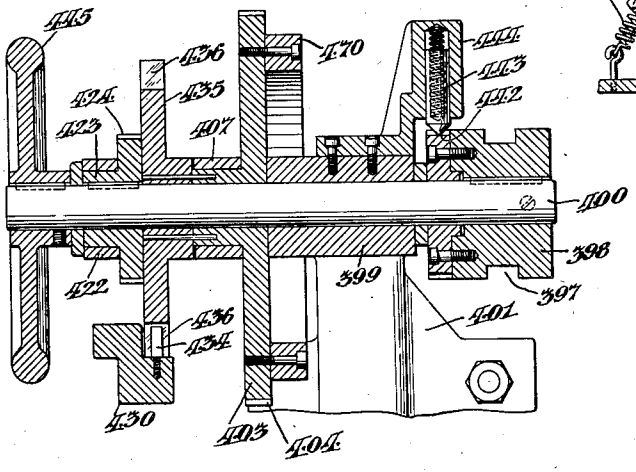


Fig. 70.



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Fig. 64.

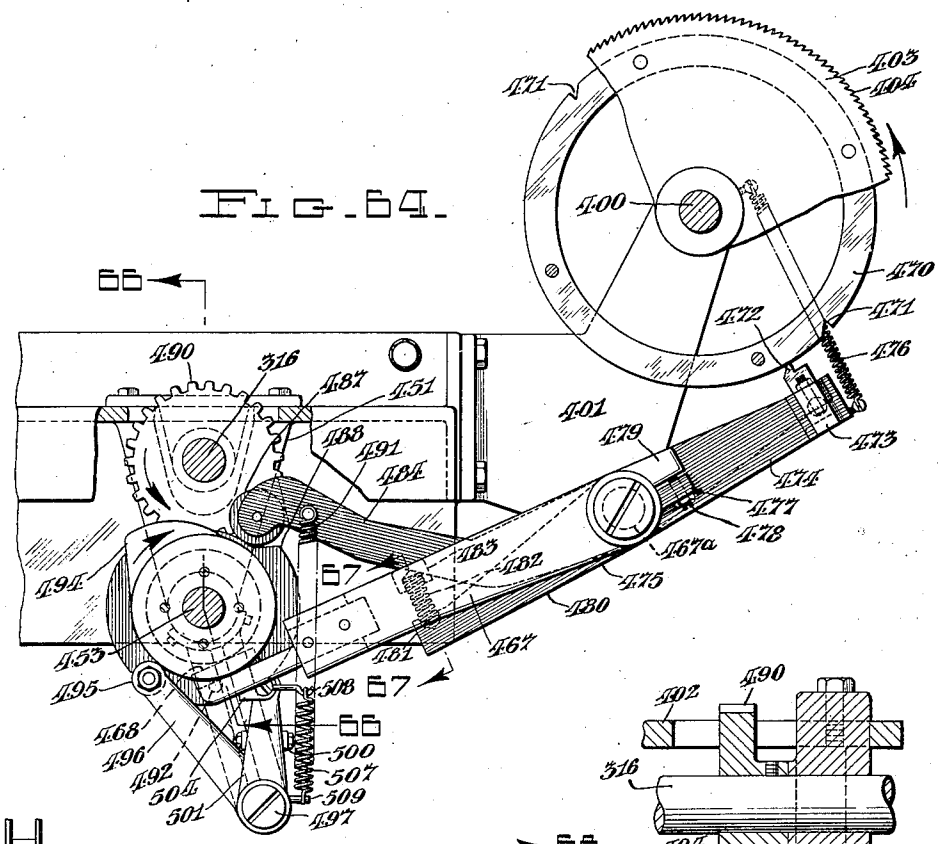


Fig. 66.

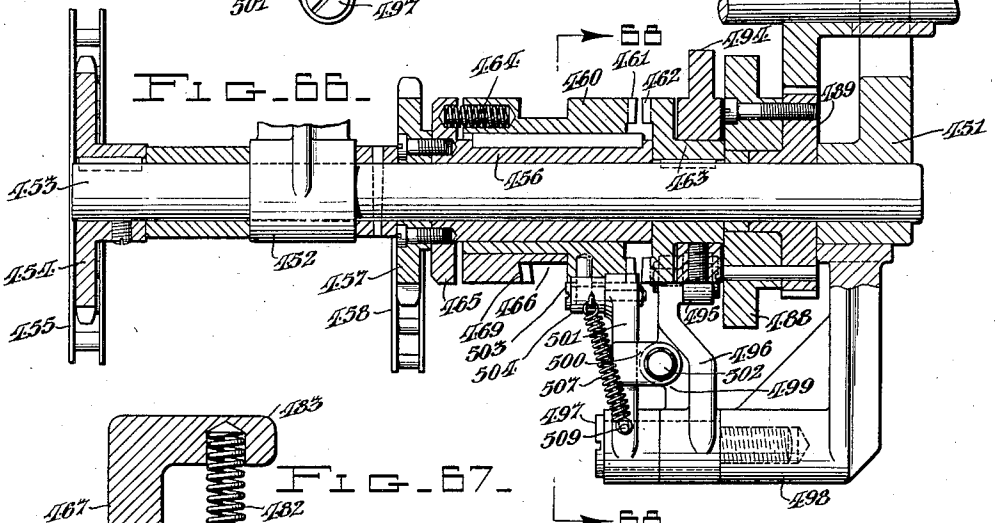
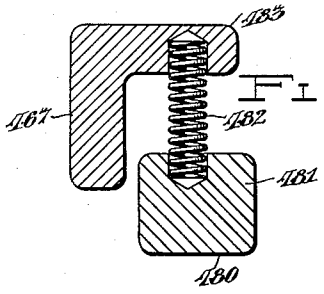


Fig. 67.



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Fig. 65.

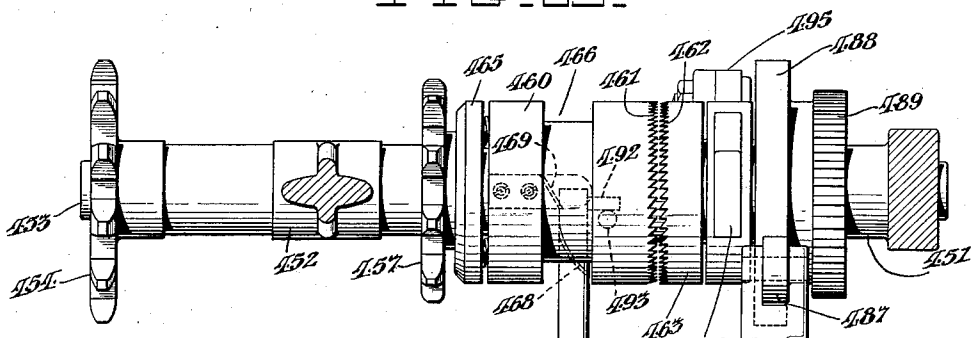
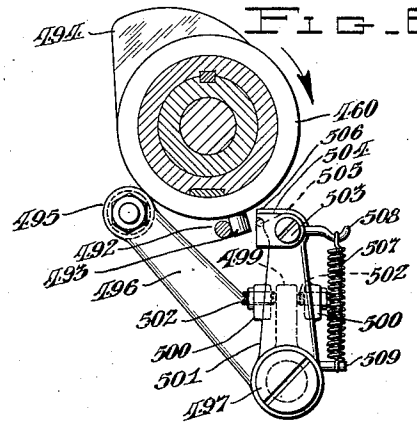


Fig. 68.



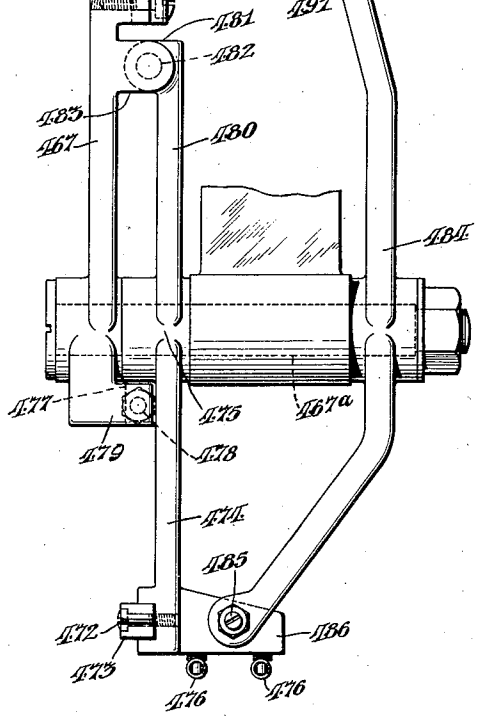
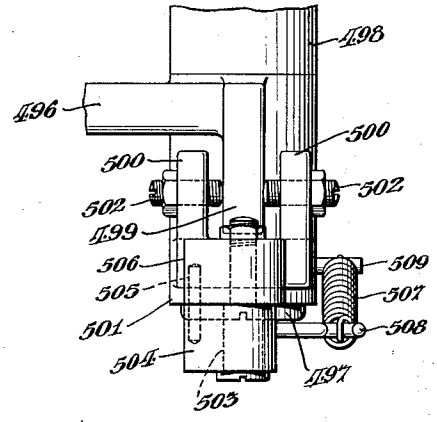


Fig. 69.



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FIG. 73a

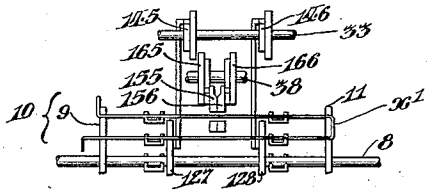


FIG. 74a

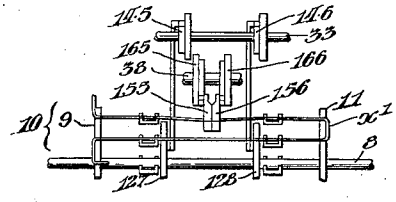


FIG. 73c

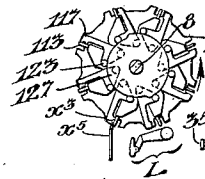


FIG. 73d

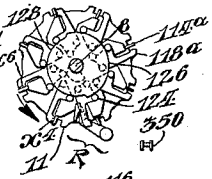


FIG. 74c

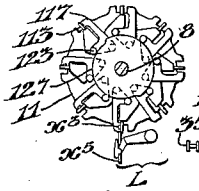


FIG. 74d

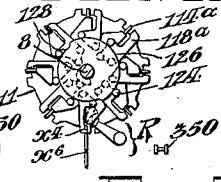


FIG. 73b

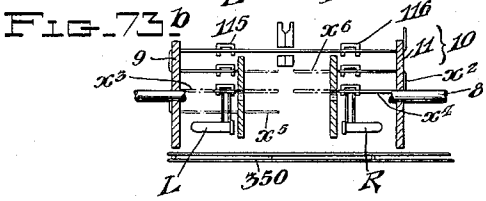


FIG. 74b

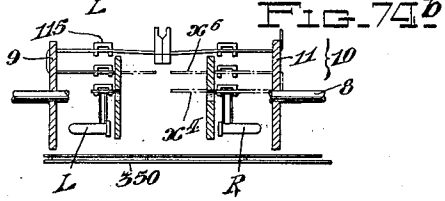


FIG. 75a

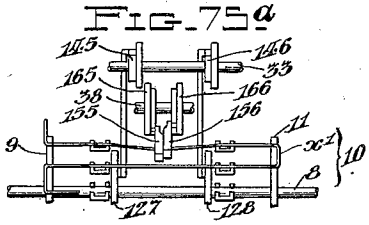


FIG. 76a

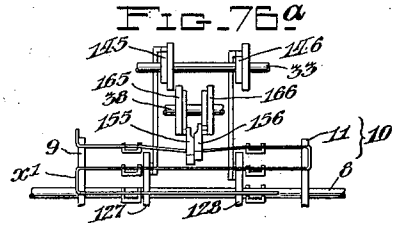


FIG. 75c

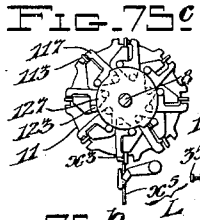


FIG. 75d

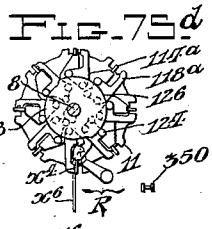


FIG. 76c

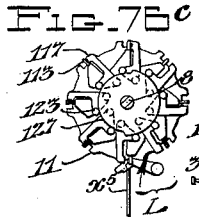


FIG. 76d

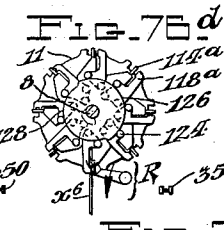


FIG. 75b

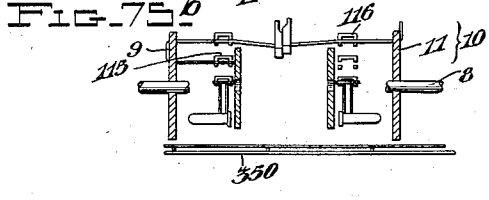
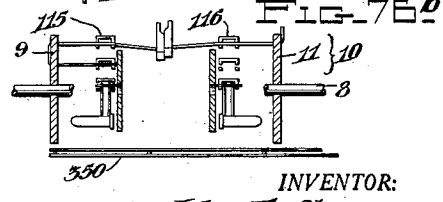


FIG. 76b



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FIG. 77a

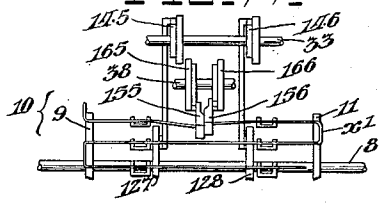


FIG. 78a

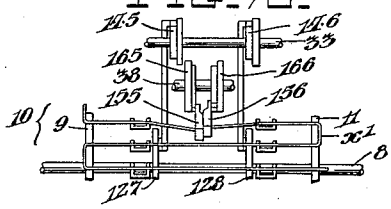


FIG. 77c



FIG. 77d

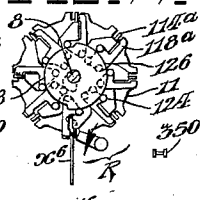


FIG. 78c

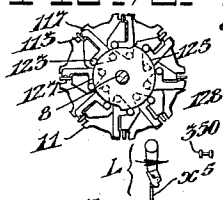


FIG. 78d

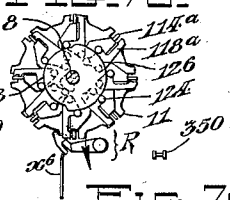


FIG. 77b

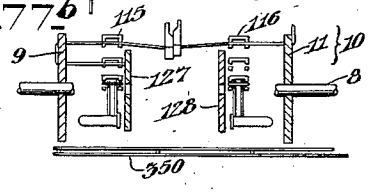


FIG. 78b

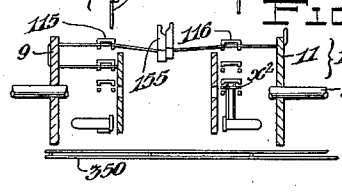


FIG. 79a

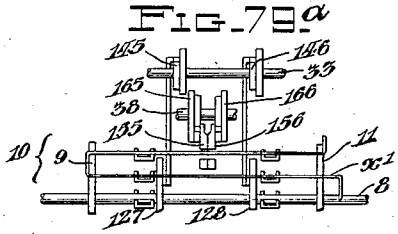


FIG. 80a

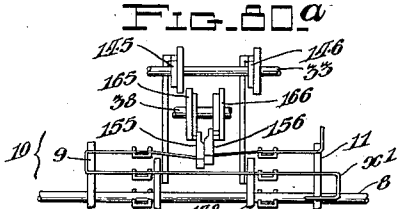


FIG. 79c

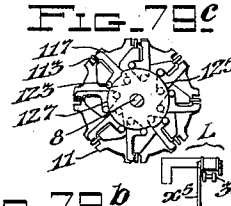


FIG. 79d

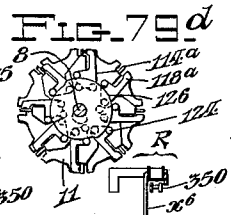


FIG. 80c

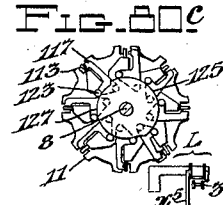


FIG. 80d

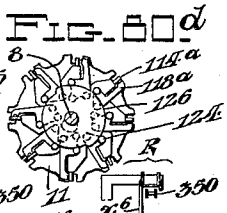


FIG. 79b

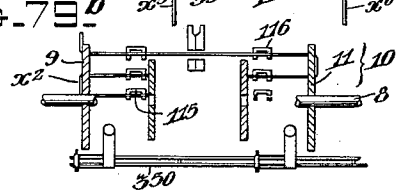
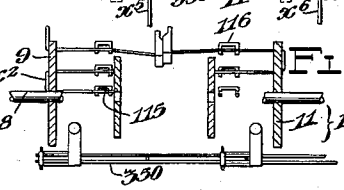


FIG. 80b



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FIG. 81a

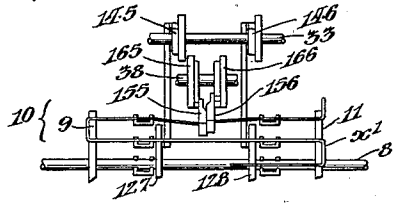


FIG. 82a

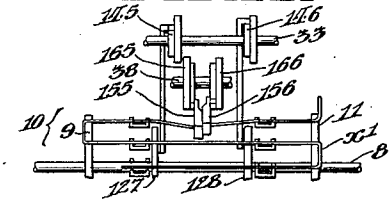


FIG. 81c

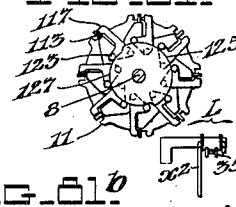


FIG. 81d

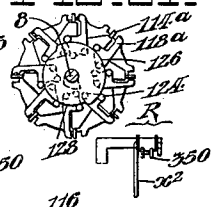


FIG. 82c

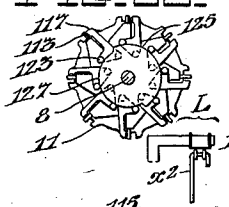


FIG. 82d

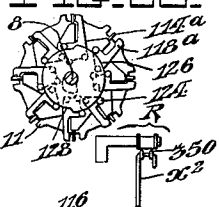


FIG. 81b

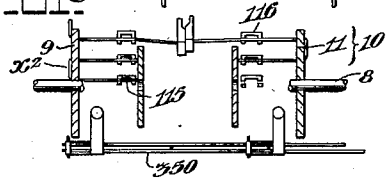


FIG. 82b

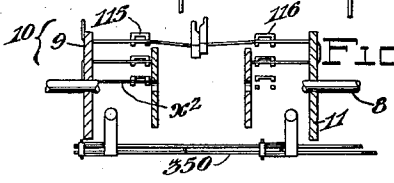


FIG. 83a

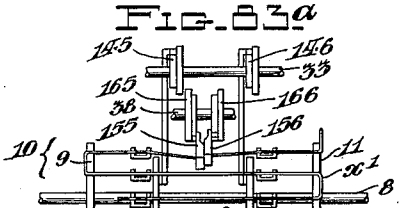


FIG. 84a

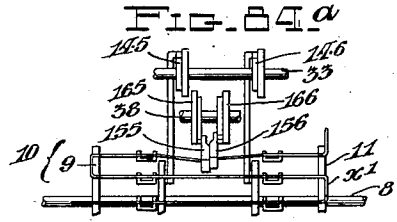


FIG. 83c

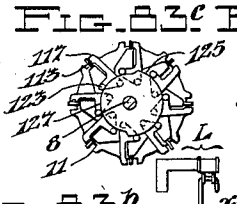


FIG. 83d

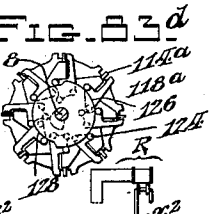


FIG. 84c

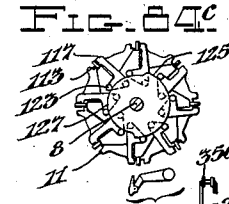


FIG. 84d

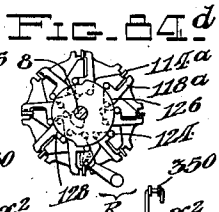


FIG. 83b

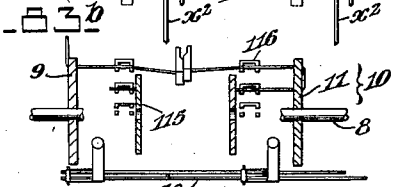
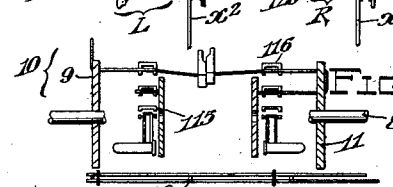


