Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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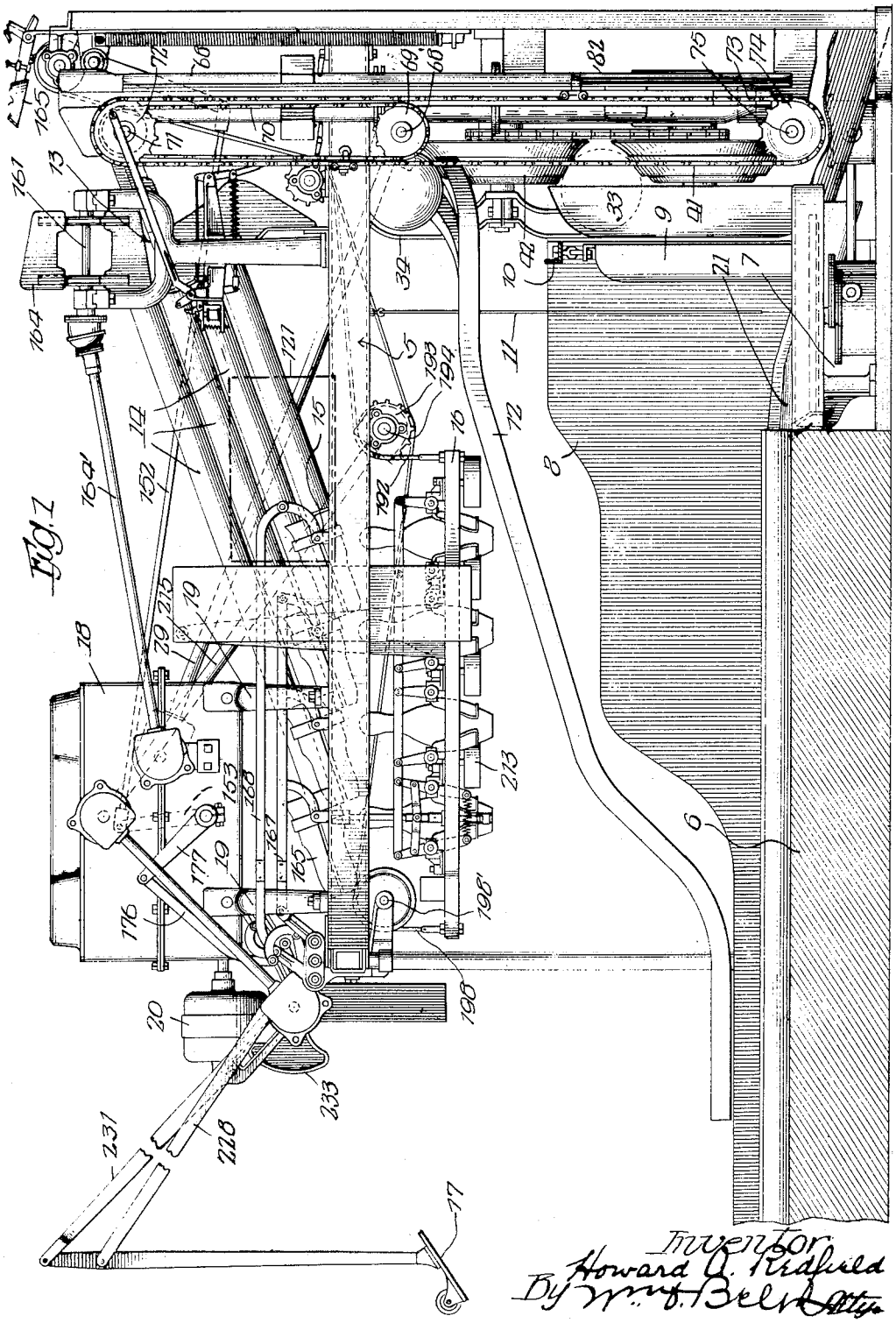


Fig. 1

Inventor
Howard A. Redfield
By Wm. S. Belden Atty.

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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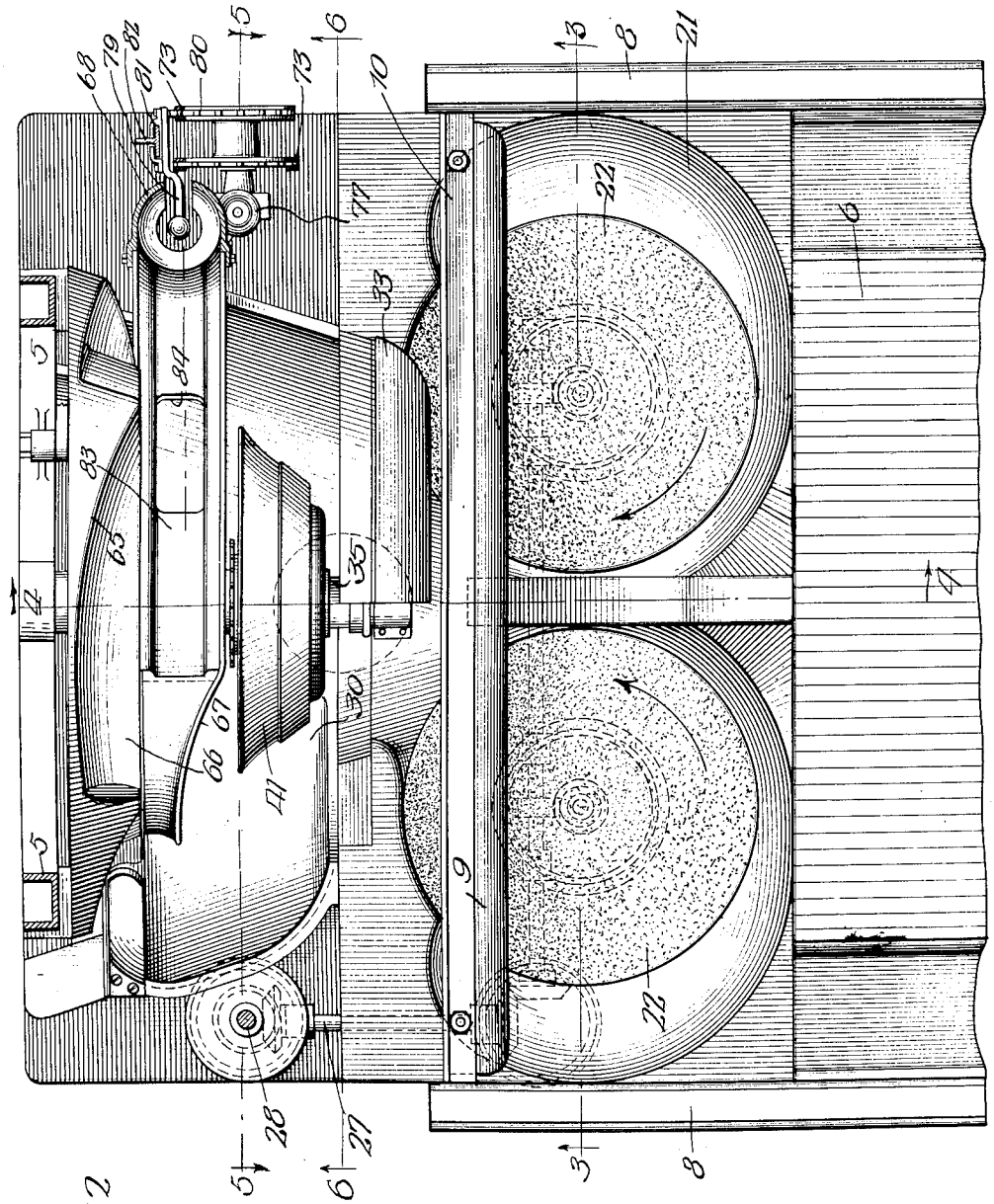


Fig. 2

Inventor
Howard A. Redfield
By Wm. G. Bell
Atty.

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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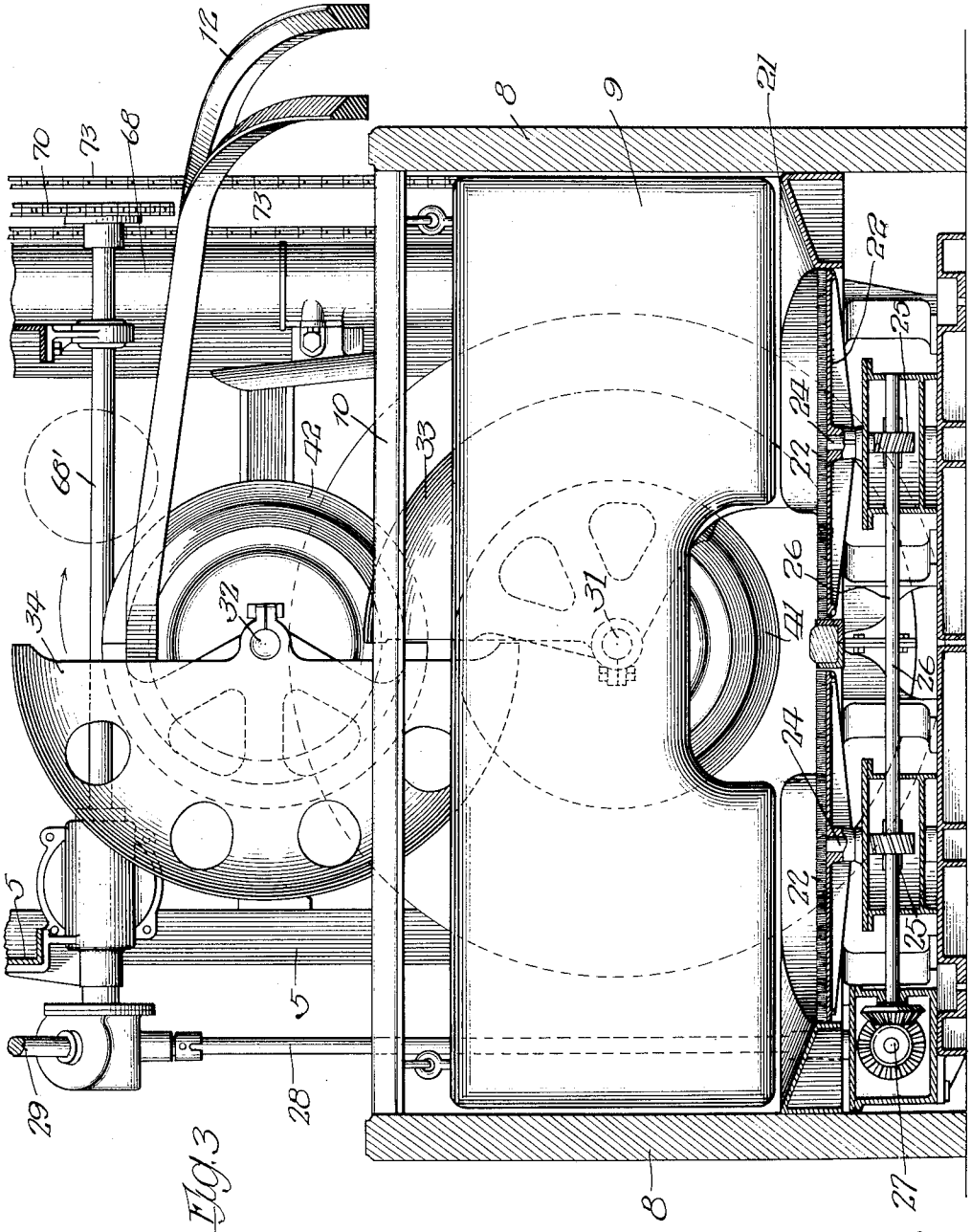


Fig. 3

Inventor
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Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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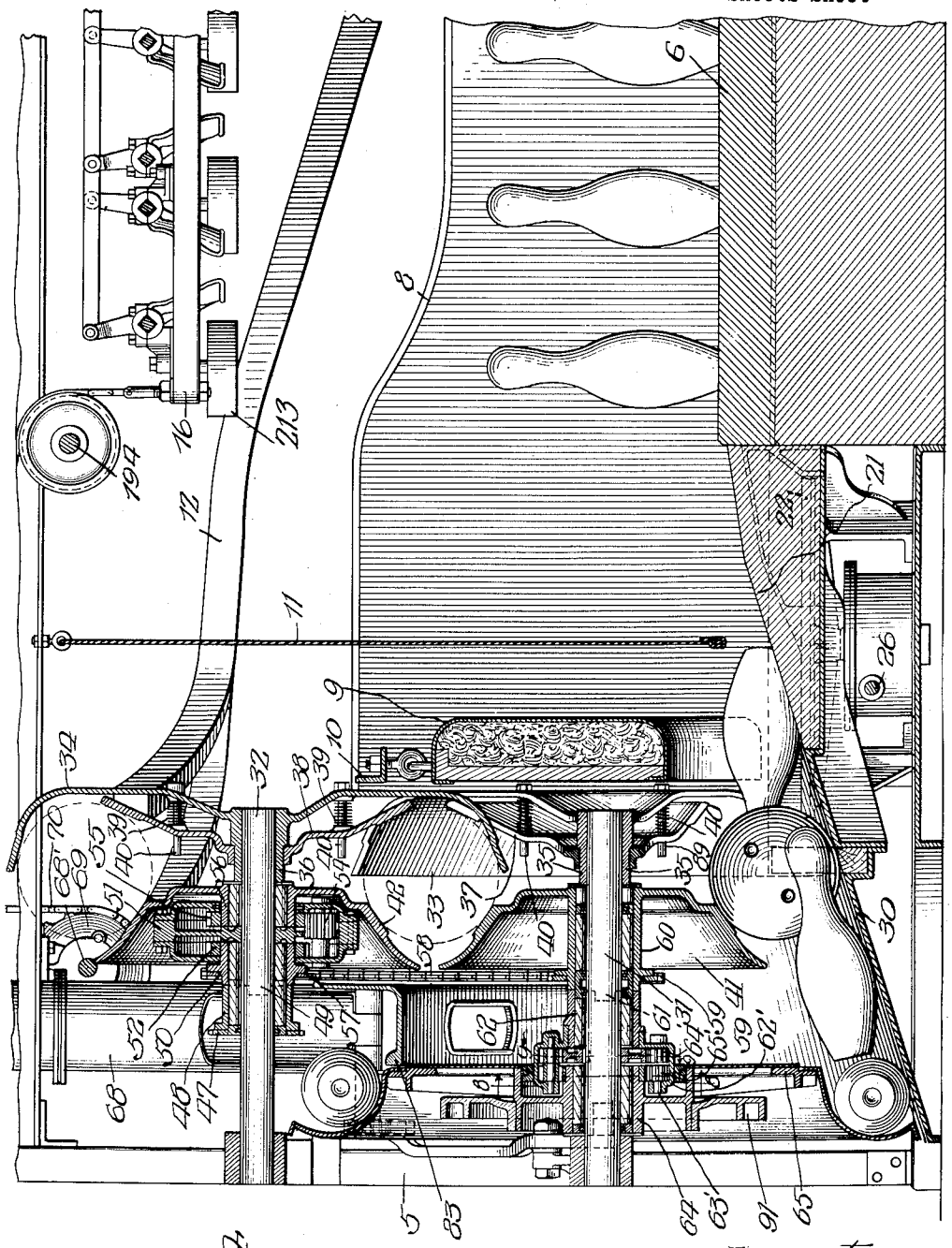


Fig. 4

Inventor
Howard A. Redfield
By Wm. F. Bell
Atty.

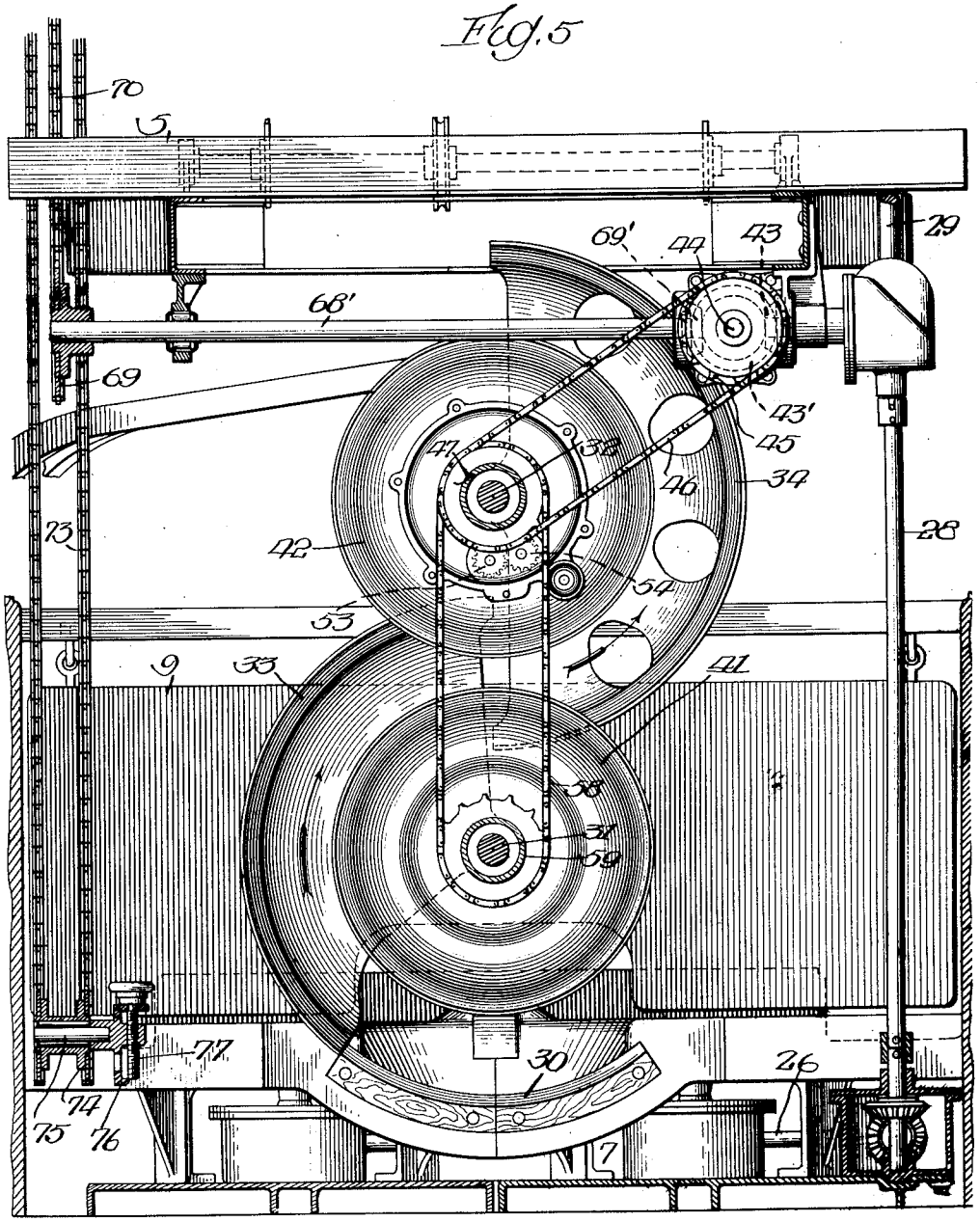
Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 5



INVENTOR.
Howard A. Redfield
BY
ATTORNEY.

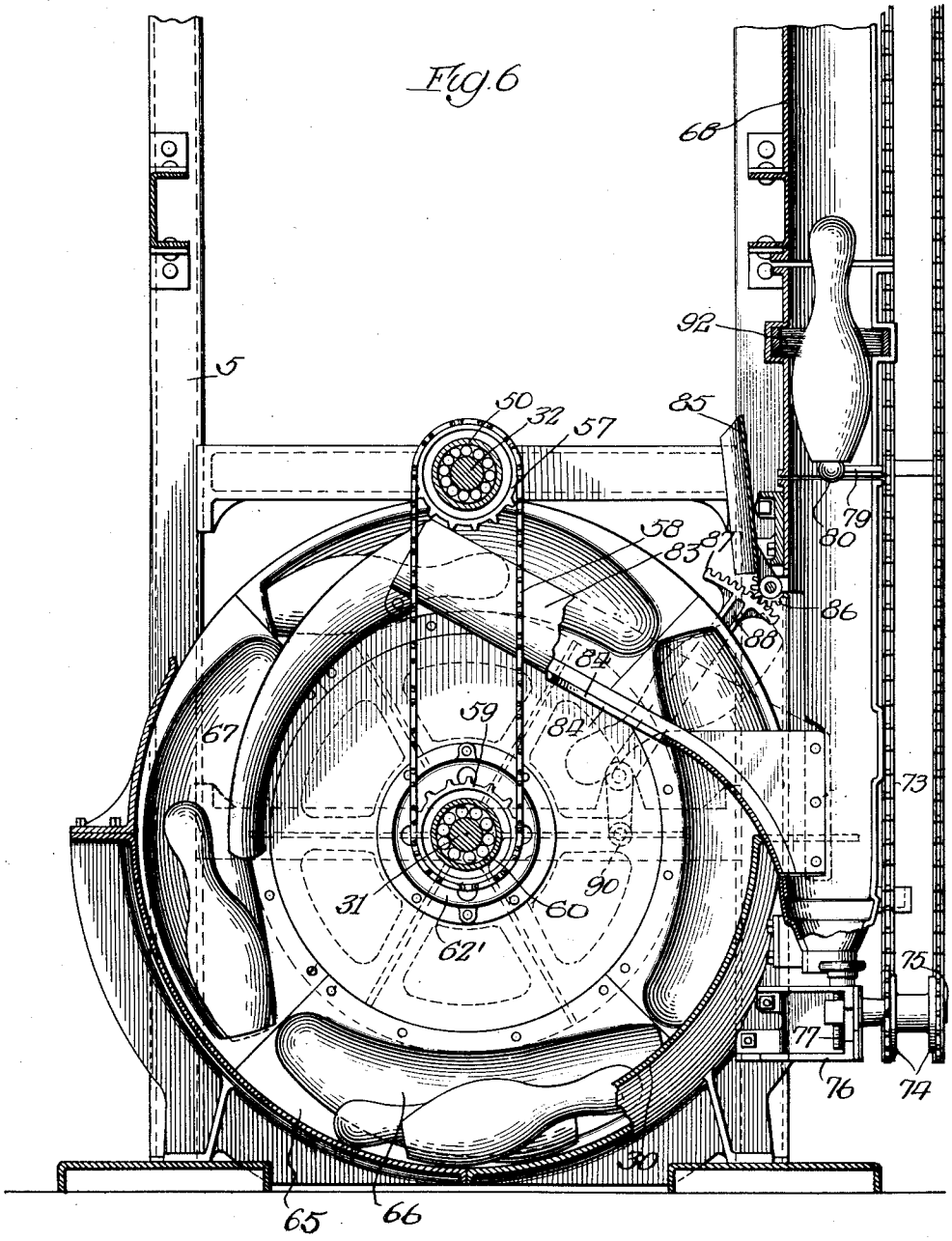
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H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 6



INVENTOR.
Howard A. Redfield
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ATTORNEY

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 8

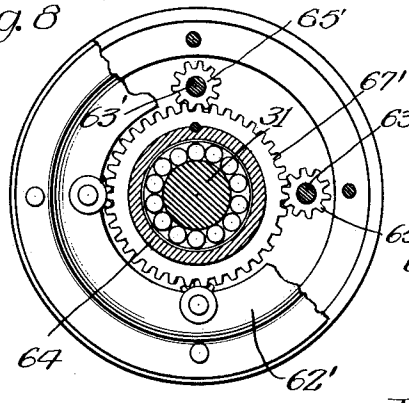


Fig. 9

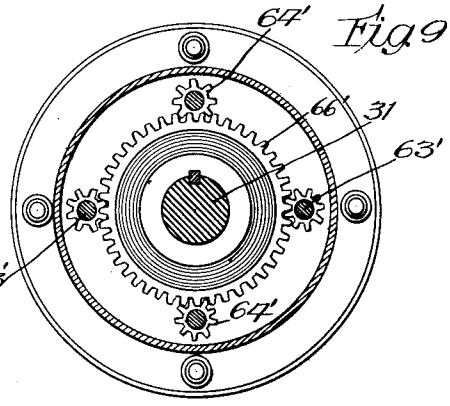
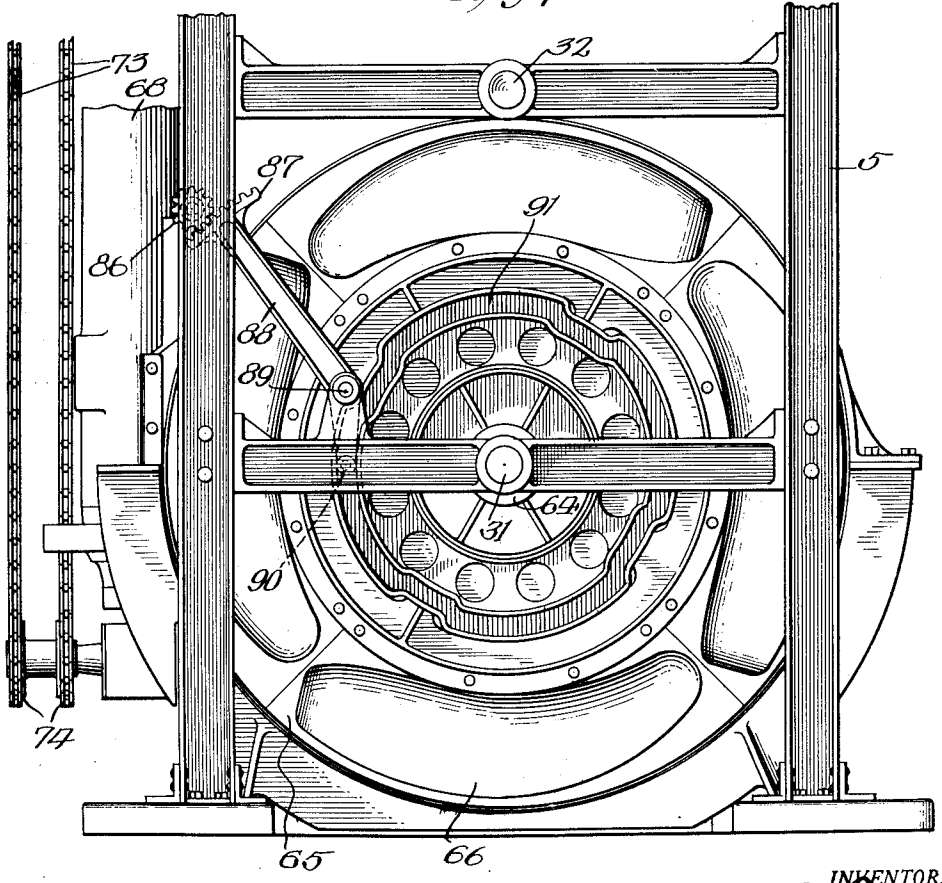


Fig. 7



INVENTOR.
Howard A. Redfield
BY
ATTORNEY

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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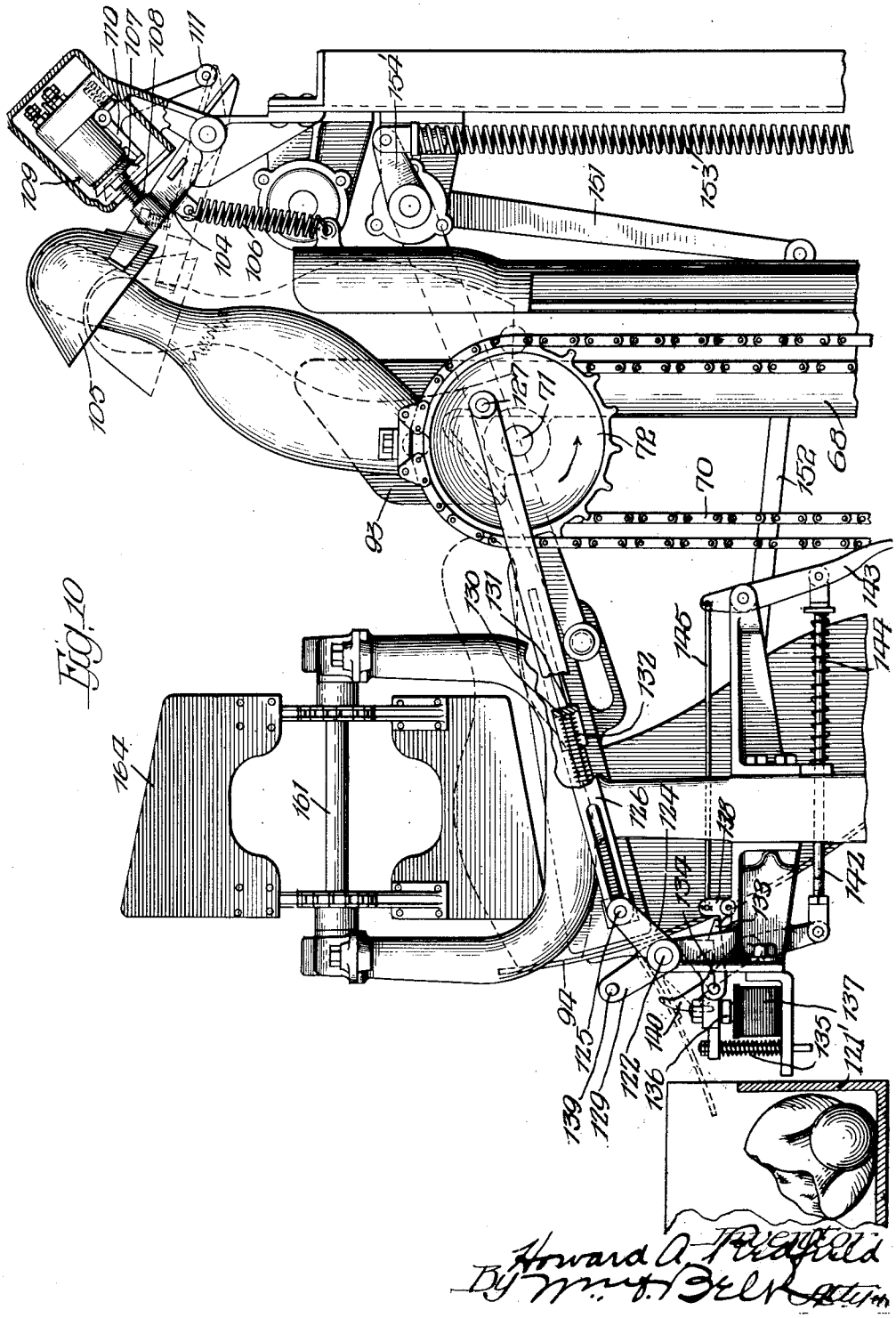