FIG. 84b



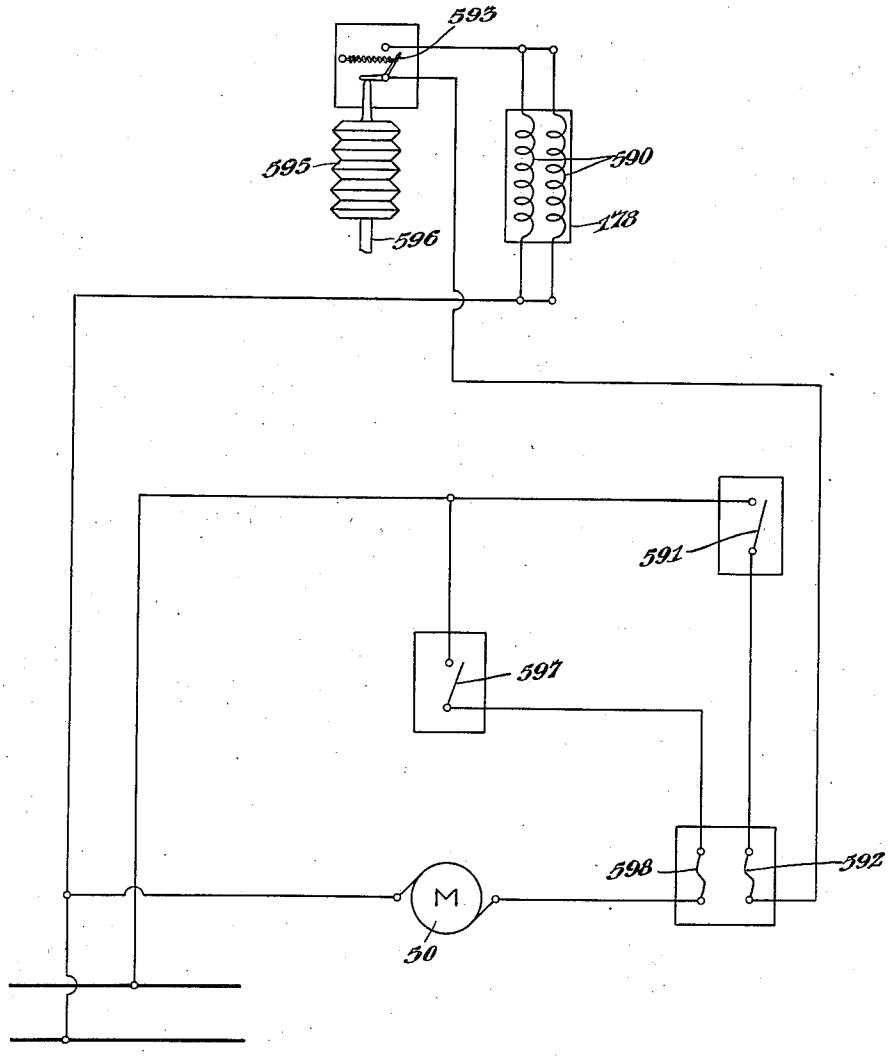
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John E. Chace,
BY Alfred E. Ischinger.
ATTORNEY.

Aug. 27, 1935. J. E. CHACE 2,012,905

LACE TIPPING MACHINE

Filed Feb. 26, 1934 31 Sheets-Sheet 31

FIG. 85.



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Patented Aug. 27, 1935 2,012,905

UNITED STATES PATENT OFFICE

2,012,905

LACE TIPPING MACHINE

John Eddy Chace, Adamsdale, Mass., assignor to The Narrow Fabric Company, West Reading, Pa., a corporation of Pennsylvania

Application February 26, 1934, Serial No. 713,003

85 Claims. (Cl. 18—1)

This invention relates generally to lace tipping machines, and more particularly to the type adapted to provide tips on shoe laces and the like.

Heretofore, lace tipping machines have been provided wherein a continuous tape is automatically laid back and forth between and around relatively spaced posts respectively carried by a pair of axially aligned laterally spaced wheels, which together constitute a tape supporting and measuring reel; and wherein such a reel is intermittently rotated to position certain portions of the tape, suspended between the wheels, successively in suitable dies adapted and operated to apply a tip of double length to each of the suspended tape runs and to sever the double tip and the portion of the tape stiffened thereby at the middle of the double tip, for providing a single tip on each end of each individual lace formed half in one run and half in the next succeeding run of the tape; and wherein the individual laces, after completion, are dropped from the reel into suitable stationary containers or onto suitable supports, whereby the laces are accumulated in bundles or bunches in predetermined numbers for subsequent manually performed pairing and packaging operations.

One object of my invention is to provide a novel lace tipping machine of this general type capable of performing its various functions faster and more efficiently than similar machines of the prior art.

Another object of the present invention is to provide novel tape-gripping means, for, and adapted to rotate with the measuring reel of such a machine, and capable of holding each run of the tape firmly between two relatively spaced points at each of the opposite sides of the tipping dies, before, during and after the tipping operation.

A further object of the invention is to provide, in a machine of the type indicated, automatically operated handling mechanism for the finished laces including a pair of universally movable grippers respectively adapted to grasp one end of alternate laces, between the above noted two relatively spaced points at which each lace is held after separation, whereby the laces are taken individually and bodily from the reel and deposited on a suitable supporting rack in predetermined spaced relation to each other, to facilitate inspection, transportation and later automatic pairing and packaging of the finished laces by mechanism which, however, forms no part of the present invention.

Another object of the invention is to provide simple and efficient means for successively releasing the finished laces from the rotary reel grippers after each lace has been grasped by the universally movable grippers of the handling mechanism.

Another object of the invention is to provide automatic mechanism for effecting intermittent relative movement between the handling grippers and the spacing rack, longitudinally of the rack, whereby each lace is positioned on the rack in its appointed place in spaced relation to its neighbors.

Another object of the invention is to provide mechanism for automatically determining when a rack is full, and means controlled by full rack determining means for moving the full rack from the lace-receiving position to a rest position, from which the rack may, subsequently, be readily removed by the operator.

Another object of the invention is to provide a magazine adapted to hold a plurality of empty racks in position to be transferred to the lace-receiving position, and means for automatically transferring an empty rack from the magazine to the filling position, together with means for positioning and holding the empty rack in the position vacated by the full rack without necessitating any interruption of the normal tape-laying, measuring, tipping, and severing operations of the machine.

Another object of the invention is to provide an automatic stop motion for detecting knots in the continuous tape, such, for example as where two strips of tape are joined together, before such knot passes to the shuttle by which the tape is laid on the measuring reel, whereby the machine will be stopped in time for the operator to correct such condition causing operation of the stop motion.

With these and other objects in view, which will become apparent from the following detailed description of the illustrative embodiment of the invention shown in the accompanying drawings, my invention resides in the novel elements, features of construction and arrangement of parts in cooperative relationship, as hereinafter more particularly pointed out in the claims.

In the drawings:—

Fig. 1 is a front elevation of the complete machine;

Fig. 2 is a plan view;

Fig. 3 is a left end elevation of the machine shown in Figs. 1 and 2;

Fig. 4 is a transverse sectional elevation taken

on the line 4—4, Fig. 2, illustrating the main drive clutch in detail;

Fig. 5 is a detached front elevation of the shuttle eye by which the tape is laid on the measuring reel;

Fig. 6 is a sectional elevation taken on the line 6—6, Fig. 5;

Fig. 7 is a transverse sectional elevation taken substantially on the line 7—7, Fig. 2, and illustrates the driving and locking mechanism for the intermittently rotatable tape supporting and measuring reel;

Fig. 8 is a transverse sectional elevation taken on the line 8—8, Fig. 2, illustrating the intermittently rotatable tape grippers associated with the reel, and the operating mechanism therefor;

Fig. 9 is a transverse sectional elevation taken on the line 9—9, Fig. 2, showing a portion of the tape gripper operating mechanism in detail;

Fig. 10 is a transverse sectional elevation taken on the line 10—10, Fig. 2, illustrating the relation between the tape grippers of the reel, the tape moistening mechanism, and the tip-strip feeding mechanism;

Fig. 11 is a longitudinal sectional elevation taken on the line 11—11, Fig. 10, illustrating the tape gripping and tip-strip feeding mechanisms;

Fig. 12 is a longitudinal sectional elevation taken on the line 12—12, Fig. 10, showing the tape moistening mechanism;

Fig. 13 is a plan view, partly in section as taken on the line 13—13, Fig. 10, illustrating the tip-strip feeding mechanism in detail;

Fig. 14 is a transverse sectional elevation taken on the line 14—14, Fig. 13;

Fig. 15 is a transverse sectional elevation taken on the line 15—15, Fig. 2, illustrating the tip-strip cutting, folding, and separating dies, in the initial position to receive the tape and tip-strip;

Fig. 16 is a view similar to Fig. 15, illustrating the tipping dies in the tip-strip cutting position;

Fig. 17 is a view similar to Fig. 15, illustrating the tipping dies in the tip-folding position;

Fig. 18 is an enlarged fragmentary sectional view of the dies in the tip folding position;

Fig. 19 is a sectional plan view taken on the line 19—19, Fig. 17, showing the dies in the tip-separating position;

Fig. 20 is a transverse sectional elevation taken on the line 20—20, Fig. 2, illustrating the die-operating mechanism;

Fig. 21 is a perspective view illustrating the dies in the initial position shown in Fig. 15;

Fig. 22 is a perspective view showing the dies in the separating position illustrated in Fig. 19;

Fig. 23 is a perspective view of a double tip after separation in the manner illustrated in Figs. 19 and 22;

Fig. 24 is a perspective view of a single tip after separation;

Fig. 25 is a plan view of one of the universally movable lace grippers of the handling mechanism;

Fig. 26 is a face view, in elevation, of the mechanism shown in Fig. 25;

Fig. 27 is a plan view of the pair of universally movable handling grippers, illustrating the relation of the two grippers in carrying a pair of finished laces from the measuring reel to the spacing rack;

Fig. 28 is a face view of the mechanism shown in Fig. 27;

Fig. 29 is a view similar to Fig. 27 with said grippers in a further advanced position;

Fig. 30 is a face view of the mechanism shown in Fig. 29;

Fig. 31 is a plan view of the pair of grippers in a still further advanced position with the pair of laces respectively carried thereby suspended over the spacing rack;

Fig. 32 is a face view of the mechanism shown in Fig. 31;

Fig. 33 is a view similar to Fig. 32, showing the grippers as placing the finished laces in the relatively spaced recesses of the supporting rack;

Fig. 34 is a front elevation of the universally movable lace gripper operating mechanism, as viewed on a plane 34—34, Fig. 3;

Fig. 35 is a sectional plan view taken on the line 35—35, Fig. 34;

Fig. 36 is a transverse sectional elevation taken on the line 36—36, Fig. 34;

Fig. 37 is a sectional elevation taken on the line 37—37, Fig. 36;

Fig. 38 is a sectional elevation taken on the line 38—38, Fig. 34;

Fig. 39 is a sectional elevation taken on the line 39—39, Fig. 34;

Fig. 40 is a sectional elevation taken on the line 40—40, Fig. 34;

Fig. 41 is a sectional elevation of the "right" universally operable lace gripper, taken on the line 41—41, Fig. 35;

Fig. 42 is a sectional elevation of the "left" universally operable lace gripper, taken on the line 42—42, Fig. 35;

Fig. 43 is a side elevation, partly in section, illustrating the lace-rack magazine, carriage and transfer mechanism;

Fig. 44 is a sectional elevation taken on the line 44—44, Fig. 43;

Fig. 45 is a side elevation of a lace-rack transfer mechanism as placing an empty rack in the lace-receiving position;

Fig. 46 is a perspective view of the rack gripping and releasing cam of the rack transfer mechanism;

Fig. 47 is a face view of the cam shown in Fig. 46;

Fig. 48 is a sectional plan view of one of the rack clutches or grippers, taken on the line 48—48, Fig. 44;

Fig. 49 is a sectional elevation taken on the line 49—49, Fig. 44;

Fig. 50 is a sectional elevation taken on the line 50—50, Fig. 44;

Fig. 51 is a sectional plan view taken on the line 51—51, Fig. 43, illustrating one portion of the empty rack centering and holding mechanism;

Fig. 52 is a sectional elevation taken on the line 52—52, Fig. 45, illustrating another portion of the rack centering and holding mechanism;

Fig. 53 is a plan view of the full-rack conveyer at one end of the rack carriage;

Fig. 54 is an enlarged fragmentary detail view of a portion of one of the lace racks;

Fig. 55 is a plan view of the rack carriage supporting track and stepping mechanism, with a part of the track base broken away;

Fig. 56 is a longitudinal sectional elevation taken on the line 56—56, Fig. 55;

Fig. 57 is a transverse sectional elevation taken on the line 57—57, Fig. 56;

Fig. 58 is a transverse sectional elevation taken on the line 58—58, Fig. 56;

Fig. 59 is a transverse sectional elevation taken on the line 59—59, Fig. 55;

Fig. 60 is a side elevation, partly in section, of

the lace counting and rack carriage controlling mechanism;

Fig. 61 is a plan view of the mechanism shown in Fig. 60;

Fig. 62 is a sectional plan view taken on the line 62—62, Fig. 60;

Fig. 63 is a sectional plan view taken on the line 63—63, Fig. 60;

Fig. 64 is a side elevation, partly in section, illustrating the rack-transfer control mechanism;

Fig. 65 is a plan view, partly in section, of the mechanism shown in Fig. 64;

Fig. 66 is a sectional elevation taken on the line 66—66, Fig. 64;

Fig. 67 is a sectional elevation taken on the line 67—67, Fig. 64;

Fig. 68 is a sectional elevation taken on the line 68—68, Fig. 66;

Fig. 69 is a fragmentary plan view of a portion of the mechanism shown in Fig. 68;

Fig. 70 is a sectional elevation of the rack-carriage reversing mechanism taken on the line 70—70, Fig. 61;

Fig. 71 is a side elevation, partly in section, of the rack-carriage reversing control cam;

Fig. 72 is a sectional plan view taken on the line 72—72, Fig. 71;

Fig. 73*a* is a partial diagrammatic plan view taken substantially as indicated by the arrows 73*a*—73*a*, Fig. 11, of sufficient of the machine to illustrate the operation of the tip-forming dies and the feeding of the tape thereto by the reel mechanism;

Fig. 73*b* is a fragmentary diagrammatic sectional view taken as indicated by the arrows 73*b*—73*b*, Fig. 1, illustrating the operation of the tip-forming dies shown in Fig. 73*a*, the feeding of the laces therefrom by the reel to the grippers and the removal of said laces from the reel to the spacing rack;

Fig. 73*c* is a fragmentary sectional diagrammatic view taken substantially as indicated by the arrows 73*c*—73*c*, Fig. 1, illustrating the spacing rack and the left half of the reel and gripper mechanisms;

Fig. 73*d* is a view similar to Fig. 73*c* taken as indicated by the arrows 73*d*—73*d*, Fig. 1, diagrammatically illustrating certain of the mechanism shown in Fig. 8;

Figs. 74*a* to 84*d* inclusive are progressive diagrammatic views, similar to Figs. 73*a* to 73*d* inclusive, illustrating the various steps from the feeding of the continuous tape to the reel member, to the hanging of the finished laces in position on the spacing rack; and

Fig. 85 is an electric diagram illustrating an automatic control for the tip-strip heating coils.

The machine primarily comprises left and right end frames 1 and 2 respectively, which are both shown in Fig. 35, and severally shown in various other of the figures. Supported by the end frames 1 and 2 is a substantially flat horizontally disposed table 3. Secured to and depending from the table 3, intermediate the end frames 1 and 2, is a vertically extending front plate 4 (see Figs. 8 and 10). Extending laterally from and secured to the right end frame 2 is a side bracket 5 (see Figs. 1 and 2).

Secured to the end frame 1 and bracket 5 respectively and extending forwardly of the table 3 is a pair of brackets 6 and 7 in which is rotatably mounted a horizontal shaft 8 which constitutes a portion of the tape measuring and supporting reel, generally indidcated at 10. The tape-supporting reel 10 also comprises a pair of axially aligned laterally spaced wheels 9 and 11, respectively, which are adjustably secured to the shaft 8.

The wheels 9 and 11, as clearly shown in Figs. 3 and 8, are respectively provided with radially extending peripheral tape-receiving notches 12, 12, which are disposed in circumferentially spaced relation to each other. Between each pair of notches is formed a relatively wide radially extending segmental projection 13, which constitutes tape-supporting posts on the wheels 9 and 11 respectively.

Secured to the brackets 6 and 7 (see Figs. 1 and 2) and extending substantially parallel to the reel shaft 8, is a shuttle rail 14 on which is reciprocably mounted a tape-laying shuttle 15. The shuttle 15 is provided with a forwardly extending lug 16 (see Figs. 2, 5 and 6) in which is vertically adjustably mounted a tape-guiding tube 17. The tape-guiding tube 17 is provided at its lower end with a horizontally elongated eye 18, through which the continuous strip of tape x passes in its passage to the reel 10.

The shuttle 15 is adapted to be reciprocated on the rail 14 from a position beyond one end of the reel 10 to a position beyond the opposite end of the reel 10, for laying the tape x in longitudinally aligned notches 12 of the wheels 9 and 11 respectively.

The reel 10 is adapted to be intermittently rotated, through an angle equal to the spacing of the notches 12, after each stroke of the shuttle 15, whereby the continuous strip of tape x is laid around the outer sides of the projections or posts 13, on the wheels 9 and 11, and through the notches 12 formed in said wheels.

Reciprocation of the shuttle 15 along the rail 14 (see Fig. 2) is effected by a sweep arm 20 which is pivotally connected at its forward end to the shuttle 15, as indicated at 19. The rear end of the sweep arm 20 is slidably mounted in a swivel bearing 21, which is pivotally mounted for horizontal swinging movement about a vertical axis provided by a suitable pivot carried by a bracket 22, which latter is secured to the table 3.

Intermediate its ends, the sweep arm 20 is pivotally connected, at 23, to one end of a connecting rod 25, the opposite end of which is pivoted, at 24, to an adjusting crank arm 26, whereby the throw of the crank, and consequently the reciprocation of the shuttle 15, may be varied in accordance with lateral spacing of the wheels 9 and 11 of the measuring and supporting reel 10.

The wheels 9 and 11 are adjustably mounted on the reel shaft 8 for axial movement relative to the reel shaft and to each other, for determining the length of the successive runs x^1 of the tape x to be laid between the wheels 9 and 11 and around the posts 13 thereon.

The adjustable crank arm 26 is carried by a horizontally disposed disc 27 which is mounted on and secured to the upper end of a vertically extending shaft 28. The shaft 28 is journaled in bearings 29 and 30 which are carried by the table 3 and end frame 2 respectively (see Figs. 1 and 35). As shown in Figs. 1 and 2, the shaft 28 is provided with a mitre gear 31 which meshes with a similar mitre gear 32, which latter is secured to a horizontally disposed shaft 33.

The shaft 33 is rotatably mounted in bearings 34 and 35 secured to the table 3 (see Figs. 1 and 2). Intermediate the bearings 34 and 35 the shaft 33 is provided with a gear 36 which meshes with a gear 37 secured to a horizontally disposed shaft 38 which extends parallel to the shaft 33

and is rotatably mounted in bearings 39 and 40 rigidly secured to the main frame of the machine.

Freely rotatably mounted on the shaft 38 is a gear 41 which meshes with a gear 42 secured to a shaft 43 which is rotatably mounted in bearings 44, 44 which are secured to the table 3. Secured to the shaft 43 is a pulley 45. The pulley 45 is connected by a belt 46 to a pulley 47 which is mounted on a shaft 48 suitably journaled in the lower portion of the machine and driven from a motor 50, through suitable gearing 51 (see Fig. 3.)

The gear 41 is loosely mounted on the main shaft 38 and is adapted to be locked to the main shaft 38 by a clutch including a member 52 which is secured to said shaft. The clutch element 52 carries a plurality of clutch pins 53, 53 (see Fig. 4) which are arranged to engage corresponding clutch pins 54, 54 carried by the gear 41.

The clutch pins 53 are slidably mounted in the clutch head 52, for movement parallel to the shaft 38, and are secured at their outer ends to a flange 55 of a circumferentially grooved clutch collar 56. Longitudinal movement of the clutch pins 53 in and out of the head 52, for engagement and disengagement with the clutch pins 54, is controlled by a clutch lever 57 which is pivotally mounted at 58 to a fixed portion of the machine. A spring 59 is provided to rock the clutch lever 57 in a direction to withdraw the clutch pins 53 into the clutch head 52, to release the pins 53 from the pins 54 on the gear 41 and thereby effect stopping of the machine. The clutch lever 57 is maintained in position to keep the pins 53 in engagement with the clutch pins 54 by a latch 60 which is pivoted at 61 to a fixed portion of a machine as shown in Fig. 1.

In order to insure uniform rotation of the shaft 38 with the gear 41, when the pins 53 are projected into the path of the continuously revolving pins 54 carried by the gear 41, a spring-pressed latch 62 (see Fig. 4) is provided on the gear 41 and arranged to snap behind one of the pins 53 when and as soon as such pin is engaged by one of the revolving pins 54, to prevent rebounding and relative movement between the pins as a result of the sudden impact of the pins one against the other.

From the above, it will be obvious that as long as the driving motor 50 is in operation and the clutch 52 on the shaft 38 is engaged with the gear 41 thereon the shuttle 15 will be uniformly reciprocated on the rail 14, across the face of the tape measuring and supporting reel 10, and will lay the tape x between the wheels 9 and 11 of the reel and around the posts 13 thereof to form the successive runs x^1 of the tape on the reel.

The carrying of the tape around the outsides of the posts 13 is effected by intermittent rotation of the reel 10, in coordination with the reciprocations of the shuttle 15.

Intermittent rotation of the reel 10, in timed relation with the reciprocations of the shuttle 15, is accomplished by the mechanism shown in Figs. 1, 2 and 7 wherein the main shaft 38 is shown as being provided with a mitre gear 63 which meshes with a mitre gear 64 secured to one end of a forwardly extending shaft 65. The shaft 65 is rotatably carried by bearings 66 and 67 secured to the frame extension 5. The opposite end of the shaft 65 is provided with a mitre gear 68 which meshes with a mitre gear 69. The mitre gear 69 is secured to a horizontally disposed shaft 70 which is rotatably mounted in bearings 71, 71 secured to the frame extension 5.

Secured to the shaft 70 is a disc 72 which forms one element of a Geneva movement and carries a laterally extending pin 73 arranged to enter radially extending slots 74 formed in the periphery of a disc 75 which forms the second element of said movement. The disc 75 is rigidly secured to the reel shaft 8 whereby each revolution of the disc 72 produces a partial revolution of the disc 75 to the extent of the annular spacing of the slots 74 in the disc 75 and such a partial rotation of the disc 75 produces an equal movement of the reel 10, through the shaft 8.

Between the intermittent rotations of the reel 10, in the manner above noted, said reel is locked against rotation, by a lever 76 which is pivoted at 77 to the bracket 7 and is provided at its free end with a blade 78 arranged to enter locking notches 79 formed in the periphery of the disc 75.

The locking lever 76 is rocked and the blade 78 is thereby moved into and out of the notches 79, in timed relation with the intermittent rotations of the disc 75, by a cam 80 which is secured to the main shaft 38 and operates against a cam follower 81 carried on the free end of a lever 82. The lever 82 is pivoted at 83 to a bracket 84 secured to the frame bracket 5. The cam follower 81 is held in contact with the cam 80 by a spring 85 which is secured at one of its ends to the lever 82 and at its opposite end to the bearing 40 which supports one end of the shaft 38.

The lever 82 is connected to the locking lever 76 by a two-part link 85, the two parts of which are slidably connected together by bolts 85a rigidly carried by one part 87 of the link and operating in slots 88 formed in the second part 89 of the link, whereby movement of the link 85 in one direction positively releases the locking blade 78 from the engaged locking notch 79 of the disc 75; and whereby movement of the link 85 in the opposite direction, with a spring 90 interposed between the two parts 87 and 89 of the link 85, resiliently presses the edge of the locking blade 78 against the circular peripheral edge of the disc 75 a short time before the next notch 79 is lined up with the blade 78, whereby, when such alignment is attained, the blade 78 will snap into the locking notch 79 and prevent further rotation of the shaft 8 and reel 10 carried thereby.

The construction of the eye 18 of the shuttle 15, as shown in Figs. 5 and 6, is such that the braid or tape x is laid on the reel 10, see Fig. 11, without a twist between the jaws 113a, 117a and 114a, 118a of reel 10 and this is effected by the tape x running through the tube 17 and engaging the lower edge 91 about which the tape bends outwardly to pass around a horizontal rib 92 on the front of the upper portion of the eye 18, said tape passing sharply around and under the rib 92 and through the elongated opening 93 of the eye 18.

As soon as the shuttle 15 starts to move in one direction of its reciprocation, as for instance from right to left, Fig. 1, x is laid flatly against one flat edge of one of the slots 12 of the wheel 11, the gripping of the tape by the jaws 114a, 118a instantaneously effected after the feeding of the tape thereto, prevents any kinks or twists in the tape, previously fed from the shuttle, from advancing beyond the jaws 114a, 118a whereas the engagement of the tape with said jaws 114a, 118a and with the lower edge 91 of the tube 17 and the sharp turning of the tape around the rib 92, prevents any kinks or twists that may be in

the tape, within or ahead of the tube 17, from passing through the eye 18 during the time the shuttle is completing that particular stroke of its reciprocation. The immediate partial rotation of the reel 10 brings the flat edge of the aligned slot 12 in the reel 9 against the tape and keeps the tape from twisting intermediate the jaws 114a, 118a and wheel 9; meanwhile, operation of lever 115 coincident with the feeding of tape thereto closes the jaws 113, 117 and 113a, 117a which, in turn, grip the tape and isolate an untwisted portion thereof between levers 115 and 116 in manner necessary to permit proper tipping of the laces as hereafter explained.

As the shuttle 15 starts its movement in the opposite direction the tension on the tape x is relieved to a slight extent, whereupon any twist that may have accumulated in the tape within the tube 17 will run out of the tube 17, through the eye 18 and along the tube to, but not beyond the jaws 113a, 117a which close as soon as the eye 18 feeds the tape thereto in this manner preventing progression of any twist therebeyond during the rightward reciprocation of 15. As the eye 18 advances in its reverse movement across the face of reel 10 the tape is brought into contact with the jaws 114a, 118a, and 114, 118 which grip the tape, in manner explained. Continued movement of 18 brings the tape into contact with the flat edge of the slot of wheel 11 through which the eye 18 passes, in such reverse movement further twisting of the tape is prevented until after the eye has passed through the aligned slot in reel 11. In this manner each of the runs x^1 of the tape is free from twists intermediate the jaws 113a, 117a and 114a, 118a.

The tape x is fed to the upper end of the tube 17 of the shuttle 15 through a stationary eye 94 which is formed in the outer end of an arm 95 (see Figs. 1 and 2). The arm 95 is secured to the table 3 with the eye 94 disposed above the path of movement of the shuttle 15 and directly above the center of the face of the reel 10.

Before passing to the eye 94 the tape x passes through another stationary eye 96 which is disposed adjacent a tensioning device 97. The tensioning device in the present instance comprises a vertically movable weight 98, between the lower surface of which and the upper surface of a fixed block 99 (see Fig. 1), the tape x passes. The weight 98 is guided, during vertical movement, by a pair of pins 100 passing through the weight 98 and between which the tape x passes. The weight 98 presses the tape x against the block 99 and thereby provides the required amount of tension on the tape x at all times.

Before passing through the tensioning device 97 the tape x passes through an eye 101 formed on the outer end of a swinging arm 102 which is pivoted at 103 to a fixed portion of the machine. The arm 102 is connected by a toggle link 104 to the clutch lever-holding latch 60. One end of one of the portions 105 of the toggle link 104 is pivotally connected to the arm 102, intermediate its ends as at 106. One end of the second part 107 of the toggle link 104 is pivotally mounted to a fixed part of the machine by the stud 108, see Fig. 1. The link parts 105 and 107 are pivotally connected together at 109. The clutch lever-holding latch 60 is resiliently maintained in a clutch lever-holding position by a spring 110.

During normal operation of the machine unobstructed movement of the tape x through the eye 101 of the swing arm 102 permits the arm 102 to remain in the full line position shown in Fig. 1, the link parts 105 and 107 assuming the full line positions of said figure. Should a knot occur in the continuous tape x, as for instance is formed in the trailing end of the lace, the knot, unable to pass through the eye 101, will cause the arm 102 to swing upwardly about its pivot 103 assuming the position shown in dot in said figure, whereby the parts 105 and 107 will fold to the dotted positions shown, said action imparting a corresponding counter-clockwise movement to the cam piece 107a of part 107 which, coacting with clutch lever-holding latch 60, swings 60 about its pivot 61 and releases the clutch lever 57, causing the stopping of the machine.

In order to support the runs x^1 of the tape firmly intermediate the wheels 9 and 11 of the reel 10, during the tipping and separating operations, and in order to facilitate the handling of the finished shoe laces, after separation, each run x^1 of the tape carried by the reel 10 is adapted to be gripped at a plurality of points, in the present instance four, between the wheels 9 and 11, i. e. at two relatively spaced points at each side of the tipping dies. For this purpose the mechanism disclosed particularly in Figs. 1, 2, 8 and 11 is provided.

Secured to the reel shaft 8 in laterally spaced relation to each other is a pair of rotary gripper wheels 111, 112 which are provided with a plurality of radially extending jaws in the form of pins 113 and 114 respectively.

Extending inwardly from each of said wheels is a series of brackets 111a, 112a provided with radially extending arms 111b and 112b on the outer ends of which are radially extending pins 113a and 114a which are respectively aligned, longitudinally of the reel 10, with the pins 113 and 114 carried by the wheels 111 and 112 respectively.

Pivotally mounted on each of the wheels 111 and 112, in uniformly spaced relation to each other around said wheels, in a series of forked levers 115 and 116 which are freely rotatable on studs 115a and 116a by which the said levers are pivotally secured to the wheels 111 and 112 respectively. Each lever 115 is provided at its outer end with a pair of jaws 117 and 117a respectively which are aligned with a pair of the jaws 113 and 113a carried by the wheel 111. Each of the levers 116 is provided at its outer end with a pair of jaws 118 and 118a respectively aligned and cooperating with a pair of pins 114 and 114a carried by the wheel 112.

Each of the levers 115 normally is rocked about its pivot 115a, to bring the jaws 117 and 117a into tape-gripping relation to the relatively fixed jaws of the gripping wheel 111 provided by the pins 113 and 113a, by a spring 119, having one end secured to the lever and its opposite end secured to a stud carried by the wheel 111.

Each of the levers 116 is normally rocked about its pivot 116a in a direction to bring the jaws 118 and 118a into tape-gripping relation to the jaws of the gripper wheel 112 afforded by the pins 114, 114a, by a spring 120.

Each lever 115 is provided with an arm 121 at the outer end of which is rotatably mounted a cam roller 123 and each of the levers 116 is provided with an arm 122, at the outer end of which is rotatably mounted a cam roller 124.

The cam rollers 123 and 124 are adapted to be engaged at predetermined times by cam segments 125 and 126 respectively, for opening the jaws to receive the tape therebetween, to close said jaws on said tape after the same has been laid between the jaws by the shuttle 15, and to reopen the jaws to release the tape after the tips have

been formed on the runs x^1 of the tape and separated and the individual laces have been grasped by the universally movable handling grippers, in a manner hereinafter described. The cam segments 125 and 126 are formed respectively on cam wheels 127 and 128 which are freely rotatably mounted on the reel shaft 8, adjacent the gripper wheels 111 and 112 respectively.

The cam wheel 128 is provided with a second internal cam surface 129 adapted to be engaged by a second cam roller 130 carried by arms 131 formed only on alternate levers 116, for opening the jaws carried by said alternate levers in a manner and for reasons hereinafter set forth.

The cam wheels 127 and 128 are provided with operating arms 133 and 134 respectively. Pivotally connected at the outer ends of the arms 133 and 134 is a pair of links 135 and 136 respectively. The second end of the link 135 is connected to one arm of a lever 137 and the second end of the link 136 is connected to one arm of a lever 138. The lever 137 is provided with a cam follower 143 adapted to be engaged by a cam 145 secured to the shaft 33 (see Fig. 8).

The lever 138 is pivoted at 140 to a bracket 142 secured to the table 3 (see Fig. 9). The second arm of the lever 138 is provided with a cam follower 144 adapted to engage a cam 146 secured to the shaft 33.

The levers 137 and 138 are adapted to be rocked about their pivots in one direction to maintain the cam followers 143 and 144 in operative engagement with the cams 145 and 146 respectively by springs such as that illustrated at 147 in Fig. 8.

The cams 145 and 146 are so timed with relation to the reciprocations of the tape-laying shuttle 15 that immediately following the passage of the tape eye 18 through the open jaws of the grippers associated with the reel 10 said grippers are closed upon the tape laid by the shuttle 15 between the open jaws of the grippers, as each of the runs x^1 of said tape is laid on and longitudinally of the reel 10, whereby each of said runs x^1 is firmly held in a relatively fixed position with respect to the reel, to be positioned in the tipping dies disposed between the wheels 9 and 11 of the reel and which are constructed and operated in a manner which will now be described.

Formed on or secured to the table 3 (see Fig. 10) is a step 150 and mounted on the step 150 is a die housing 151 which, in the present instance, is provided with a pair of rearwardly extending arms 152, 152 (see Figs. 2 and 13) at the outer ends of which are provided bearings 153, 153 for the main shaft 38. Extending forwardly from the die housing 151 is a pair of arms 154, 154 providing bearings for the reel shaft 8 (see Figs. 10 and 11).

Horizontally and slidably mounted in the housing 151 (see Figs. 15 to 22 inclusive) is a pair of die carriers 155 and 156 which are of substantially identical construction and mounted in side by side relation to each other within the die housing 151, as clearly illustrated in Fig. 19. Longitudinally aligned with the die carriers 155 and 156 and slidably mounted in the housing 151 is a second pair of die carriers 157 and 158 respectively.

Mounted in the housing 151 in relatively fixed relation thereto is an anvil 159 (see Fig. 15) upon which the runs x^1 of the tape are successively positioned by the above noted intermittent rotations of the reel 10.

Projecting vertically from the underside of and into the housing 151 between the die carriers 155—156, 157—158 and immediately adjacent the rear face of the anvil 159 is the free end of a strip y of tipping material, which may be of a metallic or other suitable nature and in the present instance is composed of celluloid.

Carried by and at the upper rear edge of the anvil 159 is a hardened plate 160 having a relatively sharp upper rear edge constituting a shear blade between which and corresponding edges of die members 161 and 162, respectively carried by the die carriers 155 and 156, the extreme upper end portion of the strip y is adapted to be engaged and severed from said strip in the form of a double tip unit y^1 (see Fig. 16).

Carried by the lower rear portions of the die carriers 157 and 158 are forming dies 163 and 164 respectively, which are adapted to cooperate with the die elements 161 and 162 respectively, for folding the double tip unit y^1 around the run x^1 of the tape positioned on the anvil 159 (see Figs. 17 and 18).

Figs. 15 and 21 illustrate the relative positions of the elements above described immediately following the projection of the strip y into position adjacent one of the runs x^1 of the tape.

Fig. 16 illustrates the dies 161 and 162 having moved forwardly in unison to sever the tip unit y^1 from the strip y and to position the tip unit over the tape run x^1 for folding thereabout.

Fig. 17 illustrates the full forward movement of the dies 161 and 162 after having pressed the unit y^1 into engagement with the dies 163 and 164 whereby the cooperation of the dies 161—162 with the dies 163—164 has effected folding of the tip unit y^1 around the tape run x^1, such folding just prior to final pressing between the dies 161—162 and 163—164 being clearly illustrated in Fig. 18.

After final pressing of the tip unit around the tape run x^1 the dies 161—163 and the dies 162—164 are moved longitudinally relative to each other, as illustrated in Figs. 17, 19 and 22, whereby the double tip unit y^1 is severed at its middle together with the tape encased by said tipping unit, to provide single tips y^2 respectively on the adjacent ends of the finished laces x^2 formed by severing the tape run x^1 as produced by the relative movement between the dies in the manner above noted. The operation of the dies, as above described, is accomplished in the following manner:

Secured to the shaft 38 (see Figs. 2, 13 and 20), intermediate the bearings 153, 153, is a pair of cams 165 and 166 which cooperate with cam followers 167 and 168 respectively carried by the die carriers 155 and 156. The cam surfaces of the cams 165 and 166 are so related one with the other that the carriers 155 and 156 are initially moved relative to each other to bring the cutting edges of the dies 161 and 162 into alignment one with the other, for shearing the unit y^1 from the tip strip y. The cam paths are so arranged that the dies 161—162 then move forwardly as a unit, first to shear the unit y^1 from the strip y and secondly, as a unit, to lay the tip unit y^1 over the tape run x^1, continuing the unitary movement forwardly until said tip unit is engaged by the dies 164 and 163 which remain stationary while the dies 161 and 162 advance forwardly and press the tip unit y^1 firmly around the tape run x^1.

In order to set the tip unit, the dies momentarily remain stationary insofar as relative movement between the dies is concerned in the tip-pressing position, which is governed by set screws

189 carried by the rear ends of the die carriers 157 and 158 respectively and which engage the forward ends of the die carriers 155 and 156 respectively. The dies 163 and 164 recede during the setting of the tip unit, by pressure exerted by the forwardly moving dies 161 and 162, the dies 163 and 164 being resiliently held in the tip-setting position during the last of the forward movement of the dies 161 and 162 by mechanism hereinafter described.

The cam paths of the cams 165 and 166 are so arranged that upon further rotation of the shaft 38 the dies 161 and 163 move as a unit longitudinally with respect to the dies 162 and 164, said action effecting the severing of the laces in the desired manner.

The resilient backing for the dies 163 and 164 is effected by the following mechanism:

Pivotally mounted in the housing 151, in longitudinal alignment with the die carriers 155—157 and 156—158 respectively, is a pair of levers 170 and 171, each of which is provided with a vertically extending arm 172, 173, respectively. The arms 172 and 173 engage the forward ends of the die carriers 157 and 158 respectively. The levers 170 and 171 are also provided with forwardly extending arms 174 and 175 respectively, which are connected by springs 176, 176 to forwardly projecting studs 177, 177 carried by the bearings 154 of the housing 151. The springs 176 normally rock the levers 170 and 171 in a manner to exert a rearward force against the die carriers 157 and 158, whereby the resilient backing for the dies 163 and 164 is effected.

When the tip strip y is composed of celluloid the tipping dies are preferably heated, in order to set the tip strip y^1 around the tape run x^1, and for this purpose an electric heating unit 178 is clamped to the underside of the housing 151, to transmit heat to the dies, by clamp bolts 179.

When celluloid is used it is preferable to premoisten the tape runs x^1 with a solvent for the celluloid, such as alcohol, by which the celluloid is softened and prepared for molding around the tape by the dies as above described.

As shown in Figs. 10 and 12, a pad of felt or other suitable absorbent material 180 is positioned in the circular path traveled by the successive runs x^1 of the tape, between the point at which the tape is laid on the reel 10 and the point at which the tape runs x^1 enter the tipping dies, above noted.

As clearly shown in Fig. 10, the pad 180 is supported by a bracket 181 secured to the die housing 151. Each intermittent rotation of the reel 10 places one tape run x^1 in the tipping dies and a succeeding run on the pad 180.

Cooperating with the fixed pad 180 is a relatively movable pad 182 which is carried on the outer end of a lever 183 secured to a short shaft 184. The short shaft 184 is journaled in the bearings 185 (see Fig. 12) which are secured to the underside of the shuttle rail 14. Also secured to the shaft 184 is a lever 186 which is connected at its outer end to one end of a push rod 187 which is slidably mounted, adjacent its opposite end, in a bearing 188 carried by the die housing 151 (see Fig. 10).

The push rod 187 is provided at its latter end with a cam follower, in the form of a roller 189, which is adapted to be engaged by a cam 190 carried by the main shaft 38, adjacent the cam 165 by which the die carriers 155—157 are operated. A spring 191 maintains the roller 189 in constant engagement with the cam 190.

The cam path of the cam 190 is such that the pad 182 is moved away from the pad 180 just prior to the beginning of each intermittent rotation of the reel 10 and returned to position adjacent the pad 180 immediate upon completion of each intermittent rotation of the reel 10, to clamp the newly positioned run x^1 of the tape between the two pads which are saturated with a suitable moistening or softening liquid.

In the present instance, the softening liquid is supplied to the pads 180—182 through a tube 192, from a suitable container 193 in the present instance carried by and at one end of the shuttle rail 14.

In the present instance the celluloid strip y is fed to the tipping dies by mechanism shown in Figs. 10, 11, 13 and 14. Secured to the lower portion of the front plate 4 is a pair of forwardly extending brackets 194, 194 which are respectively provided with suitable depressions or pockets for the reception of the opposite ends of a rod or shaft 195 which is adapted to support a roll or spool of tipping material Y.