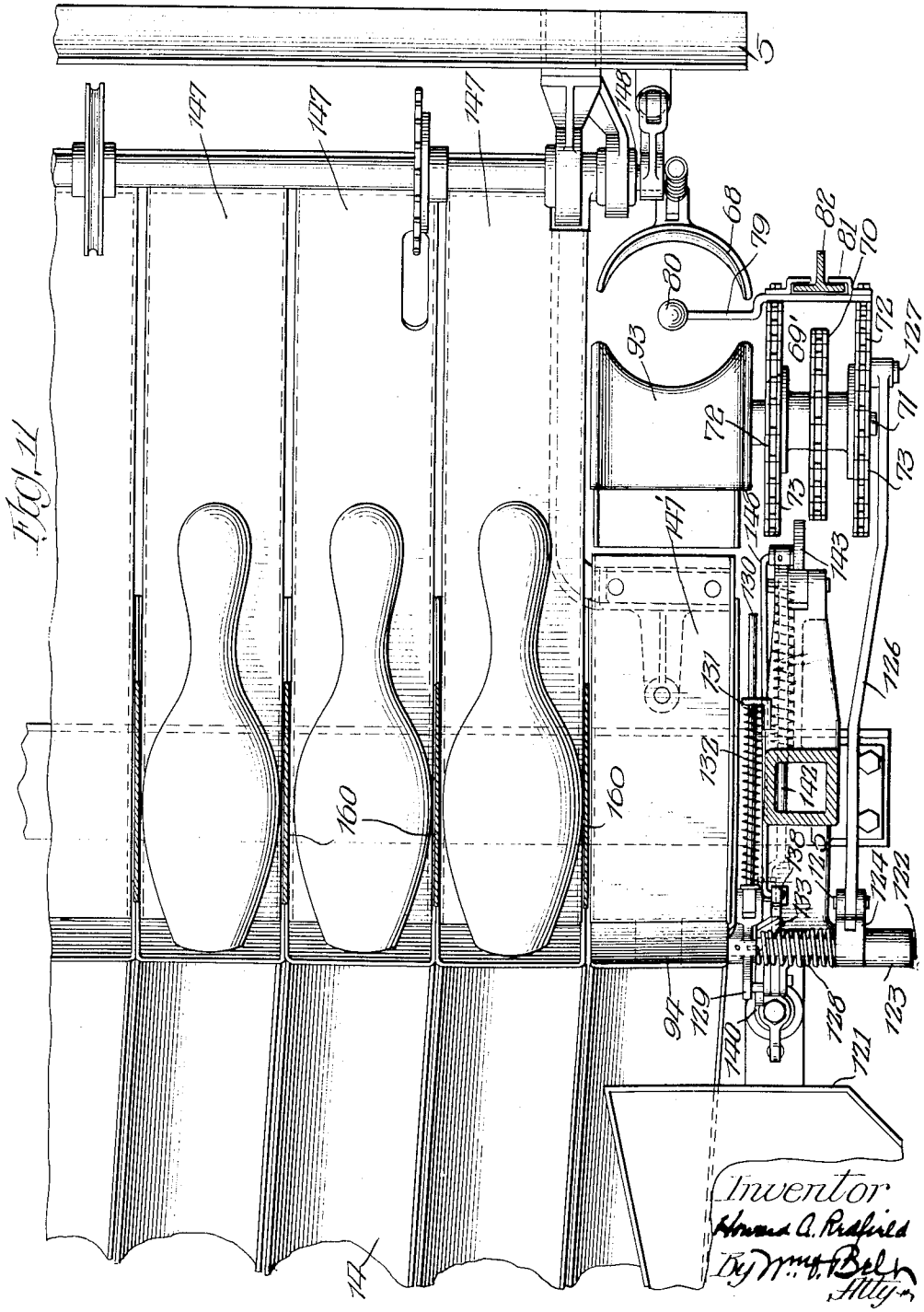
Fig. 10

Sept. 18, 1923. 1,468,212

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H. A. REDFIELD

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Fig. 12

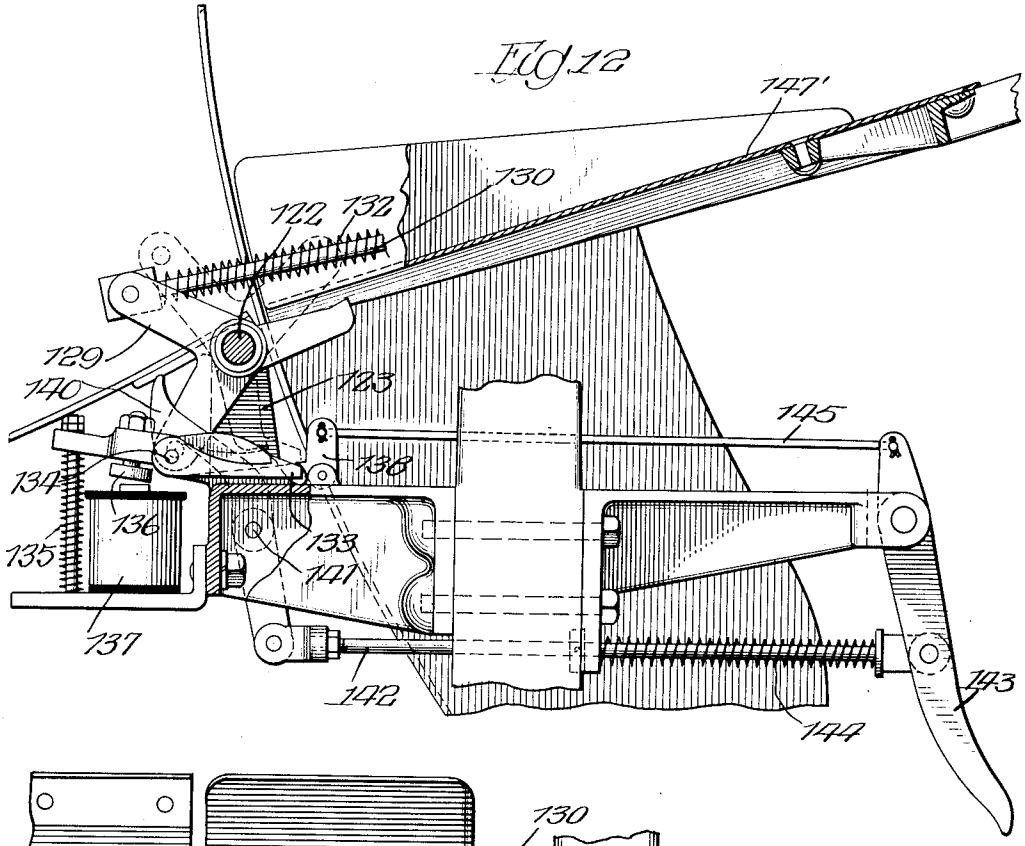
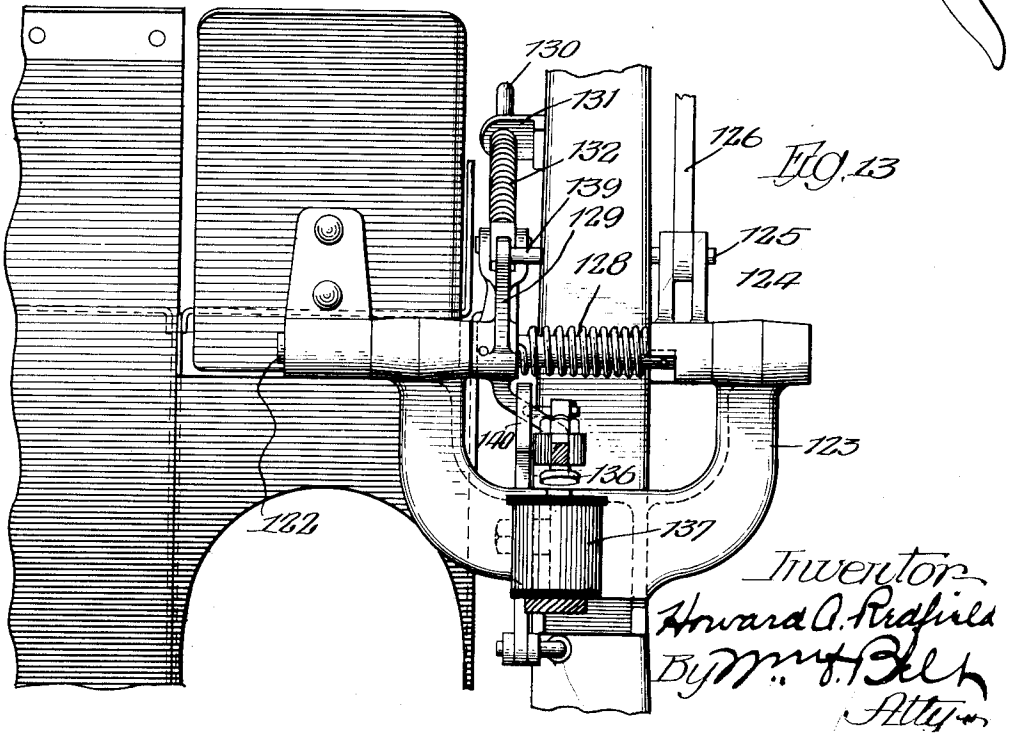


Fig. 13



Inventor
Howard A. Redfield
By Wm. G. Belt
Atty.

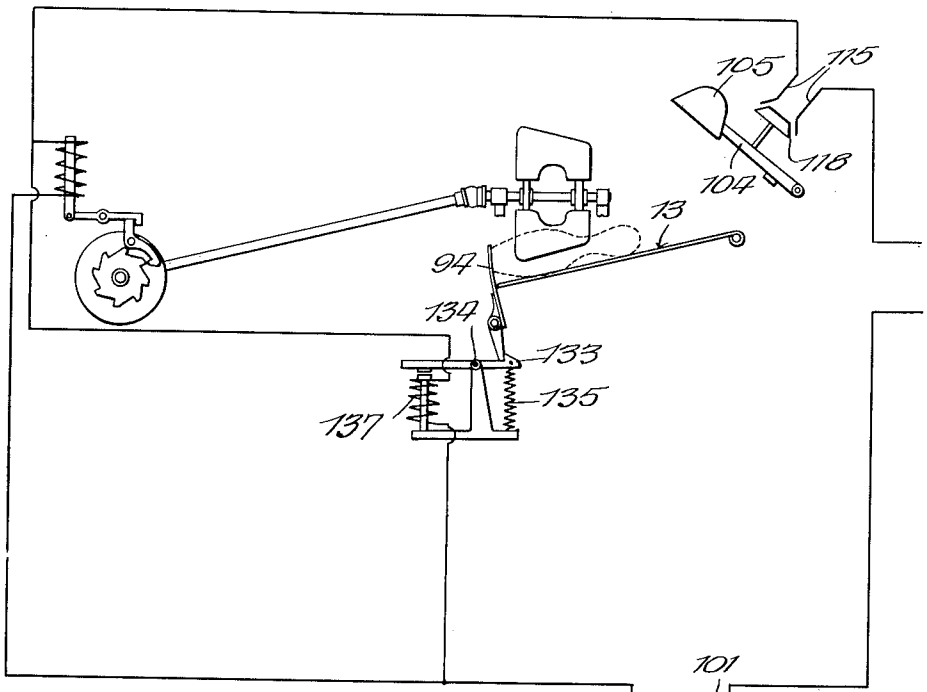
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Fig. 14



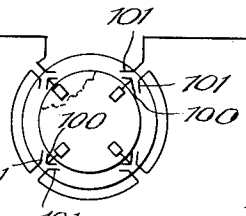


Fig. 15

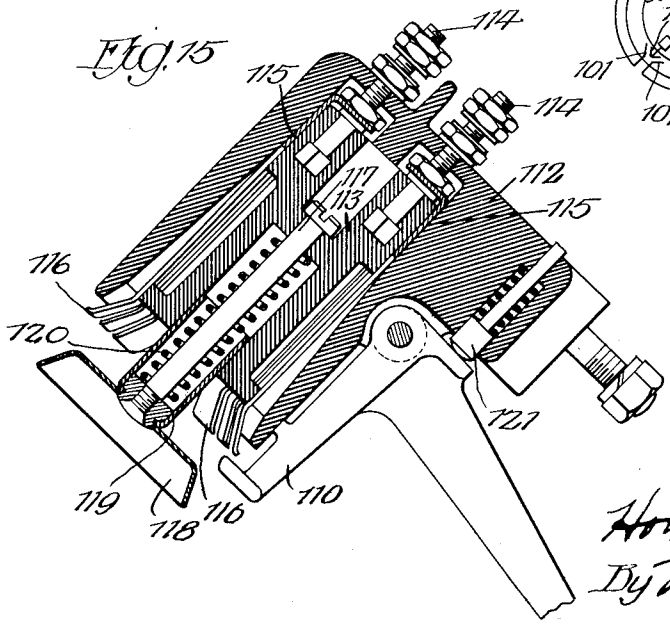
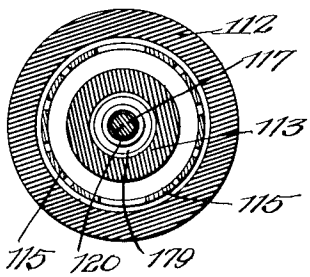


Fig. 16



Inventor
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Sept. 18, 1923. 1,468,212

H. A. REDFIELD

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Fig. 17

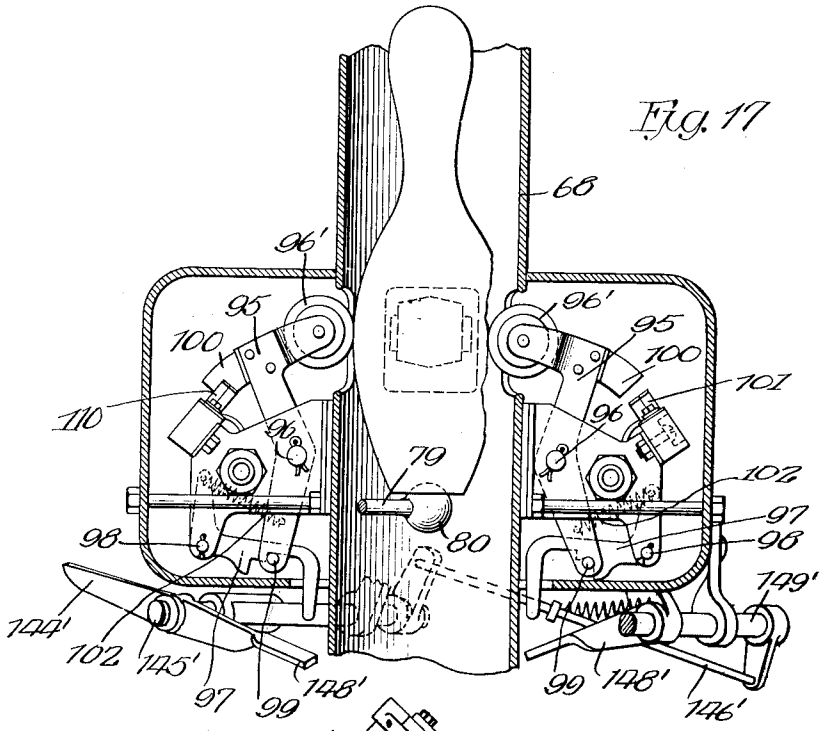
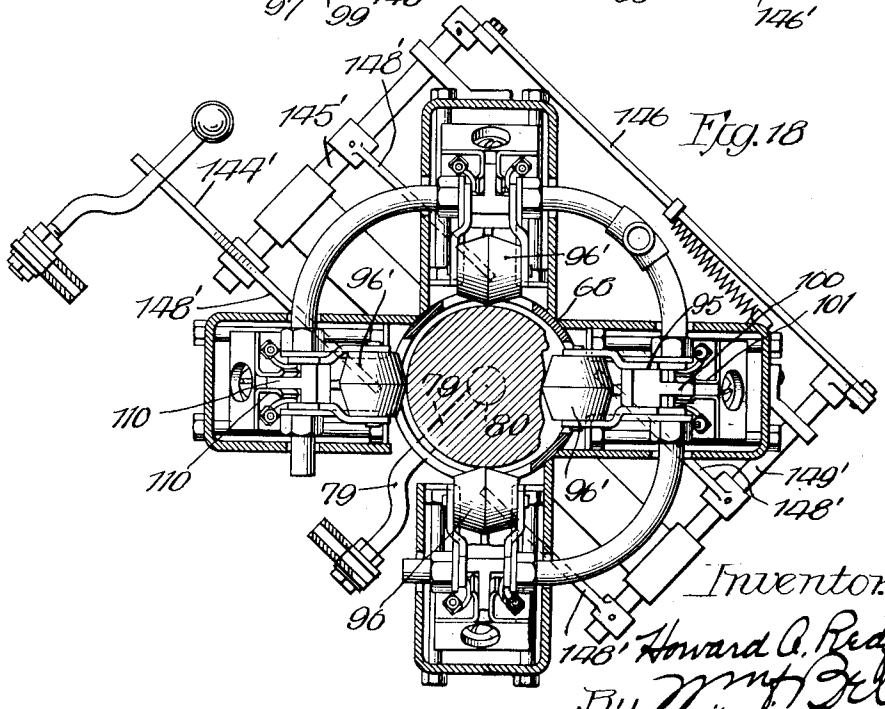


Fig. 18



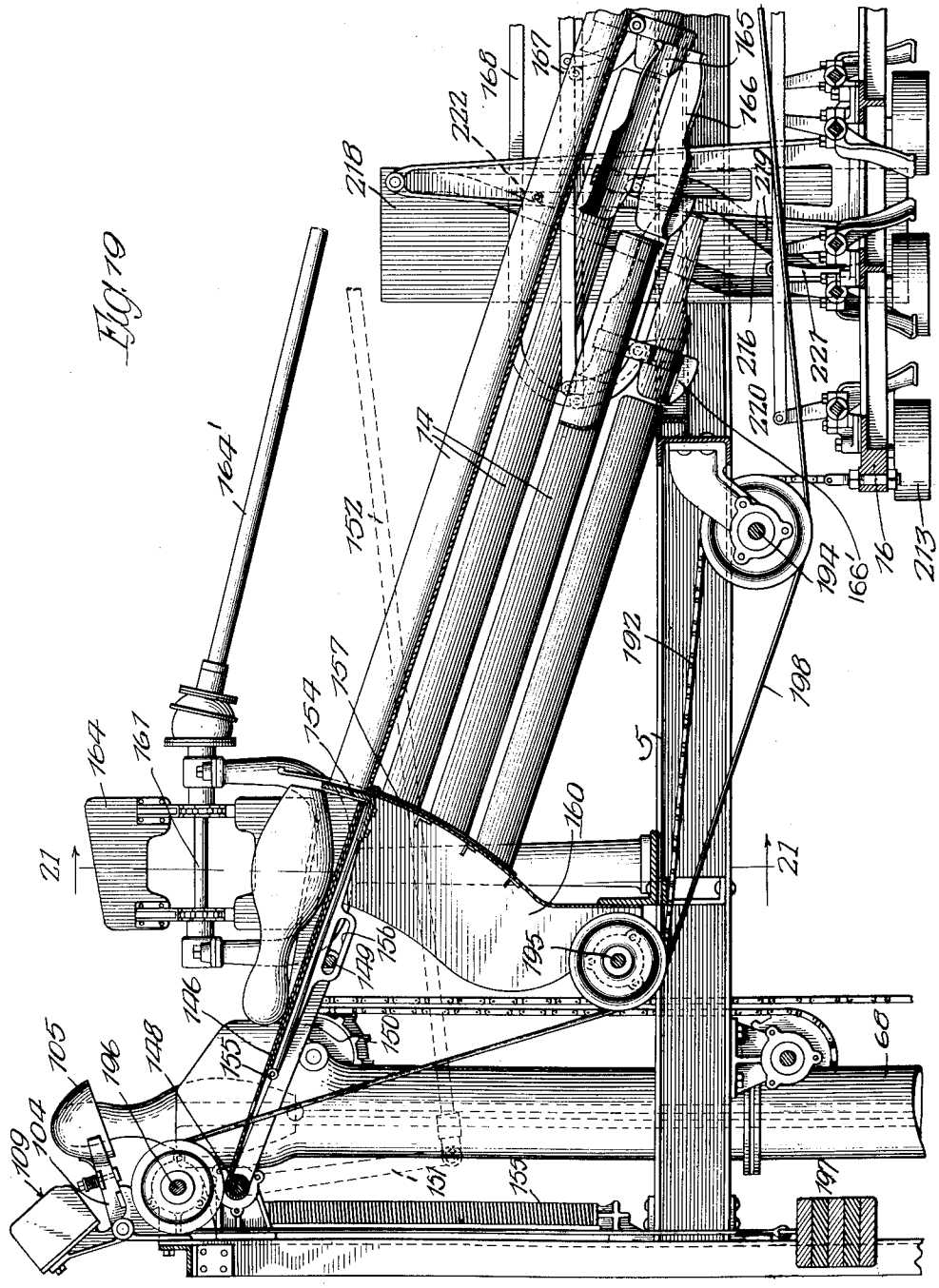
Inventor.
Howard A. Redfield
By. Wm. H. Bell
Atty.

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Inventor
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H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 20

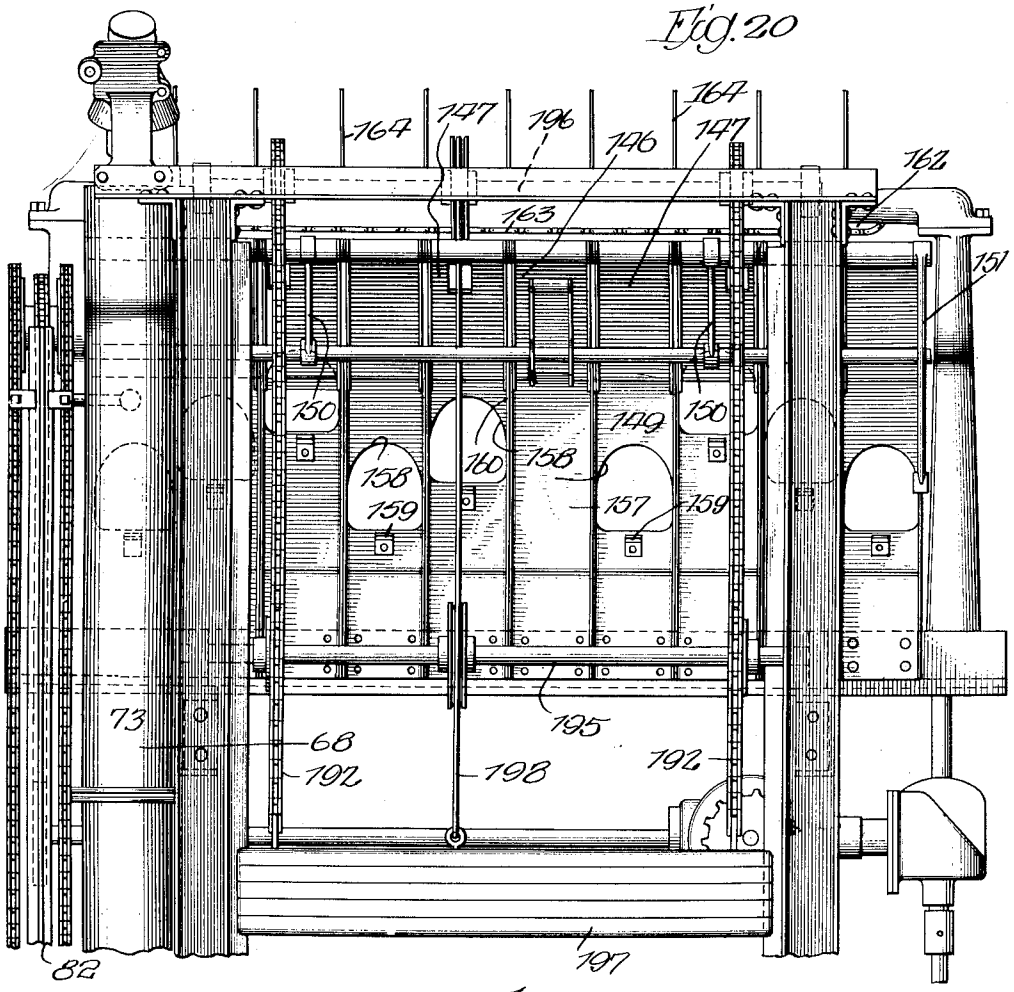
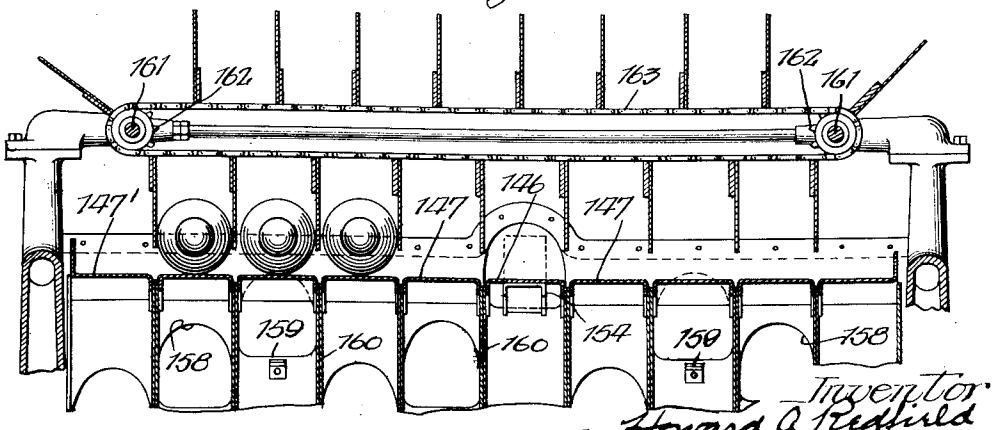


Fig 21



Inventor.
Howard A. Redfield
By Wm. F. Bell Attys

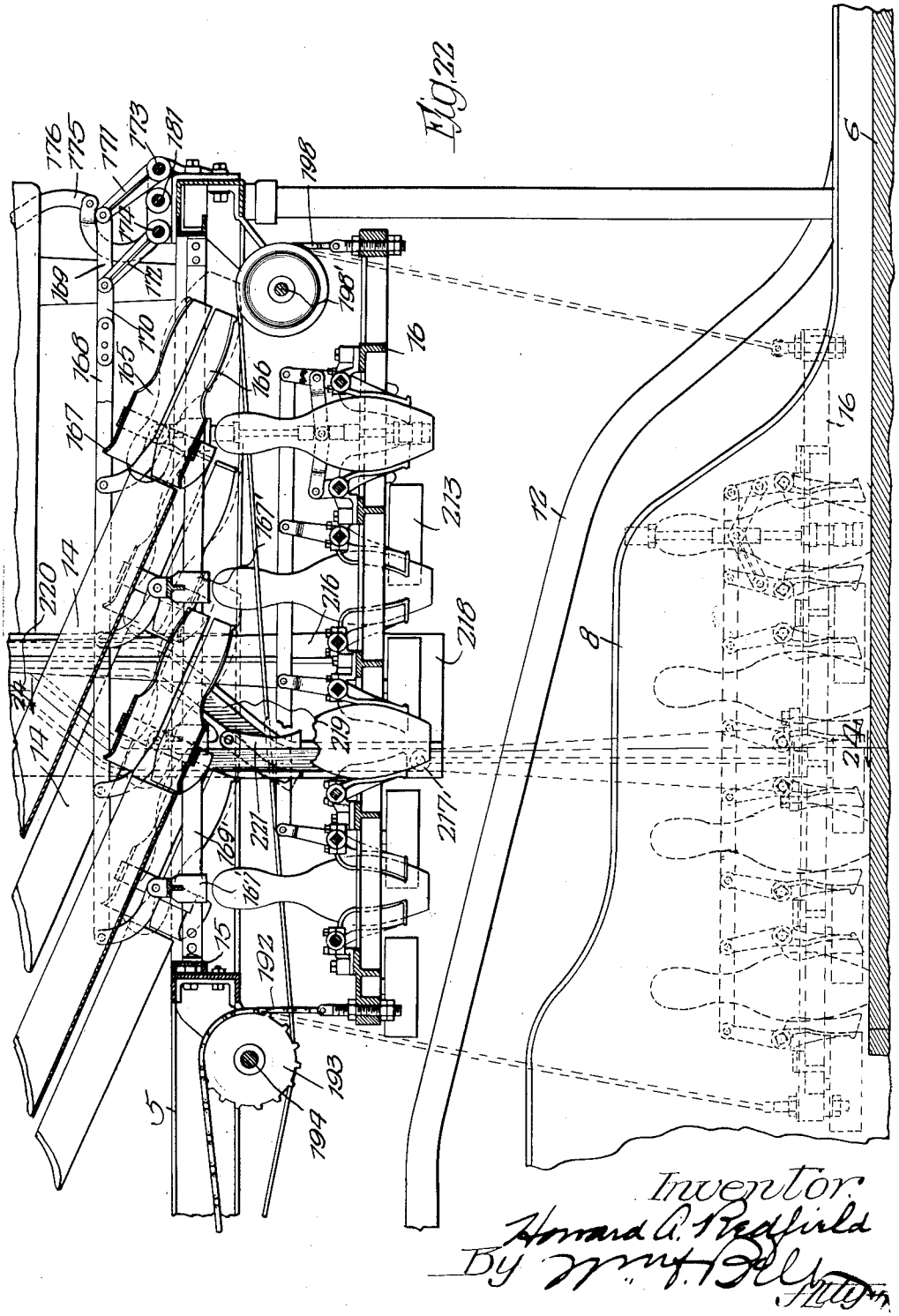
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Fig. 22



Inventor.
Howard A. Redfield
By Wm. F. Ellis
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H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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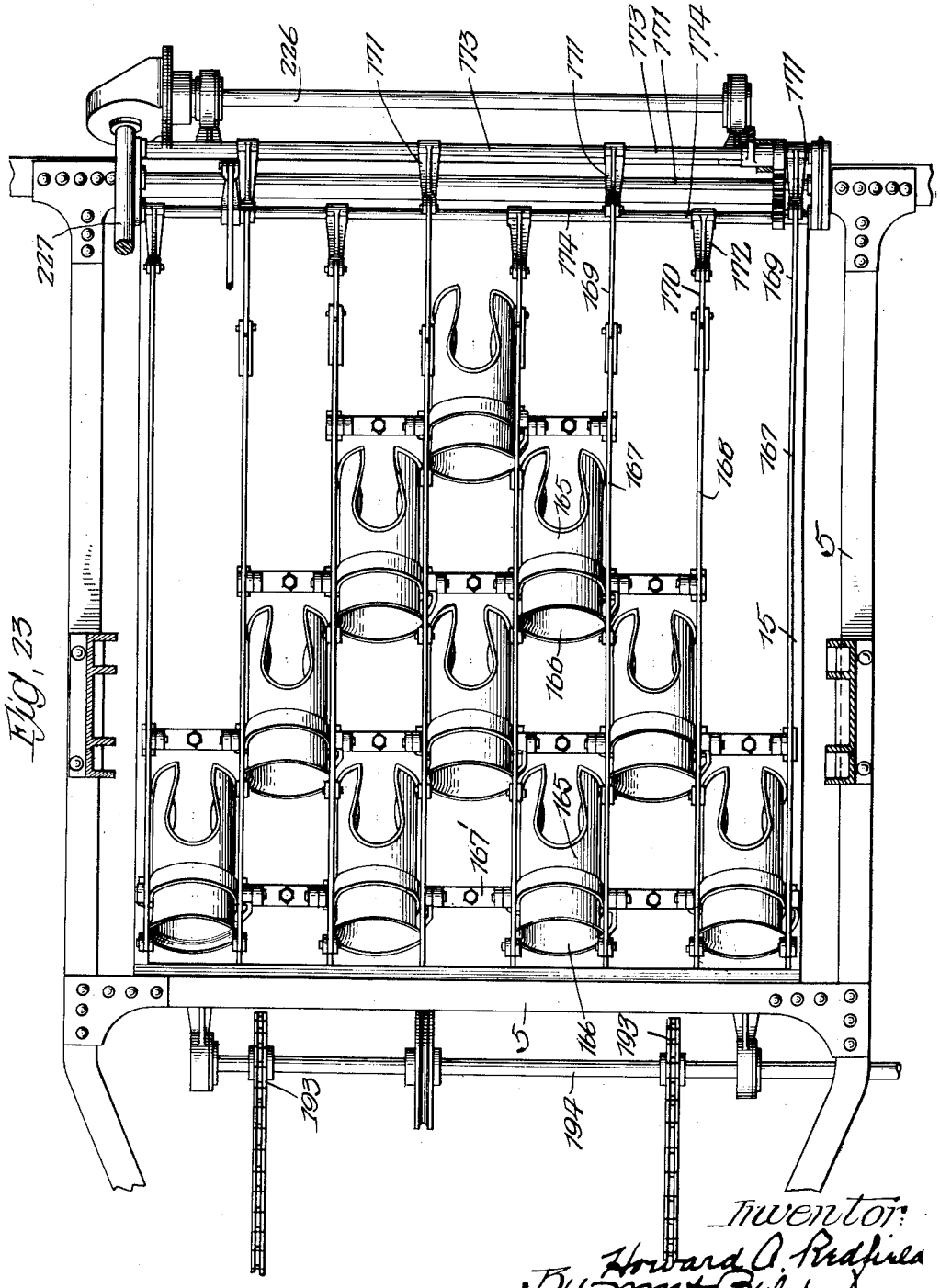


Fig. 23

Inventor:
Howard A. Redfield
By Mun & Bill Attys.