The strip y passes from the outer part of the roll Y to and between a guide roll 196 and back plate 224a, from which the strip passes upwardly to a pair of feed rolls 197 and 198.

The feed roll 198 is secured to a drive shaft 199, which is mounted in bearings 200 secured to the step 150. The feed roll 197 is secured to a shaft 201. The shaft 201 is rotatably mounted in bearings 202 which are slidably mounted, for movement toward and away from the bearings 200 of the shaft 199, springs 203 being provided to press the roll 197 toward the roll 198 at all times, for gripping the strip y therebetween.

Synchronous rotation of the roll 197 and 198 is provided by intermeshing gears 204 and 205 respectively carried by and secured to the shafts 199 and 201. Secured to the shaft 199 is a ratchet wheel 206. Rotatably mounted on the said shaft 199 is an oscillating lever 207, on the outer end of which is pivotally mounted a pawl 208. The pawl 208 is adapted to engage the teeth of the ratchet wheel 206, for intermittently rotating the shaft 199 and consequently the feed rolls 197 and 198, by which a predetermined portion y^1 of the free end of the tip-strip y is projected between the tipping dies in the manner above noted.

Intermittent rotation of the shaft 199 is effected (see Figs. 13 and 14) by rocking of the lever 207 through the medium of a link 209a having one end pivotally connected to the free end of a lever 209 and its opposite end connected to the plate 217 secured to the lever 207. The lever 209 is secured to one end of a shaft 210 which is rotatably mounted in bearings 211 secured to the table 3. Secured to the shaft 210, intermediate the bearings 211, is a lever 212 on the outer end of which is rotatably mounted a roller 213. The roller 213 rides within a groove 214 of a cam 215, which is secured to the main shaft 38.

The second end of the link 208 is attached to the oscillating lever 207 through an adjusting device 216, by which the throw of the pawl 208 may be varied to engage a fewer or greater number of the teeth of the ratchet wheel 206, for governing the extent of the intermittent strip feeding movements of the grip rolls 197 and 198. The adjusting device 216 in the present instance is in the form of a plate 217 which is pivotally mounted at 218 to the oscillating lever 207. The link 209a is pivoted to the plate 217 as indicated at 219,

The adjusting plate 217 is provided with a segmental slot 220, the arc of which is swung from the pivot 218. A clamp bolt 221 is secured to the oscillating lever 207 and passes through the slot 220 and is provided beyond the plate 217 with a butterfly nut 222 which is adapted to clamp the plate 217 rigidly to the lever 207 after the desired throw of the pawl 208 is attained, by swinging the plate 217 about its pivot 218, whereby the point 219, at which the link 209*a* is attached to the plate 217 is moved nearer to or farther away from the axis of the shaft 199 about which the lever 207 oscillates, whereby greater or lesser oscillation of the pawl 208 is obtained.

If desired, a retarding action for the strip *y* may be effected (see Figs. 11 and 13) by a clamp 223 which is carried by a bridge plate 224 and is adapted to bear against the front face of the strip *y*, to press the rear face of the strip into frictional contact with a back plate 224*a* forming part of the structure by which the bearings 200 for the shaft 199 are carried. The clamping device 223 may be either in the form of a spring-pressed plunger or a plate engaged by or formed on the end of the threaded stud by which the proper degree of frictional retardation for the strip may be procured.

After the double tip y^1 and the encased tape run x^1 have been separated by the relative movements of the tipping dies, in the manner above noted, the reel 10 carries the then separated laces x^2 into position to have one end of each lace grasped by one of the pair of universally movable grippers of the handling mechanism, which carry the finished laces from the reel 10 to and position them on the positioning racks.

Due to the manner in which the tape *x* is laid on the reel 10, by the shuttle 15, each individual lace x^2 is formed partly in one run x^1 of the tape and partly in the next succeeding run x^1 of the tape, with the intermediate portion of the lace passing around one of the reel posts 13. Thus, each individual lace x^2 is held on the reel 10, after the severing operation, in a U-shaped form, with the tipped ends of each lace pointing inwardly and each held firmly by the reel grippers at two relatively spaced points, i. e. the laces lying to the left of the severing line each have one end held by two aligned pairs of the jaws 113—113*a* and 117—117*a* of the gripper 111 and its opposite end held by the next succeeding two aligned pairs of jaws 113—113*a* and 117—117*a* of the gripper 111, while those of the laces lying to the right of the severing line each have one end held by two aligned pairs of jaws 114—114*a* and 118—118*a* of the gripper 112 and its opposite end held by the next succeeding two aligned pairs of jaws 114—114*a* and 118—118*a* of the gripper 112.

There is a universally movable handling gripper arranged to engage one end of each of the laces, lying to the left side of the severing line, (see Figs. 27 to 33 inclusive and 73*a* to 84*d* inclusive) between the jaws 113 and 113*a* and another universally movable handling gripper arranged to engage one end of each of the finished laces, lying to the right of the severing line, between the jaws 114 and 114*a* which will hereinafter be referred to as the left handling gripper, L, and the right handling gripper, R, respectively.

The grippers L and R are substantially the same in construction and for that reason but one is shown in detail in Figs. 25 and 26, while Fig. 41 shows the right handling gripper R in section and Fig. 42 illustrates the left gripper L in section.

As shown in said figures, each universally movable gripper comprises a horizontally disposed stud shaft 225 constituting a main lever arm which is arranged to swing in a horizontal plane about a vertically disposed axis.

Rotatably mounted on each main arm 225 is a tubular shaft or sleeve 226. Loosely mounted on the sleeve 226, adjacent the outer end thereof, is the hub 227 of a forearm portion 228 of the gripper which is adapted to swing in a vertical plane about the horizontal axis afforded by the main arm 225 of the gripper. In the present instance each forearm portion 228 comprises two substantially parallel arm elements 228*a*, 228*b*. Pivotally mounted at 229 to each of the arm elements 228*a* and 228*b* is a gripper finger 230. Each finger 230 is provided with a gripping surface 231 between which and a corresponding gripping surface 232 on the arm 228 a single run x^2 of the tape is adapted to be clamped.

The fingers 230, 230 of each of the handling grippers are rigidly connected together, for simultaneous operation, by a cross bar 233 on which is rotatably mounted one end of an operating link 234. The opposite end of the operating link 234 is pivotally connected at 235 to an operating lever 236 extending from a hub 237 which is freely rotatably mounted on the tubular shaft 226.

Formed on each of the operating lever hubs 227 is a lug 238 which projects between a pair of lugs 239, 239 formed on a collar 240 which is mounted on and keyed to the tubular shaft 226, beyond the outer end of the operating lever hub 227. An adjusting screw 241 carried by the collar lugs 239 and engaging with the lever hub lug 238 provides for relative angular adjustment of the forearm 228 about the axis of the tubular shaft 226 and provides means by which the forearm 228 is locked to the sleeve 226. A cap 242 secured by a bolt 243 to the outer end of the lever shaft 225 maintains the tubular shaft 226 and the collar 240 in position on the lever shaft 225.

At the opposite end of the tubular shaft 226 of each gripper is keyed a gear 244 by which rotation of the forearm lever 228 in a vertical plane about the axis of the lever shaft 225 is obtained.

Between the gear 244 and the hub 237 of the finger-operating lever 236 is loosely and rotatably mounted a gear 245. Secured to the hub of the gear 245 is a collar 246 which is provided with a radially extending lug 247. On the hub 237 of the finger-operating lever 236 is a lug 248 which is aligned with the lug 247 of the collar 246 and extending through said aligned lugs and slidably mounted in at least one of said lugs is a bolt 249. A spring 250 encircles the bolt 249, between the lugs 247 and 248 and exerts pressure in opposite directions against the lugs 247 and 248, which normally tends to rock the finger-operating lever 236 about the tubular shaft 226 in a direction to move the gripping surface 231 of the fingers 230 toward the gripping surfaces 232 of the forearm lever 228, to grip firmly the tape run x^2 between said gripping surfaces. The opposite ends of the bolt 249, outside the lugs 247 and 248 respectively, are provided with nuts 251 which limit the relative rotation between the gear 245 and the hub 237 of the finger-operating lever 236, whereby rotation of the gear 245 in one direction will effect opening of the fingers 230 and release the lace gripped thereby, under circumstances as will be fully disclosed hereinafter.

The main lever arm formed by the shaft 225 of

the right handling gripper R is provided with a hub 252 which is secured to the upper end of a vertical shaft 254 and the lever arm formed by the shaft 225 of the left handling gripper L is provided with a hub 253 which is secured to the upper end of a vertical shaft 255.

As shown in Fig. 34, the shafts 254 and 255 are respectively mounted in bearings 256—256 and 257—257 secured to vertically disposed bracket plates 258 and 259 respectively. The plates 258 and 259 are carried by steps 260 and 261 extending forwardly from the end frames 1 and 2 of the machine.

The gear 244 by which the gripping arm 228 of the right handling gripper R is rocked in the vertical plane about the axis of the horizontally extending lever shaft 225, meshes with a gear 262 which is loosely mounted on the vertical shaft 254 (see Fig. 41), and secured to the hub of the gear 262 is a gear 264 which meshes with a gear 266 freely rotatably mounted on a stud 268 which is carried by a bracket 270 secured to the vertical bracket 258.

The gear 244 which effects corresponding rotary motion of the gripper arm 228 of the left handling gripper L about the axis of the horizontally extending lever shaft 225 (see Fig. 42) meshes with a gear 263 which is loosely mounted on the vertical shaft 255.

Secured to the hub of the gear 263 is a gear 265 which meshes with a gear 267 which is keyed to a vertical shaft 269. The vertical shaft 269 is rotatably mounted in bearing 271 carried by the vertical bracket 259. Secured to the shaft 269 below the bearing 271 is a gear 273.

The gear 266 of the right handling gripper R (see Fig. 34) meshes with a horizontally slidable rack 274 and the gear 273 of the left handling gripper L meshes with a horizontally slidable gear rack 275.

Longitudinal movement of the racks 274 and 275 effects rotation of the right and left gripper forearm levers 228 in vertical planes about the axes of the horizontally disposed lever shaft 225, 225 respectively.

Opening and closing of the gripping fingers 230 of the right and left hand grippers R and L is controlled by horizontally slidable racks 276 and 277 respectively.

Bodily swinging of the grippers R and L horizontally about the axes of the vertical shafts 254 and 255 is effected by means of racks 278 and 279 respectively.

The right rack 274 is slidably mounted in the bracket 258 and the right racks 276 and 278 are slidably mounted in a supplementary bracket 258a secured to the bracket 258. The left rack 275 is slidably mounted in the bracket 259 and the left racks 277 and 279 are slidably mounted in a supplementary bracket 259a secured to the bracket 259.

The operating mechanisms for the racks 274, 276 and 278 and the operating mechanisms for the racks 275, 277 and 279 are substantially the same, in view of which but one will be described.

Rotatably mounted on a stud 280 carried by the rack 274 (see Figs. 37 and 38) is a roller 281 which runs in a slot 282 formed in the upper end of a lever 283. The lever 283 is pivotally mounted at 284 to the bracket 258. Intermediate its ends the lever 283 is provided with a radially extending slideway 285 for the reception of a slide block 286. The lever 283 is provided with a lug 287 in which is rotatably mounted an adjusting screw 288, said screw having a collar 289 secured thereto adjacent one side of the lug 287 and a knurled head 290 at the opposite side of said lug, to prevent axial movement of the screw 288 in the lug 287. The threaded end 291 of the adjusting screw 288 is threaded into a lug 292 formed on the slide block 286.

Carried by the slide block 286 is a pivot stud 293 for one end of a link 294, the opposite end of said link being pivotally connected to a lever 295. The lever 295 is pivotally mounted on a short shaft 296 having one end mounted in a bearing 296a on the plate 258 and its opposite end mounted in a bearing 296b formed on a bracket spaced from the plate 258 (see Figs. 35 and 36). Intermediate its ends the lever 295 is provided with a cam roller 297 which rides in a cam groove 298 formed in a disc 300. The cam disc 300 is secured to a horizontally disposed shaft 302.

The corresponding rack 275 for the left handling gripper is operated, through mechanism corresponding to that just described, from a horizontal shaft 303.

The shafts 302 and 303 are rotatably mounted at their outer ends in bearings 304 and 305 respectively (see Figs. 34 and 35) forming parts of supplementary brackets 306 and 307 which are mounted on the frame steps 260 and 261 respectively. The shafts 302 and 303 are also rotatably mounted in bearings 308 and 309 formed in the brackets 258 and 259 respectively, and adjacent the rear ends the shafts 302 and 303 are rotatably mounted in bearings 310 and 311 formed in front plates 4a and 4b secured to the front of the table 3, at opposite sides of the front plate 4.

The shafts 302 and 303 are provided at their rear ends with gears 312 and 313 respectively which mesh with gears 314 and 315 which are secured to a horizontal shaft 316 which is rotatably mounted in bearings 317, 317 carried by the front plates 4a and 4b respectively, and in a bearing 318 carried by the end frame 2.

Adjacent the bearing 318, the shaft 316 has secured thereto a gear 319. The gear 319 meshes with a gear 320 which is secured to a short shaft 321. The shaft 321 is rotatably mounted in bearings 322, 322 carried by the end frame 2. Secured to the shaft 321 intermediate the bearings 322, 322 is a gear 323 which meshes with a gear 324 secured to the lower end of a vertical shaft 28. The vertical shaft 28, as previously described, receives its rotary motion from the shaft 33, in the manner above noted. Hence the shafts 302—303 are continuously rotated in unison with the cam shafts 33 and 28.

Formed in the opposite face of the cam 300 from that in which the cam path 298 is formed (see Fig. 36) to control the movement of the handling grippers in a vertical plane around a horizontal axis, is a cam groove 325 which controls the opening and closing of the fingers 230. Running in the cam groove 325, in each instance, is a cam roller 326 which is rotatably mounted on a lever 327, said lever being pivotally mounted on the pivot shaft 296 adjacent the lever 295. The upper end of the lever 327 is forked at 328 (see Figs. 34 and 39) for the reception of a roller 329 which, in the case of the right handling gripping mechanism, is carried by the slide rack 276 and, in the case of the left handling mechanism, is rotatably mounted on the slide rack 277.

The right rack 276 meshes with a gear 330 which is secured to the hub 331 of a gear 332 (see Fig. 40). The gear 332 shown in Fig. 41, rotates

freely partly on hub 333 of the gear 334 which is secured to the vertical shaft 254, and partly on the hub of gear 262; whereas the gear 332 shown in Fig. 42 rotates freely on the hub 333 of gear 334 and the spacer sleeve 262a. A similar gear 334 is mounted on the vertical shaft 255 of the left handling mechanism and supports the gears 330, 331 and 332 in the manner above noted, the gear 330 of the left handling mechanism being in mesh with the left rack 277. The cam grooves 325 control the opening and closing of the fingers 230 in the manner above noted.

The gears 334, 334 on the shafts 254 and 255 respectively mesh with the gear racks 278 and 279 and are operated thereby to swing the handling grippers bodily in horizontal planes about the axes of the shafts 254 and 255.

The slide racks 278 and 279 are each provided with a roller 335 which rides in a slot 336 (see Fig. 34) formed in the upper end of a supplementary lever 337 which is pivoted at 338 to a main lever 339. The main lever 339 is pivotally mounted on the pivot shaft 296 adjacent the lever 327. The main lever 339 is of a T-shaped construction and at each of the opposite ends of the cross bar of the T at the outer end of the lever is provided a lug 340 through which is threaded an adjusting screw 341 having its inner end in engagement with a lug 342 formed on the supplementary lever 337, by which the supplementary lever may be adjusted on the main lever to effect adjustment of the travel of the slide rack 278 or 279, as the case may be.

In each instance the main lever 339 is provided with a cam roller 343 arranged to ride in a cam groove 344 formed in one face of a cam disc 345, one of which is secured to the shaft 302, for controlling the slide rack 278, and another of which is secured to the shaft 303, for controlling the slide rack 279.

From the above, it will be clear that synchronous rotation of the shafts 302 and 303 with the cams 298, 325 and 344 in predetermined relation to each other on each of said shafts will effect bodily rotation of the handling grippers L and R in horizontal planes about the vertical axes afforded by the shafts 254 and 255 respectively; rotation of the forearm levers 228 in vertical planes about horizontal axes afforded by the shaft levers 225; and opening and closing of the fingers 230 on the outer ends of the arms 228, whereby the finished laces are taken from the reel 10 and placed in predetermined relation to each other in a spacing rack 350 extending across the front of the machine in a position substantially parallel to the axis of the reel 10.

In the series of diagrammatic views 73a to 84d inclusive, which illustrate successive operations, of the reel 10, of the dies 155 and 156 and of the grippers L and R, from the time the tape is fed to the reel until the finished lace is removed therefrom and deposited on the spacing rack 350 by the grippers L and R, it will be clear that throughout the various figures those marked with the superscript *a* progressively illustrate the feeding of the tape to the reel 10, the corresponding instantaneous position of said reel and of the dies 155 and 156, as well as the manner in which the tape is supported by the reel 10 from the time said tape is fed thereto to the time it is acted upon by the dies; that those figures designated by the superscript *b* show identical positions of the dies 155 and 156, corresponding instantaneous positions occupied by the grippers L and R relative to the tape and rack 350, and that portion of the reel 10 intermediate the dies and grippers; that the figures designated by the superscript *c* illustrate the series of positions successively maintained by the jaws 113, 117 and 113a, 117a of the forked levers 115, in addition to the corresponding positions of the left gripper L relative to the tape and rack 350; and the figures designated by the superscript *d* diagrammatically illustrate the corresponding cycle positions in which the jaws 114, 118 and 114a, 118a of the forked levers 116 are progressively positioned, as well as the corresponding positions of the right gripper R relative to the tape and rack 350.

As noted previously, each finished lace x^2 is in a U-shaped form on the reel 10 as the reel is rotated to bring the finished laces to position to be grasped by the handling grippers L and R. The grippers L and R, as noted above, grasp but one end of each finished lace, between the relatively spaced reel grippers 113—113a and 117—117a and between the relatively spaced reel grippers 114—114a and 118—118a respectively. In the present instance (see Fig. 73b) the left gripper L graps the trailing end x^3 of the lace on the left side of the reel 10 and the right gripper R grasps the leading end x^4 of the lace on the right side of the reel 10, which, due to the manner of laying the tape x on the reel 10, are in alignment one with the other longitudinally of the reel 10.

In order that the handling grippers L and R will pick the finished laces x^2 off the reel 10 in a proper manner to place the laces on the spacing rack 350 properly, i. e. with one end of the lace held in the rack and the other end of the lace hanging freely, as shown in Fig. 44, the leading end x^5 of the lace on the left side of the reel 10 is released from the reel gripper jaws 113—113a and 117—117a by which it is held; and the trailing end x^6 of the lace at the right side of the reel is released from the reel-gripping jaws 114—114a and 118—118a by which it is held previous to, simultaneous with, or following the grasping of the trailing end x^3 of the left lace and the grasping of the leading end x^4 of the right lace by the handling grippers L and R respectively, whereupon the released ends x^5 and x^6 of the laces drop from the reel 10 leaving the left lace hanging from and by its trailing end x^3, which is still held firmly by the left set of reel grippers 113—113a, 117—117a following those which release the leading end x^5 of said left lace; and the right lace hanging from and by its leading end x^4 which is still held firmly by the right set of reel grippers 114—114a, 118—118a preceding those which release the trailing end x^6 of said right lace.

The release of the left and right reel grippers as just noted is effected by the timely actuation of the reel cam wheels 127 and 128, whereby the tip 125a of the cam segment 125 on the left cam wheel 127 engages the cam roller 123 of the forked arm 115 which has held the leading end of the left lace; and whereby the cam 129 on the right cam wheel 128 engages the cam roller 130 of the forked lever 116 which has held the trailing end of the right lace.

In the present instance, as shown in Figs. 73b and 73c the leading end x^5 of the left lace is released as the trailing end x^3 of said lace is carried, by rotation of the reel 10, into vertical alignment with the open fingers 230 of the left handling gripper L, as shown in Fig. 74c, and the trailing end x^6 of the right lace is released at

substantially the same time, as the leading end x^4 of said right lace moves into vertical alignment with the open fingers **230** of the right gripper R, as shown in Fig. 74*d*.

The left gripper L then swings upwardly and the right gripper R swings downwardly into grasping relation to the trailing end x^3 of the left lace and to the leading end x^4 of the right lace respectively, as shown in Figs. 76*c* and 76*d* respectively.