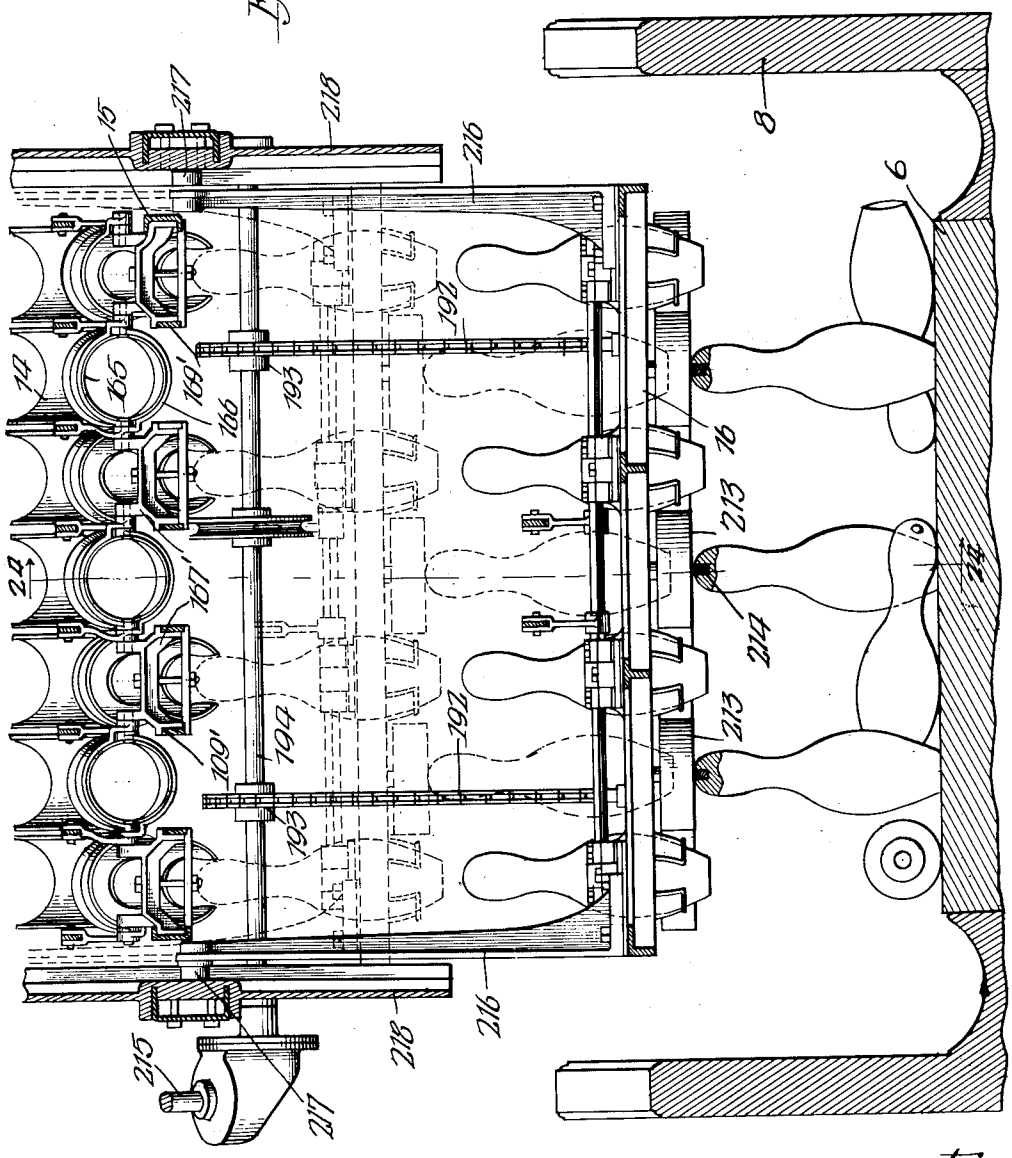
Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 24



Inventor
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Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 25

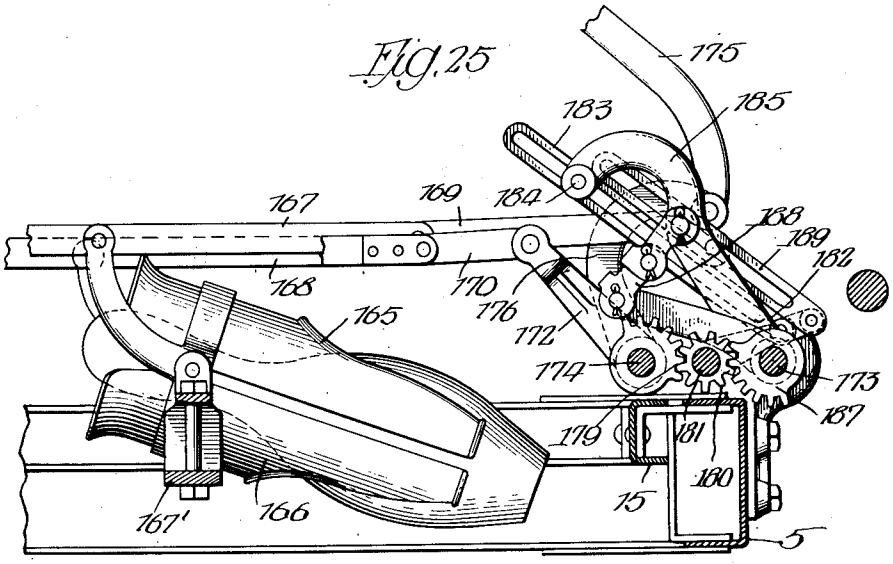
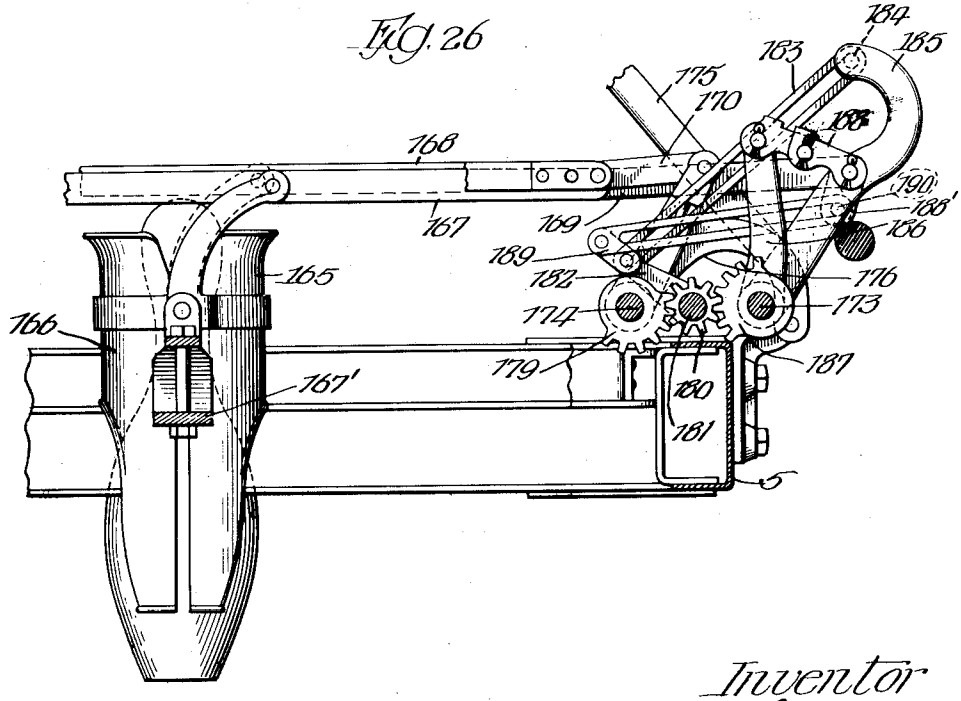


Fig. 26



Inventor
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By Wm. F. Belk Atty

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 27

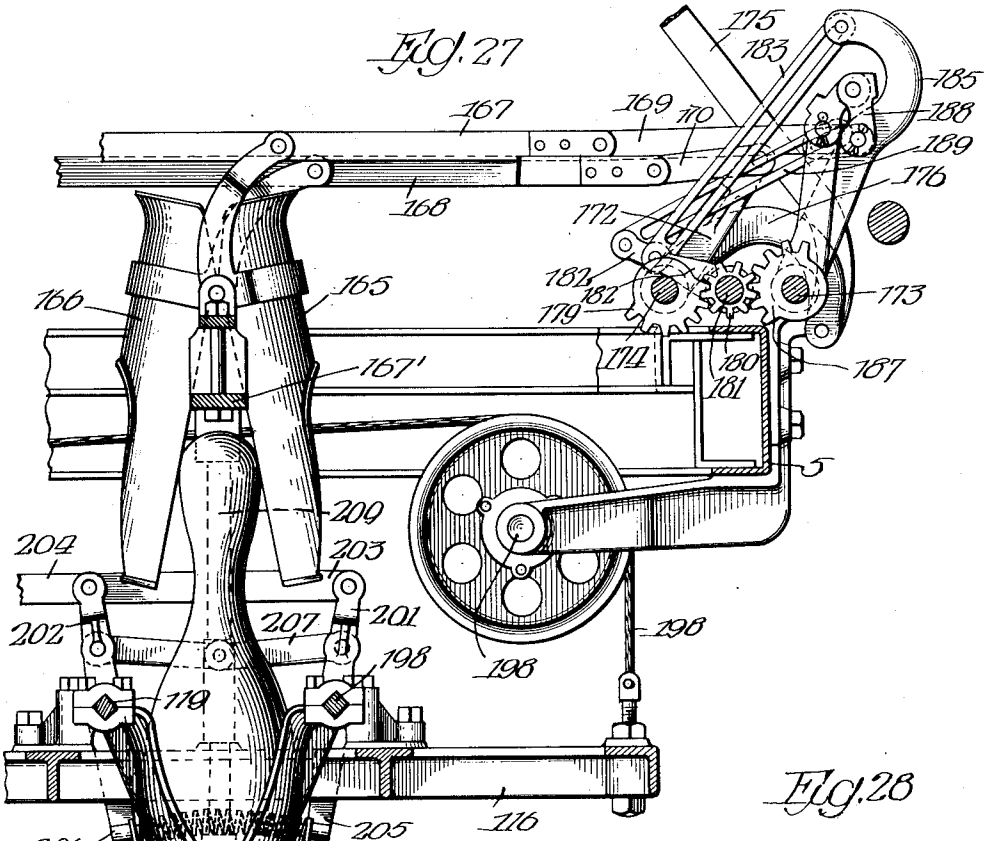
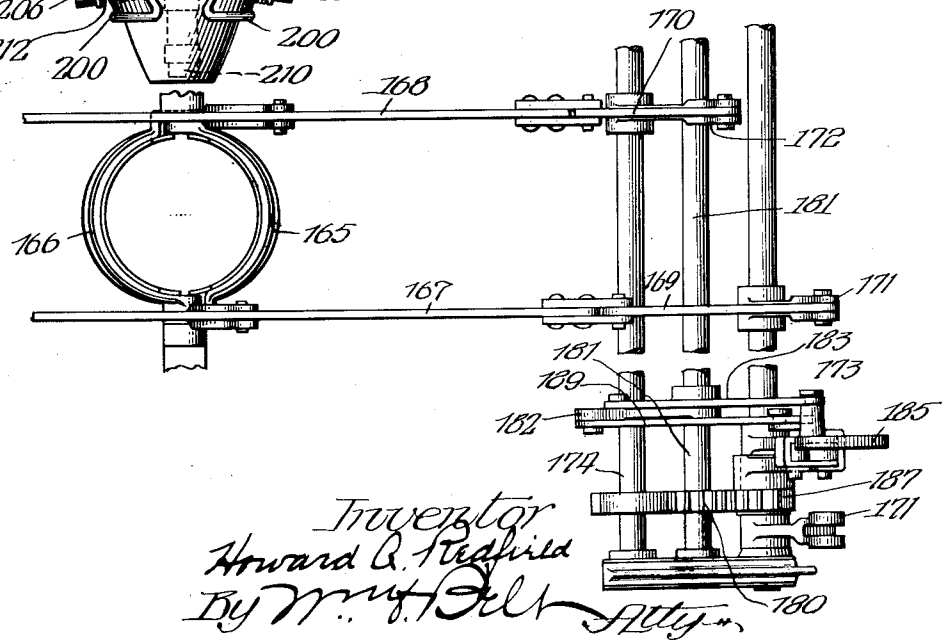


Fig. 28



Inventor
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By Wm. J. Fell Atty.

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 30

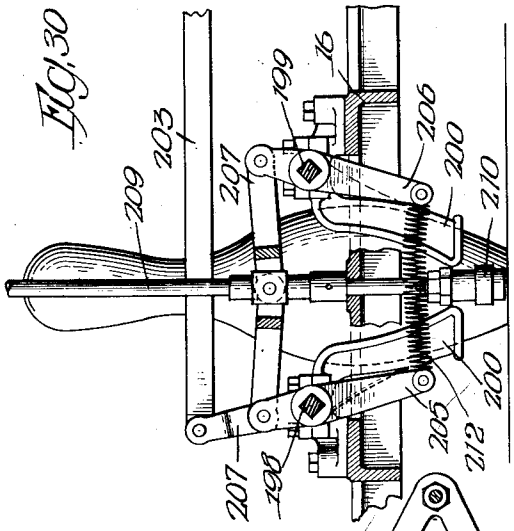


Fig. 31

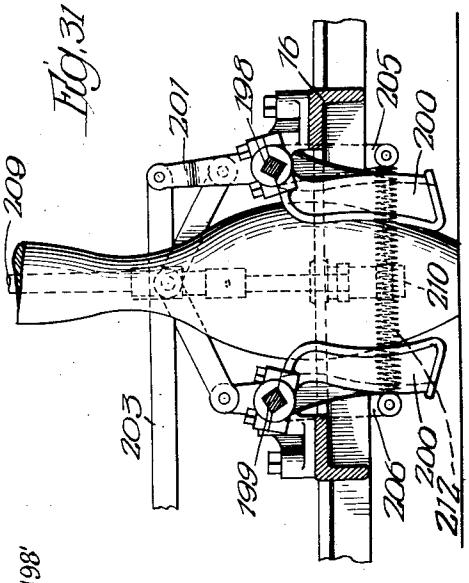
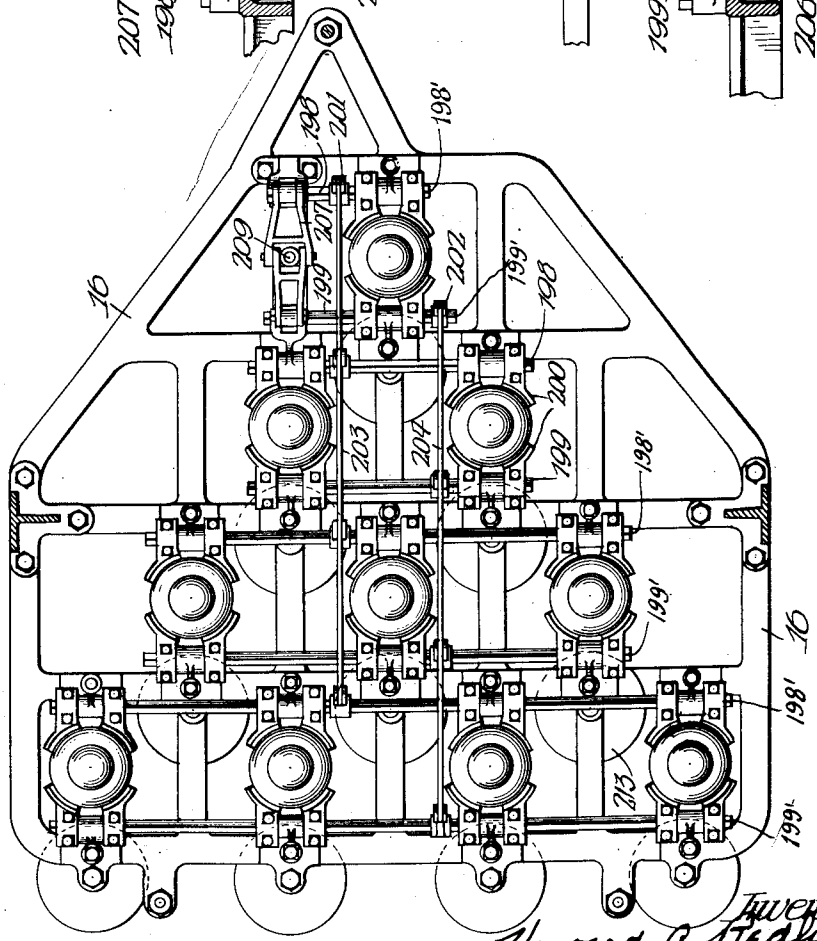


Fig. 29



Inventor
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By Wm. F. Bell
Atty.

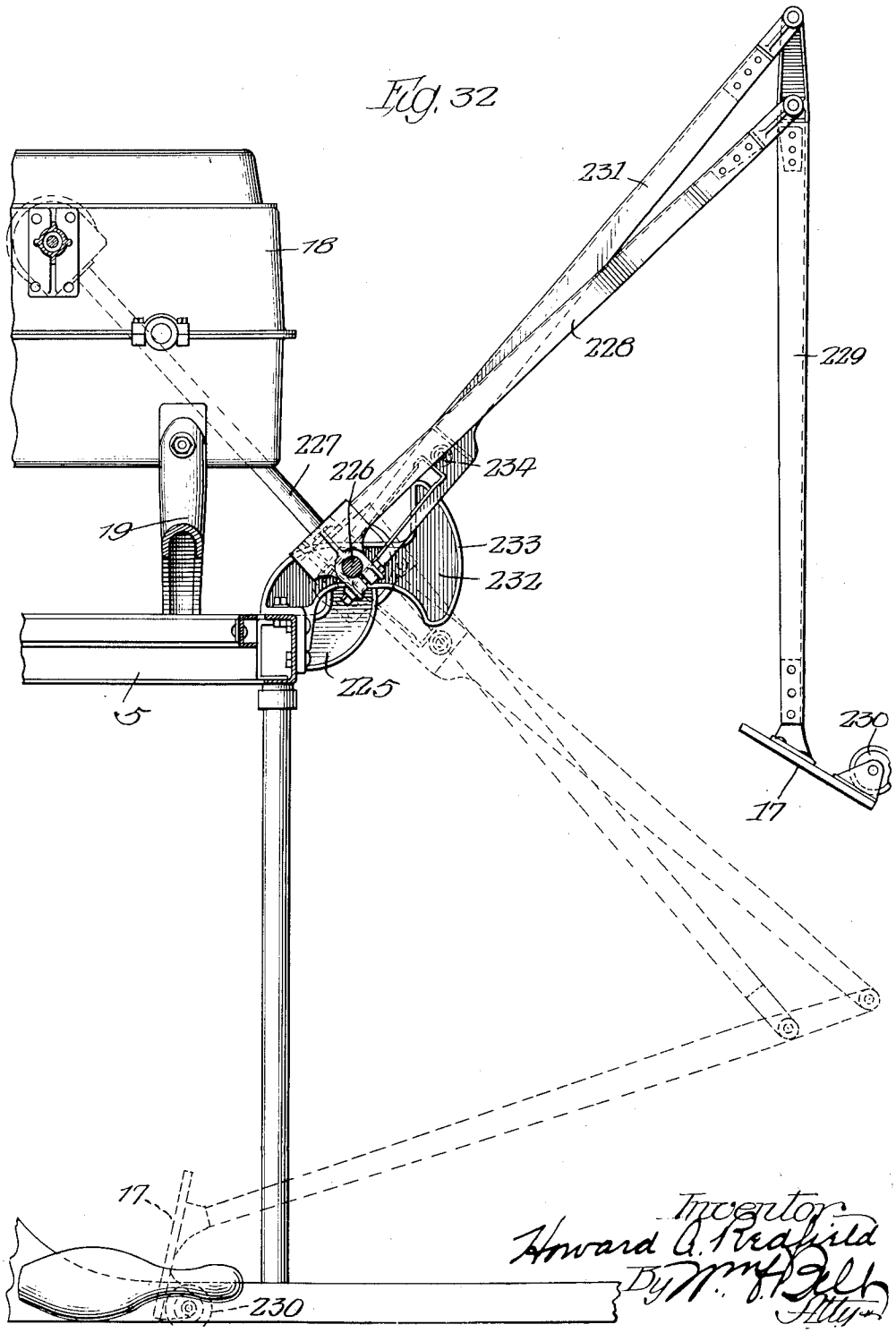
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H. A. REDFIELD

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Fig. 32



Inventor
Howard A. Redfield
By Wm. H. Fitly
Atty.

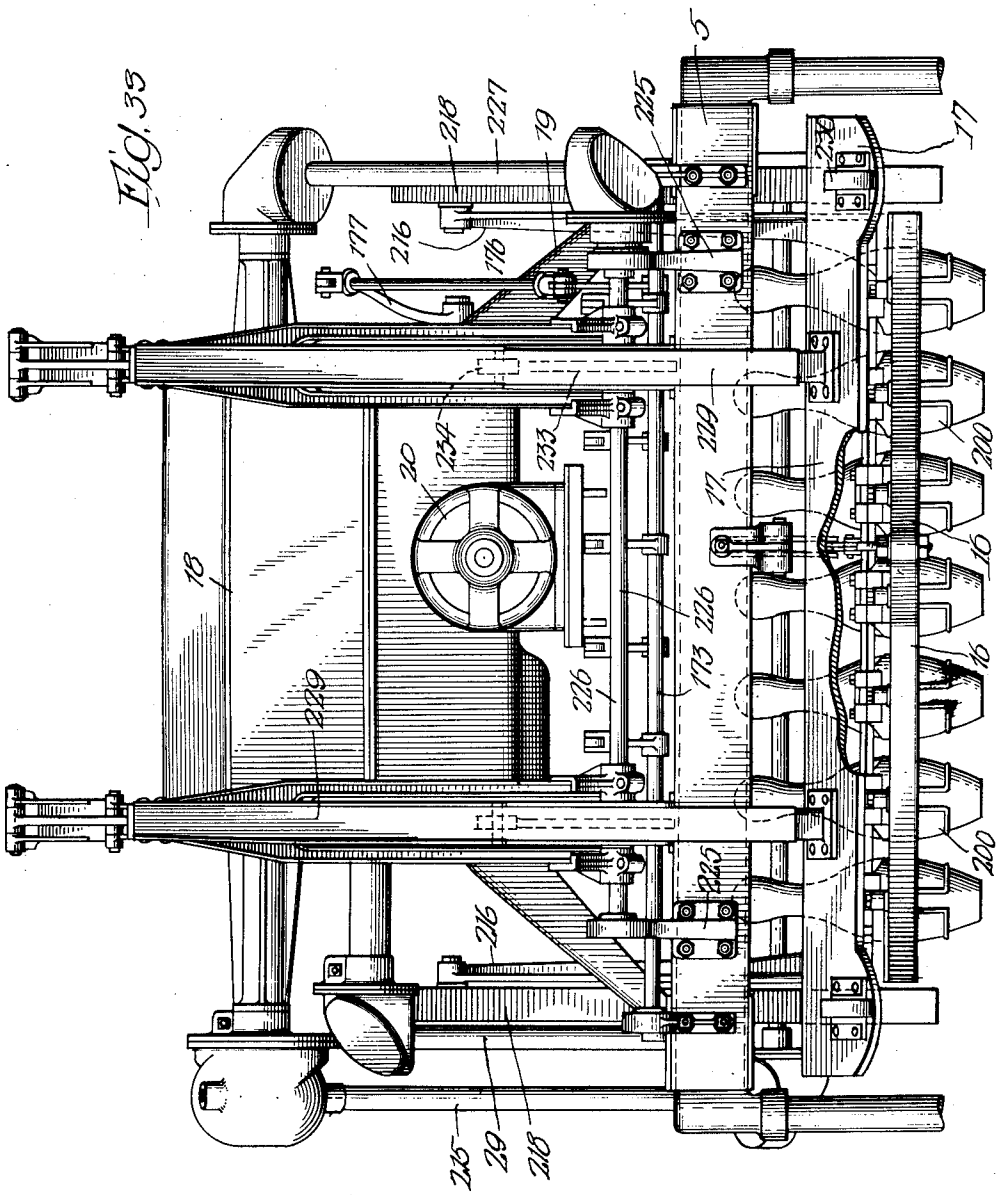
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H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 35



Inventor
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By Wright Brown & Quinby
Attys.

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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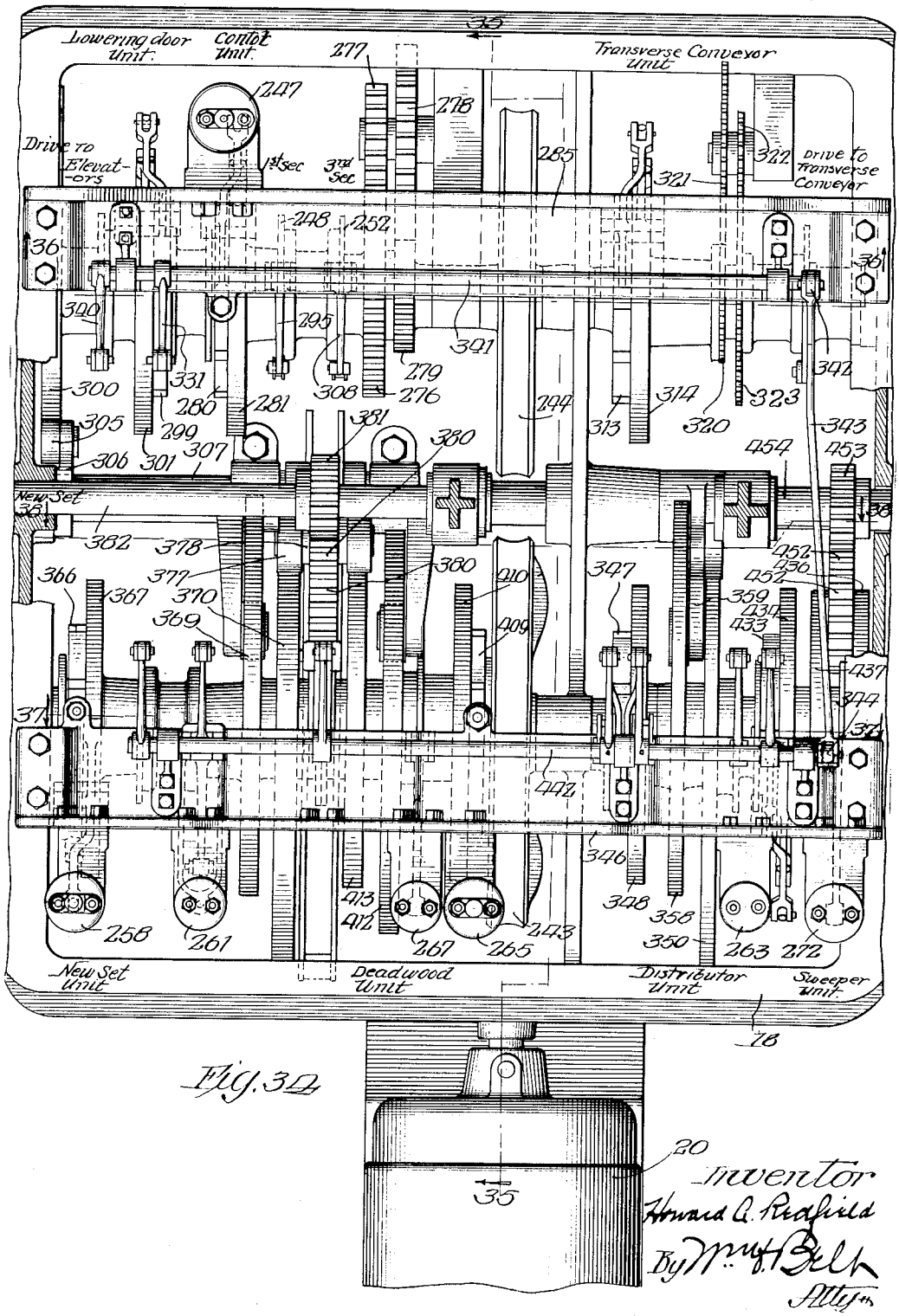


Fig. 34

Inventor
Howard A. Redfield
By Wm. G. Belk
Atty.