The fingers **230** of each of the handling grippers L and R then close and the reel cam wheels **127** and **128** operate to open the left reel grippers **113**—**113***a*, **117**—**117***a*, and the right reel grippers **114**—**114***a*, **118**—**118***a*, respectively to release the trailing end x^3 of the left lace and the leading end x^4 of the right lace which are then in the grasp of the left and right handling grippers L and R respectively.

The handling grippers L and R then swing downwardly about the horizontal axes of the main arm lever shafts **225**, **225**, as shown in Figs. 77*c*–78*d*, to carry the laces clear of the reel **10**.

The left handling gripper L which previously has been upside down with respect to the right gripper R continues to swing under its shaft **225** while the right gripper R remains in a substantially horizontal plane, as shown in Figs. 78*c* and 78*d* respectively.

When the left gripper L comes up again, by its continued rotation about its shaft **225** to the horizontal position of the right gripper R (see Figs. **27** and **28**) the two grippers then swing in horizontal planes about the vertical axes of the shafts **254** and **255**, (see Figs. 29 and 30) the right gripper R swinging to the right and the left gripper L swinging to the left until the forearms, **228**, **228** of said grippers R and L are substantially aligned with each other, with and above the spacing rack **350**, as shown in Figs. 31, 32, 79*c* and 79*d*.

The forearms **228**, **228** of the handling grippers R and L respectively then swing downwardly about the axes of the horizontal lever shafts **225**, **225** from the positions shown in Figs. 32, 80*c* and 80*d* to the position shown in Figs. 33, 81*c* and 81*d* wherein the ends of the laces held by said handling grippers are pressed into notches or slots formed in the upper edges of the spacing rack **350**.

The fingers **230**, **230** of the handling grippers R and L are then opened and the grippers progressively returned to their initial positions coincident with cooperative movements of the associated members, said movements being illustrated in Figs. 82*a* to 84*d*, inclusive.

In order to align the grippers R and L with the rack **350**, for pressing the lace ends into the notches of the spacing rack, and to absorb shock attending the stopping of their swinging movement the grippers L and R are adapted to engage resilient stops **575**, **576** respectively (see Figs. 34 and 35) which are secured to the supplementary brackets **258***a* and **259***a* respectively.

In order to align the grippers L and R with the reel **10** in the lace-grasping position, and to keep the grippers from swinging accidently from such position the grippers are adapted to be engaged by resilient fingers **578** and **579**, or solid fingers resiliently mounted, which are carried by a forwardly extending rigid arm **580** (see Figs. 8, 34 and 35) which is secured to the front plate **4**. The fingers **578**, **579** are adapted to snap over the caps **242** which are secured rigidly to the outer ends of the lever shafts **225** of the main arms of the grippers R and L.

The spacing rack **350** comprises a pair of laterally spaced bars **351**, **351** which are maintained in rigid fixed relation to each other by shouldered rivets **352**, **352**. Each rack bar **351** is provided along one of its edges with a series of lace-receiving slots or notches **351***a*, the slots of one bar being in transverse alignment with the slots of the other bar of the rack (see Figs. 31, 32, 44 and 54).

The bars **351**, **351** of each rack **350** are spaced apart to an extent slightly less than the spacing of the arms **228***a* and **228***b* of the gripper forearms **228**, so that the portion of the lace held between the fingers **230** and the arms **228***a* and **228***b* are positively pressed into and positioned in the slots **351***a* of the rack (see Fig. 54) before the fingers **230** are opened to release the lace from the handling gripper.

The rack **350** is supported at its ends by and on tracks **353**, **353** (see Fig. 44) formed along the upper horizontal edges of uprights **354**, **354** respectively of a rack carriage **355** (see Figs. 2, 3 and 43) which also includes a base **356** on which the uprights **354** are mounted and secured. The base **356** is provided with longitudinally extending laterally projecting ribs **357**, **357** which are slidably mounted in a slideway comprising guide grooves **358**, **358** formed respectively in the opposite sides of a base or track **360** (see Figs. 43, 55 and 56) rigidly secured in a fixed position in front of the machine and extending parallel to the axis of the reel **10**.

The carriage **355** is adapted to be moved longitudinally, step by step, to the extent of the spacing of the slots **351***a* in the rack **350** and for this purpose the movable base **356** of the carriage **355** is provided with a pair of rack bars **361** and **362** (see Fig. 56). The rack bars **361** and **362** are provided with ratchet teeth **363** and **364** respectively which point in opposite directions, one to the other, whereby the carriage **355** may be moved, step by step, in one direction a predetermined number of times during the placing of the finished laces in successive slots **351***a* of the rack **350**, until the rack is filled with laces from end to end, after which the full rack is removed and an empty rack is placed in the lace-receiving position on the carriage **355**. The direction of the movement of the carriage is then reversed until the second rack is filled from end to end, and so on throughout the filling of racks which are successively placed in the lace-receiving position.

In order to move the carriage **355** in the manner above noted the ratchet toothed rack bars **361** and **362** are adapted to be engaged respectively by vertically and horizontally movable detents **365** and **366** held in yielding engagement therewith by the spring members **365***a* and **366***a* respectively. The detents **365** and **366** are carried by a horizontally reciprocating head **367** which is slidably mounted in a U-shaped housing **368** secured to and within the stationary base **360**.

The adjustable screw members **356***a* carried by the guides **356***b* in turn fixed to the rack gear carrying base **356** are provided to abut opposite sides of the lug **362***a* which is fastened to the rack gear **362** by the screws **362***b* in manner shown in Figs. 55, 56 and 59, and thereby permit minute adjustments of **362**. When the position of rack gear **362** is to be changed relative to **361** the screws **362***c* are loosened in their respective elongated slots and the desired adjustment made by resetting the screws **356***a* accordingly as desired, which action imparts a corresponding movement to the lug **362***a* and to the rack gear **362** without,

however, disturbing the position of the rack gear 361.

Longitudinal reciprocation of the actuating head 367 is effected by means of an adjustable bar 369 the length of which may be increased or shortened by readjusting the screw 369a; one end of 369 is secured at 370 to the head 367 while its opposite end is provided with a roller 371 which is adapted to ride in a cam groove 372 formed in a cylindrical cam 373 which is secured to a short shaft 374. The shaft 374 is rotatably mounted in bearings 375, 375 formed on or carried by a bracket 376 which is secured to one end of the stationary base 360.

Secured to the shaft 374, adjacent the cylindrical cam 373, is a sprocket wheel 377 which is driven by a sprocket chain 378 which passes around the sprocket 377 and a sprocket 379 secured to the above noted shaft 316 (see Fig. 3) which imparts the above noted motions to the handling grippers.

The direction of movement of the carriage 355 is controlled by moving one of the detents 365—366 into an operative position, for engagement with a ratchet toothed rack bar 361 or 362 with which such detent is adapted to cooperate, and moving the other detent to an inoperative position relative to its associated rack bar.

Movement of one detent into an operative position and movement of the other detent into an inoperative position is controlled and effected by a sliding cam bar 380 (see Figs. 55 and 56) having a cam surface 381 adapted to cooperate with a pin 383 which extends laterally from the detent 365 into a slot 385 formed in the cam plate 380. The cam plate 380 is slidably mounted in the U-shaped housing 368 in lateral abutting relation to the reciprocating head 367, in which the detents 365 and 366 are mounted. The cam plate 380 is also provided with a cam surface 382 adapted to engage a pin 384 which extends laterally from the detent 366 into a slot 386 formed in the cam plate 380.

Longitudinal movement of the cam plate 380 will effect the withdrawal of one of said detents from the operating position and the placing of the other of the detents in its operating position, in the manner above noted. The lengths of the slots 385 and 386 at each side of the cam surfaces 381 and 382 respectively are such that the relation of the detents 365 and 366 will not be affected by the short reciprocations of the head 367 necessary for moving the carriage 355 step by step. The relation of the detents is affected only by the longitudinal movements of the cam plate 380.

The shifting of the cam plate 380, to effect reversal of the movement of the carriage 355, is effected by suitable timing and counting mechanism, at the time the spacing rack, then in the lace-receiving position, is full. The timing mechanism also controls the removal of the full rack from the lace-receiving position and the placing of an empty rack in the lace-receiving position.

The longitudinal movements of the cam plate 380 are effected by a connecting rod 390, whose length may be varied by re-adjusting the screw 390a; one end of 390 is connected to the cam plate, at 391, and its opposite end connected to the lower end of a lever 393 by a connector 392. The lever 393 is pivoted at 394 to a bracket 395 (see Fig. 60) secured to the frame step 261. The lever 393 is provided at its upper end with a roller 396 which runs in a cam groove 397 formed in a cylindrical reversing cam 398 (see Figs. 61 and 70). The reversing cam 398 is secured to one end of a reversing and counting shaft 400 which is rotatably mounted in a bearing 399 formed on a bracket 401. The bracket 401 is secured to another bracket 402 which is mounted on and projects laterally from the end frame 1.

Loosely mounted on the reversing shaft 400 is a counting wheel 403 which is provided with ratchet teeth 404 adapted to be engaged by a pawl 405. The pawl 405 is pivotally mounted at 406 to the outer end of a lever 407 which is loosely mounted on the hub of the counting wheel 403. The arm 407 and the pawl 405 are adapted to be oscillated about the axis of the shaft 400 by a link 408, one end of which is pivoted to the pawl lever 407 at 409. The opposite end of the link 408 is pivotally connected to a crank pin 410 (see Figs. 61 and 62) which is eccentrically mounted with respect to the axis of a shaft 411.

The shaft 411 is rigidly secured in a bracket 412 which is carried by the frame bracket 402. Rotatably mounted on the fixed shaft or stud 411 is a sprocket wheel 413 which is operatively connected by sprocket chain 414 to a sprocket wheel 415 (see Fig. 2) carried by and secured to the main shaft 38. Pinned to the hub of a sprocket 413 (see Fig. 62) is a gear wheel 416 and secured to the gear wheel 416 is a bridge member 417 which passes around the end of the fixed shaft 411 and affords the eccentric mounting for the crank pin 410 to which the one end of the link 408 is connected and by which the oscillation of the pawl arm 407 and corresponding intermittent rotation of the ratchet wheel 403 is effected.

Meshing with the gear wheel 416 is a gear wheel 418. The gear wheel 418 is provided with a crank pin 419 to which is connected one end of a link 420, the opposite end of which is connected at 421 to a lever 422. The lever 422 is freely mounted for oscillation about the axis of the reversing shaft 400, on the hub 423 of a ratchet wheel 424 (see Figs. 60 and 70), said ratchet wheel 424 being keyed to the reversing shaft 400.

Pivoted at 425 to the oscillating lever 422 is a pawl 426 which is arranged to engage successively four notches 427 formed in the wheel 424 at 90° apart, whereby one oscillation of the lever 422 will, under predetermined circumstances, affect 90° rotation of the reversing shaft 400 and a corresponding 90° rotation of the reversing cam 398 secured thereto.

A 90° rotation of the cam 398 will effect rocking of the lever 393 and a movement of the cam plate 380 into a position whereby both detents 365 and 366 are held in a neutral position, out of engagement with the racks 361 and 362 respectively, and a second 90° rotation of the cam 398 will move one of the detents into operative position and retain the other of the detents in an inoperative position, whereupon the direction of movement of the carriage 355 will be governed accordingly, upon rotation of the stepping cam 373.

The pawl 426 is normally held out of engagement with the wheel 424 and is brought into engagement with said wheel only at such time as the rotation of the counting wheel 403 indicates that the spacing rack 350, then in the lace-receiving position, has been filled.

The pawl 426 is normally controlled by a lever 430 which is pivoted at 431 to a bracket 432 carried by the frame extension 402, a spring 433 tending to rock the lever 430 about its pivot to

bring the pawl 426 into operative engagement with the wheel 424. However, the lever 430 is provided with a pin 434 which normally rides the peripheral edge of a disc 435 which is pinned to the hub of the counting wheel 403 and rotates in unison with said counting wheel. The disc 435 is provided with a pair of diametrically opposed radially extending slots 436 into which the pin 434 drops when one of the said slots is moved into alignment therewith, as a result of the step by step rotation of the counting wheel 403.

The lever 430 is provided with the segmental shoe 437 and the pawl 426 is provided with a roller 438 which is held in engagement, at all times, with the shoe 437 by a spring 439 having one end attached to the pawl 426 and its opposite end attached to the hub of the lever 422. At such times as the end of the pin 434 on the end of the lever 430 is riding the peripheral edge of the disc 435 the shoe 437 and consequently the pawl 426, is held in an outer position thereby permitting the pawl 426 to oscillate freely about the wheel 424 without engaging the notches thereof, but, as soon as the disc 435 is rotated to an extent wherein one of its slots 436 is aligned with the pin 434 the spring 433 immediately rocks the lever 430 about its pivot, throwing the shoe 437 and consequently the pawl 426 into the operative position shown in Fig. 60, whereupon by the rotation of the gear 418, the lever 422, and consequently the reversing shaft 400 and the reversing cam 398 thereon, receive a quick 90° movement followed by a second quick 90° movement, thereby effecting the 180° rotation of the reversing cam 398 by which reversing of the carriage 355 is effected.

On the return stroke of the lever 422, during each oscillation thereof, the shoe 437 is moved to its outer position by a cam 440 on the gear 418 engaging a curved portion 441 of the lever 430, whereby the pin 434 is moved out of the slot 436. Simultaneous rotation of the counting wheel 403 moves the peripheral edge of the disc 435 under the end of the pin 434 and maintains the lever 430 in its outer position until such time as another of the reversing slots 436 is moved into alignment with the pawl-controlling pin 434.

In order to prevent drifting of the reversing cam 398, which may effect an improper operation of the detents 365 and 366, a portion of the periphery of the cam 398, or a separate disc secured to said cam is provided with diametrically opposed peripheral notches 442 which are adapted to receive a projecting end of a spring-pressed detent 443, which is slidably mounted in a bracket 444 secured to the bearing 399 in which the reversing shaft 400 is rotatably mounted.

If manual reversing of the carriage 355 is desired or necessary at any time, such reversing may be accomplished by means of a hand wheel 445 which is secured to the outer end of a reversing shaft 400.

Simultaneously with the automatic reversing of the carriage 355 the full rack 350 is moved out of the lace-receiving position and an empty rack is moved into the lace-receiving position. Such movement is accomplished by a shaft 450 (see Figs. 1, 2, 3 and 43) which is rotatably mounted in bearings 448 and 449 which are secured to the opposite ends of the fixed base 360 and support the shaft 450 in longitudinal parallel relation to said base.

Rotation of the shaft 450 is effected and timed by mechanism controlled by the counting wheel 403. Rotatably mounted in bearings 451 and 452 secured to the frame extension 402 is a shaft 453 (see Figs. 64, 65 and 66), on the outer end of which is a sprocket 454. The sprocket 454 (see Figs. 1 and 2) is operatively connected by a drive chain 455 to a sprocket 454a secured to the main shaft 38, by which the shaft 453 is continuously rotated.

Loosely mounted on the shaft 453 (see Fig. 66) is a sleeve 456 to one end of which is secured a sprocket wheel 457. The sprocket wheel 457 is operatively connected by a sprocket chain 458 to a sprocket wheel 459 secured to the shaft 450 (see Fig. 3). Splined to the sleeve 456 (see Fig. 66) is a clutch sleeve 460 having jaws 461 at one of its ends which are adapted to be engaged by jaws 462 formed on one end of a clutch element 463 which is secured to the continuously rotating shaft 453.

The clutch sleeve 460 is constantly urged to move in a direction longitudinally of the sleeve 456, for effecting engagement of the jaws 461 and the jaws 462, by springs 464 each having one of its ends mounted in a counterbore formed in the end of the clutch sleeve 460 and its opposite end mounted in a counterbore formed in the flange 465 of the sleeve 456.

The clutch sleeve 460 is circumferentially grooved at 466 for the reception of a control arm 467 which is pivoted at 467a to the bracket 401 and provided at its outer free end with a cam surface 468. The cam surface 468 is adapted to engage a cam surface 469 formed in and on one of the side walls of the groove 466 of the clutch sleeve 460, to effect axially sliding movement of the clutch sleeve 460 in one direction on the sleeve 456, to withdraw the clutch jaws 461 from engagement with the constantly rotating clutch jaws 462 and to maintain the clutch 460 in such disengaged relation to the movable clutch element 462 during the normal operation of the machine, while the finished laces are being successively placed on the spacing rack 350 then in the lace-receiving position. When the rack 350 is filled, engagement of the clutch element 461 with the clutch element 462 is effected by withdrawing the lever 467 from the groove 466 in the clutch sleeve 460 whereupon the springs 464 slide the clutch sleeve 460 in the opposite direction and effect operative engagement between the clutch jaws 461 and 462.

Secured to the counting wheel 403 is a ring 470 (see Fig. 64) which is provided with diametrically opposed notches 471, 471. The notches 471 are adapted to receive a pointed end 472 of a pin 473 which is carried by one arm 474 of a lever 475. The lever 475 is loosely mounted on the pivot 467a of the lever 467, said lever arm 474 being urged toward the ring 470 by springs 476. The lever arm 474 is provided with a laterally extending lug 477 which carries an abutment screw 478 arranged to engage the underside of a lug 479 formed on the lever 467.

When the rotation of the counting wheel 403 effects reversing of the carriage 355 such rotation of the counting wheel at the same time effects alignment of one of the notches 471 of the ring 470 with the sharp end 472 of the pin 473, which permits the lever 475 to be rocked by the springs 476 about its pivot 467a, which, through the lug 477 on said lever, the abutment screw 478 carried thereby and the lug 479 on the lever 467, withdraws the clutch release cam 468 from the groove 466 of the clutch sleeve 460, whereupon the springs 464 slide the clutch sleeve 460 axially of the shaft 453 of the sleeve 456 and

effects engagement of the clutch jaws 461 with the continuously revolving clutch jaws 462 of the clutch element 463, which latter is secured to the continuously rotating shaft 453.

Engagement of the clutch jaws in this manner effects rotation of the sprocket 457 which, through the sprocket chain 458 and sprocket 459, effects rotation of the shaft 450. Rotation of the shaft 450 effects removal of the full rack 350 from the lace-receiving position and places an empty rack in said lace-receiving position in a manner which will be hereinafter described.

The lever 475 is provided with a second arm 480 at the outer end of which is a laterally extending lug 481 (see Fig. 67). The lug 481 affords support for one end of a compression spring 482, the opposite end of which bears against the underside of a laterally extending lug 483 formed on the clutch-releasing lever 467. Rocking of the lever 475 in an opposite direction to that above noted compresses the spring 482 which in turn rocks the lever 467 about its pivot and moves the clutch-releasing cam 468 again into the clutch groove 466, whereupon, as the clutch 460 is rotated, the cam 468 on the lever 467 is engaged by the cam 469 on the clutch sleeve 460 and causes an axial movement of the clutch sleeve 460 in the opposite direction to that above noted, which withdraws the clutch jaws 461 from the clutch jaws 462, whereby rotation of the sprockets 457 and 459 and consequently rotation of the shaft 450 is interrupted.

Rocking of the lever 475 in the manner noted, to release the clutch 460, is effected by a lever 484 (see Figs. 64, 65 and 66) which is pivotally mounted on the pivot shaft 467a and provided at one end with an abutment screw 485 which is adapted to engage a lug 486 extending laterally from the arm 474 of the lever 475 adjacent the pin 473 carried by said lever arm. The opposite end of the lever 484 is provided with a cam roller 487 which is adapted to be engaged by a cam 488. The cam 488 is secured to a gear 489 which is loosely rotatably mounted on the shaft 453 and meshes with a gear 490 which is secured to the constantly rotating shaft 316. The cam roller 487 is held in contact with the cam 488 at all times by a spring 491.

In order to insure the shaft 450 of getting a full revolution, and no more, the clutch-releasing lever 467 is provided with a laterally extending pin 492 or other abutment which, as the clutch 460 is released, is adapted to be engaged by a stop pin or other abutment 493 carried by the clutch sleeve 460. Engagement of the abutments 492—493 after each revolution of the clutch sleeve 360 indicates that the sprocket 457 and consequently the shaft 450 have received a full and complete revolution.

In order to insure the last portion of the revolution of the clutch sleeve 460 and consequently the sprocket wheel 457 as the clutch 460 is being released from the clutch element 463 the constantly rotating clutch element 463 is provided with a cam 494 (see Figs. 66 and 68). The cam 494 is adapted to engage a cam roller 495 which is rotatably mounted on a lever 496. The lever 496 is rotatably mounted on a pivot stud 497 which is secured in the bracket 498 depending from the bearing 451 in which the shaft 453 is rotatably mounted.