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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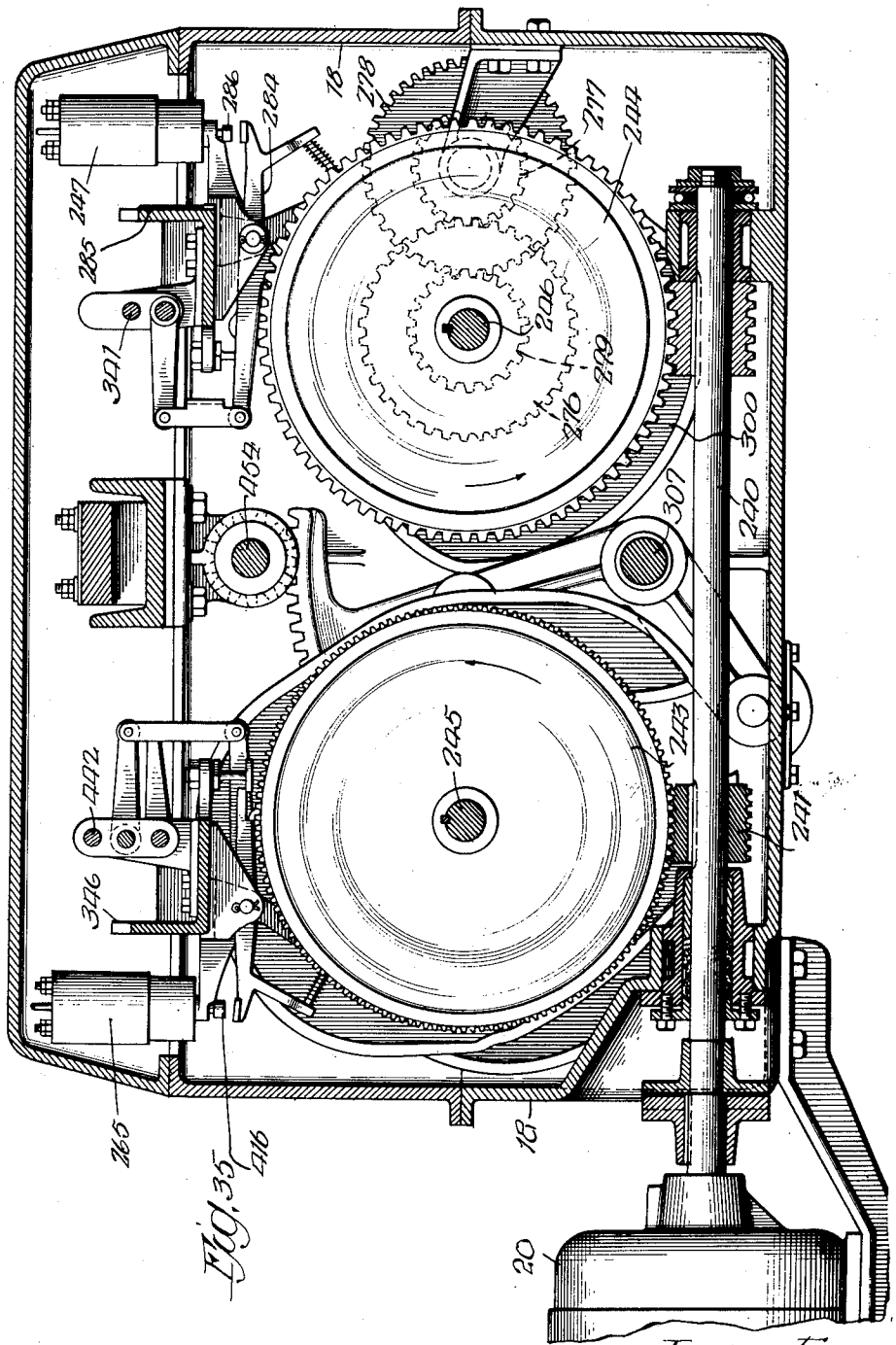


Fig. 35

Inventor
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By Wm. H. Gilbert
Attorney

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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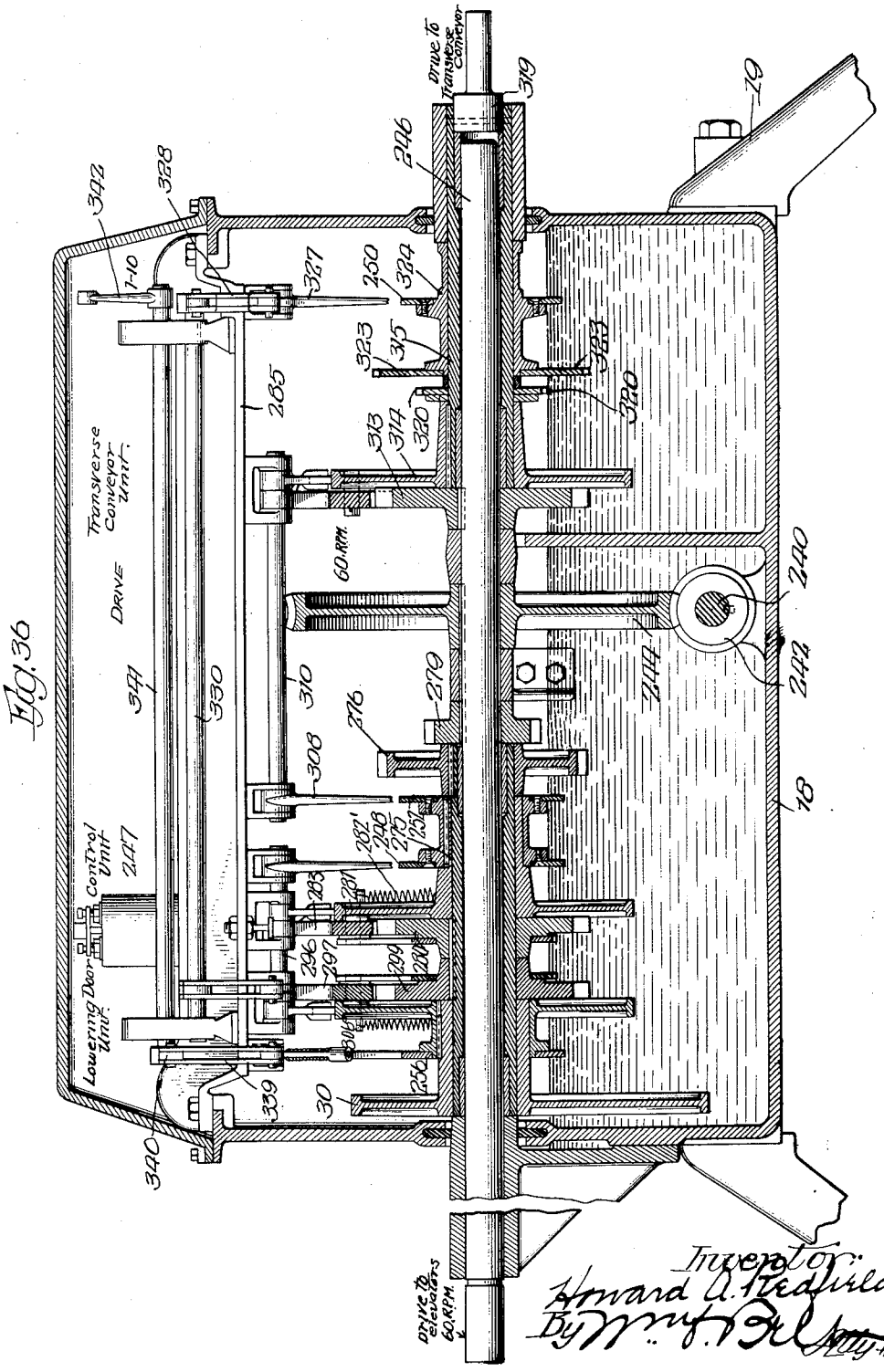


Fig. 36

Inventor
Howard A. Redfield
By
Atty.

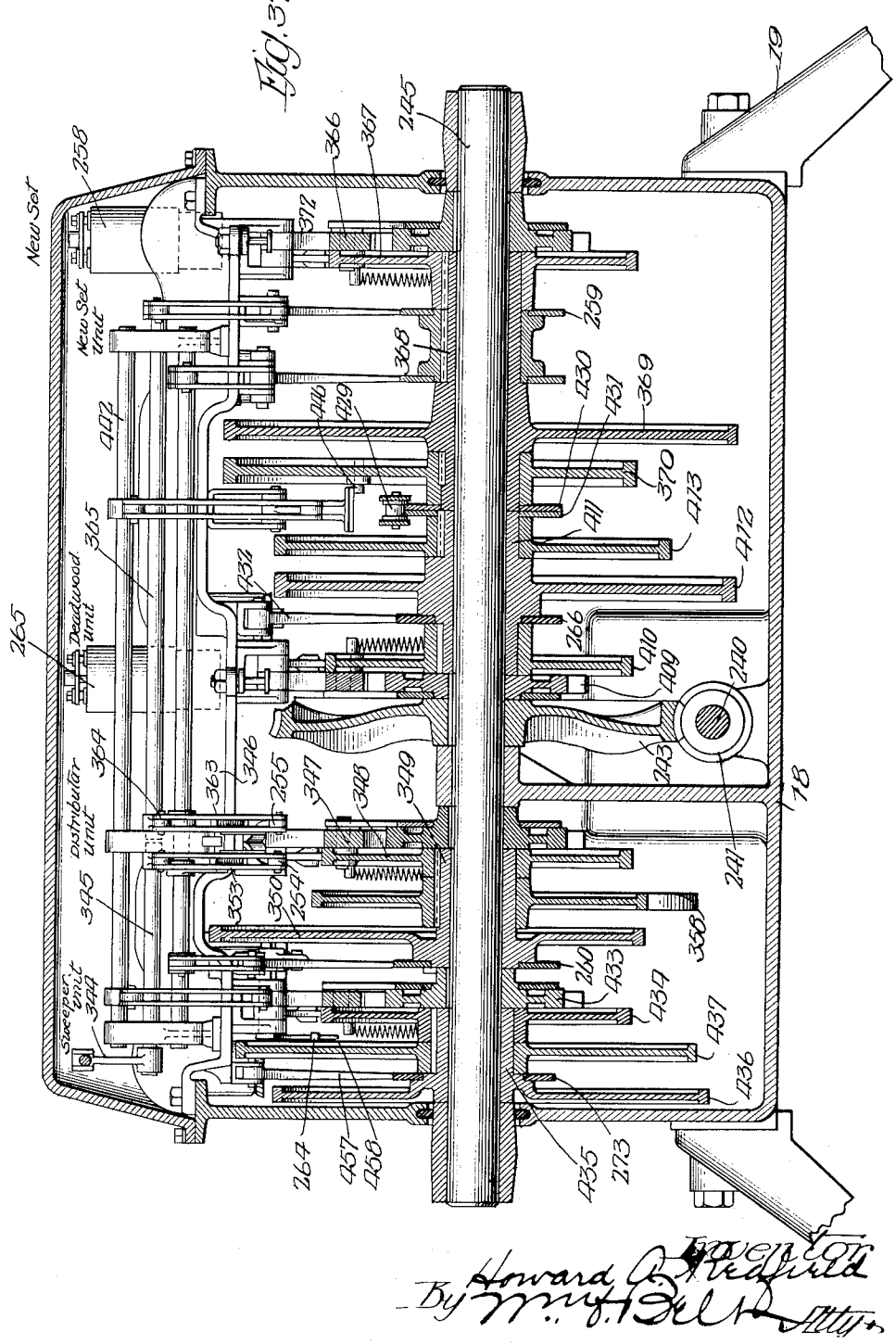
Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 37



Inventor
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By Mitchell & Bell Attys.

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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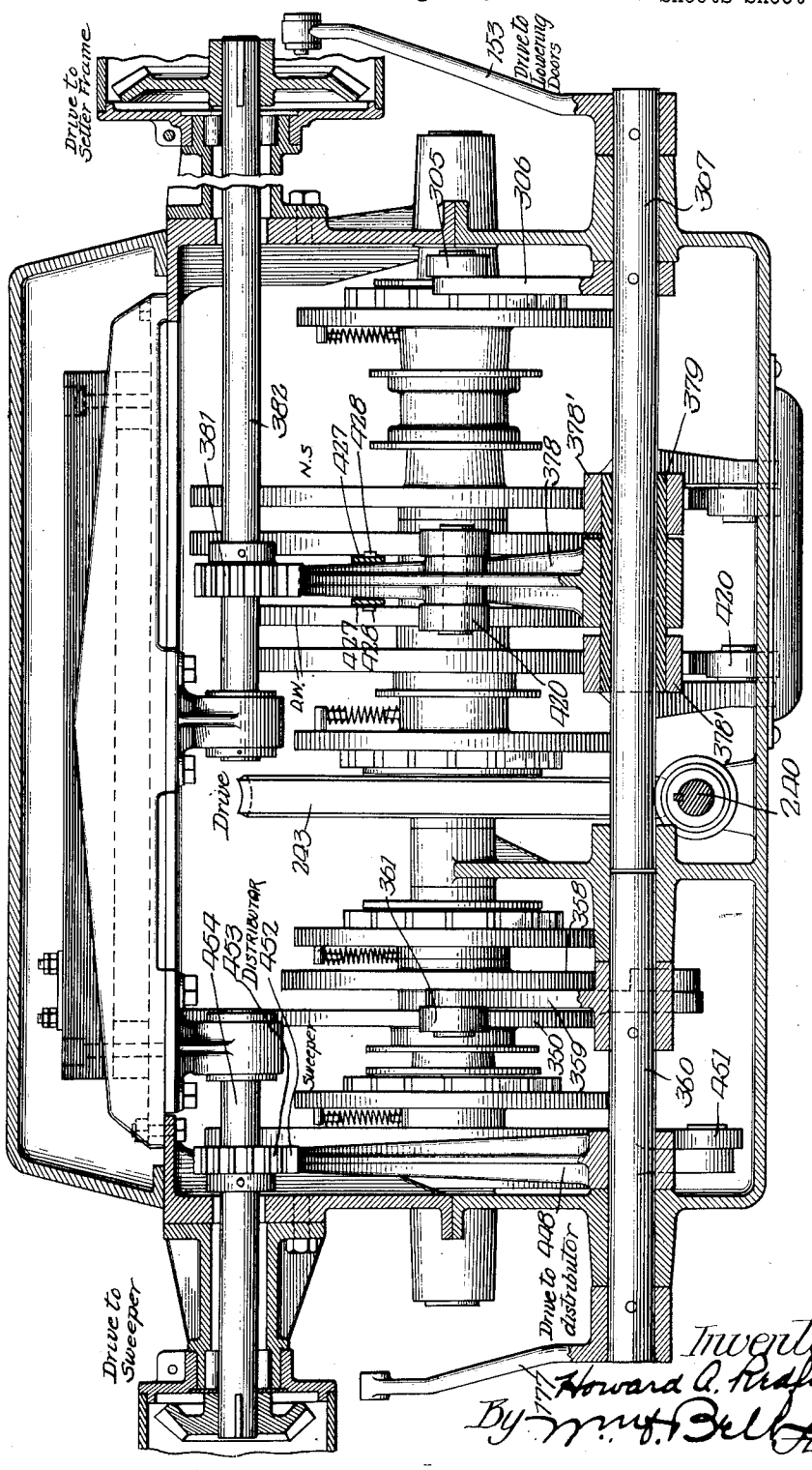


Fig. 38

Inventor
Howard A. Redfield
By Wm. H. Bell Atty.

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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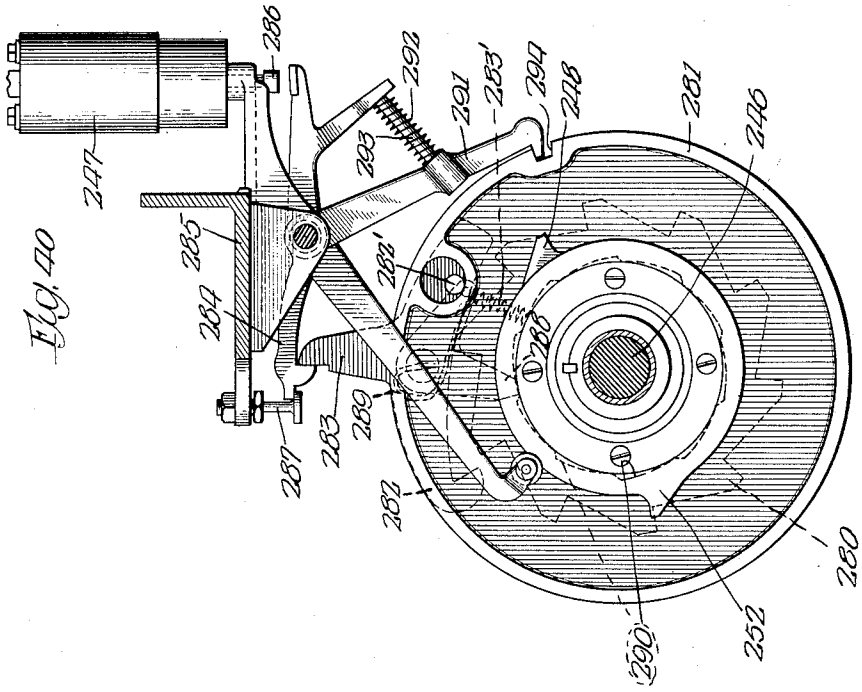


Fig. 40

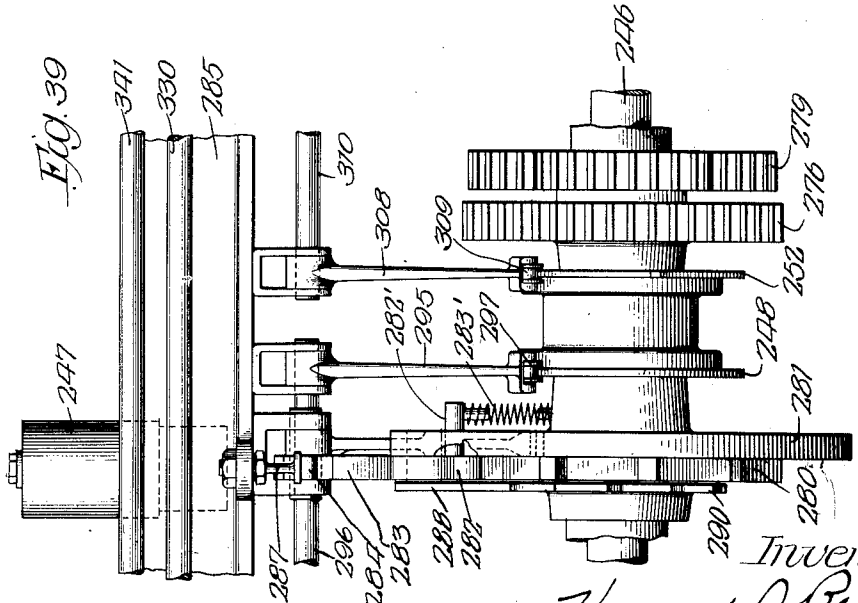


Fig. 39

Control Unit

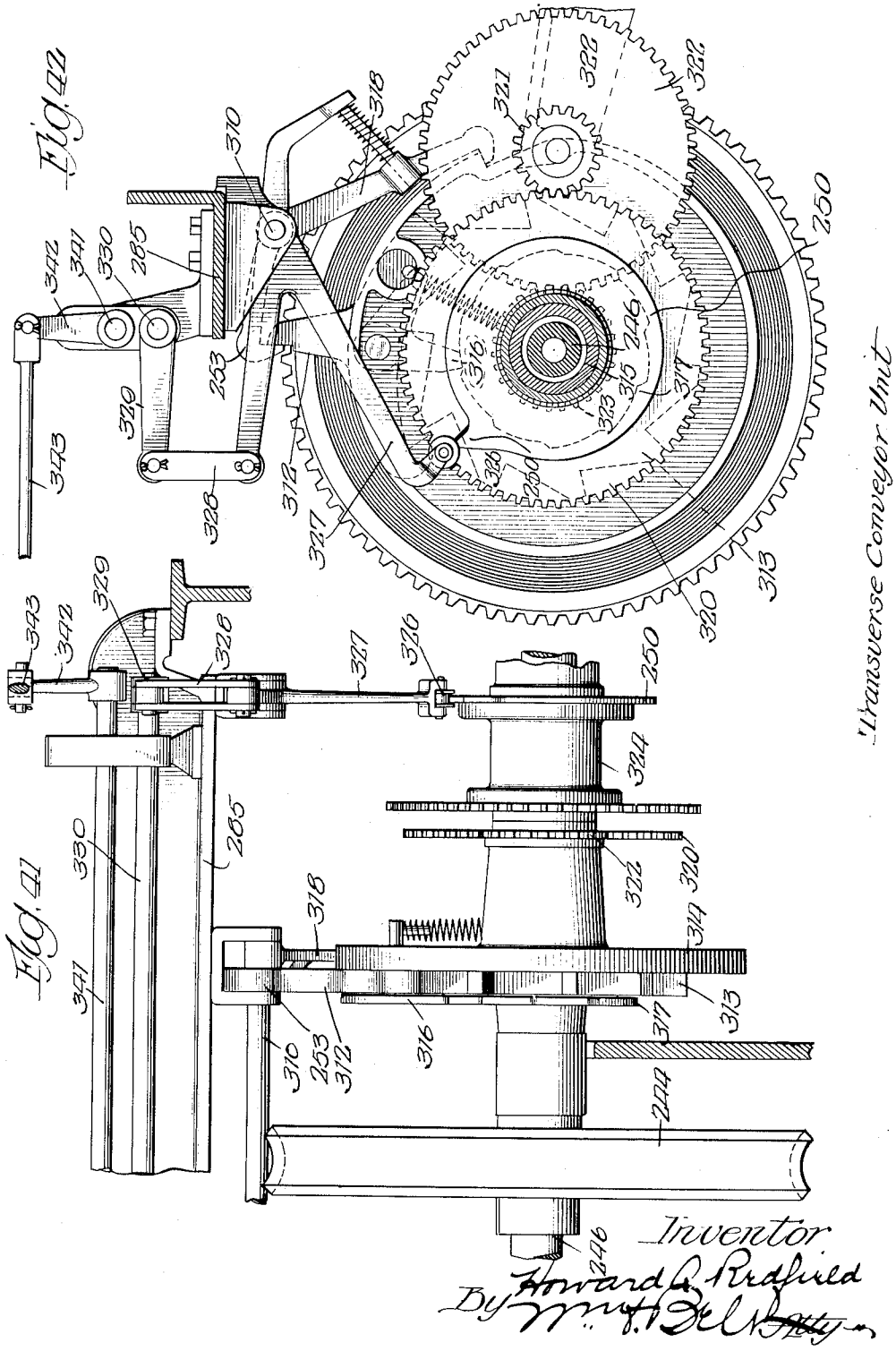
Inventor
Howard A. Redfield
By Mitchell & Bell
Attys

Sept. 18, 1923. 1,468,212

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AUTOMATIC PIN SETTING MACHINE

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Fig. 45

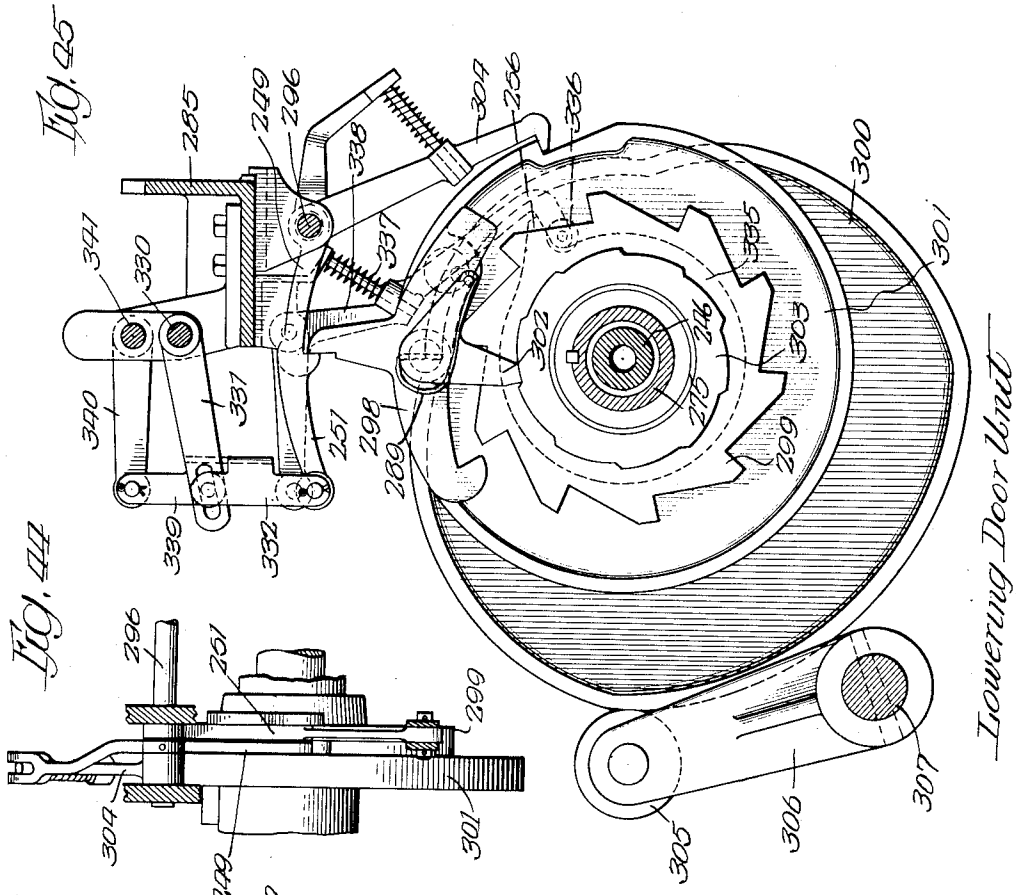
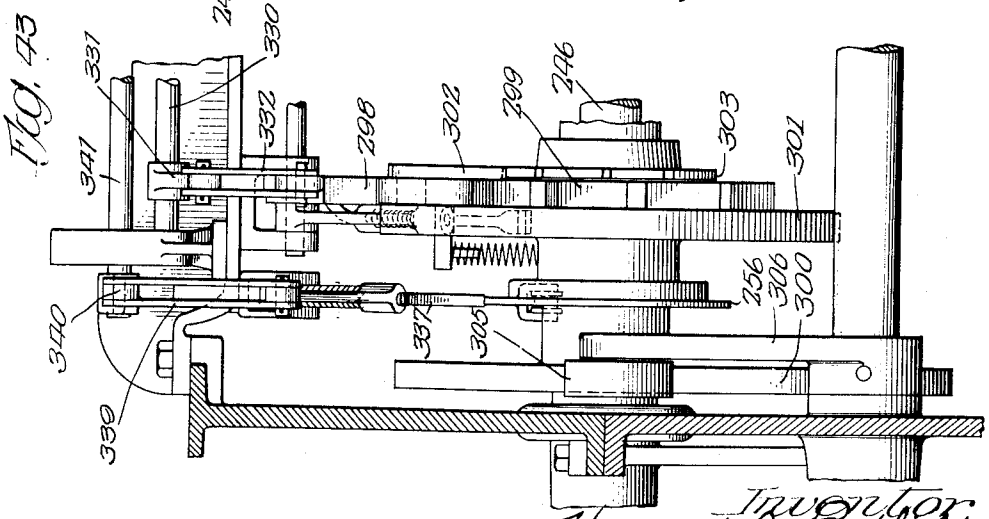


Fig. 44

Fig. 43



Inventor
Howard A. Redfield
By Wm. F. Dell Atty

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H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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Fig. 47

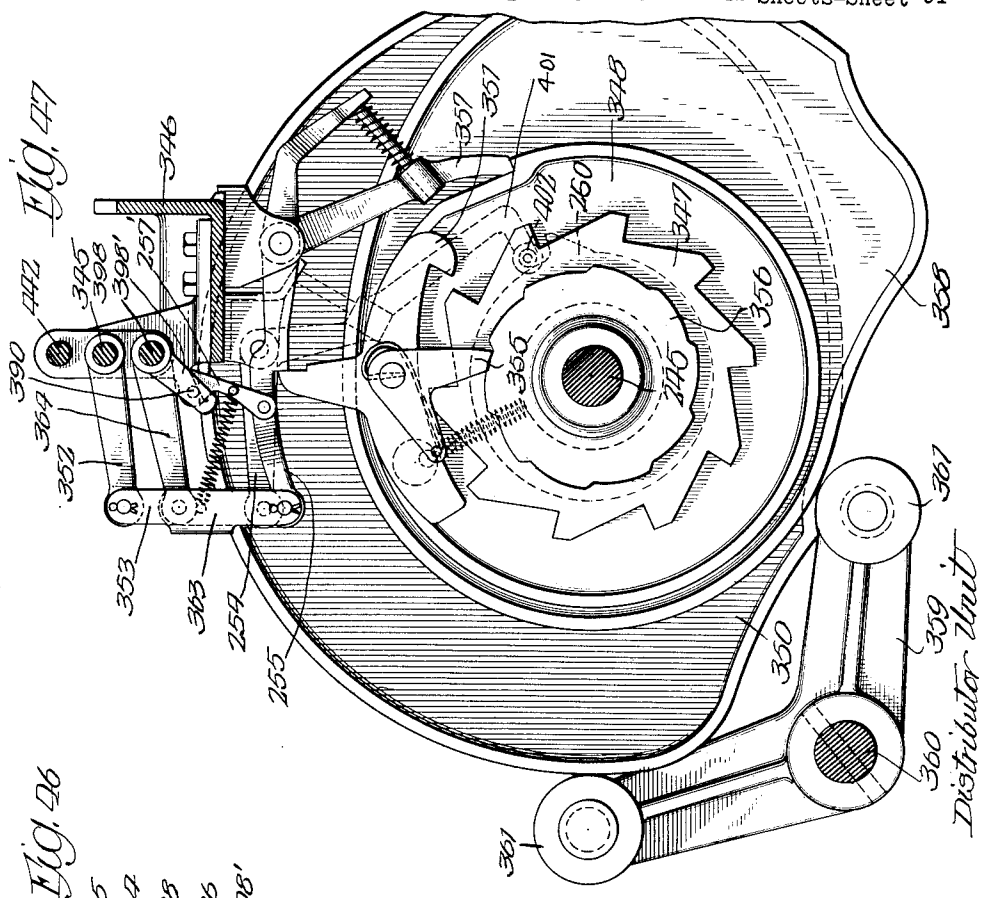
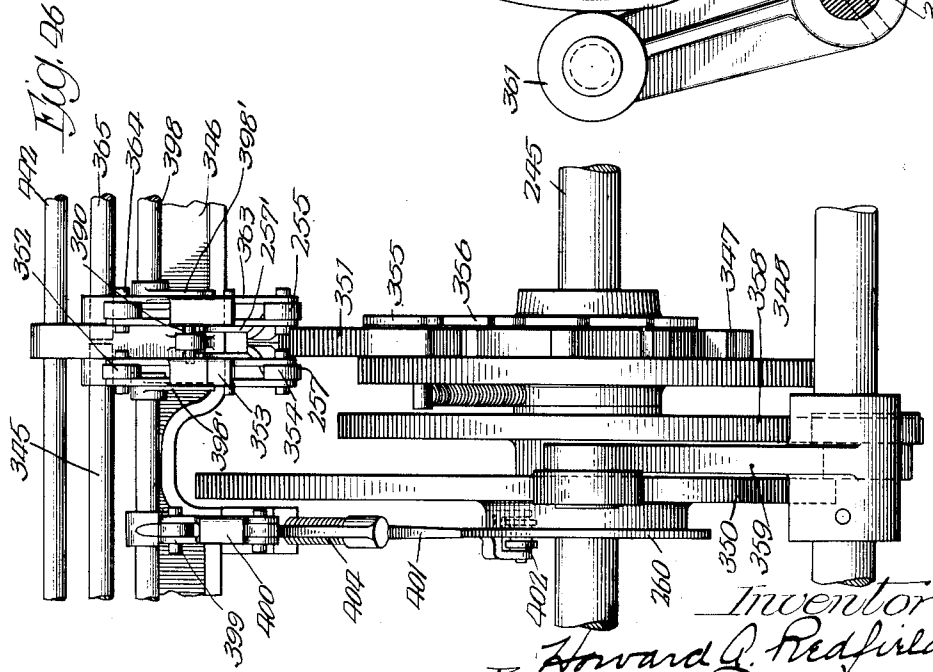


Fig. 46



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H. A. REDFIELD

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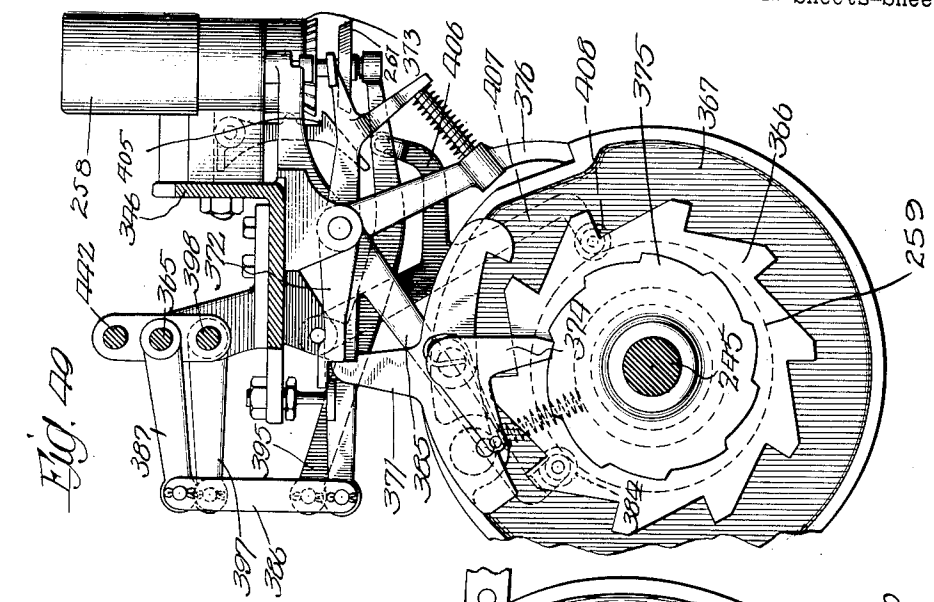


Fig. 40

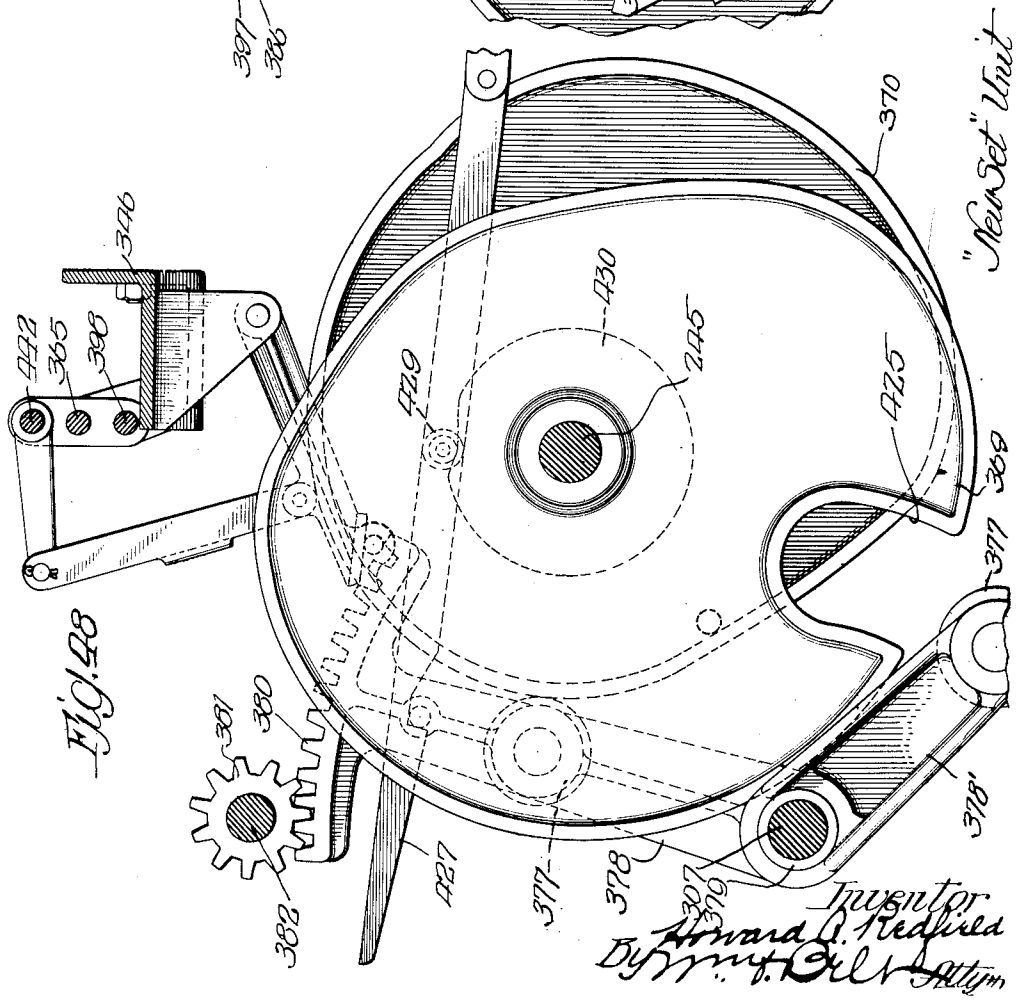


Fig. 28

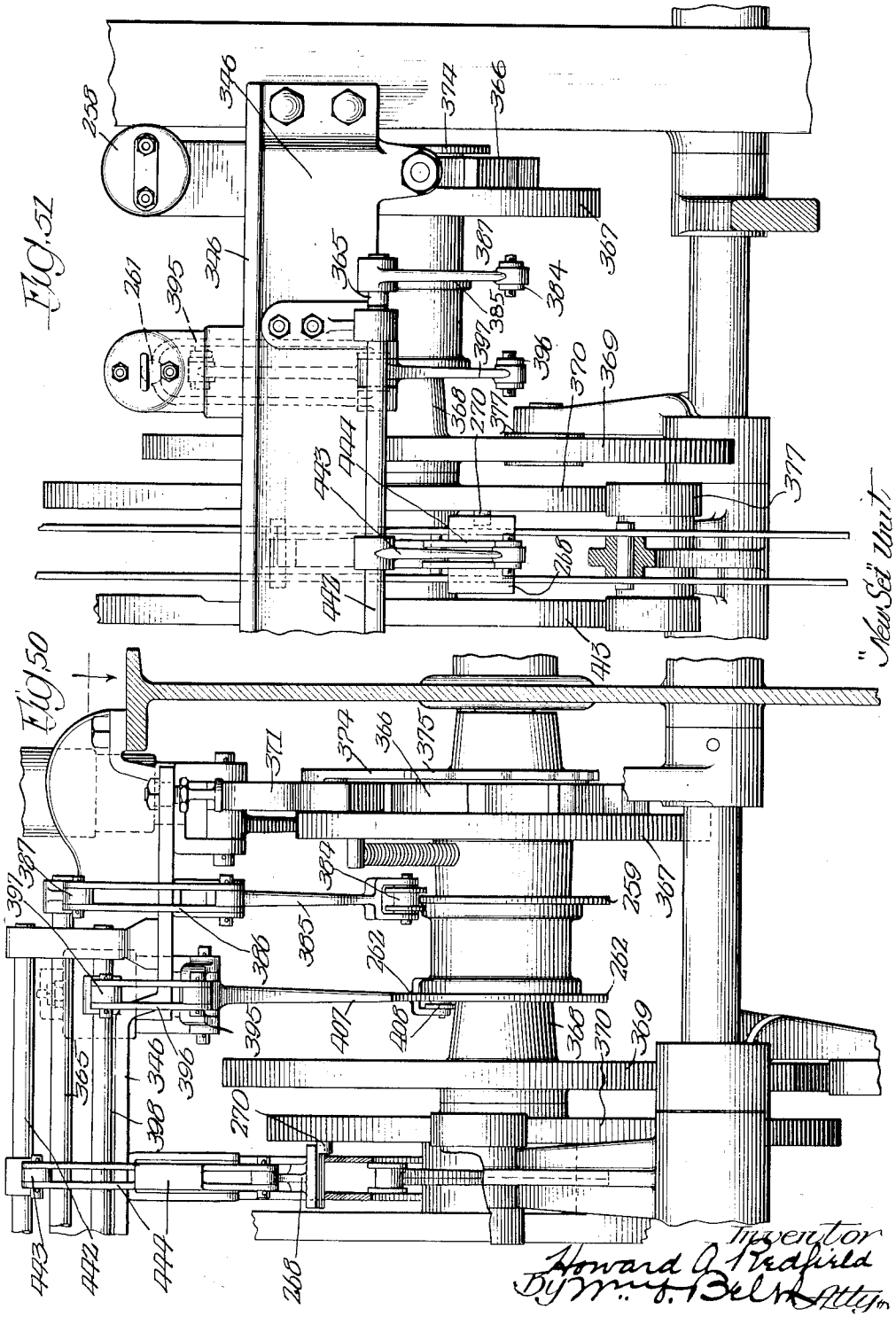
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By Wm. F. Dill Attorney

Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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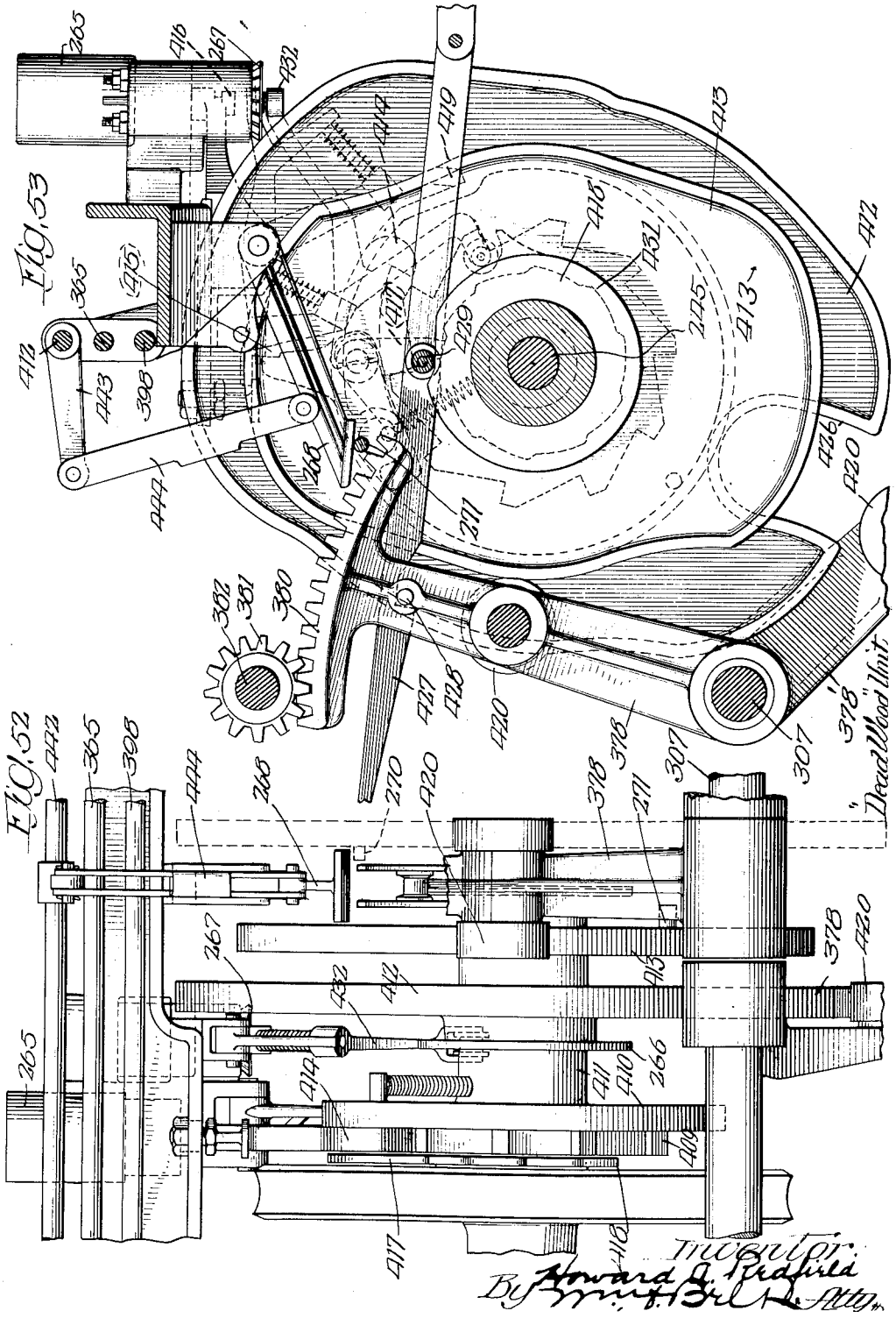


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H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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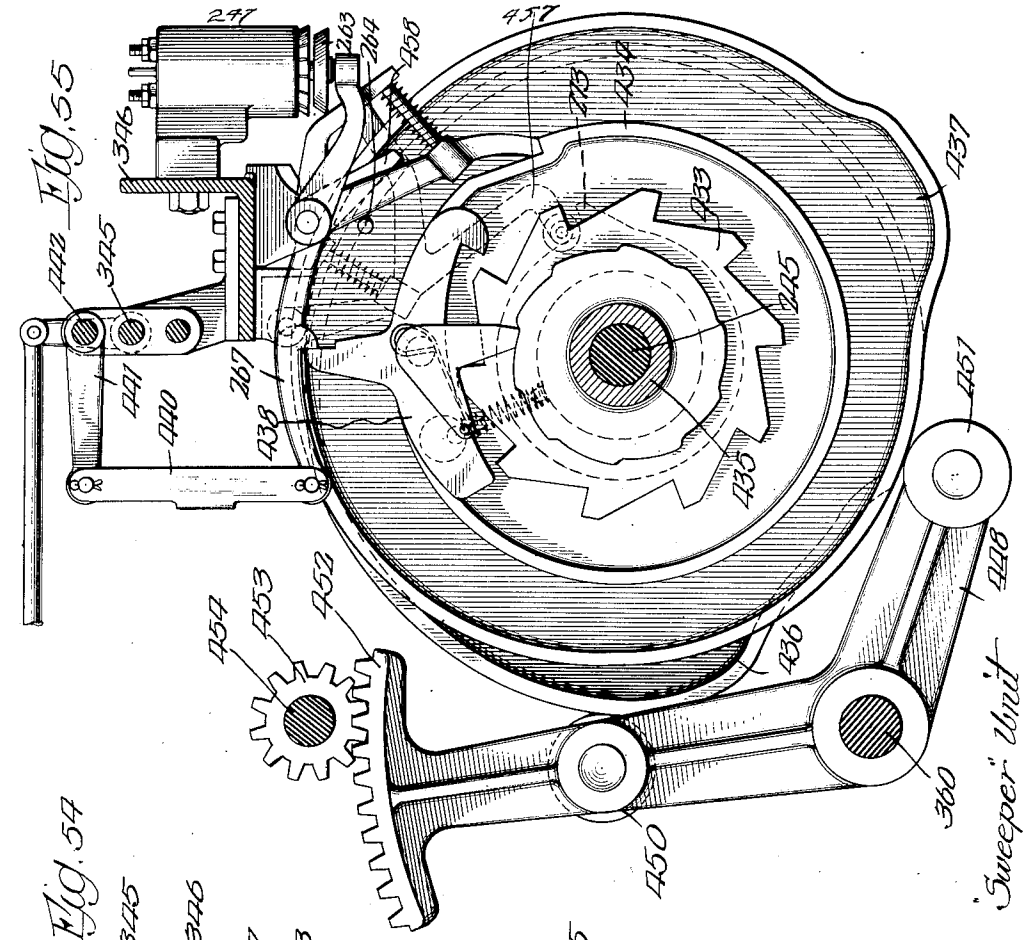


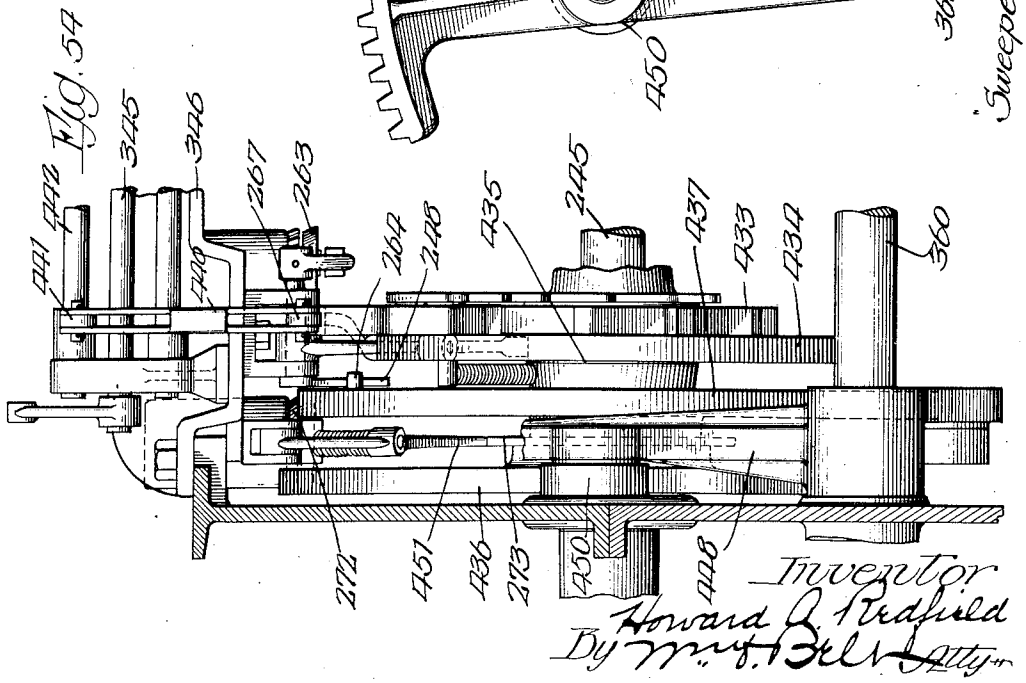
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AUTOMATIC PIN SETTING MACHINE

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H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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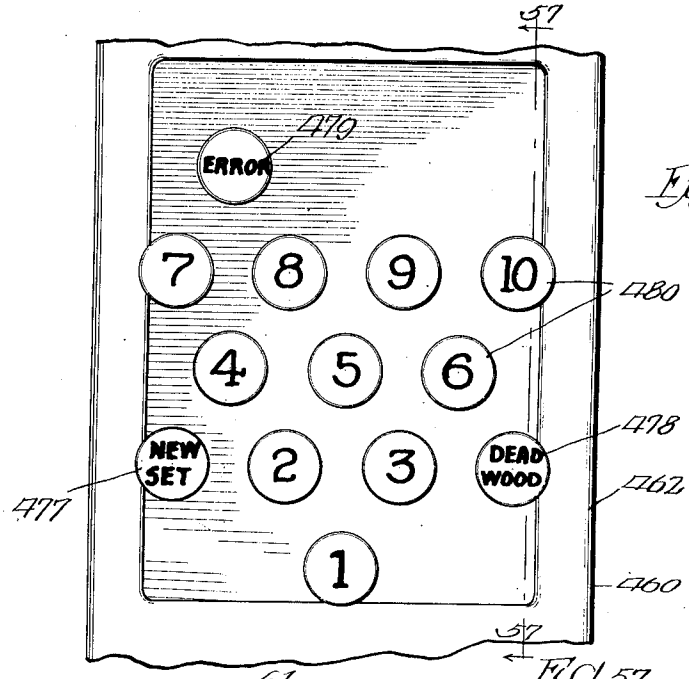
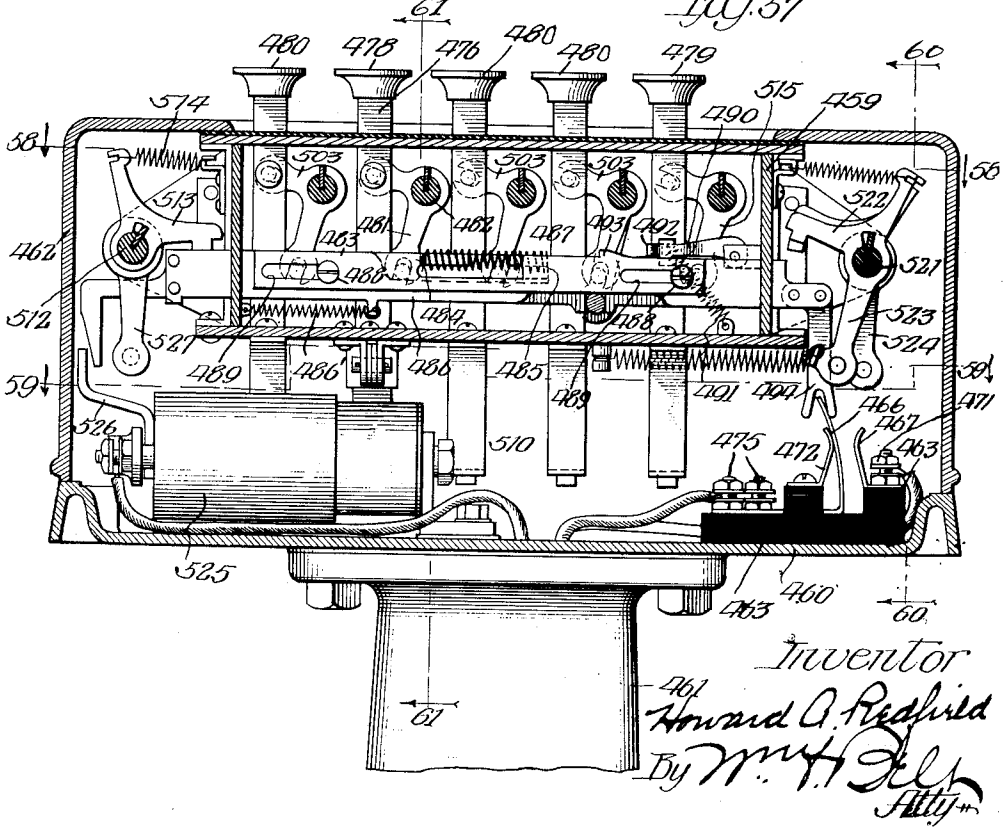


Fig. 56

Fig. 57



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Atty.

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AUTOMATIC PIN SETTING MACHINE

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Fig. 58

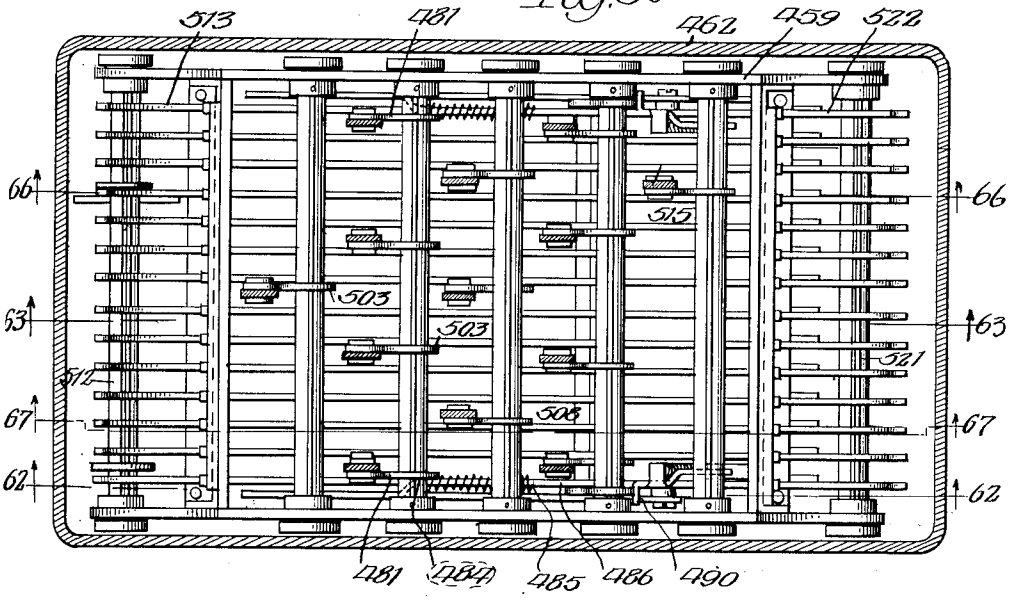
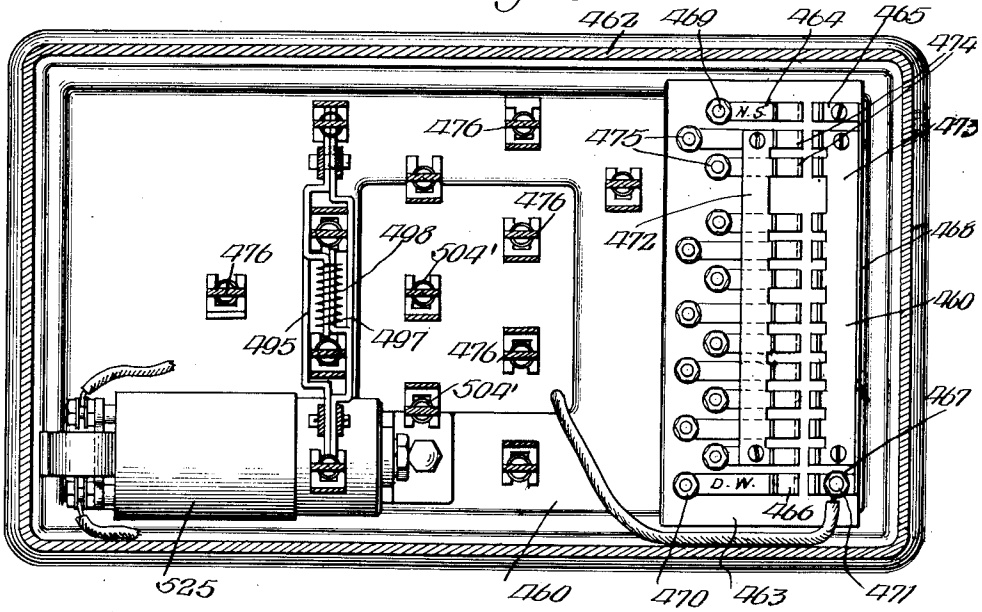


Fig. 59



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AUTOMATIC PIN SETTING MACHINE

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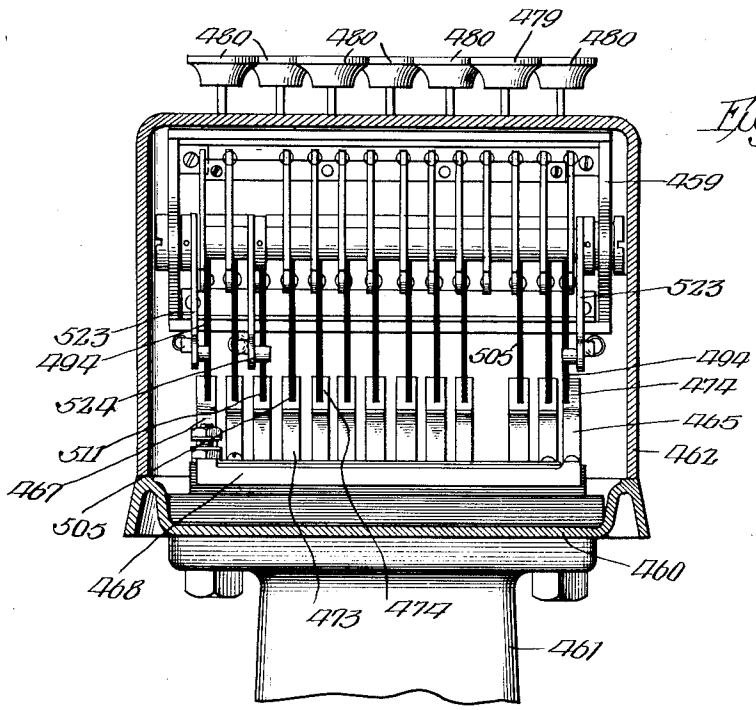


Fig. 60

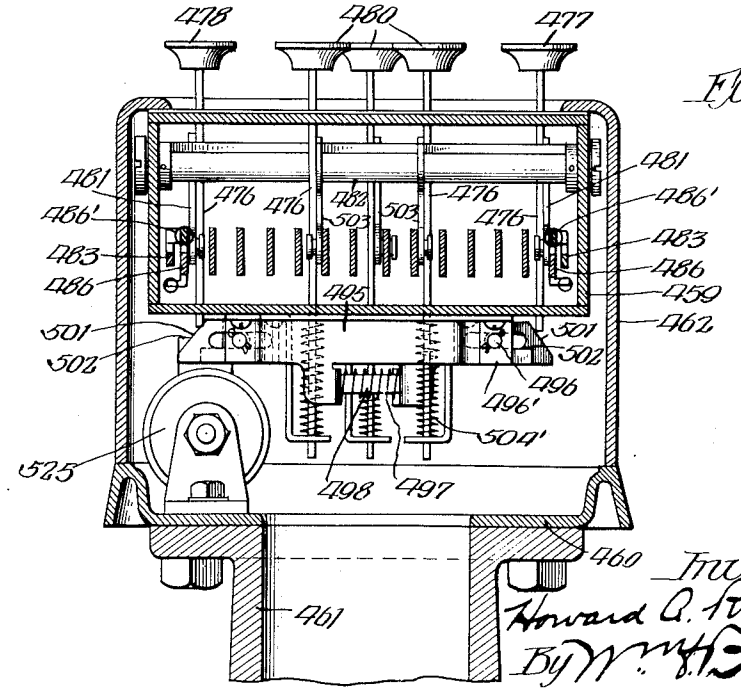


Fig. 61

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AUTOMATIC PIN SETTING MACHINE