The lever 496 is provided with a rib or lug 499 which extends laterally therefrom into a recess formed by and between a pair of relatively spaced lugs 500, 500. The lugs 500 are formed on and extend laterally from a lever 501 and carry abutment screws 502, 502 respectively which engage the opposite sides of the lug 499 on the lever 496, whereby annular adjustment between the levers 496 and 501 may be effected, and whereby rocking of one of said levers will effect corresponding rocking motion of the other of said levers.

Pivoted at 503 to the lever 501 is a kicker block 504 which is adapted to engage one side of the abutment 493 on the clutch sleeve 460, to effect rotation of the clutch sleeve 460 to an extent sufficient to bring the opposite side of the abutment 493 on the clutch sleeve 460 into engagement with the abutment 492 on the clutch-releasing lever 467, after the clutch sleeve has been released from the continuously rotating clutch element 463.

The kicker block 504 is adapted to move out of the way of the pin 493, to permit the said pin to assume a position in front of the kicker block 504 before the clutch sleeve 460 is released and for this purpose the kicker block 504 is provided with a stop pin 505 adapted to engage and to be held in engagement with a stop lug 506 on the lever 501, by a spring 507 having one end attached to a hooked end lever extension 508 of the kicker block 504 and its opposite end secured to a pin 509 on the lever 501.

The last portion of each revolution of the clutch sleeve 460 is necessary for the proper positioning of the empty rack on the carriage 355, to align the lace-receiving notches of the rack with the depositing position of the outer ends of the handling grippers by which the finished laces are removed from the reel 10 and placed on the rack 350.

As noted above, the opposite ends of the lace rack, when the rack is in the lace-receiving position, each rests in a right angle groove, rail, or track 353 formed along the upper inner edges of the carriage uprights 354, 354 respectively. The rack is adapted to be moved longitudinally of the rails 353, 353 from the lace-receiving position, when full, to a rest position, by rotation of the shaft 450 in the manner above noted.

Parallel to each track groove 353 is an upper run of a pusher or conveyor chain 510 which passes around sprockets 511 and 512 rotatably mounted on studs 513 and 514 located respectively adjacent the opposite ends of the supporting track 353 on each of the uprights 354. Projecting laterally from the chains 510 are lugs 515 which are adapted to engage the full rack 350 at its opposite ends respectively and slide it forwardly in the carriage 355 along the tracks 353, 353. The chains 510, 510 are simultaneously driven through sprockets 516, secured to the front conveyer sprockets 511, 511 respectively. The sprockets 516, 516 are driven by sprocket chains 517, 517 which pass around sprocket wheels 518, 518 rotatably mounted on studs 519, 519 respectively carried by the uprights 354, 354. Secured to each of the sprockets 518 is a sprocket 520. The sprockets 520, 520 are operatively connected to sprockets 521, 521 by sprocket chains 522, 522 respectively. The sprockets 521, 521 are splined to the shaft 450 and slide longitudinally of the shaft 450 with the carriage 355 during the step by step movements of the carriage 355.

Rotation of the shaft 450 at the time and in the manner above noted effects movement of the conveyer chains 510, 510 and a consequent movement of the full rack 350 along the tracks 353, 353 from the lace-receiving position to an idle

position, as noted above, leaving the lace-receiving position vacant. However, as the full rack is being moved forwardly from the lace-receiving position an empty rack is being moved into the lace-receiving position, from a rack magazine for empty racks carried by the carriage **355** and disposed in a position above the rails **353** of the carriage.

The rack magazine comprises a pair of vertically disposed guides **525**, **525** of U-shaped cross section in plan. Each guide **525** comprises a foot **526** which is mounted on and is secured to a bracket **527** which in turn is secured to one of the carriage uprights **354** (see Figs. 1, 2, 3, 43 and 44). The lowermost rack **350** rests on a pair of L-shaped supports **528**, **528** carried by and at the lower ends of the guides **525**, **525** respectively, said supports affording openings at the lower ends of the guides **525**, toward the rear of the magazine, as indicated at **529** in Fig. 43 through which the lowermost rack only is removed from the magazine.

The lowermost rack **350** is adapted to be engaged at its opposite ends respectively by fingers **530**, **530** (see Figs. 44 and 48). Each finger **530** is adapted for longitudinal sliding movement in a head **531** formed on the upper end of a rack transfer lever **532**. Each transfer lever **532** is secured to a pivot shaft **533** which is rotatably mounted in a bearing **534** carried by one of the magazine brackets **527**.

Each rack transfer lever **532** is provided with a pair of laterally spaced outwardly extending lugs **535**, **535** which respectively support the opposite ends of a short pivot shaft **536** for a rack-gripping finger operating lever **537** which is mounted on the pivot shaft **536** between the lugs **535** of the transfer lever **532**. Each finger-operating lever **537** is pivotally connected at **538** to the outer end of its associated rack-gripping finger **530**.

The lower end of each finger-operating lever **537** is provided with a roller **539** which is adapted to run first in one and then in the other of a pair of substantially parallel cam grooves **540** and **541** which are formed in a segmental cam plate **542**. The segmental cam plate **542** at each side of the rack magazine is provided with a foot **543** which is secured to the carriage uprights **354**, **354** respectively.

The inner end of each of the rack-gripping fingers **530** is notched or grooved at **544** for engagement with the outermost of the spacing rivets **352** at the opposite ends respectively of the lowermost rack **350**, said finger being resiliently pressed into engagement with said spacing rivet by a spring **545** having one end attached to the finger-operating lever **537** and its opposite end attached to the transfer lever **532**.

Mounted on and secured to each of the transfer levers **532** is a gear **546** (see Fig. 44), the teeth of which mesh with the teeth of a gear rack **547** which is slidably mounted in guideway **548** formed in the bracket **527**. The lower end of which rack **547** is pivotally connected at **549** to the one end of a link **550**, the opposite end of which is rotatably mounted on a crank pin **551** carried by and extending laterally from one side of a sprocket **552**. Each sprocket **552** is secured to a short shaft **553** which is rotatably mounted in a bearing **554** carried by a bracket **555** secured to the carriage upright **354**. The sprocket **552** is driven by the sprocket chain **522**, above referred to (see Fig. 43).

Upon rotation of the shaft **450**, in the manner above noted, the sprockets **552** at each end of the carriage **355** are rotated by the chains **522**, which effects rotation of the cranks **551**. The cranks **551**, **551** in turn effect simultaneous longitudinal upward movement of the racks **547**, **547**. Upward movement of the racks **547** effects rotation of the gears **546** and the transfer levers **532** about the axes of the short shafts **533**. Such rotation of the transfer levers **532**, **532** causes the fingers **530**, **530** to swing outwardly from the rack magazine and thereby remove the lowermost rack **350** from the magazine through the openings **529** in the rear side thereof. Continued upward movement of the gear racks **547** causes the empty rack to be swung through an angle of substantially 90°, ending at and placing the empty rack in the lace-removing position on the rails **353**, **353** which has been just vacated by the full rack removed from the lace-receiving position by the conveyer chains **510**, **510**.

During this outward and downward swinging movement of the transfer levers **532** the rollers **539** on the outer ends of the levers **537** swing inwardly and upwardly and their rollers **539** run in the outer cam grooves **540** of the segments **542**. As the empty rack is deposed on the rails **353** the rollers **539** engage inclines **556** at the upper ends of the cam slots **540**, **540** respectively. The inclines **556** shift the rollers **539** from the outer cam paths **540** into the inner cam paths **541** of the segments **542**, which swings the levers **537** about their pivots **536** and causes the fingers **530**, **530** to be moved outwardly, thereby releasing the empty rack from the transfer levers **532**.

Continued rotation of the sprockets **552** then lowers the racks **547** and causes the transfer levers **532** to be swung in an opposite direction, for gripping another empty rack **350** which has dropped to the bottom position in the rack magazine. During this reverse swinging of the transfer levers **532** the rollers **539** on the levers **537** ride in the inner cam grooves **541** and retain the fingers **530** in the open or rack-releasing position. As the sprockets **552** complete one revolution the rollers **539** of the levers **537** each attain a rearward extreme position in the cam grooves **541** which brings the rollers **539** into line with cam passages **557**, **557** respectively, which connect the lower ends of the outer cam grooves **540** with the lower ends of the inner cam grooves **541** in the segments **542**. The springs **545** then act to swing the levers **537** about their pivots **536**, moving the rollers **539** into the lower ends of the cam grooves **540** and moving the fingers **530**, **530** inwardly into gripping contact with the lowermost empty rack **350** in the magazine.

In order to insure the rollers **539** returning through the cam grooves **541**, to retain the fingers **530** in the open position during the backward swinging movement of the transfer levers **532**, each segment **542** is provided with a switch **558** which is pivoted at **559** in said segment, said pivot extending through and having a bearing in the segment **542** and being provided with a lever **560**, outside the segment **542**, to which is connected one end of a spring **561**, the other end of the spring being connected to said segment. The spring **561** at all times tends to press the point **558***a* of the switch **558** into contact with the inclined portion **556** of the cam groove **540**, whereby the cam roller **539**, in moving into the extreme end **541***a* of the cam groove **541** passes the point of the switch and, upon reverse swinging movement of the transfer lever **532**, is guided into the lower portion of the groove **541**.

In addition to the positive grip afforded by the

rigid sliding fingers 530 each rack is frictionally engaged by resilient fingers 562, 562 disposed respectively above and below each rigid sliding finger 530 and adapted to engage frictionally the bars 351, 351 of the rack being transferred.

As shown in Figs. 44, 48, 49 and 50, the resilient fingers 562 at the left side of the carriage engage the inside surfaces of the bars 351 of the rack 350. The opposite or right end of each of the racks 350 is offset inwardly, as indicated in Fig. 44, by providing a short extension 351c on each of the side bars 351 of the rack and between which the outermost spacing rivet 542 is placed. The resilient fingers 562 at the right side of the carriage engage the outer surfaces of the rack extensions 351c, as clearly shown in Figs. 44 and 50.

The offsetting of the one end of the rack is for the purpose of aligning the racks and holding the racks together end to end subsequent to their removal from the tipping machine for purposes of no interest to the present application.

As each empty rack is dropped into the lace-receiving position on the rails 353 it is engaged at each of its opposite ends to insure its being properly positioned on and between said rails by the upper broadened blunt ends 565, 565 respectively (see Figs. 43, 44 and 52) of levers 566, 566 which are pivoted at 567 to brackets 568 secured to the uprights 354, 354 respectively. The lower ends of the levers 566 (see Figs. 43 and 51) are provided with rollers 569 adapted to be engaged by cams 570 mounted on the outer ends of the shafts 553, 553 of the sprockets 552.

The upper broad ends 565 of the levers 566 are resiliently maintained in contact with the opposite ends of the rack 350 respectively during the entire loading of the rack by the handling grippers above described, whereby the rack is held against longitudinal movement by the placing of the laces in the rack. Each broadened end 565 is provided with a lip 565a which passes between the side bars 351 of the rack 350 as seen in Fig. 44, and the extensions 351c on the right side of the rack 350, to prevent lateral movement of the rack; and the rack is shouldered at 351b, 351b for engagement by the lower side of the broadened upper end of the lever, in each case, to prevent raising of the rack, by the lace-handling grippers.

However, as soon as the rack is filled and the shaft 450 is rotated, in the manner before described, the cams 570 are rotated and rock the levers 566 against the action of the springs 571, to release the upper ends 565 of the levers from the filled rack, in order that the filled rack may be moved longitudinally of the rails 353 by the conveyers 510, and as soon as the empty rack is placed in the lace-receiving position the cams 570 release the levers 566 permitting the upper ends 565 of the levers to engage the opposite ends of the newly deposited rack.

From the above detailed description of the construction and operation of the elements and units of which the machine is composed, it will be clear that, as long as the motor 50 is in operation and the main clutch comprising the elements 52—41 is engaged, the shuttle 15 will lay the tape x back and forth across the face of the reel 10 and the reel will be intermittently rotated in one direction, one step for each stroke of the shuttle, to carry the tape around the posts 13 of the reel, whereby the tape will be measured for the desired lengths of individual shoe laces and supported in the form of the successive runs x^1, x^1 on and by the reel 10. It follows that each run x^1 will be gripped at four separate and relatively spaced points longitudinally thereof by the grippers of the reel 10; that the intermittent rotations of the reel 10 will position the tape runs x^1 successively between the moistening pads 180—182 and then carry said runs to and position them successively on the anvil 160 of the tipping unit, between the tipping dies 161—163 and 162—164; that the tipping strip y will be intermittently projected between the tipping dies adjacent the tape run disposed on the tipping anvil. It will likewise be clear that the tipping dies 161—163 will be operated simultaneously first to shear a double tip unit y^1 from the tip-strip y, then to fold and set the unit y^1 around the tape run x^1 on the anvil and then relatively to shear the double tip unit y^1 and the encased tape at the middle of the double tip unit which separates the tape into individual laces having a tip at each of their ends, with each end of each lace, which is then in a U-shaped form on the reel 10, gripped at two relatively spaced points to be grasped therebetween by the handling grippers L or R, as the case may be; that the handling grippers L will grasp one end of each lace carried on the left side of the reel 10 and the grippers R will engage one end of each lace carried on the right side of the reel 10; that the reel grippers will be operated to release first the end of each lace that is not grasped by the handling grippers, to permit such end to drop free of the reel and free of the handling grippers, and then to release that end of the lace which is grasped by the handling grippers. It will also be understood that the handling grippers are operated more or less universally by swinging in vertical planes about horizontal axes and in horizontal planes about vertical axes, at different times on some occasions and at the same time on other occasions, to move the handling grippers into position to grasp the laces, to close the grippers on the laces held by the reel grippers, to swing the laces away from the reel into positions above a spacing rack 350, to place the laces positively in the spacing slots 350a of the rack, to open the fingers after the laces have been positively inserted in the spacing rack slots, and to return the grippers to the position for taking other laces from the reel 10. It will also be clear that the placing of the laces in the rack 350 is started at one end of the rack and in the middle of the rack at the same time by the simultaneous operation of the handling grippers L and R respectively; that the rack is moved step by step, longitudinally in one direction until the rack is full; that the laces are counted in pairs as they are placed on the rack and that as soon as the rack is filled the counting mechanism acts to cause the filled rack to be automatically moved laterally from the lace-receiving position to a position for manual removal from the machine, while an empty rack is automatically placed in the lace-receiving position, whereupon the new rack is moved longitudinally in the opposite direction to its predecessor so that no time is lost by returning the rack stepping mechanism to a single starting position, all without necessitating the stopping of the machine or interrupting the continuous laying of the tape on the measuring reel.

It will also be quite clear from the foregoing detailed description how the empty racks are carried in a magazine on the carriage by which the rack undergoing filling is moved longitudinally; how the filled racks are moved out of the lace-receiving position and the empty racks are successively moved into the lace-receiving position

without necessitating any interruption of the handling grippers in taking the finished laces from the reel and depositing them on the spacing rack; and how, if a knot is encountered in the tape x or if the supply of tape is about to be exhausted, the machine will be automatically stopped before the knot or the end of the tape reaches the shuttle.

It is advisable when using certain materials for the tips of the laces which require, or work more readily under, heat, to provide an automatic control for the heating unit. In the present instance the heating unit, the anvil, the dies, or the die carriers, may be provided with a thermo-sensitive device by which the temperature of the dies may be governed.

In the present case it is more convenient to employ electrical heating means which, as hereinbefore noted, comprises heating coils **590** (see Fig. 85) enclosed within the unit **178** and connected in circuit with the main manually operable switch **591** which controls the flow of electric energy to the coils **590** through a fuse **592**, and through an automatic cut off switch **593** which is controlled by an expansible and contractible unit **595** containing an expansible gas or other medium such as mercury conducted by a tube **596** from the region in which the temperature is affected by the heating unit **178**. In the present case the one end of the tube **596** is sealed and placed and secured in close intimate contact with that portion of the die casing **151** which supports the anvil **159** and heating unit **178**.

The motor **50** is connected through a separate switch **597** and fuse **598** to the source of electric energy in order that the motor **50** and heating unit **178** may be independently controlled.

Of course, my improvements in shoe lace tipping machines as specifically shown and described can be changed and modified in various ways without departing from the inventions herein disclosed and hereinafter claimed.

I claim:—

1. In a lace-tipping machine, means for holding one or more laces during tipping thereof, means for supporting each lace subsequent to said tipping, and movable handling means for transferring each lace from said holding means to said supporting means.

2. In a lace-tipping machine, means for holding one or more laces during tipping thereof, means for supporting a plurality of said laces subsequent to said tipping, and movable handling means for grasping and transferring each lace from said holding means to said supporting means and releasing the grasp on each lace to deposit the same on the supporting means.

3. In a lace-tipping machine, means for holding one or more laces during tipping thereof, means for supporting a plurality of said laces subsequent to said tipping, handling means for transferring said laces from said holding means to said supporting means, and means for effecting relative movement between said supporting means and said transferring means within the interval of transfer of individual laces thereto for spacing individual laces relatively on said supporting means.

4. In a lace-tipping machine, means for holding one or more laces during tipping thereof, means for supporting a plurality individual laces in lateral spaced alignment subsequent to said tipping, handling means for transferring said laces from said holding means to said supporting means, means for effecting relative movement between said supporting means and said tranferring means within the interval of transfer of individual laces thereto for spacing said laces relatively on said supporting means, and means for counting the laces transferred to said supporting means.

5. In a lace-tipping machine, means for holding a lace during tipping thereof, means for supporting a plurality of said laces subsequent to said tipping, handling means for transferring said laces from said holding means to said supporting means, means for effecting relative movement between said supporting means and said transferring means for spacing in individual laces relatively on said supporting means, means for counting the laces transferred to said supporting means, and independent means for removing said supporting means from the lace-receiving position.

6. In a lace-tipping machine, means for holding a lace during tipping thereof, means for supporting a plurality of said laces subsequent to said tipping, handling means for transferring said laces from said holding means to said supporting means, means for effecting relative movement between said supporting means and said transferring means for spacing in individual laces relatively on said supporting means, means for counting the laces transferred to said supporting means, independent means for removing said supporting means from the lace-receiving position, and means for placing empty supporting means in the lace-receiving position.

7. In a lace-tipping machine, means for holding a lace during tipping thereof, means for supporting a plurality of individual laces in lateral alignment subsequent to said tipping, handling means for transferring said laces from said holding means to said supporting means, means for counting the laces transferred to said supporting means, means for removing said supporting means from the lace-receiving position, and separate means for placing empty supporting means in the lace-receiving position.

8. In a lace-tipping machine, means for holding a lace during tipping thereof, means for supporting a plurality of individual laces in lateral alignment subsequent to said tipping, handling means for transferring said laces from said holding means to said supporting means, means for counting the laces transferred to said supporting means, and means for removing said supporting means from the lace-receiving position.

9. In a lace-tipping machine, means for holding the opposite ends of a lace during tipping thereof, means for supporting the lace after tipping, handling means adapted to grasp the lace adjacent one tipped end thereof for transferring the lace from the holding to the supporting means, and means for releasing the holding means for the two ends of the lace to permit said transfer.

10. In a lace-tipping machine, means for holding the opposite ends of each lace during tipping thereof, means for supporting a plurality of said laces after tipping, handling means adapted to grasp each lace adjacent one of the tipped ends thereof for transferring said laces from said holding means to said supporting means, means for releasing said ends successively from said holding means to permit the non-grasped end to assume a free hanging position prior to the release of said grasped end to permit said transfer, and means for effecting relative movement between the lace-supporting means and the han-

dling means to space the laces relative to each other on said supporting means.

11. In a lace-tipping machine, means for holding the opposite ends of each lace during tipping thereof, means for supporting a plurality of said laces after tipping, handling means adapted to grasp each lace adjacent one of the tipped ends thereof for transferring said laces from said holding means to said supporting means, means for releasing said ends successively from said holding means to permit the non-grasped end to assume a free hanging position prior to the release of said grasped end to permit said transfer, means for effecting relative movement between the lace-supporting means and the handling means to space the laces relative to each other on said supporting means, means for counting the laces transferred to said supporting means, and means controlled by said counting means for removing said support from the lace-receiving position upon having a predetermined number of laces placed thereon.

12. In a lace-tipping machine, means for holding the opposite ends of each lace during tipping thereof, means for supporting a plurality of said laces after tipping, handling means adapted to grasp each lace adjacent one of the tipped ends thereof for transferring said laces from said holding means to said supporting means, means for releasing said ends successively from said holding means to permit the non-grasped end to assume a free hanging position prior to the release of said grasped end to permit said transfer, means for effecting relative movement between the lace-supporting means and the handling means to space the laces relative to each other on said supporting means, means for counting the laces transferred to said supporting means, means controlled by said counting means for removing said support from the lace-receiving position upon having a predetermined number of laces placed thereon, and means controlled by said counting means for placing an empty support in the lace-receiving position.

13. In a lace-tipping machine, means for supporting a continuous strip of lacing in successive laterally spaced runs, means for gripping each run at a plurality of longitudinally spaced points, means for severing said runs intermediate said points to produce individual laces each formed partly in one run and partly in the next succeeding run with the opposite ends of each lace held by said gripping means for said runs respectively, handling means adapted to grasp said laces respectively intermediate the opposite ends thereof, and means for releasing the grippers for said opposite ends in predetermined relation to each other and to the grasping of the laces by said handling means.

14. In a lace-tipping machine, means for supporting a continuous strip of lacing in successive laterally spaced runs, means for gripping each run at a plurality of longitudinally spaced points, means for severing said runs intermediate said points to produce individual laces each formed partly in one run and partly in the next succeeding run with the opposite ends of each lace held by the gripping means for said runs respectively, handling means adapted to grasp each lace adjacent one end thereof, and means for releasing the gripping means for the said opposite ends of each lace in predetermined relation to each other and to the grasping of the end of each lace by said handling means.

15. In a lace-tipping machine, means for supporting a continuous strip of lacing in successive laterally spaced runs, means for gripping each run at a plurality of longitudinally spaced points, means for severing said runs intermediate said points to produce two series of individual laces at opposite sides respectively of the line of severing with each lace formed partly in one run and partly in the next succeeding run and with the opposite ends of each lace held by the gripping means for said runs respectively, handling means adapted to grasp each lace adjacent one end thereof, and means for releasing the grippers for the opposite ends of at least one of said series of laces in succession.

16. In a lace-tipping machine, means for supporting a continuous strip of lacing in successive laterally spaced runs, means for gripping each run at a plurality of longitudinally spaced points, means for severing said runs intermediate said points to produce two series of individual laces at opposite sides respectively of the line of severing with each lace formed partly in one run and partly in the next succeeding run and with the opposite ends of each lace held by the gripping means for said runs respectively, handling means adapted to grasp each lace adjacent one end thereof, and means for releasing the grippers for the opposite ends of the laces of one of said series in succession subsequent to the grasping of the one end of each lace of said series by said handling means.

17. In a lace-tipping machine, means for supporting a continuous strip of lacing in successive laterally spaced runs, means for gripping each run at a plurality of longitudinally spaced points, means for severing said runs intermediate said points to produce two series of individual laces at opposite sides respectively of the line of severing with each lace formed partly in one run and partly in the next succeeding run and with the opposite ends of each lace held by the gripping means for said runs respectively, handling means adapted to grasp each lace adjacent one end thereof, means for releasing the grippers for the opposite ends of the laces of one of said series in succession subsequent to the grasping of the one end of each lace of said series by said handling means, and means for releasing the grippers for the opposite ends of the other series of laces in succcession, with the release of the grasped end of the lace occurring subsequent to said grasping, and the release of the opposite end occurring prior to said grasping.

18. In a lace-tipping machine, a reel for supporting a continuous strip of lacing in successive runs extending longitudinally and spaced circumferentially of the reel, a pair of wheels intermediate the opposite ends of the reel, independently operable grippers carried by each wheel for gripping each run at a plurality of points spaced longitudinally of each run, means for severing each run intermediate said wheels to produce two series of individual laces respectively formed partly in one run and partly in the next succeeding run with each end of each lace of one series held by the grippers of one of said wheels and the ends of the laces of the other series held by the grippers of the other of said wheels, handling means adapted to grasp each lace adjacent one end thereof, and means for actuating said grippers in predetermined relation to each other for releasing the ends of said laces to permit removal of the laces from the reel by the handling means.

19. In a lace-tipping machine, a reel for sup-

porting a continuous strip of lacing in successive runs extending longitudinally and spaced circumferentially of the reel, a pair of wheels intermediate the opposite ends of the reel, independently operable grippers carried by each wheel for gripping each run at a plurality of points spaced longitudinally of each run, means for severing each run intermediate said wheels to produce two series of individual laces respectively formed partly in one run and partly in the next succeeding run with each end of each lace of one series held by the grippers of one of said wheels and the ends of the laces of the other series held by the grippers of the other of said wheels, handling means adapted to grasp each lace adjacent one end thereof, means for actuating said grippers in predetermined relation to each other for releasing the ends of said laces to permit removal of the laces from the reel by the handling means, including a cam wheel adjacent each gripper wheel, and means on said grippers engaged by cams on said cam wheels, and means for rotating said cam wheels about the axis of the reel and relative to the gripper wheels.

20. In a lace-tipping machine, a reel for supporting a continuous strip of lacing in successive runs extending longitudinally and spaced circumferentially of the reel, a pair of wheels intermediate the opposite ends of the reel, independently operable grippers carried by each wheel for gripping each run at a plurality of points spaced longitudinally of each run, means for severing each run intermediate said wheels to produce two series of individual laces respectively formed partly in one run and partly in the next succeeding run with each end of each lace of one series held by the grippers of one of said wheels and the ends of the laces of the other series held by the grippers of the other of said wheels, handling means adapted to grasp each lace adjacent one end thereof, means for actuating said grippers in predetermined relation to each other for releasing the ends of said laces to permit removal of the laces from the reel by the handling means, including a cam wheel adjacent each gripper wheel, a single cam follower on each gripper for engagement with a gripper-actuating cam on one of said cam wheels and a second cam follower on alternate grippers carried by one of said gripper wheels for engagement with a second cam on the cam wheel adjacent the last said gripper wheel.

21. In a lace-tipping machine, a reel for supporting a continuous strip of lacing in successive runs extending longitudinally and spaced circumferentially of the reel, a pair of wheels intermediate the opposite ends of the reel, independently operable grippers carried by each wheel for gripping each run at a plurality of points spaced longitudinally of each run, means for severing each run intermediate said wheels to produce two series of individual laces respectively formed partly in one run and partly in the next succeeding run with each end of each lace of one series held by the grippers of one of said wheels and the ends of the laces of the other series held by the grippers of the other of said wheels, handling means adapted to grasp each lace adjacent one end thereof, means for actuating said grippers in predetermined relation to each other for releasing the ends of said laces to permit removal of the laces from the reel by the handling means, including a cam wheel adjacent each gripper wheel, a single cam follower on each gripper for engagement with a gripper-actuating cam on one of said cam wheels and a second cam follower on alternate grippers carried by one of said gripper wheels for engagement with a second cam on the cam wheel adjacent the last said gripper wheel, and cam-actuated means for rocking said cam wheels about said axis in predetermined relation to each other.

22. In a lace-tipping machine, a lace-supporting reel comprising a pair of gripper-carrying wheels respectively equipped with independently operable grippers for the opposite ends respectively of the laces carried by the reel, mechanism for actuating said grippers at predetermined points circumferentially of the reel, and means for intermittently rotating the reel and gripper-carrying wheels synchronously to bring said grippers successively into position relative to said actuating means for operation thereby, said means including a constantly moving drive member, a driven element and means cooperating between said drive member and driven element for moving said element intermittently.

23. In a lace-tipping machine, a lace-supporting reel comprising a pair of gripper-carrying wheels respectively equipped with independently operable grippers for the opposite ends respectively of the laces carried by the reel, mechanism for actuating said grippers at predetermined points circumferentially of the reel, means for intermittently rotating the reel and gripper-carrying wheels synchronously to bring said grippers successively into position relative to said actuating means for operation thereby, said means including a constantly moving drive member, a driven element and means cooperating between said drive member and driven element for moving said element intermittently and means for locking said reel and gripper-carrying wheels against circular movement intermediate said intermittent rotations thereof.

24. In a lace-tipping machine, handling means for transferring the laces from one to another of a plurality of relatively spaced supports, said handling means comprising lace-gripping means, and means for swinging said gripping means about a plurality of axes arranged at predetermined angles one to another in carrying a lace from one to the other of said supports.

25. In a lace-tipping machine, handling means for transferring the laces from one to another of a plurality of relatively spaced supports, said handling means comprising lace-gripping means, means for swinging said gripping means about a plurality of axes arranged at predetermined angles one to another in carrying a lace from one to the other of said supports, and means for closing and opening said grippers relative to the lace in position at said supports respectively.

26. In a lace-tipping machine, handling means for transferring the laces from one to another of a plurality of relatively spaced supports, said handling means comprising lace-gripping means, and cam-controlled means for swinging said gripping means about a plurality of axes arranged at predetermined angles one to another in carrying a lace from one to the other of said supports.

27. In a lace-tipping machine, handling means for transferring the laces from one to another of a plurality of relatively spaced supports, said handling means comprising lace-gripping means, first cam-controlled means for swinging said gripping means about a plurality of axes arranged at predetermined angles one to another in carrying a lace from one to the other of said supports, and second cam-controlled means for

closing and opening said grippers relative to the lace in position at said supports respectively.

28. In a lace-tipping machine, handling means for the laces comprising a main lever arranged to swing about one axis, a supplementary lever pivotally mounted on the main lever for swinging about an axis disposed at an angle to the first said axis, and lace-gripping means carried by the supplementary lever.

29. In a lace-tipping machine, handling means for the laces comprising a main lever adapted to swing about one axis, a supplementary lever pivotally mounted on the main lever for swinging about an axis disposed at an angle to the pivot axis of the main lever, lace-gripping means on the supplementary lever and including a finger pivotally mounted on said supplementary lever, means for rocking the finger relative to the supplementary lever for gripping and releasing said lace, means for swinging the supplementary lever about its pivot on the main lever, and means for swinging the main and supplementary levers about the pivot axis of said main lever.

30. In a lace-tripping machine, handling means for the laces comprising a main lever adapted to swing about one axis, a supplementary lever pivotally mounted on the main lever for swinging about an axis disposed at an angle to the pivot axis of the main lever, lace-gripping means on the supplementary lever and including a finger pivotally mounted on said supplementary lever, means for rocking the finger relative to the supplementary lever for gripping and releasing said lace, means for swinging the supplementary lever about its pivot on the main lever, means for swinging the main and supplementary levers about the pivot axis of said main lever, said finger rocking means comprising intermeshing gears rotatable about said lever axes respectively, and cam-actuated means for rotating said gears.

31. In a lace-tipping machine, handling means for the laces comprising a main lever adapted to swing about one axis, a supplementary lever pivotally mounted on the main lever for swinging about an axis disposed at an angle to the pivot axis of the main lever, lace-gripping means on the supplementary lever and including a finger pivotally mounted on said supplementary lever, means for rocking the finger relative to the supplementary lever for gripping and releasing said lace, means for swinging the supplementary lever about its pivot on the main lever, means for swinging the main and supplementary levers about the pivot axis of said main lever, said supplementary lever swinging means comprising intermeshing gears rotatable about said lever axes respectively, and cam-actuated means for rotating said gears.

32. In a lace-tipping machine, handling means for the laces comprising a main lever adapted to swing about one axis, a supplementary lever pivotally mounted on the main lever for swinging about an axis disposed at an angle to the pivot axis of the main lever, lace-gripping means on the supplementary lever and including a finger pivotally mounted on said supplementary lever, means for rocking the finger relative to the supplementary lever for gripping and releasing said lace, means for swinging the supplementary lever about its pivot on the main lever, means for swinging the main and supplementary levers about the pivot axis of said main lever, said main lever swinging means comprising a gear rotatable about the pivot axis of said main lever, and cam-actuated means for rotating said gear.

33. In a lace-tipping machine, handling means for the laces comprising a main lever adapted to swing about one axis, a supplementary lever pivotally mounted on the main lever for swinging about an axis disposed at an angle to the pivot axis of the main lever, lace-gripping means on the supplementary lever and including a finger pivotally mounted on said supplementary lever, means for rocking the finger relative to the supplementary lever for gripping and releasing said lace, means for swinging the supplementary lever about its pivot on the main lever, means for swinging the main and supplementary levers about the pivot axis of said main lever, said finger-rocking and lever-swinging means each comprising a gear rotatable about the pivot axis of the main lever, a longitudinally slidable gear rack for rotating said gear, and a cam for effecting longitudinal movement of said gear rack.

34. In a lace-tipping machine, lace handling means, comprising a pivot shaft rotatably mounted in fixed bearings, a main lever comprising a stud shaft fixed to and extending at right angles from said pivot shaft, a sleeve shaft rotatably mounted on said stud shaft, a supplementary lever secured to said sleeve shaft, a gripping finger pivoted to said supplementary lever, intermeshing gears freely rotatably mounted on said pivot and sleeve shafts respectively for actuating said finger, intermeshing gears loosely and fixedly mounted on said pivot shaft and said sleeve shaft respectively for swinging said supplementary lever about the stud shaft constituting said main lever, and means for rotating said pivot shaft in its bearings to effect swinging of said main lever about the axis of said pivot shaft.

35. In a lace-tipping machine, lace handling means, comprising a pivot shaft rotatably mounted in fixed bearings, a main lever comprising a stud shaft fixed to and extending at right angles from said pivot shaft, a sleeve shaft rotatably mounted on said stud shaft, a supplementary lever secured to said sleeve shaft, a gripping finger pivoted to said supplementary lever, intermeshing gears freely rotatably mounted on said pivot and sleeve shafts respectively, a lever loosely mounted on said sleeve shaft adjacent the loosely mounted gear thereon, a rod connecting said lever with said finger, resilient means connecting said gear and said lever, and means for rotating the gear loosely mounted on said pivot shaft for actuating said finger.

36. In a lace-tipping machine, lace handling means, comprising a pivot shaft rotatably mounted in fixed bearings, a main lever comprising a stud shaft fixed to and extending at right angles from said pivot shaft, a sleeve shaft rotatably mounted on said stud shaft, a supplementary lever secured to said sleeve shaft, a gripping finger pivoted to said supplementary lever, intermeshing gears loosely mounted on and fixedly secured to said pivot and sleeve shafts respectively, and means for rotating said loosely mounted gear about said pivot shaft for effecting swinging movement of the supplementary lever about the stud shaft constituting said main lever.

37. In a lace-tipping machine, lace handling means, comprising a pivot shaft rotatably mounted in fixed bearings, a main lever comprising a stud shaft fixed to and extending at right angles from said pivot shaft, a sleeve shaft rotatably mounted on said stud shaft a supplementary lever

secured to said sleeve shaft, a gripping finger pivoted to said supplementary lever, intermeshing gears freely rotatably mounted on said pivot and sleeve shafts respectively for actuating said finger, intermeshing gears loosely and fixedly mounted on said pivot shaft and said sleeve shaft respectively for swinging said supplementary lever about the stud shaft constituting said main lever, a gear secured to said pivot shaft for swinging said main arm about the axis of said pivot shaft, and cam-controlled and actuated means for rotating the gears on said pivot shaft in predetermined relation to each other to effect opening and closing of said gripping finger and the swinging of the main and supplementary levers about their respective pivots to handle the lace.

38. In a lace-tipping machine, means for holding a lace at two relatively spaced points longitudinally thereof, a universally movable gripper comprising a pair of fingers spaced apart laterally a distance less than the spacing of said holding points for grasping the lace at a pair of points between said holding points respectively, a support for said lace having a width less than the space between said fingers, and means for actuating said universally movable gripper to take said lace from said holding means and to transfer said lace to said support with said fingers disposed respectively at opposite sides of said support.

39. In a lace-tipping machine, means for holding a lace at two relatively spaced points longitudinally thereof, a universally movable gripper comprising a pair of fingers spaced apart laterally a distance less than the spacing of said holding points for grasping the lace at a pair of points between said holding points respectively, a support for said lace having a width less than the space between said fingers and provided with laterally spaced transversely extending recesses for receiving a plurality of said laces in laterally spaced relation to each other, means for actuating said universally movable gripper to take said lace from said holding means and to transfer said lace to said support with said fingers disposed respectively at opposite sides of said support and to press said lace into a lace-receiving recess of said support, and means for releasing the fingers from said lace while in said lace-pressing position relative to said support.

40. In a lace-tipping machine, means for supporting one end of each lace of a pair thereof approximately in longitudinal alignment one with the other, means spaced from the first said supporting means for supporting said lace ends in substantially parallel laterally spaced relation to each other, and lace-handling means comprising a pair of universally movable grippers and means for actuating said grippers to transfer said pair of lace ends respectively from the first to the second of said supporting means and for positioning said lace ends on the second said supporting means in said relation to each other.

41. In a lace-tipping machine, means for supporting one end of each lace of a pair thereof approximately in longitudinal alignment one with the other, means disposed substantially parallel to and spaced laterally from the first said supporting means and provided with a series of closely spaced notches for receiving and holding a plurality of pairs and for supporting said lace ends in substantially parallel laterally spaced relation to each other, and lace-handling means comprising a pair of universally movable grippers and means for actuating said grippers to transfer said pair of lace ends respectively from the first to the second of said supporting means and for positioning said lace ends respectively in the notches of the second said supporting means in said relation to each other.

42. In a lace-tipping machine, means for supporting one end of each lace of a pair thereof approximately in longitudinal alignment one with the other, means disposed substantially parallel to and spaced laterally from the first said supporting means and provided with a series of closely spaced notches for receiving and holding a plurality of pairs and for supporting said lace ends in substantially parallel laterally spaced relation to each other, lace-handling means comprising a pair of universally movable grippers and means for actuating said grippers to transfer said pair of lace ends respectively from the first to the second of said supporting means and for positioning said lace ends respectively in the notches of the second said supporting means in said relation to each other, and means for moving said second supporting means step by step a distance equal to spacing of said notches for receiving said lace ends in said pairs successively.

43. In a lace-tipping machine, a lace support comprising a rectilinear rack element having lace-receiving recesses provided along one longitudinal edge thereof in predetermined spaced relation to each other, and means for moving said element in a horizontal plane during the placing of laces thereon.

44. In a lace-tipping machine, a lace support comprising a rectilinear rack element comprising a pair of laterally spaced bars having lace-receiving recesses provided along one longitudinal edge thereof in predetermined spaced relation to each other with the recesses of one bar aligned with those of the other bar transversely of said supporting element and portions of each bar at and inwardly from one end of said support offset laterally with respect to the corresponding portions of the two bars at the opposite end of said support.

45. In a lace-tipping machine, a rectilinear rack support for receiving a plurality of laces in spaced relation longitudinally of the support, means for placing laces on said support and means for intermittently moving said support in a horizontal plane step by step a distance corresponding to the spacing of the laces on said support.

46. In a lace-tipping machine, a rectilinear rack support for receiving a plurality of laces in spaced relation longitudinally of the support, a carriage for said support, and means for moving said carriage in a horizontal plane step by step a distance corresponding to the spacing of the laces on said support.

47. In a lace-tipping machine, rectilinear support for receiving a plurality of laces in spaced relation longitudinally of the support, a carriage for said support, means for moving said carriage step by step a distance corresponding to the spacing of the laces on said support, and means for moving the support laterally on the carriage from a lace-receiving position to an idle position.

48. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of the support, a carriage for said support, means for moving said carriage step by step a distance corresponding to the spacing of the laces on said support, means for moving the support laterally on the carriage from a lace-receiving position to an idle position,

a magazine for holding a plurality of said supports in a predetermined position on the carriage spaced from said lace-receiving position, and means for transferring one of said supports from the magazine to the lace-receiving position.

49. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of the support, a carriage for said support, means for moving said carriage step by step a distance corresponding to the spacing of the laces on said support, means for moving the support laterally on the carriage from a lace-receiving position to an idle position, a magazine for holding a plurality of said supports in a predetermined position on the carriage spaced from said lace-receiving position, means for transferring one of said supports from the magazine to the lace-receiving position, means for counting the laces placed on the support in the lace-receiving position, and means controlled by said counting means for effecting said movements of the carriage and the supports thereon.

50. In a lace-tipping machine, a rectilinear support for receiving laces in spaced relation longitudinally of said support, a carriage for said support, means for moving said carriage step by step a distance for each step corresponding to the spacing of the laces on said support, and means for reversing the direction of the step by step movement of the carriage after a predetermined number of such movements of the carriage in each direction longitudinally of the support.

51. In a lace-tipping machine, a rectilinear support for receiving laces in spaced relation longitudinally of said support, means for placing laces on said support, a carriage for said support, a ratchet bar on said carriage having teeth spaced equal to the lace spacing on the support, a detent cooperating with the ratchet bar, and means for reciprocating the detent longitudinally of the support for effecting step by step movement of the carriage and the support thereon.

52. In a lace-tipping machine, a rectilinear support for receiving laces in spaced relation longitudinally of said support, a carriage for said support, a pair of ratchet bars on the carriage and having oppositely extending teeth respectively spaced equal to the lace spacing on the support, a pair of detents respectively cooperating with said ratchet bars, means for reciprocating said detents longitudinally of the bars, and means for selectively rendering said detents effective for controlling the direction of movement of the carriage.