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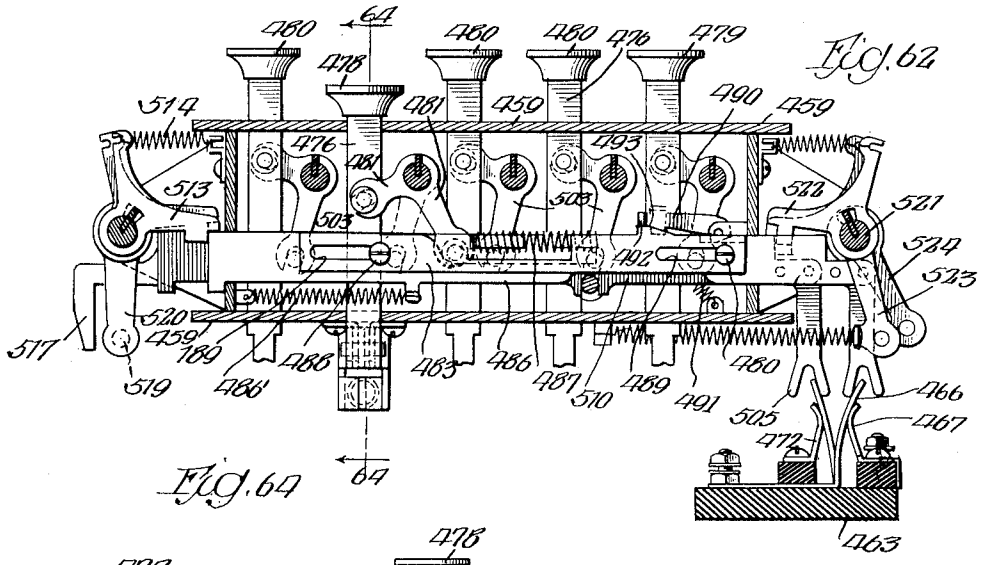


Fig. 64

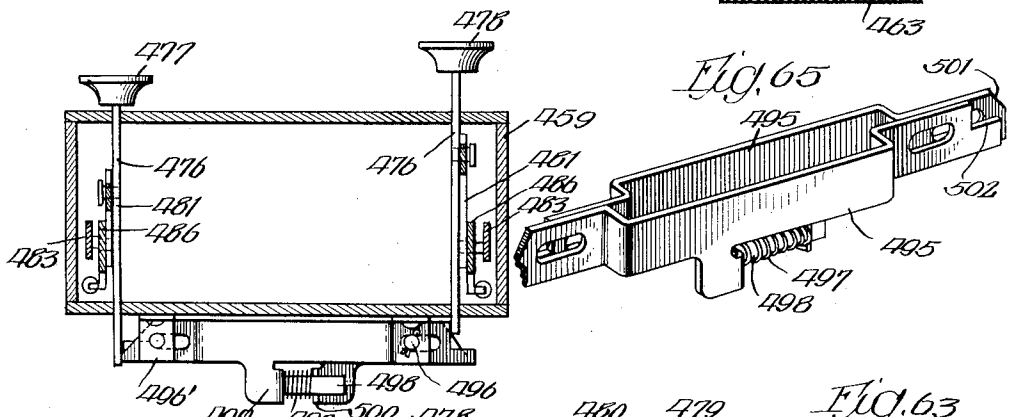
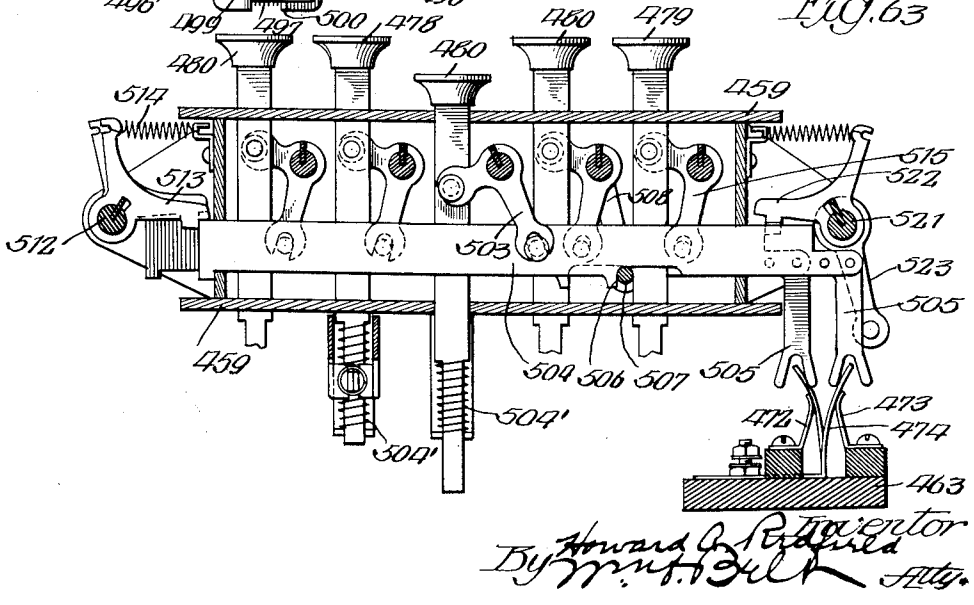


Fig. 65

Fig. 63



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Sept. 18, 1923. 1,468,212

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AUTOMATIC PIN SETTING MACHINE

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Fig.66

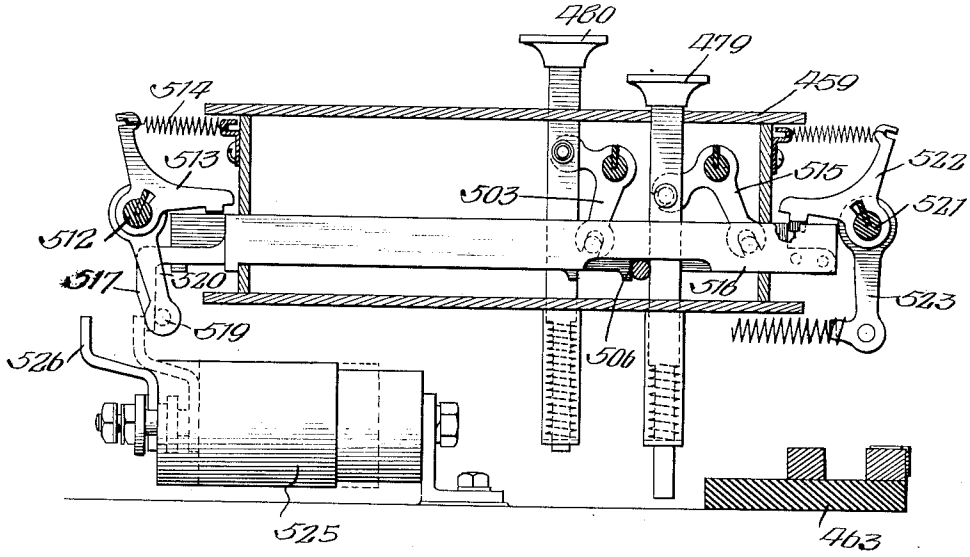
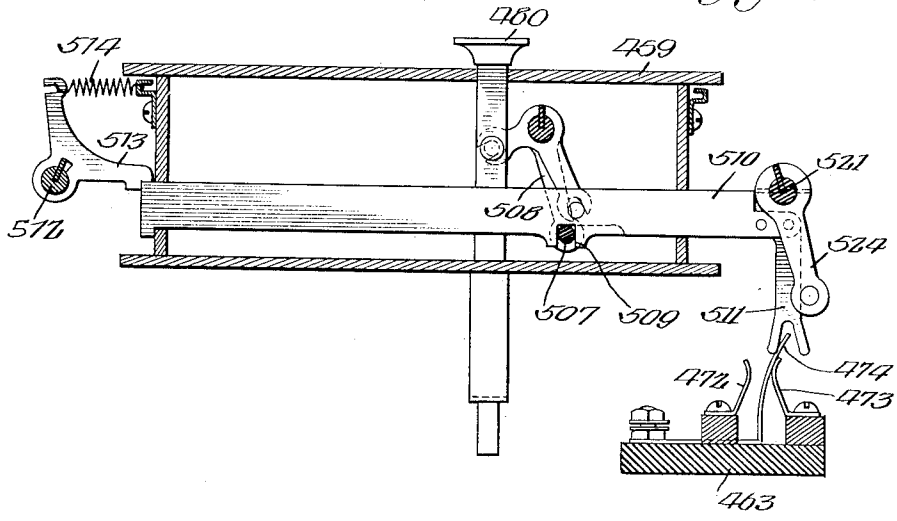


Fig.67



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Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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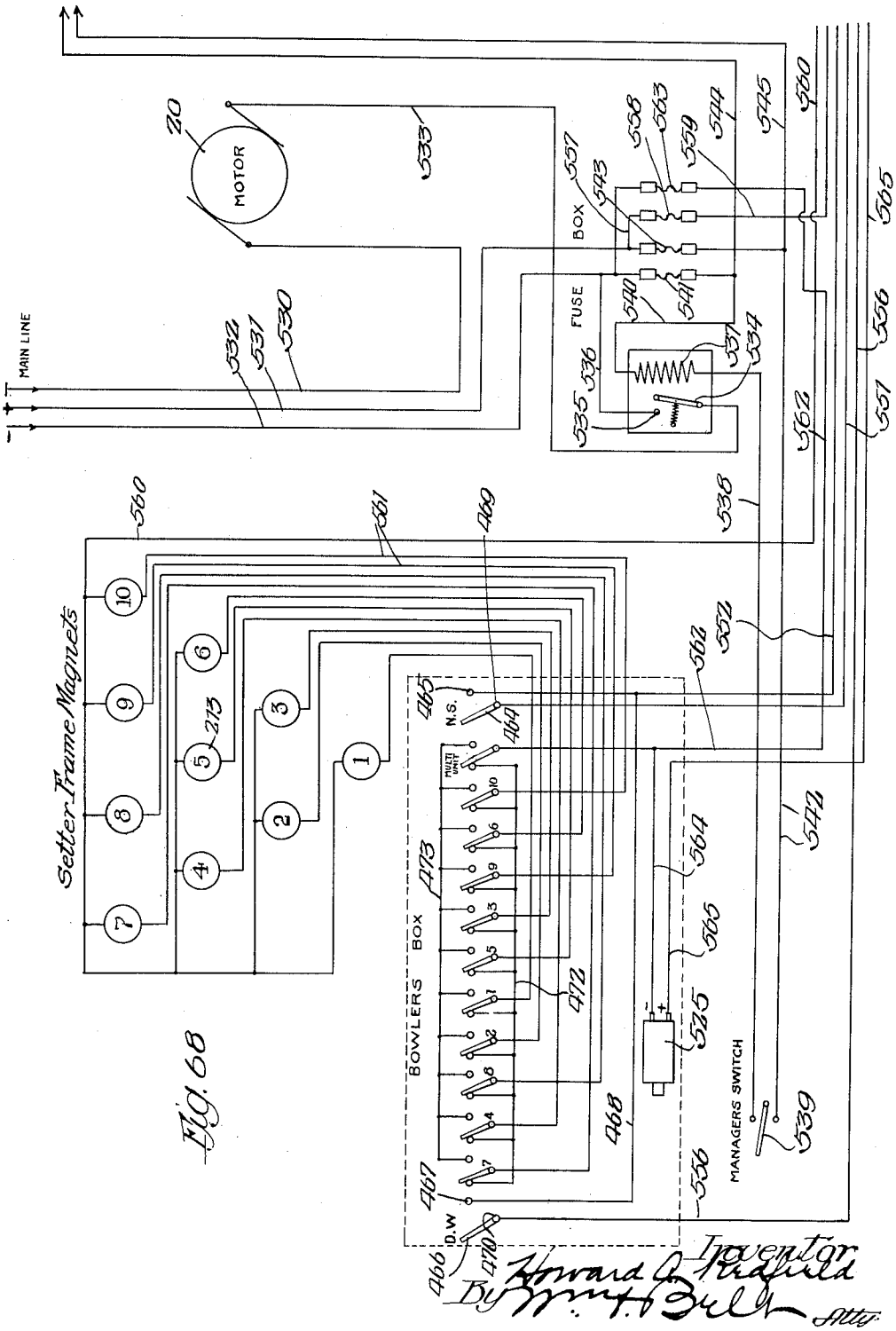


Fig. 66

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Sept. 18, 1923. 1,468,212

H. A. REDFIELD

AUTOMATIC PIN SETTING MACHINE

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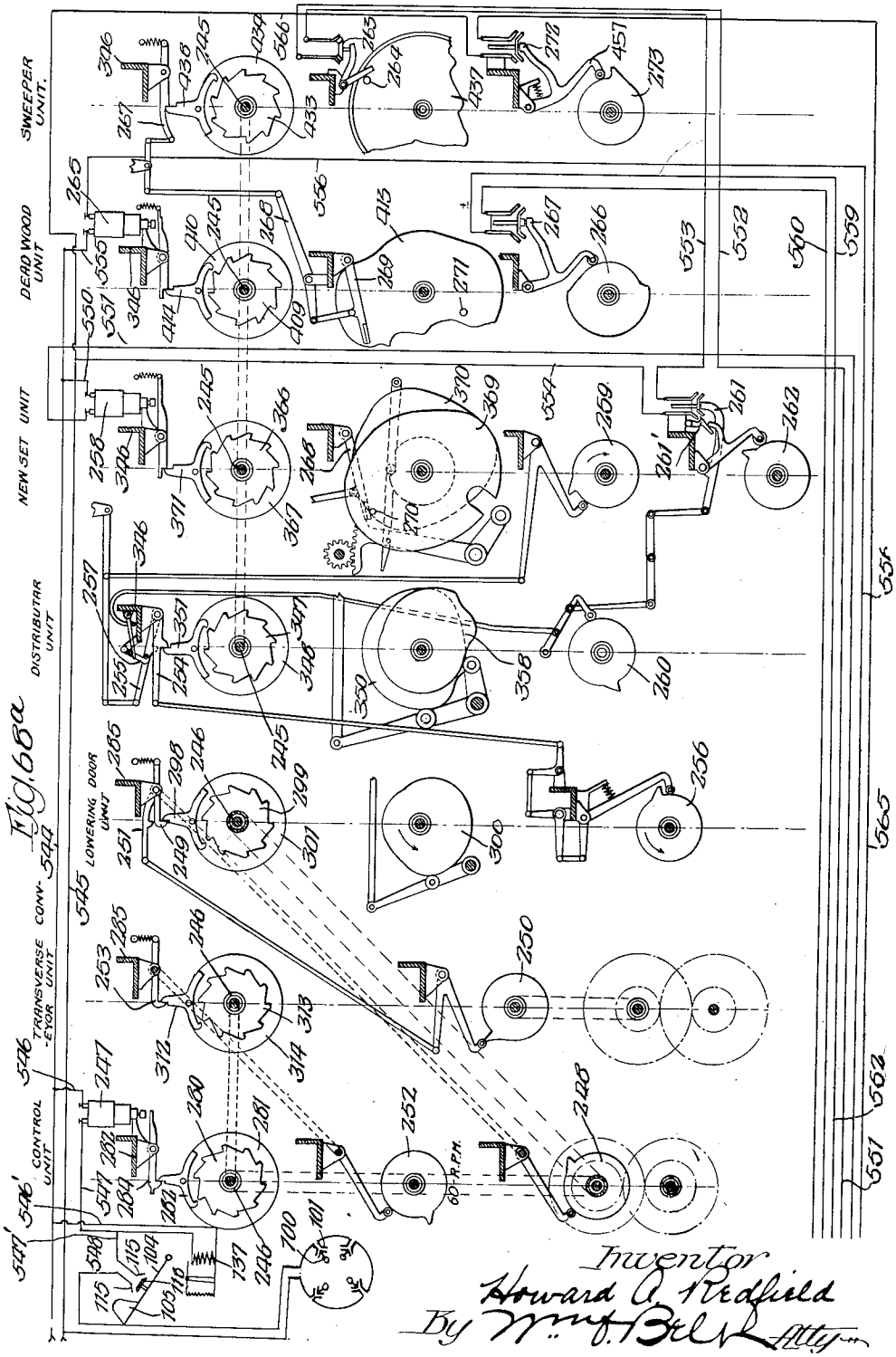


Fig. 66a

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Patented Sept. 18, 1923. 1,468,212

UNITED STATES PATENT OFFICE.

HOWARD A. REDFIELD, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE BRUNSWICK-BALKE-COLLENDER COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

AUTOMATIC PIN-SETTING MACHINE.

Application filed August 21, 1918. Serial No. 250,821.

To all whom it may concern:

Be it known that I, HOWARD A. REDFIELD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Pin-Setting Machines, of which the following is a specification.

This invention relates to automatic machines for setting pins on bowling alleys whereby the services of a pin boy are dispensed with, the usual functions of the boy being performed entirely by mechanical devices electrically actuated and controlled from the player's end of the alley.

To properly perform the functions of a pin boy the machine must be capable of two distinct operations, namely "new set," whereby a new stand of pins is arranged upon the alley bed after all pins and balls remaining from a preceding play have been removed therefrom, and "deadwood" removal, whereby the overturned pins or "deadwood" are removed after each ball is rolled without disturbing the relative positions of the standing pins. The machine must also be capable of selectively spotting one or more of the pins as a phase of the "deadwood" operation to permit the player to practice with particular problems.

It is the primary object, therefore, of my invention to provide a machine, of the simplest possible character compatible with the requirements above outlined, which is capable of complete control from the player's end of the alley to continuously and efficiently perform the desired functions with a minimum of required attention by skilled mechanics.

A further object of the invention is the provision of novel mechanism for handling the pins and balls after they have been delivered to the alley pit and for elevating and again arranging them for continued use, including means for cleaning the pins and for rejecting those which have been damaged in play.

A further object is the provision of novel mechanical means for distributing and handling the pins after they have been elevated and for delivering them in sets to the alley bed.

A further object of the invention is the provision of a novel sweeper for removing pins from the alley bed and delivering them to the pit, the sweeper being particularly designed to eliminate shock and noise in operation.

A still further object of the invention resides in the arrangement of all of the controlling and timing mechanism for the various operative parts as an assemblage of units which are readily accessible, and in the provision of a novel electrical switch mechanism or bowler's box adjacent the player's end of the alley, whereby the various units are actuated and the player is prevented from initiating any of the operations while others are in progress.

Further objects and advantages of the invention reside in the various combinations hereafter described and claimed as will be better understood by reference to the following specification when read in connection with the accompanying drawing illustrating the preferred embodiment thereof, in which

Fig. 1 is a side elevation of the machine, a portion of the alley bed with which it cooperates being illustrated in section;

Fig. 2 is a plan section of the rearward portion of the machine illustrating the mechanism for delivering the pins and ball from the pit;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is a section on the line 4—4 of Fig. 2;

Fig. 5 is a section on the line 5—5 of Fig. 2;

Fig. 6 is a section on the line 6—6 of Fig. 2;

Fig. 7 is a rear elevation of the lower portion of the machine illustrating the mechanism for delivering the pins to the elevator;

Figs. 8 and 9 are detail sections on the lines 8—8 and 9—9 of Fig. 4;

Fig. 10 is a side elevation of the upper portion of the pin elevator and the assembly shelf;

Fig. 11 is a plan section illustrating a portion of the assembly shelf;

Figs. 12 and 13 are enlarged detail views of a portion of the broken pin ejector mechanism;

Fig. 14 is a diagrammatic view illustrating the controlling circuit of the broken pin ejector mechanism;

Figs. 15, 16, 17, and 18 are details of switches in the circuit illustrated in Fig. 14;

Fig. 19 is a longitudinal section through

the upper rear portion of the machine illustrating the assembly shelf and the chutes leading to the distributor frame;

Fig. 20 is a rear elevation of the structure illustrated in Fig. 19;

Fig. 21 is a section on the line 21—21 of Fig. 19;

Fig. 22 is a longitudinal section through the lower forward portion of the machine illustrating the distributor and setter frames;

Fig. 23 is a plan view of the distributor frame;

Fig. 24 is a section on the line 24—24 of Fig. 22 illustrating the position of the setter frame during one phase of the "deadwood" removal operation;

Figs. 25, 26, and 27 are details illustrating the operation of one section of the distributor frame;

Fig. 28 is a plan view of the structure illustrated in Fig. 26;

Fig. 29 is a plan view of the setter frame;

Figs. 30 and 31 are details illustrating the operation of one pair of pin grippers in the setter frame;

Fig. 32 is a side elevation of the sweeper;

Fig. 33 is a front elevation of the upper portion of the machine;

Fig. 34 is a plan view of the controlling mechanism, the upper portion of the enclosing casing being removed;

Figs. 35, 36, 37, and 38 are sections on the lines 35—35, 36—36, 37—37, and 38—38 of Fig. 34;

Figs. 39 to 55 are details illustrating the separate units of the controlling mechanism shown in Fig. 34;

Fig. 56 is a plan view of a portion of the bowler's box;

Fig. 57 is a section on the line 57—57 of Fig. 56;

Figs. 58 and 59 are sections on the line 58—58 and 59—59 of Fig. 57;

Figs. 60 and 61 are sections on the lines 60—60 and 61—61 of Fig. 57;

Figs. 62 and 63 are sections on the lines 62—62 and 63—63 of Fig. 58;

Fig. 64 is a detail illustrating the interlock between the "deadwood" and "new set" keys;

Fig. 65 is a detail in perspective of the interlocking bars;

Figs. 66 and 67 are sections on the lines 66—66 and 67—67 of Fig. 58; and

Figs. 68 and 68[a] are diagrammatic views illustrating the controlling circuits.

The various mechanisms constituting the automatic pin setting machine may be conveniently grouped, so that these mechanisms and the co-operating relationship thereof may be readily understood, as the general structure, the ball elevator, the pin elevator and broken pin ejector, the assembly shelf, the distributor frame, the setter frame, the sweeper, the control mechanism, the bowler's box, and the electrical circuits connecting the bowler's box and control mechanism. These groups will be described in the order named.

The general structure.

Referring to Fig. 1 of the drawing, the mechanism is supported on a frame 5 above an alley bed 6, which terminates in the usual pit 7 and is provided with "kick-backs" 8 at either side; a padded back-stop 9 is suspended from an angle bar 10 between the "kick-backs." Preferably because of the relatively short distance between the end of the alley bed 6 and the back-stop 9 a curtain 11 is suspended from the frame 5 to overcome the momentum of pins or balls which are forcefully projected from the alley bed. The balls and pins move from the alley bed 6 into the pit 7 whence they are advanced through an opening in the lower edge of the back-stop 9, (Fig. 3) to the ball and pin elevators respectively. The balls are elevated in the manner hereinafter described and delivered to a run-way 12 which carries them to the player's end of the alley. The pins are elevated in a manner also hereinafter described and are delivered to an assembly shelf 13 where they are assembled in sets of ten.

Each set of ten pins under suitable control passes through chutes 14 to the distributor frame 15 which in turn delivers them to the setter frame 16. The setter frame is lowered from time to time to deposit a set of pins on the alley bed or to lift standing pins from the alley bed while fallen pins or "deadwood," are removed. The sweeper 17 is actuated as required to remove pins and balls from the alley bed in preparation for a "new set" or to clear the alley of "deadwood." All of the various groups of mechanisms are controlled and timed by units within a casing 18 supported by brackets 19 on the frame 5, the timing units being driven by an electric motor 20 supported adjacent the casing 18. The operations of the control units within the casing 18 are initiated through the actuation of electric switches within a bowler's box disposed adjacent the player's end of the alley.

The Ball Elevator.

The pit 7 is provided with a floor 21 sloping toward two disks 22 (Figs. 2 and 3) each having a friction surface of cork matting or the like. The disks 22 are supported on spindles 24 for rotation in the directions of the arrows on Fig. 2. The spindles 24 are driven by spiral gears 25, (Fig. 3) on a shaft 26. The shaft 26 is continuously driven through shafts 27, 28 and 29, (Figs. 1, 2, 3 and 5) the latter shaft being connected to driving means within the casing 18. The pins and balls upon engagement with the

disks 22 are carried thereby toward the opening, (Fig. 3) in the back-stop 9 and pass there-through onto an inclined floor 30, (Fig. 4).

Two spindles 31 and 32, (Fig. 4) project forwardly from transverse members of the frame 5 and support guide shells 33 and 34 (Fig. 5) which are releasably secured to the outer ends of the spindles. The guide shells 33 and 34 are provided with sleeves 35 and 36 upon which disks 37 and 38 are loosely mounted. The disks 37 and 38 are resiliently biased away from the shells 33 and 34 by springs 39 surrounding pins 40 which are fast to the shells and project through suitable openings in the disks. The shells and disks have suitable faces adapted for engagement with a bowling ball, the resiliency of the springs 39 permitting variation in size of the ball. The shells form a curved pathway from the floor 30 to the ball run-way 12. Mounted on the spindles 31 and 32 and co-operating respectively with the shells 33 and 34 are two drums 41 and 42 having bearing faces adapted to engage the balls and move them along the pathway formed by the shells 33 and 34. The ball rotates on an axis which is substantially perpendicular to the engaging faces of the disks 37 and 38 at the line of engagement of the ball therewith.

The drums 41 and 42 are rotated in opposite directions through the following mechanism: A bevel pinion 43, (Fig. 5), driven from the shaft 29 drives a bevel gear 43′ on a stub shaft 44 carrying a sprocket 45 which is connected by a chain 46 to a sprocket 47, (Fig. 4) carried by a sleeve 48 which is rotatably mounted on the spindle 32. The sleeve 48 has a clutch jaw 49 connecting it with a similar sleeve 50 also rotatably mounted on the spindle 32. Within and rotating with the drum 42 is a housing 51 enclosing a gear 52 fixed to the sleeve 50 and meshing with a pinion 53, (Fig. 5) carried by the housing. The pinion 53 meshes with a pinion 54, also carried by the housing and engaging a gear 55, (Fig. 4), fast to a sleeve 56 integral with the drum 42. The gears 52 and 55 and the pinions 53 and 54 constitute an ordinary form of "back gearing" whereby the drum 42 is caused to rotate in a direction opposite to the direction of rotation of the sprocket 47. A sprocket 57 (Fig. 6) on the sleeve 50 is connected by a chain 58 to a sprocket 59 fast to a sleeve 60 integral with the drum 41. Thus the drum 41 is driven in the same direction as the sprocket 47. When a ball rolls into engagement with the drum 41 it is moved thereby into the guide shell 33 and is carried upwardly in engagement therewith until it passes into the guide shell 34. Eventually it is delivered to the run-way 12 and passes to the player's end of the alley.

It may be desirable to arrange the run-way 12 on either side of the machine. The shells 33 and 34 may, therefore, be removed from the spindles 31 and 32, after which the drums 41 and 42 may be interchanged, the clutch jaw 49 permitting separation of the sleeve 50 from the sleeve 48. The sleeve 60 integral with the drum 41 is provided with a similar clutch jaw 61 so that it may be readily connected to the sleeve 48. The shells 33 and 34 are then returned to the spindles 31 and 32, being arranged thereon in opposite relation to their positions as shown in Fig. 5. As will be readily understood, with this arrangement, the drum 41, being now uppermost, rotates in the direction of the sprocket 47 while the drum 42 rotates in the opposite direction. In other words, if the drum 41 rotates in a clock-wise direction, viewing Fig. 5, the drum 42 in the rearranged position will rotate in an anti-clock-wise direction and the ball will be eventually delivered to the run-way 12 on the opposite side of the machine. It is of course understood that the runway has been previously disposed to receive the balls from the shell 34.

The pin elevator and broken pin ejector.

A sleeve 62, (Fig. 4) is mounted on the spindle 31 and is provided with a jaw co operating with the clutch jaw 61 of the sleeve 60. The sleeve 62 carries a housing 62′ which supports a plurality of short shafts 63′ bearing pinions 64′ and 65′ (Figs. 8 and 9). The pinions 64′ mesh with a gear 66′ fast to the spindle 31 while the pinions 65′ mesh with a gear 67′ fast to a hub 64, (Fig. 4) which supports an annulus 65 having pin receiving pockets 66 in its face as clearly shown in Figure 6. The annulus 65 is thus driven through a speed reducing planetary gearing. The pins as shown in Fig. 4 pass the drum 41 and roll on the floor 30 into engagement with the annulus 65. They are picked up one by one by the pockets 66 and are carried by the annulus upward and into engagement with a shield 67 which prevents them from falling from the pockets.

Adjacent the side of the machine I provide a cylindrical stack 68 of a diameter slightly larger than the diameter of the pins. A shaft 68′ (Fig. 5) driven through a bevel pinion 69′ from the bevel gear 43′ is provided with a sprocket 69 at its end. The sprocket 69 is connected by a chain 70 to a corresponding sprocket 69′ on a stub shaft 71, (Figs. 1 and 11) adjacent the top of the stack 68. Two sprockets 72 on the shaft 71 and fast to the sprocket 69′ are connected by chains 73 to sprockets 74 on the stub shaft 75 adjacent the bottom of the stack. The latter shaft is supported on a bracket 76, (Fig. 6) and is slidably connected thereto, being adjustable by means of a screw 77 to take up any slack which may appear in the chains 73.

The chains 73 are provided at intervals with bars 79, (Figs. 2, 6, and 11), carrying balls 80 at their ends, and projecting through a slot in the side of the stack 68. Flanges 81 on the bars 79 are adapted to embrace a T bar 82 to steady the bars during their upward movement.

A chute 83, (Fig. 6), communicating with the end of the shield 67 is adapted to receive the pins from the pockets 66 as the annulus 65 revolves and to convey them to an opening in the wall of the stack 68 into which they are delivered in position to engage one of the bars 79 which are timed with respect to the annulus 65 to enter the bottom of the stack as the pin is delivered thereto. Obviously, the pins may enter the pockets 66 in either of two positions. It is essential that the pins be delivered to the stack with their butt ends downward. The bottom of the chute 83, is therefore provided with an opening 84, (Figs. 2 and 6), the width of which is less than the diameter of the pins. If a pin is delivered to the chute with its butt end foremost, the pin passes the opening but if the head of the pin is forwardly directed the head drops into the opening as indicated in dotted lines in Fig. 6 and the pin is thereby reversed before delivery to the stack.