53. In a lace-tipping machine, a rectilinear support for receiving laces in spaced relation longitudinally of said support, a carriage for said support, a pair of ratchet bars on the carriage and having oppositely extending teeth respectively spaced equal to the lace spacing on the support, a pair of detents respectively cooperating with said ratchet bars, a head carrying said detents, a constantly rotating cam and a cam follower cooperating therewith and operatively connected to said head for reciprocating said head and detents longitudinally of said bars, and means for selectively rendering said detents effective for controlling the direction of movement of the carriage.

54. In a lace-tipping machine, a rectilinear support for receiving laces in spaced relation longitudinally of said support, a carriage for said support, a pair of ratchet bars on the carriage and having oppositely extending teeth respectively spaced equal to the lace spacing on the support, a pair of detents respectively cooperating with said ratchet bars, a head carrying said detents, a constantly rotating cam and a cam follower cooperating therewith and operatively connected to said head for reciprocating said head and detents longitudinally of said bars, a plate slidably mounted in and relative to said head adjacent said detents and having cam slots extending longitudinally of the plate, pins on said detents respectively extending into the cam slots of said plate, and means for effecting relative sliding movement between the plate and the detents longitudinally of said slots for selectively rendering said detents effective for controlling the direction of movement of the carriage.

55. In a lace-tipping machine, a rectilinear support for receiving laces in spaced relation longitudinally of said support, a carriage for said support, a pair of ratchet bars on the carriage and having oppositely extending teeth respectively spaced equal to the lace spacing on the support, a pair of detents respectively cooperating with said ratchet bars, a head carrying said detents, a constantly rotating cam and a cam follower cooperating therewith and operatively connected to said head for reciprocating said head and detents longitudinally of said bars, a plate slidably mounted in and relative to said head adjacent said detents and having cam slots extending longitudinally of the plate, pins on said detents respectively extending into the cam slots of said plate, cam and lever means for effecting relative sliding movement between the plate and the detents longitudinally of said slots for selectively rendering said detents effective for controlling the direction of movement of the carriage, and lace counting means controlling the operation of said cam and lever means.

56. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of the support, a carriage for said support, means for moving the carriage and the support longitudinally of the support in step by step movements equalling the spacing of the laces on the support, means for moving the support laterally on and relative to the carriage from a lace-receiving position to an idle position adjacent said receiving position, and means for holding the support in the lace-receiving position against movement relative to the carriage.

57. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of the support, means for transferring laces to said support, a magazine for holding a plurality of said supports, and means for transferring said supports successively from the magazine to the lace-receiving position.

58. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of the support, means for transferring laces to said support, a magazine for holding a plurality of said supports, means for transferring said supports successively from the magazine to the lace-receiving position, and means for moving the support from the lace-receiving position in timed relation to the placing of the next support in said lace-receiving position by said transferring mechanism.

59. In a lace-tipping machine, a rectilinear

support for receiving a plurality of laces in spaced relation longitudinally of the support, a magazine for holding a plurality of said supports, means for transferring said supports successively from the magazine to the lace-receiving position, and means for moving the support longitudinally in the lace-receiving position.

60. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of the support, a magazine for holding a plurality of said supports, means for transferring said supports successively from the magazine to the lace-receiving position, means for moving the support longitudinally in the lace-receiving position, and means for moving the support laterally from the lace-receiving position to an idle position adjacent said lace-receiving position.

61. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of said support, a magazine for holding a plurality of said supports, means for gripping one of said supports at its opposite ends respectively for removal from said magazine, and means for swinging said support gripping means about a common axis to transfer the gripped support from the magazine to the lace-receiving position.

62. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of said support, a magazine for holding a plurality of said supports, means for gripping one of said supports at its opposite ends respectively for removal from said magazine, means for swinging said support gripping means about a common axis from said magazine to said lace-receiving position of the support, means for closing said gripping means on a support carried by the magazine, and means for opening said gripping means to release the support at the lace-receiving position.

63. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of said support, a magazine for holding a plurality of said supports, means for gripping one of said supports at its opposite ends respectively for removal from said magazine, means for swinging said support gripping means about a common axis from said magazine to said lace-receiving position of the support, means for closing said gripping means on a support carried by the magazine, means for opening said gripping means to release the support at the lace-receiving position, means holding the gripping means closed during swinging thereof from the magazine to the lace-receiving position of the support, and means for retaining the gripping means open during the return of the gripping means to the magazine.

64. In a lace-tipping machine, a rectilinear support for receiving a plurality of laces in spaced relation longitudinally of said support, a magazine for holding a plurality of said supports, a pair of arms pivotally mounted on a common axis at opposite ends of the magazine respectively, grippers carried by said arms for grasping the opposite ends respectively of one of the supports carried by the magazine, levers respectively pivotally mounted at and traversely of the axis of said gripper arms for operating said grippers respectively to grasp and release said support ends, means for swinging said gripper arms about said axes, and segmental cam tracks concentric with said axes respectively for swinging said levers about said transversely disposed pivots to open and close said grippers and for holding said grippers in said open and closed positions during swinging of said arms to and from the magazine respectively.

65. In a lace-tipping machine, a carriage, a track for said carriage, a shaft rotatably mounted parallel to said track, means for moving the carriage step by step along said track, a magazine for empty lace racks carried by the carriage, means for supporting a lace rack in lace-receiving position on said carriage, means for transferring a rack from the magazine to the lace-receiving position on the carriage, means splined to the shaft and movable with the carriage for actuating said transfer means upon rotation of the shaft, means for counting the laces received by the rack in said receiving position, and means controlled by said counting means for rotating said shaft.

66. In a lace-tipping machine, a carriage, a track for said carriage, a shaft rotatably mounted parallel to said track, means for moving the carriage step by step along said track, a magazine for empty lace racks carried by the carriage, means for supporting a lace rack in lace-receiving position on said carriage, means for moving a rack laterally along its supporting means on the carriage from the lace-receiving position to a position adjacent thereto, means for locking the rack in the lace-receiving position against movement relative to the carriage, means for transferring a rack from the magazine to the lace-receiving position on the carriage, means splined to the shaft and movable with the carriage for actuating said rack moving means, said rack locking means and said transfer means upon rotation of the shaft, means for counting the laces received by the rack in said receiving position, and means controlled by said counting means for rotating said shaft.

67. In a lace-tipping machine, a carriage, a track for said carriage, a shaft rotatably mounted parallel to said track, means for moving the carriage step by step along said track, a magazine for empty lace racks carried by the carriage, means for supporting a lace rack in lace-receiving position on said carriage, means for moving a rack laterally along its supporting means on the carriage from the lace-receiving position to a position adjacent thereto, means for locking the rack in the lace-receiving position against movement relative to the carriage, means for transferring a rack from the magazine to the lace-receiving position on the carriage, means splined to the shaft and movable with the carriage for actuating said rack moving means, said rack locking means and said transfer means upon rotation of the shaft, means for reversing the movement of the carriage on the track, means for counting the laces received by the rack in said receiving position, means controlled by said counting means for effecting operation of the carriage reversing means, and means controlled by said counting means for rotating said shaft.

68. In a lace-tipping machine, a carriage, a lace rack magazine on the carriage, means supporting a rack in lace-receiving position on the carriage, handling means for placing laces successively on said rack, mechanism for moving the carriage step by step relative to said handling means for spacing the laces on the rack, mechanism for moving a full rack from the lace-receiving position, mechanism for transferring an empty rack from the magazine to the lace-receiving position, mechanism for reversing the

carriage, means operating in synchronization with said handling means for counting the lace-placing actuations of the handling means, and means controlled by said counting means for effecting actuation of said mechanisms in predetermined timed relation to each other.

69. In a lace-tipping machine, a carriage, means for moving the carriage longitudinally step by step, means for reversing the carriage comprising a reversing shaft, a ratchet wheel loose on said shaft, a ratchet wheel tight on the shaft, synchronously oscillating pawls respectively cooperating with said ratchet wheels, and a disc secured to said loose ratchet wheel for holding the pawl of the tight ratchet wheel out of engagement therewith and provided with a recess permitting engagement of said pawl with said tight ratchet wheel after a predetermined number of intermittent rotations of the loose ratchet wheel and the disc, whereby the next oscillation of said pawl will turn the tight ratchet wheel and thereby effect partial rotation of the shaft and a consequential reversal of the carriage.

70. In a lace-tipping machine, a carriage, means for moving the carriage longitudinally step by step, means for reversing the carriage comprising a reversing shaft, a ratchet wheel loose on said shaft, a ratchet wheel tight on the shaft, synchronously oscillating pawls respectively cooperating with said ratchet wheels, a disc secured to said loose ratchet wheel out of engagement therewith and provided with a recess permitting engagement of said pawl with said tight ratchet wheel after a predetermined number of intermittent rotations of the loose ratchet wheel and the disc, whereby the next oscillation of said pawl will turn the tight ratchet wheel and thereby effect partial rotation of the shaft and a consequential reversal of the carriage, and means for retaining the shaft in fixed position during the intervening intermittent rotations of the loose ratchet wheel about the shaft.

71. In a lace-tipping machine, a carriage, means for moving the carriage longitudinally step by step, means for reversing the carriage comprising a reversing shaft, a ratchet wheel loose on said shaft, a ratchet wheel tight on the shaft, synchronously oscillating pawls respectively cooperating with said ratchet wheels, a disc secured to said loose ratchet wheel for holding the pawl of the tight ratchet wheel out of engagement therewith and provided with a recess permitting engagement of said pawl with said tight ratchet wheel after a predetermined number of intermittent rotations of the loose ratchet wheel and the disc, a pair of ratchet toothed bars on the carriage, a pair of detents cooperating with said bars respectively, means for synchronously reciprocating said detents longitudinally of the bars, a detent control cam adjacent said detents and provided with cam paths respectively engaged by the detents for selectively moving the detents to inoperative position upon operation of said detent control cam, a rotary cam on said shaft, and a lever operatively connected to and between said cams for actuating the detent control cam upon partial rotation of said shaft and said rotary cam by engagement of the tight ratchet pawl with said tight ratchet wheel.

72. In a lace-tipping machine, including lace supporting means adapted to receive laces, transferred thereto by handling means, means for moving said rack from lace receiving position after a predetermined number of laces have been transferred thereto, the combination with said last named means, of a normally quiescent shaft adapted for periodic rotation for effecting said rack moving operation of the machine, a constantly rotating shaft, a clutch having one element fixed to the constantly rotating shaft and a second element loosely mounted thereon, means operatively connecting said loose clutch element with said normally quiescent shaft, counting mechanism, means normally holding said loose clutch element disengaged from said fixed clutch element under control of said counting mechanism, whereby a predetermined number of actuations of said counting mechanism will effect engagement of said clutch and a consequent periodic rotation of the normally quiescent shaft, and means for disengaging said clutch upon completion of said predetermined rotation of said normally quiescent shaft.

73. In a lace-tipping machine, including lace supporting means adapted to receive laces, transferred thereto by handling means, means for moving said rack from lace receiving position after a predetermined number of laces have been transferred thereto, the combination with said last named means, of a normally quiescent shaft adapted for periodic rotation for effecting said rack moving operation of the machine, a constantly rotating shaft, a clutch having one element fixed to the constantly rotating shaft and a second element loosely mounted thereon, means operatively connecting said loose clutch element with said normally quiescent shaft, counting mechanism, means normally holding said loose clutch element disengaged from said fixed clutch element under control of said counting mechanism, whereby a predetermined number of actuations of said counting mechanism will effect engagement of said clutch and a consequent periodic rotation of the normally quiescent shaft, means for disengaging said clutch upon completion of said predetermined rotation of said normally quiescent shaft, and means for insuring the completion of said periodic rotation of said normally quiescent shaft as said clutch is released.

74. In a lace-tipping machine, including lace supporting means adapted to receive laces, transferred thereto by handling means, means for moving said rack from lace receiving position after a predetermined number of laces have been transferred thereto, the combination with said last named means, of a normally quiescent shaft adapted for periodic rotation for effecting said rack moving operation of the machine, a constantly rotating shaft, a clutch having one element fixed to the constantly rotating shaft and a second element loose and slidable axially on and relative to said constantly rotating shaft, means operatively connecting said loose clutch element and said normally quiescent shaft, a counting wheel having a recessed surface, a lever having one end riding said recessed surface and its opposite end holding said loose clutch element disengaged from said tight clutch element, means for intermittently rotating said counting wheel to effect alignment of a recess in said surface with said lever to effect engagement of the clutch and a consequent predetermined periodic rotation of the normally quiescent shaft, a clutch release cam on said constantly rotating shaft, a clutch release lever controlled by said cam, and means resiliently connecting said clutch release lever with said clutch-engaging lever for releas-

ing the clutch upon completion of said predetermined periodic rotation of said normally quiescent shaft.

75. In a lace-tipping machine, including lace supporting means adapted to receive laces, transferred thereto by handling means, means for moving said rack from lace receiving position after a predetermined number of laces have been transferred thereto, the combination with said last named means, of a normally quiescent shaft adapted for periodic rotation for effecting said rack moving operation of the machine, a constantly rotating shaft, a clutch having one element fixed to the constantly rotating shaft and a second element loose and slidable axially on and relative to said constantly rotating shaft, means operatively connecting said loose clutch element and said normally quiescent shaft, a counting wheel having a recessed surface, a lever having one end riding said recessed surface and its opposite end holding said loose clutch element disengaged from said tight clutch element, means for intermittently rotating said counting wheel to effect alignment of a recess in said surface with said lever to effect engagement of the clutch and a consequent predetermined periodic rotation of the normally quiescent shaft, a clutch release cam loosely mounted on said constantly rotating shaft, a clutch release lever controlled by said cam, means resiliently connecting said clutch release lever with said clutch-engaging lever for releasing the clutch upon completion of said predetermined periodic rotation of said normally quiescent shaft, a second constantly rotating shaft, and a pair of intermeshing gears respectively fixed to said second constantly rotating shaft and said clutch release cam for operating said clutch release cam independent of the first said constantly rotating shaft.

76. In a lace-tipping machine, including lace supporting means adapted to receive laces, transferred thereto by handling means, means for moving said rack from lace receiving position after a predetermined number of laces have been transferred thereto, the combination with said last named means, of a normally quiescent shaft adapted for periodic rotation for effecting said rack moving operation of the machine, a constantly rotating shaft, a clutch having one element fixed to the constantly rotating shaft and a second element loose and slidable axially on and relative to said constantly rotating shaft, means operatively connecting said loose clutch element and said normally quiescent shaft, a counting wheel having a recessed surface, a lever having one end riding said recessed surface and its opposite end holding said loose clutch element disengaged from said tight clutch element, means for intermittently rotating said counting wheel to effect alignment of a recess in said surface with said lever to effect engagement of the clutch and a consequent predetermined periodic rotation of the normally quiescent shaft, means for disengaging said clutch upon completion of said predetermined periodic rotation of said normally quiescent shaft, cooperating abutments carried by said clutch lever and said loose clutch element respectively for determining the extent of the predetermined rotation of the normally quiescent shaft, and means for assuring engagement of said abutments one with the other for said purpose.

77. In a lace-tipping machine, including lace supporting means adapted to receive laces, transferred thereto by handling means, means for moving said rack from lace receiving position after a predetermined number of laces have been transferred thereto, the combination with said last named means, of a normally quiescent shaft adapted for periodic rotation for effecting said rack moving operation of the machine, a constantly rotating shaft, a clutch having one element fixed to the constantly rotating shaft and a second element loose and slidable axially on and relative to said constantly rotating shaft, means operatively connecting said loose clutch element and said normally quiescent shaft, a counting wheel having a recessed surface, a lever having one end riding said recessed surface and its opposite end holding said loose clutch element disengaged from said tight clutch element, means for intermittently rotating said counting wheel to effect alignment of a recess in said surface with said lever to effect engagement of the clutch and a consequent predetermined periodic rotation of the normally quiescent shaft, means for disengaging said clutch upon completion of said predetermined periodic rotation of said normally quiescent shaft, cooperating abutments carried by said clutch lever and said loose clutch element respectively for determining the extent of the predetermined rotation of the normally quiescent shaft, kicker mechanism comprising a cam fixed to the constantly rotating shaft, and lever mechanism engaged by the kicker cam and adapted to engage the abutment on the loose clutch element for assuring engagement of said abutments one with the other for said purpose.

78. In a lace-tipping machine, including lace supporting means adapted to receive laces, transferred thereto by handling means, means for moving said rack from lace receiving position after a predetermined number of laces have been transferred thereto, the combination with said last named means, of a normally quiescent shaft adapted to effect said rack moving operation of the machine, a constantly rotating shaft, a clutch element fixed to said rotating shaft, a sleeve loose on said rotating shaft and operatively connected to said quiescent shaft, a clutch element splined to said sleeve, resilient means for sliding the splined clutch element axially of the sleeve into engagement with the clutch element fixed to the rotating shaft, a lever having a cam surface adapted to be engaged by a cam surface on the splined clutch element for sliding the splined clutch element in an opposite direction on the sleeve to disengage the clutch, a second and a third lever coaxially pivoted with the first said lever, a pair of normally contacting abutments on the first and second levers respectively for positively rocking the first lever in one direction upon a corresponding rocking of the second lever, a pair of spaced abutments on said first and second levers with a resilient element interposed therebetween for yieldingly rocking the first lever in the opposite direction upon a corresponding reverse rocking of the second lever, a pair of interengageable abutments on the second and third levers respectively, means adapted to rock the third lever to effect rocking of the second and first levers in a direction to release the clutch, and means for rocking the second and first levers independently of the third lever in an opposite direction to engage the clutch.

79. In a lace tipping machine comprising a reciprocating cross-head for laying braid on a reel, grippers mounted on the reel and adapted to grip the braid at spaced points longitudinally

of the reel, the combination with said cross-head, of guide means attached to the cross-head and guiding the braid downwardly therefrom, means attached to the bottom of said guide means, for guiding said braid substantially perpendicular from the downward direction, whereby said braid is placed under tension sufficient to eliminate twisting of the braid between the grippers.

80. In a lace tipping machine comprising a reciprocating cross-head for laying lace braid on a reel, grippers mounted on the reel adapted to engage the braid, mechanism for tipping the opposite ends of laces formed in said mechanism and transfer means adapted to transfer the finished laces to a rack support, the combination with said reciprocating cross-head, of means facilitating the laying of the braid in substantially untwisted condition between the grippers comprising a tube mounted on the cross-head, and an elongated eye mounted transversely of the tube.

81. In a lace tipping machine, a lace reel comprising spaced discs provided with circumferentially spaced notches, a reciprocating shuttle provided with a braid laying needle having braid threaded therethrough, said needle being adapted to pass through the circumferentially spaced notches; laterally spaced gripper elements mounted on said reel between the spaced discs, and adapted to grip the braid successively immediately upon the passage of the braid laying needle, whereby an untwisted portion of lace braid exists between the laterally spaced gripper elements.

82. The combination in a lace tipping machine, a reel comprising spaced discs, a plurality of gripper wheels including circumferentially spaced gripper elements mounted between said discs; reciprocating shuttle means including a braid laying needle adapted to guide lace braid from one disc to the other, means actuating said gripper elements successively to grip the braid immediately upon the passage of the braid laying needle, means to partially rotate said reel, and means actuating other gripper elements to successively grip the braid immediately upon the passage of the braid laying needle during the return reciprocation of the shuttle.

83. In a lace tipping machine, the combination of a reciprocating shuttle including a vertical tube through which the lace braid is adapted to pass, a horizontal elongated eye attached to the vertical tube, through which the braid is threaded; spaced gripper wheels comprising circumferentially spaced gripper elements adapted to grip the braid immediately upon the passage thereby of the braid laying needle, means for reciprocating said shuttle and means for intermittently rotating said gripper wheels in timed relation with the reciprocation of said shuttle.

84. In a lace tipping machine, the combination of a reel comprising spaced discs, a plurality of individual grippers mounted between the spaced discs adapted to grip lace braid issuing from a reciprocating needle immediately upon the needle passing said individual grippers, means actuating said grippers comprising normally stationary cams, intermittently oscillatable at predetermined times during the reciprocation of the needle.

85. In a lace tipping machine, the combination with a reel including spaced lace receiving discs, of reciprocating means feeding lace braid to said reel, a plurality of separated gripper wheels located between the reel discs, mechanism severing the lace braid to produce a series of distinct laces about the periphery of each reel disc, pairs of circumferentially spaced gripper units surrounding each gripper wheel and adapted to support opposite ends of each lace of each series, means releasing each gripper of the pairs of gripper units of one series in succession, and means successively releasing each gripper of the pairs of gripper units of the remaining series in reversed step relation.

JOHN EDDY CHACE.