A door 85, (Fig. 6), is pivotally mounted adjacent the opening through which the pins enter the stack and is actuated to close the opening after the pin has been delivered to prevent the pin from over-turning as it is lifted by the bar 79. The door is actuated through a pinion 86, (Fig. 7), meshing with a rack 87 on the end of a lever 88 pivoted at 89 and having a roller 90 operating in a cam track 91 which is secured to the hub 64. The cam track is timed with respect to the pockets 66 so that the door 85 is opened as each pocket approaches pin delivering position and closed as soon as the pin has been delivered to the stack. A brush 92 (Fig. 6) is arranged in the stack 68 to engage the entire surface of the pin as it is lifted, thereby cleaning each pin every time it passes through the machine. The pin is carried to the upper end of the stack 68 and is delivered through the movement of the bar 79 about the axis of the sprockets 72 to a guide chute 93 (Fig. 11) which directs it onto one of the sections 147' of the assembly shelf. The pin comes to rest against a door 94, (Figs. 10, 12, and 13).

It frequently happens that a pin is damaged in play, either by breaking the head or by splitting portions from the sides and it is desirable to eject such pins from the machine since they are no longer suitable for use. A plurality, preferably four, switch arms 95, (Figs. 17 and 18), are, therefore, mounted on pivots 96 arranged about the stack 68 and carry rollers 96' projecting through openings in the walls of the stack for engagement with the pins as they pass upwardly therein. Latches 97 supported on pivots 98 are adapted to engage pins 99 on the ends of the switch arms 95 to lock them in the position indicated at the left-hand of Fig. 17 in which position the contacts 100 engage co-operating contacts 101 suitably supported and insulated from the switch arms. The switch arms 95 and latches 97 are connected by springs 102 which tend to hold the switches in their innermost position. As will be readily understood should a pin be defective because of the loss of a side thereof, one or the other of the switch arms 95 will not be moved outwardly when the pin passes.

Adjacent the top of the stack 68, a pivoted lever 104, (Fig. 10) is mounted and carries a cap 105 which is normally held by a spring 106 in the path of each pin as it leaves the stack. Should the head be broken away the cap will not be thus engaged. A plunger 107 is resiliently supported on the lever 104 by a spring 108. The plunger 107 actuates a circuit closer 109 which when moved to closed position is held by a pivoted latch 110 until released by engagement of the end of the lever 104 with a roller 111 on the end of the latch, when the lever 104 returns to its normal position.

Owing to the necessity of providing a circuit closer capable of continuous and repeated operations, a structure illustrated in Figs. 15 and 16 has been devised. An insulating base 112 is provided with a central opening, within which an insulating core 113 is arranged and held by binding posts 114. Between the base 112 and the core 113, I arrange two semi-cylindrical contacts 115 connected to the respective binding posts 114 and preferably slotted and having the ends of the fingers 116, thus formed, turned outwardly as is clearly shown in the drawing. A centrally disposed screw 117 is slidably supported in the core 113 and carries at its outer end a rotatable dished bridge 118, frustro-conical in form, and adapted to contact with the ends of the fingers 116. A sleeve 119 also secured to the end of the screw 117 and bearing in a recess in the end of the core 113 serves as a guide to maintain the bridge 118 in proper alignment. A spring 120 surrounding the screw 117 normally holds the bridge 118 out of engagement with the ends of the fingers 116. The plunger 107 on the lever 104 engages the bridge 118 and forces it against the spring 120 into engagement with the fingers 116 to close the circuit and in this position it is held by the latch 110 until released, as previously described. A spring pressed plunger 121 biases the latch 110 to operative position. I have found that this structure presents new contact faces at each successive operation so that the

life of the circuit closer is indefinitely prolonged.

Each of the contacts 100, 101, and 115 are connected in series as indicated in Fig. 14 and as will be readily understood each pin, if unbroken, completes a circuit hereinafter described, as it passes upwardly and is delivered from the stack 68. If, however, the sides or the head of the pin are broken the circuit is not completed. The completion of the circuit above referred to insures closure of the door 94 against which the pin rests on the assembly shelf, as previously described. The door is otherwise lowered to permit passage of the broken pin to a receptacle 121', (Fig. 10), by mechanism, hereinafter described.

The door 94 is secured to a shaft 122, (Figs. 10–13) supported in suitable bearings in a bracket 123. An arm 124 loosely supported on one end of the shaft 122, is provided with a pin 125 engaging a slot in the end of a link 126, the other end of which is connected to a crank pin 127 on one of the sprockets 72. The arm 124 is connected by a spiral spring 128 to a bell crank 129 fast to the shaft 122 and having three arms. One arm is connected to a rod 130 extending through and slidably mounted on a bracket 131. A spring 132 surrounding the rod 130 and engaging the bracket 131 tends to move the bell crank in an anti-clockwise direction viewing Fig. 12 to open the door 94. Another arm of the bell crank 129 is adapted to be engaged by a latch 133 pivotally mounted at 134 and normally held by a spring 135 in inoperative position. An armature 136 on the latch 133 is adapted to be drawn toward an electro magnet 137 when the latter is energized, by completion of the circuit through contacts 100, 101, and 115, thus moving the latch to position to engage the arm of the bell crank. When in operative position the latch 133 is engaged by a pivoted finger 138 which prevents disengagement of the latch from the bell crank until the finger is tripped. A third arm of the bell crank is provided with a pin 139 adapted to engage a latch 140 pivoted at 141 and connected by a link 142 to a trip lever 143. A spring 144 surrounding the link 142 normally holds the latch 140 in operative position. The trip lever 143 is connected by a link 145 to the finger 138.

At each revolution of the sprocket 72 the link 126 is reciprocated and the shaft 122 is rotated through the spring 128 connecting the arm 124 to the bell crank 129. The door 94 is thus moved to closed position as a pin approaches the position indicated in Fig. 10. If the circuit through the contacts 100, 101, and 115 has been closed, in the manner hereinbefore described, the latch 133 is actuated by the electric magnet 137 to engage the arm of the bell crank lever 129 thus holding the door 94 in closed position as the pin descends onto the assembly shelf. The latch 133 is held in engagement with the arm of the bell crank lever by the finger lever 138 until the elevator bar 79 reaches the trip lever 143 when the finger lever 138 is actuated to release the bell crank 134. Meanwhile the pin has been moved by the transverse conveyer, presently to be described, along the assembly shelf. The door 94 is then opened under the actuation of the spring 132.

If the circuit is not closed as above described, the door 94 upon continued rotation of the sprocket 72 is permitted to open under the actuation of the spring 132 thus releasing the pin which passes into the receptacle 121'. At the same time the pin 139 on the bell crank 129 engages the latch 140 which retains the door in open position during a single revolution of the sprocket 72. Movement of the arm 124 relative to the bell crank 129 is permitted by the spring 128. At the beginning of the second revolution of the sprocket 72, the elevator bar 79 engages the trip lever 143, thus releasing the pin 139 from the latch 140 and permitting movement of the door 94 to closed position under the actuation of the link 126 in readiness for the delivery of another pin to the assembly shelf. Thus ejection of imperfect pins is assured while perfect pins are retained for further use in the machine.

The contacts 100, 101, and 115 which were engaged by the ascending pin in the stack 68 are separated through engagement of the descending elevator bar 79 with an arm 144' (Figs. 17 and 18) on a shaft 145' connected by a link 146' to a similar shaft 149', the shafts being supported by suitable brackets beneath the switch arms 95. Fingers 148' on the shafts 145' and 149' actuate the latches 97 to release the switch arms, which are returned by the springs 102 to normal position in readiness for the passage of the next pin upwardly in the stack 68.

The assembly shelf.

The assembly shelf comprises a centrally disposed fixed support 146, (Fig. 19), and a plurality of lowering doors 147 and 147' (Figs. 11, 20, and 21), loosely mounted upon a shaft 148 and normally disposed in a plane extending transversely of the machine. The lowering doors 147 and 147' are supported by a universal bar 149 carried on the arms 150 secured to the shaft 148. An arm 151, (Fig. 10) at one end of the shaft 148 is connected by a link 152 to an arm 153, (Fig. 1), which is actuated through mechanism, within the casing 18, as the tenth pin of each set is deposited upon the assembly shelf to release the pins

therefrom. A spring 153', (Fig. 10) connects an arm 154' at the other end of the shaft 148 to the frame 5. The spring 153' counter balances the weight of the lowering doors. A gate 154 is pivotally connected at 155 to the fixed support 146 and is provided with a slot 156 to receive the universal bar 149. A partition 157 is arranged in front of the assembly shelf and is provided with a plurality of openings 158 communicating with the respective chutes 14 into which the pins pass, when the lowering doors 147 and gate 154 are permitted to drop with the universal bar 149. A stop 159 is arranged on the partition 157 adjacent the lower edge of each of the openings 158 to limit downward movement of the corresponding lowering doors. Shields 160 are disposed between the fixed support 146 and the lowering doors 147 and between the respective lowering doors to prevent side-wise movement of the pins during the discharge thereof.

To advance the pins along the assembly shelf, I provide a transverse conveyer consisting of shafts 161, (Figs. 19 and 21), journaled in suitable supports and carrying sprockets 162 about which chains 163 are disposed. The chains 163 carry flights 164 spaced a distance slightly greater than the diameter of a pin. One of the shafts 161 is driven by a shaft 164' which is in turn actuated through mechanism within the casing 18 to advance the transverse conveyer a distance equivalent to the spacing of the flights periodically as the pins are delivered to the assembly shelf. The operation of the mechanism within the casing 18 is initiated as will be hereinafter described by closure of the electrical circuit, when the contacts 100, 101, and 115 are engaged. Consequently, the transverse conveyer is actuated only when a perfect pin is delivered to the chute 93.

The distributor frame.

As previously stated when a set of ten pins has been assembled on the assembly shelf the lowering doors 147 and 147' and gate 154 are dropped to permit pins to pass into the chutes 14 which carry them to the distributor frame. The distributor frame consists of a plurality of semi-casings 165 and 166, (Figs. 25, 26, and 27), pivotally supported on brackets 167', (Figs. 22, 23, and 24), carried by a channel frame 15 and bars 169'. The channel frame 15 is rigidly supported on the frame 5 of the machine.

The semi-casings 165 and 166 are respectively connected by bars 167 and 168, (Figs. 25–28) and links 169 and 170 to arms 171 and 172 on two shafts 173 and 174 supported in the frame 5. A link 175 connects an arm 176 on the shaft 174 to an arm 177, (Fig. 1), which is actuated by the mechanism within the casing 18, presently to be described, to deliver the pins from the distributor frame. The shaft 174 is provided with a mutilated gear 179 which meshes with a pinion 180 on a shaft 181 disposed between the shafts 173 and 174. An arm 182 on the shaft 181 is provided with a slotted link 183 which engages the pin 184 on an arm 185 fast to the shaft 173. An arm 186 loose on the shaft 173 is provided with a mutilated gear 187 meshing with the pinion 180. The end of the arm 186 is connected by a toggle link 188 to the arm 185. The arm 182 carries a second slotted link 189 engaging a pin 190 on an arm 188' connected to the toggle link 188.

The normal position of this mechanism is shown in Fig. 25, the semi-casings 165 and 166 being disposed to receive a pin from the chute 14 communicating therewith. As the shaft 174, carrying the arms 172, is rotated in a clock-wise direction under actuation of the mechanism within the casing 18, the arm 186 is swung, through the operation of the mutilated gear 187, in the same direction. The toggle link 188 being locked, the arm 185 is similarly swung carrying the shaft 173 and consequently, the arms 171 to the position indicated in Fig. 26. The semi-casings 165 and 166 are thus swung to an upright position. The pins 184 and 190 are now in the ends of the slots in links 183 and 189 by reason of the movement of the arm 182 with the pinion 180. Further rotation of the shaft 174 causes the link 189 to break the toggle permitting relative movement of the arms 185 and 186, and the link 183 moves the arm 185 and consequently the shaft 173 in reverse direction, thus swinging the semi-casings 165 to the right viewing Fig. 27. The semi-casings 166 are simultaneously swung, by the continued rotation of the shaft 174, to the left, viewing Fig. 27, and the pins are released and drop into the setter frame.

The setter frame.

The setter frame comprises a frame 16, (Fig. 29), roughly triangular in form. The two rear corners of the frame are supported on chains 192, (Fig. 22) which engage sprockets 193 on a driven shaft 194, and similar sprockets on the shafts 195 and 196. The ends of the chains are connected to a counter-weight 197, (Figs. 19 and 20). The forward corner of the setter frame is supported by a cable 198 which is disposed about sheave wheels on the shafts 198', 194, 195, and 196 and is also connected to the counter weight 197. Thus the weight of the setter frame is balanced so that a relatively small amount of power is required to shift it vertically during the operation of the machine.

Upon the frame 16 a plurality of pairs of

shafts 198 and 199, (Figs. 29 to 31), are mounted in suitable bearings. Each shaft supports one or more pin grippers 200, the pin grippers on each pair of shafts being arranged in co-operative relation. The shafts 198 and 199 are provided with arms 201 and 202 which are connected by the links 203 and 204 so that the shafts 198′ and 199′ are actuated in unison with shafts 198 and 199. To actuate the pin grippers I provide levers 205 and 206 on the respective shafts 198 and 199 adjacent the forward end of the frame and connect these levers by a toggle 207. A plunger rod 209 is connected to the joint of the toggle and depends through an opening in the frame 16. The rod 209 is provided with a shoe 210 which is adapted to engage the alley bed when the setter frame is lowered thus breaking the toggle and permitting a compression spring 212 connected to the lower ends of the levers 205 and 206 to swing the levers, thereby moving the pin grippers to the position indicated in Fig. 31. The pins are thus released and remain on the alley bed when the setter frame is raised. The upper end of the rod 209 is adapted to engage the under side of the distributor frame, (Fig. 27, to again set the toggle, returning the pin grippers to the position indicated in Fig. 30. The spring 212 while desirable is not essential as the pin grippers will move to open position when the toggle is broken without the aid of the spring. The frame 191 carries on its underside a plurality of electromagnets 213, (Figs. 24 and 29), which are energized at intervals and the function of which is to lift the standing pins from the alley bed during the removal of "dead wood." For this purpose the pins are provided with iron plugs 214 (Fig. 24) at their heads.

The raising and lowering of the setter frame is accomplished by the rotation of the shaft 194 which is connected by a shaft 215, (Fig. 1), to timing mechanism, within the casing 18. In the "new set" and "dead wood" operations the setter frame moves through different distances, it being necessary in the "new set" operation that the frame closely approach the alley bed as indicated in Figs. 30 and 31, whereas in the "dead wood" operation, the frame is only lowered sufficiently, (Fig. 24), to permit the electro magnets 213 to pick up the pins. The electro magnets 213 are arranged behind the respective pairs of pin grippers and it is necessary, therefore, to move the frame rearwardly before setting the pins on the alley bed in order that their heads may be directly beneath the electro magnets 213 when the frame is lowered for the "dead wood" operation. To guide the setter frame in its vertical movement it is provided with two arms 216, (Fig. 19, 22, 24, and 33), having rollers 217 at their upper ends operating in tracks in cam plates 218 secured to the frame 5. The tracks in each cam plate have two branches 219 and 220, and gates 221 and 222 are pivotally supported on the cam plates 218 at the points of convergence of the branches to insure proper movement of the rollers 217 in the tracks.

Viewing Fig. 19, when the setter frame descends in the "new set" operation, the rollers 217 pass downwardly in the branches 219, pass the gates 221 and continue downwardly until the pins are deposited. Upon return movement the rollers pass upwardly in the branches 220, pass the gates 222, and continue upwardly until the setter comes to rest in its uppermost position. It will be seen that the lower portions of the tracks 219 are curved to the left thus carrying the pin setter rearwardly during the latter part of its downward movement, a distance sufficient to insure depositing the pins with their heads directly under the electro magnets 213 when the pin setter is at the upper limit of its travel.

In the "dead wood" operation the rollers 217 pass downwardly in the branches 219 but movement of the pin setter is arrested before the rollers pass into the curved lower portions of the branches. The electro magnets 213 are energized when the magnets are contiguous to the tops of the standing pins and the setter frame returns guided by the branches 219, thereby lifting the pins from the alley bed. After the sweeper has removed the fallen pins, as hereinafter described, the setter frame again descends, the rollers 217 being guided by the branches 219. The magnets 213 are de-energized and after depositing the pins upon the alley bed the setter frame returns it to its normal position.

The sweeper.

Two brackets 225 (Figs. 32 and 33) are supported at the forward end of the frame 5 and provide bearings for a shaft 226. This shaft is driven through a shaft 227 from mechanism, presently to be described, within the casing 18 and supports two arms 228. Levers 229 are fulcrumed on the ends of the arms 228 and support the sweeper 17 which is provided with rollers 230 adapted to engage the alley bed. The opposite ends of the levers 229 are pivotally connected to links 231 slotted at their inner ends to embrace and slide on the shaft 226. Brackets 232, mounted on the frame 5, are provided with cam faces 233 adapted to be engaged by rollers 234 on the links 231 adjacent the ends of the slots therein.

The normal position of the sweeper mechanism is illustrated in Figs. 32 and 33. When the shaft 226 is rotated in a clock-wise direction, viewing Fig. 32, the arms 228 and 331 swing downwardly and the rollers 234 are brought into engagement with the cam

faces 233. During the continued downward movement of the arms 228 the cam faces 233, through the links 231, cause the levers 229 to swing inwardly until the alley bed is substantially tangential with the path of movement of the rollers 230. Further movement of the shaft 226 carries the rollers 233 into engagement with the alley bed without any shock to the mechanism. The rollers 234 then pass off the cam faces 233 and the sweeper 17 is moved rearwardly along the alley bed until all of the pins and balls thereon are carried into the pit. The sweeper is then returned to its normal position through a reverse rotation of the shaft 226, the rollers 234 again engaging the cam faces 233 and finally leaving the cam faces when the parts approach the position indicated in Figs. 32 and 33.

The action of the sweeper precedes movement of the setter frame in the "new set" operation, whereas in the "dead wood" operation the setter frame first descends to pick up the standing pins after which the sweeper removes the fallen pins and balls and the standing pins are again returned to the alley bed. The mechanism for controlling these operations, as well as the various other movements hereinbefore described, will now be explained.

The controlling mechanism.

The controlling mechanism is illustrated in Figs. 34 to 55 inclusive and may be more readily understood by the division into units each having a specific function as indicated in Fig. 68ª. These units will be described as far as possible in the order indicated from left to right of Fig. 68ª.

The pin elevating mechanism is constructed and arranged to deliver a pin to the assembly shelf every four seconds when pins are passing through the machine and the various operations leading to the delivery of pins from the assembly shelf to the distributor frame must be timed accordingly. As each pin is delivered to the assembly shelf a circuit is closed through the contacts 100, 101, and 115, (Fig. 14), to the solenoid 247, (Fig. 68ª). The energization of the solenoid 247 trips the control unit, which is permitted to rotate at an angular speed requiring four seconds for the completion of a single revolution and is arrested at the conclusion of each revolution.

The four seconds of time allowed is divided for the following operations; one second for lowering the doors 147 aud 147′ of the assembly shelf, one second for the pins to pass into the chutes 14, one second for the lowering doors to return, during which second the transverse conveyer is operated, and one second for delivery of each pin successively to the assembly shelf. Assuming that nine pins have been assembled on the assembly shelf a cam 250 on the transverse conveyer unit and moving through one tenth of a revolution at each complete revolution of the transverse conveyer unit will have lifted a latch 251 controlling the lowering door unit. When the tenth pin is lifted closing the circuit to the solenoid 247, one second is consumed while the pin is passing onto the shelf. At the end of the first second a cam 248, on the control unit operates a latch 249 to release the lowering door unit permitting the lowering doors to swing downwardly during the following second.

The third second is consumed in permitting the pins to pass into the chutes 14. At the beginning of the fourth second a cam 252, on the control unit trips a latch 253 whereby the transverse conveyer unit is permitted to complete a single revolution. The transverse conveyer is moved through a distance equivalent to the diameter of a pin while the lowering doors are returning. During the operation as herein described the transverse conveyer is ineffective for the reason that the lowering doors have been tripped to discharge the pins.

It will be noted that had less than nine pins been arranged upon the assembly shelf the latch 251 on the lowering door unit would not have been tripped by the cam 250 to release the lowering doors and the transverse conveyer would, therefore, be effective to advance the pins a distance equivalent to the diameter of a single pin along the assembly shelf. The transverse conveyer is always operated during the fourth second after the control unit is tripped by an ascending pin.

The pins are now deposited in the distributor frame controlled by the distributor unit (Figures 46, 47). Two latches 254 and 255 normally prevent operation of this unit. The latch 254 is controlled by a cam 256 on the lowering door unit. The cam 256 trips the latch 254 at each operation of the lowering doors and the latch is thereafter held in inoperative position by a hook 257 until the pins are discharged into the setter frame. The pins should not be discharged into the setter frame until the latter is free from pins as after a "new set" operation in which pins are delivered from the setter frame to the alley bed. The "new set" unit is controlled by a solenoid 258 which, when energized through the closure of a circuit, hereafter described, trips the unit permitting the setter frame to descend and release a set of pins. A cam 259 on the "new set" unit is arranged to trip the latch 255 on the distributor unit when the setter frame returns after a "new set" operation. The latch 255 is, thereafter, held in inoperative position by the hook 257 until the pins are discharged into the setter frame. Both latches 254 and

255 are released from the hook 257 after the distributor unit has commenced its revolution through mechanism actuated by the cam 260 on the distributor unit.

Should the setter frame return before a set of pins have been assembled on the assembly shelf, the operation is reversed, the latch 255 being first tripped and held inoperative by the hook 257 until the cam 256 on the lowering door unit trips the latch 254 to permit a set of pins to pass from the distributor frame to the setter frame.

Normally twenty-nine pins are used in the machine so that a full set of pins cannot be accumulated on the assembly shelf until the distributor frame has delivered its pins to the setter frame. To guard, however, against the possibility of accident, should additional pins be used, the semi casings 166 on the distributor frame are provided with fins 166′, (Fig. 19), having arcuately shaped edges. These fins close the ends of the chutes 14 when the semi casings are swung to deliver pins to the setter frame and stop further descent of any pins which may pass into the chutes 14 before the semi-casings have returned to their normal position. As soon as the semi-casings have returned, the fins 166′ permit the pins to pass into the semi-casings.

To prevent operation of the setter frame to deliver a set of pins to the alley bed before a set of pins is deposited in the setter frame, the cam 260, when the distributor unit has delivered a set of pins to the setter frame, actuates a switch 261 in the circuit of the solenoid 258. The switch is held in closed position by a latch 261′ and is released immediately after the commencement of the "new set" operation by a cam 262 on the "new set" unit. The circuits to the solenoid 258 is also controlled by a switch 263 which is moved by a pin 264 on a rotating part of the sweeper unit to closed position when the sweeper unit has completed its operation. As soon as the sweeper unit commences to operate the switch 263 is opened so that the "new set" unit cannot again be actuated until the sweeper has completed its operation. This prevents the initiation of a "new set" operation while the "deadwood" unit is in operation.

The "dead wood" unit is controlled by a solenoid 265 which when energized through the closure of a circuit, hereafter described, trips the unit permitting the setter frame to descend to the level of the pins standing on the alley bed. A cam 266 on the "deadwood" unit closes a circuit through a switch 267 to the electromagnets 213 on the setter frame whereby the magnets are energized to pick up the standing pins. The magnet circuit is broken when the setter frame has again deposited the pins on the alley bed.

The sweeper unit is controlled from both the "new set" and "dead wood" units because the sweeper co-operates with the setter frame in both the "new set" and "dead wood" operations. It is necessary, however, that the sweeper operate before the descent of the setter frame in the "new set" operation and after the first descent of the setter frame in the "dead wood" operation. A latch 267, which normally holds the sweeper unit inoperative, is connected to an arm 268 which is actuated by the pins 270 and 271 on the operating cams of the "new set" and "dead wood" units respectively. It will be noted that the pins 270 and 271 are situated with respect to the commencement of rotation of the two units so that the sweeper is brought into operation in proper relation to the movement of the setter frame. A switch 272 is controlled by a cam 273 on the sweeper unit and is actuated thereby at the conclusion of the operation thereof to close a circuit to a solenoid, hereinafter described which releases the switches in the bowler's box thus clearing the entire mechanism and placing it in condition for the next operation.

With this preliminary consideration of the arrangement and function of the controlling mechanism we may pass to a detailed description of the necessary structure. Within the casing 18 and connected directly to the motor 20 is a shaft 240, (Fig. 35), carrying two worms 241 and 242 meshing with worm gears 243 and 244 supported on transverse shafts 245 and 246 upon which the various units are mounted. The shaft 245 is termed the manual control shaft because the various units thereon are primarily under control of the bowler and the shaft 246 is termed the automatic control shaft because the units thereon are controlled by some other portion of the mechanism.

The shaft 246, (Figs. 36, 39, and 40) supports a sleeve 275 carrying a gear 276 which is driven through a pinion 277 and gear 278, (Fig. 34) from a pinion 279 fast to the shaft The shaft rotates at a speed of 60 R. P. M. and the sleeve 275 is driven through the speed reducing gearing at a speed equivalent to one revolution in four seconds.

The control unit.—A ratchet 280, (Figs. 39 and 40) is keyed to the sleeve 275 and rotates continuously therewith. A disk wheel 281 is rotatably mounted upon the sleeve adjacent the ratchet 280 and is adapted to be operatively connected to the ratchet by a hook pawl 282 pivoted on the disk wheel 281 and having an arm 283 adapted to engage a latch 284 pivoted on the underside of a bar 285, which extends across the casing 18 above the shaft 246. A pin 282′ on the hook pawl 282 extends through an opening in the disk wheel 281 and a spring 283′ supported on the hub of the disk wheel en-

gages the pin to bias the hook pawl toward the ratchet 280. Engagement of the pin 282' with the edge of the opening in the disk wheel limits rotative movement of the hook pawl 282 relatively to the disk wheel.

The end of the latch 284 is disposed in the path of a plunger 286 operated by the solenoid 247. When the solenoid is energized the plunger 286 is depressed engaging the latch 284 and swinging it to release the arm 283. When the arm 283 is released the hook pawl 282 engages the ratchet 280 latching the disk wheel thereto. After a single revolution of the disk wheel the arm 283 again engages the latch 284 releasing the disk wheel from the ratchet.

An adjustable screw 287 limits downward movement of the latch 284. A pawl 288 pivoted concentrically with the hook pawl 282 is held by a spring 283' in engagement with a ratchet 290 fast to the ratchet 280 and prevents the disk wheel 281 from rotating independently of the ratchet 280 when the arm 283 is released. A dog 291 pivoted concentrically with the latch 284 and connected thereto by a compression spring 292 surrounding a pin 293 is adapted to engage a notch 294 in the disk wheel 281 to serve as a drag and insure proper starting of the disk wheel. The spring 292 insures the return of the latch 284 to its normal position when the plunger 286 is withdrawn The cams 248 and 252, previously described, are secured to the hub of the disk wheel 281.

The transverse conveyer unit.—A shaft 310 supported in suitable bearings on the underside of the bar 285, (Fig. 36) is provided at one end with an arm 308 carrying a roller 309 which engages the cam 252, (Fig. 39). The other end of the shaft 310 carries a latch 253, (Figs. 41 and 42) which is adapted to engage and hold a hook pawl 312 from engagement with a ratchet 313 fast to the shaft 246. A disk wheel 314 adjacent the ratchet 313 and fast to a sleeve 315 on the shaft 246 pivotally supports the hook pawl 312. A pawl 316 pivoted concentrically with the hook pawl 312 engages a ratchet 317 fast to the ratchet 313 to prevent the disk wheel from rotating independently of the ratchet 313 when the hook pawl 312 is released. A dog 318 serves as a drag to insure proper starting of the disk wheel.

When the latch 253 is tripped through its connection with the cam 252 the hook pawl 312 engages the ratchet 313 locking the disk wheel 314 to the ratchet whereby the sleeve 315 is caused to turn through a single revolution. As previously stated, the rotation of this sleeve occurs during the fourth second after the control unit is tripped. A plug 319 (Fig. 36) in the end of the sleeve 315 and rotatable therewith is operatively connected to the shaft 164' (Fig. 1) driving the transverse conveyer. A gear 320 fast to the hub of the disk wheel 314 drives, through a pinion 321 and gear 322, (Fig. 34), a pinion 323 fast to a sleeve 324 which is loosely mounted on the sleeve 315 and carries the cam 250, (Figs. 41 and 42).

The lowering door unit.—A shaft 296, (Fig. 39) is supported in suitable bearings on the underside of the bar 285 and is provided at one end with an arm 295 having a roller 297 engaging the cam 248. A latch 249, (Figs. 43–45) is mounted on the opposite end of the shaft 296 and normally holds a hook pawl 298 from engagement with a ratchet 299 fast on a sleeve 275. A cam 300 is loosely supported on the sleeve 275 and is provided with a hub carrying a disk wheel 301 adjacent the ratchet 299. The hook pawl 298 is mounted on the disk wheel 301. A pawl 302 is pivoted concentrically with the hook pawl 298 and engages a ratchet 303 fast to the ratchet 299 to prevent the disk wheel from rotating independently of the ratchet 299 when the hook pawl 298 is released. A dog 304 engages a notch in the disk wheel and serves as a drag when the latter starts.

The cam 250 on the sleeve 324 is engaged by a roller 326, (Figs. 41 and 42) on a bell crank 327 pivoted on the underside of the bar 285. The bell crank is connected by a link 328 to an arm 329 on a shaft 330 extending longitudinally of the bar 285. An arm 331, (Figs. 43–45) on the shaft 330 is connected by a link 332 to the latch 251 pivoted concentrically with the latch 249 and arranged in the path of the hook pawl 298. The sleeve 324 is driven through the speed reducing gearing, above described, so that the cam 250 makes a complete revolution only after ten actuations of the sleeve 315 which drives the transverse conveyer. When the ninth pin has been delivered to and moved along the assembly shelf the roller 326 rides on the point of the cam 250 as indicated in Fig. 42 thus actuating the intermediate mechanism to lift the latch 249, as previously described, to permit operation of the lowering door unit.

As will be readily understood, when the latch 249 is lifted through its connection with the cam 248, and the latch 251 is lifted through its connection with the cam 250 the disk wheel 301 is operatively connected to the ratchet 299 and is driven thereby to rotate the cam 300. This cam engages a roller 305 on an arm 306 fast to a shaft 307, (Fig. 38) which is journaled in suitable bearings and carries the arm 153, previously described, which releases the lowering doors. The latch 249 is lifted at each actuation of the control mechanism but the latch 251 is lifted only after the ninth pin has been moved by the transverse conveyer along the assembly shelf and consequently the pins are never released from the as-

sembly shelf until a full set of pins has been accumulated thereon.

The cam 256 is mounted on the hub of the disk wheel 301 of the lowering door unit and is adapted to be engaged by a roller 336, (Figs. 43 and 45), on a bell crank 338 pivoted on the underside of the bar 285. A spring 337 normally holds the roller 336 in engagement with the cam. A link 339 connects the bell crank 337 to an arm 340 on a shaft 341 extending longitudinally of the bar 285, (Fig. 36), and provided at its opposite end with an arm 342 which is connected by a link 343, (Fig. 34), to an arm 344, (Fig. 37) on a shaft 345 supported in suitable bearings on a bar 346 extending transversely of the casing 18 above the shaft 245.

The distributor unit.—A ratchet 347 is keyed to the shaft 245 (Figs. 37, 46, and 47), and a disk wheel 348 is secured to the hub 349 of a cam 350 loose on the shaft 245. A hook pawl 351 is pivotally supported on the disk wheel 348 and is adapted to engage the ratchet 347 to lock the disk wheel thereto whereby the cam 350 is driven with the shaft 245. An arm 352 on the shaft 345 is connected by a link 353 to the latch 254 having a shoulder adapted to be engaged by the hook pawl 351 which is thereby held from engagement with the ratchet 347. When the shaft 345 is actuated by the cam 256 at the conclusion of the operation of the lowering doors the latch 254 is moved to disengage the shoulder thereon from the hook pawl 351. The latch 254 is thereafter held in inoperative position by the hook 257 carried by the latch and adapted to engage a pin 390 on the bar 346, until released, as hereinafter described. A pawl 355 pivoted concentrically with the hook pawl 351 engages a ratchet 356 fast to the ratchet 347 to prevent the disk wheel 348 from rotating independently of the ratchet 347 when the hook pawl 351 is released. A dog 357 pivoted concentrically with the latch 354 engages a notch in the disk wheel and serves as a drag when the latter starts.

A cam 358 complementary to the cam 350 is supported on the hub thereof, adjacent thereto, and a bell crank lever 359, (Fig. 38) is secured to a shaft 360 and is provided with rollers 361 engaging the respective cams 350 and 358 so that the shaft 360 is caused to oscillate during the rotation of the cams. The shaft 360 carries the arm 177, (Fig. 1) outside the casing 18, which actuates the distributor frame.

It is not desirable to actuate the distributor frame to deliver pins to the setter frame until the latter has descended and delivered the pins already therein upon the alley bed. The latch 255 (Figs. 46 and 47) is therefore mounted concentrically with the latch 254 and is provided with a shoulder disposed to be engaged by the hook pawl 351. A link 363 connects the latch 255 to an arm 364 on a shaft 365, (Fig. 37) disposed in alignment with the shaft 345. The latch 255 is lifted upon the return of the setter frame after a "new set" operation by the cam 259, (Figs. 49 and 50) on the "new set" unit which is engaged by a roller 384 on a bell crank 385. A link 386 connects the bell crank 385 to an arm 387 on the shaft 365. The latch 255 is thereafter held in inoperative position by the hook 257′ (Figs. 46 and 47) similar to the hook 257 until released as hereinafter described.

Obviously either of the latches 254 and 255 may be first lifted and held in inoperative position, the setter frame being first operated to discharge the pins therein or the distributor frame, first receiving a set of pins from the assembly shelf as the case may be. When both latches have been raised the distributor unit commences its revolution. Arms 398′ (Figs. 46 and 47) on a shaft 398 actuated during the revolution of the distributor unit, as hereinafter described, release the hooks 257 and 257′ and permit the latches 254 and 255 to return to their normal position, in which they are engaged by the hook pawl 351 at the conclusion of a single revolution of the disk wheel 348.

The "new set" unit.—A ratchet 366, (Figs. 37 and 49–51) is keyed to the shaft 245 and a disk wheel 367 is supported on a sleeve 368 loose upon the shaft 245 and carrying complementary cams 369 and 370. A hook pawl 371, (Fig. 49), is pivotally mounted on the disk wheel 367, and engages an abutment on a latch 372 pivoted on the underside of the bar 346. The end of the latch 372 is disposed in the path of a plunger 373 operated by the solenoid 258 which is energized, as previously stated, through the closure of a suitable circuit. A pawl 374 is pivoted concentrically with the hook pawl 371 and engages a ratchet 375 to prevent the disk wheel 367 from rotating independently of the ratchet 366 when the hook pawl 371 is released. A dog 376 pivoted concentrically with the latch 372 engages a notch in the disk wheel and serves as a drag when the latter starts. When the hook pawl 371 is released the disk wheel 367 is connected to and driven by the ratchet 366 thus rotating the cams 369 and 370 which are engaged by the rollers 377 on arms 378 and 378′ supported on a sleeve 379 which is loose on the shaft 307, (Fig. 38). The arm 378 is provided with a rack 380 meshing with a pinion 381 on a shaft 382. The shaft 382 is connected to the shaft 215, (Fig. 1.)

It is essential that the "new set" unit be inoperative until the distributor unit is operated to deliver the pins therein to the

setter frame. Accordingly, the switch 261, (Fig. 49) in the circuit of the solenoid 258, is supported on a pivoted yoke 395, which is connected by a link 396 to an arm 397 on a shaft 398. The shaft 398 carries an arm 399, (Fig. 46) which is connected by a link 400 to a pivoted arm 401 carrying a roller 402 which is held in engagement with the cam 260 on the distributor unit by a spring 404. When the distributor unit has delivered its pins to the setter frame, the switch 261 is moved through the connecting mechanism by the cam 260 to circuit closing position where it is held by a latch 261'. As soon as the operation of the "new set" unit has been initiated the latch 261' is released by engagement therewith of an arm 406 (Fig. 49) on a pivoted lever 407 having a roller 408 engaging the cam 262 on the "new set" unit. The circuit to the solenoid 258 is further controlled by a switch operated by the sweeper unit hereinafter described.

The "dead wood" unit.—A ratchet 409, (Fig. 37), is keyed to the shaft 245 and a disk wheel 410 is supported adjacent thereto on a sleeve 411 loose on the shaft 245 and carrying complementary cams 412 and 413. A hook pawl 414, (Figs. 37, 52, and 53) pivoted on the disk wheel 410 is held from engagement with the ratchet 409 by a latch 415, one end of which is disposed in the path of a plunger 416, (Fig. 53), operated by the solenoid 265. A pawl 417, (Fig. 53), is pivoted concentrically with the latch 415 and is adapted to engage a ratchet 418 to prevent the disk wheel 410 from rotating independently of the ratchet 409 when the hook pawl 417 is released. A dog 419 pivoted concentrically with the latch 415 engages a notch in the disk wheel and serves as a drag when the latter starts. When the solenoid 265 is energized, the hook pawl 414 is released and locks the disk wheel 410 to the ratchet 409 permitting a single revolution of the sleeve 407 carrying the cams 412 and 413 which are engaged by the rollers 420 on arms 378 and 378', (Fig. 38), carried by the sleeve 379.

It will be noted that the actuating cams of both the "new set" and "deadwood" units are connected to the same shaft 245 which operates the setter frame. It is necessary, therefore, to provide recesses 425 and 426, (Figs. 48 and 53) in the cams 369 and 412, which recesses, when the "new set" and "dead wood" units are at rest, are disposed in the path of the rollers 377 and 420. Either the "new set" or "dead wood" units may thus be actuated while the roller 377 or 420, as the case may be, rides into the recess in the cam on the stationary unit. To hold the arm 378 in normal inoperative position, when both the "new set" and "dead wood" units are inoperative, latches 427, (Figs. 38, 48, and 53) are adapted to engage pins 428 on the arm 378. The latches are provided with rollers 429 engaging two cams 430 and 431 rotating respectively with the "new set" and "dead wood" units. When either unit is actuated the corresponding cam lifts the latch 427 to release the arm 378.

The cam 266, (Figs. 37 and 52) on the sleeve 411 is engaged by a lever 432 adapted to actuate the switch 269 which closes the circuit to the magnets 213 on the setter frame. The cam 266 is so formed that the circuit is closed when the setter frame has descended to the level of the tops of the standing pins and maintained closed while the setter frame rises and until it again deposits the pins on the alley bed.

The sweeper units.—A ratchet 433, (Figs. 37, 54 and 55) is keyed to the shaft 245 and a disk wheel 434 is mounted adjacent thereto on a sleeve 435 carrying complementary cams 436 and 437. A hook pawl 438, pivoted on the disk wheel 434 is adapted to engage the ratchet 433 to lock the disk wheel 434 thereto. The hook pawl 438 normally is held inoperative by the latch 267 connected by a link 440 to an arm 441 on a shaft 442. An arm 443, (Figs. 52 and 53) on the shaft 442 is connected by a link 444 to the pivoted arm 268 having a cam face disposed in the path of the pins 270 and 271 on the cams 370 and 413 of the "new set" and "dead wood" units respectively. The pins 270 and 271 are disposed in such relation to the starting position of the cams 412 and 413 that the latch 267 will be elevated immediately after the release of the "new set" unit or after the "dead wood" unit has made a partial revolution, The sweeper unit is thus released in the proper relation to the movement of the setter frame. A bell crank 448, (Figs. 38 and 55) loose on the shaft 360 is provided with rollers 450 and 451 engaging the cams 436 and 437 respectively and is provided with a rack 452 meshing with a pinion 453 on a shaft 454 which is connected exteriorly of the casing 18 to the sweeper driving shaft 455, (Fig. 1).

The cam 273 rotating with the sweeper unit is engaged by a pivoted arm 457 which actuates the switch 272 to close a circuit to the bowler's box hereinafter described. The closure of this circuit releases the mechanism of the bowler's box in preparation for the next operation. The pin 264, (Fig. 55) on the cam 437 actuates an arm 458, at the conclusion of a revolution of the sweeper unit to close the switch 263 in the circuit of the solenoid 247 which controls the "new set" unit. The circuit through the switch 263 is immediately broken when the sweeper commences to operate so that the initiation of the "new set" operation be-

comes impossible until the sweeper is again returned to its normal position.

The bowler's box.

Referring to Figs. 56 to 67 inclusive illustrating the bowler's box, 460 indicates a suitable base preferably mounted on a pedestal 461. A casing 462 is mounted on the base 460 to enclose a frame 459 which supports the mechanism. Extending across the base 460 is an insulating switch support 463, (Fig. 59) upon which two pairs of spring contacts 464, 465, 466, and 467 are mounted, the contacts 465 and 467 being connected by a bar 468 and to a binding post 471. The contacts 464, 466, and 467 are connected respectively to binding posts 469, 470 and 471. Between the two pairs of contacts two contact combs 472 and 473 are secured to the support 463 and between these combs spring contacts 474 are supported and each provided with individual binding posts 475. The connections between the respective contacts and the solenoids and magnets in the control mechanism and setter frame will be hereinafter explained.

Extending through the top of the casing 462 and supported in the frame 459 are a plurality of key bars 476 bearing the "new set" button 477, "deadwood" button 178, the error button 479, and buttons 480 arranged to correspond with the positions of the pins upon the alley bed and numbered respectively 1 to 10 inclusive. The key bars 476, corresponding to the "new set" and "deadwood" buttons 477 and 478 are each connected by a bell crank 481, Figs. 57 and 62, mounted on a transverse shaft 482 to a pusher bar 483 having an offset lug 484 (Fig. 58) between which and a shoulder 485, on a switch bar 486, a compression spring 487 is disposed. The bars 483 and 486 are connected by screws 488, the bar 483 having slots 489 whereby the bars are relatively movable. A latch 490 is pivotally supported on the frame 459 and is normally held by a spring 491 in position to engage a shoulder on the bar 486. The latch 490 carries an extension 492 disposed in the path of a cam surface 493 on the bar 483. Thus when the bell cranks 481 are actuated through depression of the "new set" or "deadwood" buttons 477 and 478 the corresponding bar 483, through its connection with the bell crank, will be first advanced, compressing the spring 487 until the cam surface 493 works under the extension 492, lifting the latch 490, and releasing the bar 486 which is then projected forwardly by the spring. An insulating arm 494 carried on each bar 486 moves the contact 464 or 466 into engagement with the contact 465 or 467 when either bar 486 is advanced to close the circuit to the solenoid 258 controlling the "new set" unit or the solenoid 265 controlling the "deadwood" unit.

To prevent simultaneous depression of both the "new set" button 477 and the "deadwood" button 478, an interlock is provided which comprises bars 495, (Figs. 64, 65, and 68) slotted to receive pins 496 in brackets 496' depending from the underside of the frame 459. Normally the bars are projected in opposite directions by a compression spring 497 mounted on a pin 498 secured to a depending lug 499 on one of the bars 495 and projecting through an opening in a depending lug 500 on the other bar. The bars 495 are provided at opposite ends with cam faces 501 and shoulders 502 disposed in the path of the key bars 476 carrying the "new set" and "dead wood" buttons. When either the "deadwood" or "new set" buttons are depressed the end of the key bar 476 engages the contiguous cam face 501 on one of the bars 495 forcing the latter away from the key bar depressed, into the path of the other key bar and effectually blocking it. If an attempt is made to simultaneously depress both keys the corresponding bars 495 will each be actuated and both keys will be blocked.

Each of the key bars 476 corresponding to the numbered buttons 480 is connected by a bell crank 503, (Fig. 63) to switch bars 504 carrying insulating arms 505 at their ends adapted to move the spring contacts 474 from engagement with the contacts on the comb 472 into engagement with contacts on the comb 473. Each of the key bars 504 is provided with a shoulder 506 adapted to engage a universal bar 507 supported on the pivoted arms 508 and engaged in a slot 509, (Fig. 67) in a multi unit bar 510, (Fig. 67) having an insulating arm 511 adapted to move one of the spring contacts 474 from engagement with a contact on the comb 472 into engagement with a corresponding contact on the comb 473. Thus whenever one or more of the numbered keys are depressed the circuit is shifted to pass through the comb 473 and the individual contacts 474 which may be engaged therewith instead of through the comb 472 and all of the contacts 474, which are normally in engagement therewith.

A shaft 512 is supported in suitable bearings in the frame 459 and is provided with a plurality of latches 513 each having a shoulder adapted to drop behind the respective switch bars when the latter are advanced under the actuation of the corresponding keys. Springs 514 connected to the frame 459 and to the latches insure operation thereof in the manner described. The error key 479 is connected by a bell crank 515 (Fig. 66) to a bar 516 having a tail 517 adapted to engage a pin 519 on an

arm 520 fast to the shaft 512. Thus when the error key is depressed the bar 516 is advanced to oscillate the shaft 512 and thus withdraw the latches 513 permitting the switch bars to return to their normal position.

It is not desirable, however, to permit operation of the error key after either the "new set" or "deadwood" buttons have been depressed. Accordingly the shaft 521 is mounted in suitable bearings in the frame 459 and is provided with a plurality of latches 522 having shoulders adapted to be disposed in the path of the respective key bars when either the "new set" or "deadwood" buttons have been depressed. The shaft 521 is actuated through the arms 523 (Figs. 57 and 62) secured thereto and disposed in the path of the insulating arms 494 carried by the "new set" or "deadwood" switch bars. Thus when either the "new set" or "deadwood" keys are depressed all other switch bars are blocked by engagement with the shoulders on the latches 522.

When one or more of the numbered keys are depressed as in the selective positioning of certain pins the "new set" switch bar must be blocked while the "deadwood" switch bar is permitted to operate. Consequently an arm 524 (Fig. 67) on the shaft 521 is disposed in the path of the insulating arm 511 on the multi-unit bar 510. The multi unit bar oscillates the shaft 521 through a portion only of its normal range of movement. The latch 522 co-operating with the "new set" switch bar has, however, a somewhat longer shoulder than the remaining latches and when the shaft 521 is actuated by the multi unit bar the latch 522 corresponding to the "new set" switch bar is depressed sufficiently to block operation thereof.

Until the "dead wood" key is depressed the numbered keys may be released at will by depressing the error key. As soon as the "dead wood" key is depressed the error key, as well as all other keys on the machine, are blocked by the latches 522 until completion of the "dead wood" operation.

To reset the mechanism at the completion of either the "deadwood" or "new set" operation a solenoid 525 is mounted on the base 460 and carries an arm 526 adapted to engage and actuate an arm 527 on the shaft 512. The circuit to the solenoid 525 is closed through a switch 272 operated by the sweeper unit at the conclusion of its operation. When the solenoid is energized the shaft 512 is oscillated to withdraw the latches 513 from the path of the respective switch bars which are thus permitted to return to their normal position under the actuation of their respective springs 486′ and 504′. The bowler's box is thus cleared for the next operation.

The circuits.

Referring to Figs. 68 and 68ª, 530, 531, and 532 represent main conductors from the source of power. The conductor 530 is connected to one side of the motor 20. The other side of the motor is connected by a conductor 533 to a no-voltage release switch 534. A contact 535 adapted to be engaged by the switch is connected by a conductor 536 to the main conductor 532. The switch 534 is held in closed position by a magnet coil 537 connected by a conductor 538 to one of the terminals of the manager's switch 539. A conductor 540 connects the magnet coil 537 through a fuse 541 to the main conductor 532. The other terminal of the manager's switch 539 is connected by a conductor 542 through a fuse 543 to the main conductor 531. Conductors 544 and 545 connected to the conductors 540 and 542 complete the circuits through the solenoids 247, 258, and 265, as hereinafter explained. The conductor 544 is connected by a branch 546 to one terminal of the solenoid 247 actuating the control unit. The other terminal is connected by a conductor 547 to one of the contacts 115. The other contact 115 is connected by a conductor 548 to the contacts 100 and 101 in series and then to the conductor 545. A branch 546′ from the conductor 544 is connected to the electro magnet 137 which is in turn connected by a conductor 547′ to the circuit controlled by the contacts 100, 101 and 115 Thus whenever the contacts 100, 101 and 115 are engaged the solenoid 247 and magnet 137 are energized.

A branch 550 connects the conductor 544 to one terminal of the solenoid 258. The other terminal is connected by a conductor 551 to the binding post 469 in the bowler's box. The contact 465 in the bowler's box is connected through the bar 468 and binding post 471 by a conductor 552 to one terminal of the switch 263. The other terminal is connected by a conductor 553 to one terminal of the switch 261. The other terminal of the switch 261 is connected by a conductor 554 to the conductor 545. Thus when the "new set" button is depressed and the switches 261 and 263 are closed the solenoid 258 is energized to release the "new set" unit. A branch 555 connects the conductor 544 to one terminal of the solenoid 265. The other terminal is connected by a conductor 556 to the binding post 470 in the bowler's box. The contact 467 in the bowler's box is connected by a conductor 468 to the conductor 552 and the circuit proceeds through the switches 263 and 261 as previously described to the conductor 545.

Thus when the "deadwood" button is depressed and the switches 261 and 263 are engaged the solenoid 265 is energized to release the "deadwood" unit.

A branch 557 from the main conductor 531 is connected through a fuse 558 to a conductor 559 leading to one terminal of the switch 267 actuated by the "dead wood" unit. The other terminal is connected by the conductor 560 to each of the magnets 213 on the setter frame, the magnets being arranged in parallel and connected by the conductors 561 to the individual binding posts 475 of the spring contacts 465 within the bowler's box. The contacts 474 including the contact actuated by the multiunit bar engage the comb 472 so that all of the contacts 474 are connected in series. A conductor 562 connects the binding post 475 of the contact 474 actuated by the multiunit bar through a fuse 563 to the main conductor 532. Thus when the contacts 474 engage the comb 472 and the circuit is closed through the switch 267 all of the magnets 213 are energized. If, however, the multiunit contact 474 is moved into engagement with the comb by the depression of one or more of the numbered keys only those magnets corresponding to the contacts 474, which engage the comb 473 will be energized. This latter arrangement permits the selective spotting of pins on the alley bed.

A branch 564 from the conductor 562, which as previously pointed out, is connected to the main conductor 532 is fast to one terminal of the solenoid 525 within the bowler's box. The other terminal is connected by a conductor 565 to one terminal of the switch 272 actuated by the sweeper unit. The other terminal of the switch 272 is connected by a conductor 566 to the conductor 545. Thus when the switch 272 is closed, in the manner previously described, the solenoid 525 will be energized to clear the mechanism in the bowler's box for subsequent operations.

The operation.

We may assume that twenty-nine pins are in the machine, ten being deposited in the setter frame, ten in the distributor frame, and nine on the assembly shelf. The latch 251 will then be lifted in readiness for the release of the lowering doors to deliver the pins to the distributor frame as soon as the set of pins on the assembly shelf is completed.

The bowler desiring a "new set" of pins on the alley bed presses the "new set" button on the bowler's box thus energizing the solenoid 258 and releasing the "new set" unit whereby the setter frame is lowered onto the alley bed to deposit its pins thereon. The latch 254 on the distributor unit is already raised through the previous operation of the lowering door unit, and upon the return of the setter frame, the latch 255 is raised thus releasing the distributor unit which deposits its pins in the setter frame. The distributor frame is thus free to receive another set of pins but only nine pins have yet been accumulated on the assembly shelf.

The bowler rolls a ball along the alley bed overturning some of the pins. The ball usually passes immediately into the pit and is picked up by the ball elevator and returned to the bowler. The bowler now desires to remove the fallen pins without disturbing the relative positions of the standing pins and, therefore, presses the "deadwood" button on the bowler's box. This energizes the solenoid 265, releases the "deadwood" unit, and permits the setter frame to descend to the level of the tops of the standing pins. While in this position the magnets 213 are energized and pick up the standing pins so that they are carried upward by the setter frame upon its return movement. Meanwhile the sweeper unit is tripped and the sweeper descends forcing the fallen pins and the ball, if it remains upon the alley bed, into the pit. Upon the return of the sweeper the setter frame again descends returning the pins to the alley bed after which the magnets 213 are de-energized to release the pins, and the setter frame again returns to its normal position.

The pins are delivered from the pit to the pin elevator which picks them up one by one and delivers them to the assembly shelf. When the first pin closes the circuit through the contacts 100, 101, and 115 the solenoid 247 of the control unit is energized and the control unit is released. One second later the latch 249 is lifted to permit operation of the lowering door unit whereby the pins are discharged from the assembly shelf into the distributor frame which has already been cleared of pins as previously described.

At the beginning of the fourth second after the release of the control unit the transverse conveyer is actuated. As previously pointed out the transverse conveyer is ineffective when the tenth pin is delivered to the assembly shelf. When the next succeeding pin is delivered by the elevator to the assembly shelf the transverse conveyer is again operated to advance the pin along the assembly shelf a distance equal to the diameter of the pin, and thereafter as the pins are delivered to the assembly shelf all of the pins are advanced along the assembly shelf until a set of nine pins have been accumulated.

The bowler rolls a ball at the remaining pins standing on the alley bed after which it becomes necessary to provide a "new set" of pins. The "new set" button is again pressed, the sweeper descends, to remove all pins and balls from the alley bed, and the setter frame descends to deliver a set of

pins, after which the various operations as above described are repeated, the machine continuously replenishing the setter frame with pins as the pins are delivered therefrom.

The bowler sometimes desires to arrange selected pins in position for practice work. To accomplish this the "new set" button is first depressed to permit the machine to deliver a set of pins upon the alley bed. The bowler then depresses the numbered keys corresponding to the desired pins and finally depresses the "deadwood" key causing the setter frame to descend as in the "deadwood" operation. Only the magnets 113, corresponding to the depressed numbered keys, are energized in this operation and, consequently, the corresponding pins are lifted while the remaining pins are swept from the alley bed. The selected pins are then deposited upon the alley bed in readiness for play.

From the foregoing it will be readily appreciated that the machine herein described is capable of performing all of the necessary operations incident to the work of a pin boy. The structure and arrangement is such that no confusion can possibly occur so that the machine may be operated by the most inexperienced or careless person without endangering the structure which is relatively simple and may be maintained in operative condition with a minimum of care and attention. Broken pins are immediately ejected from the machine so that the bowler is insured a complete and satisfactory set of pins, spotted with precision at each "new set."

Various changes may be made in the form, construction, and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing any of its material advantages, the form hereinbefore described being merely preferred embodiments thereof.

I claim:

1. In a pin setting machine for bowling alleys the combination of means for setting the pins on an alley bed, means for delivering pins in sets thereto, both said means including intermittently actuated mechanism, a casing, and means comprising a compact assemblage of essentially similar units within said casing for timing said intermittently actuated mechanism.

2. In a pin setting machine for bowling alleys the combination of means for setting the pins on an alley bed, means for delivering pins in sets thereto, both said means including intermittently actuated mechanism, a casing, means comprising a compact assemblage of essentially similar units within said casing for timing all of said intermittently actuated mechanism, and means under control of the bowler for initiating the operation of certain of said units, the other units being automatically operative.

3. In a pin setting machine for bowling alleys the combination of means for setting the pins on an alley bed, means for delivering pins in sets thereto, both said means including intermittently actuated mechanism, a casing, and means within said casing including a driven shaft and a plurality of units assembled on said shaft and adapted to be selectively actuated and when so actuated to drive said intermittently actuated mechanism.

4. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto, both said means including intermittently actuated mechanism, a casing, and means within said casing including two driven shafts and a plurality of units on said shafts adapted to be driven thereby in predetermined relation and when so driven to actuate said pin setting and delivering means.

5. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto and means including two parallel driven shafts, each bearing a plurality of timing units arranged side by side and adapted to be operatively connected to said shafts and when so connected to drive the pin setting and delivering means.

6. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto, a casing, and a compact assemblage of timing units arranged in readily accessible position within said casing, said units being operable from a single source of power, certain units independently of and others in predetermined relation to each other.

7. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto, a casing, a pair of driven shafts within said casing, a plurality of timing units on said shafts and adapted to be actuated thereby, and operating connections between said units and the setting and delivering means.

8. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto, a driven shaft, independent units on said shaft adapted to be selectively connected thereto, cams operating with said units, and means operatively connecting the cams on both of said units to the setting means whereby the latter is actuated when either unit is connected to said shaft.

9. In a pin setting machine for bowling

alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto, a driven shaft, independent units on said shaft, magnetically controlled means for selectively connecting said units to said shaft, cams operating with said units, and means operatively connecting the cams on both of said units to the setting means whereby the latter is actuated when either unit is connected to said shaft.

10. In a pin setting machine for bowling alleys the combination of means for setting pins upon an alley bed, means for delivering pins in sets thereto, a driven shaft, a plurality of units on said shaft and each comprising a ratchet fixed to said shaft and a disk wheel carrying a pawl adapted to engage said ratchet, means for normally holding said pawls out of engagement with said ratchets, means for releasing said pawls, operative connections between said disk wheels and the pin setter, and delivering means whereby the latter are actuated when the respective disk wheels are connected to said ratchets.

11. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto and a timing mechanism comprising a plurality of driven shafts, a plurality of normally quiescent units arranged on each of said shafts, means for selectively connecting said units to said shafts and operative connections between said units and the setting and delivering means.

12. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto, and a timing mechanism comprising a plurality of driven shafts, a plurality of normally quiescent units arranged on said shafts and adapted to be connected thereto, operative connections between said units and the setting and delivering means, and means under control of the bowler for initiating the operation of certain units.

13. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto, and a timing mechanism comprising a plurality of driven shafts, a plurality of normally quiescent units arranged on said shafts and adapted to be connected thereto, operative connections between said units and the setting and delivering means, and means under control of the bowler for initiating the operation of certain units, and automatic means for initiating the operation of other units.

14. In a pin setting machine for bowling alleys the combination of means for setting pins upon an alley bed, means for delivering pins in sets thereto, a compact assemblage of timing units, each comprising a driving and a driven element and normally inoperative connections therebetween, driving means between the driven elements of said timing units and said setting and delivering means, and means controlling said normally inoperative connections.

15. In a pin setting machine for bowling alleys the combination of means for setting pins upon an alley bed, means for delivering pins in sets thereto, a compact assemblage of timing units, each comprising a driving and a driven element and normally inoperative connections therebetween, driving means between the driven elements of said timing units and said setting and delivering means, and electromagnetic means controlling certain of said connections at the will of the bowler, the remaining connections being automatically operative.

16. In a pin setting machine for bowling alleys the combination of means for setting pins upon an alley bed, means for delivering pins in sets thereto, a compact assemblage of timing units, each comprising a driving and a driven element, and normally inoperative connections therebetween, driving connections between the driven elements of said timing units and said setting and delivering means, electromagnetic means controlling certain of said connections at the will of the bowler and means preventing the bowler from energizing any of said electromagnetic means until the conclusion of an operation initiated by the energization of another electromagnetic means.

17. In a pin setting machine for bowling alleys the combination of means for setting pins upon an alley bed, means for delivering pins in sets thereto, a constantly rotating shaft, a compact assemblage of timing units on said shaft, each comprising an element rotating constantly with said shaft and an element loose thereon, means adapted to connect said elements and driving means between the loose elements and said setting and delivering means.

18. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for delivering pins in sets thereto, a constantly revolving shaft, and a compact assemblage of timing units comprising fast and loose elements on said shaft, means for operatively connecting said fast and loose elements, and driving means between said loose elements and said setting and delivering means.

19. In a pin setting machine for bowling alleys the combination of a setter frame, a distributor frame, an assembly shelf, a pin elevator, a casing and a compact assemblage of timing units within said casing operatively connected to said setter and distributor frames and to said assembly shelf to control the operation thereof,

20. In a pin setting machine for bowling alleys the combination of a setter frame, a distributor frame, an assembly shelf, a pin elevator, a casing, a compact assemblage of timing units within said casing operatively connected to said setter and distributor frames and to said assembly shelf to control the operation thereof, and electromagnetic means for initiating the operation of certain of said units, the others being automatically operative under predetermined conditions.

21. In a pin setting machine for bowling alleys the combination of a setter frame, a distributor frame, an assembly shelf, a pin elevator, a casing and timing means for said setter and distributor frames and assembly shelf, operatively connected thereto and compactly arranged within said casing as an assemblage of units, certain units being under control of the bowler while the others are automatically operative.

22. In a pin setting machine for bowling alleys the combination of a setter frame, means for delivering pins in sets thereto, a sweeper, a casing, and timing means for said setter frame, delivering means and sweeper operatively connected thereto and compactly arranged within said casing as an assemblage of units, manually controlled means for initiating the operation of the unit controlling said setter frame, and means operated by the last mentioned unit for initiating the operation of the unit controlling said sweeper.

23. In a pin setting machine for bowling alleys the combination of a setter frame, means for delivering pins thereto, a sweeper, a casing, timing means for said setter frame, delivering means and sweeper operatively connected thereto and compactly arranged within said casing as an assemblage of units, a shaft supporting said units, means for continuously driving said shaft and means whereby said units are actuated by said shaft.

24. In a pin setting machine for bowling alleys the combination of a setter frame, means for delivering pins thereto, a sweeper, a casing, timing means for said setter frame, delivering means and sweeper operatively connected thereto and conjointly arranged within said casing as an assemblage of units, a shaft supporting said units, means for continuously driving said shaft, normally inoperative connecting means between said shaft and units, and means controlling said connecting means.

25. In a pin setting machine for bowling alleys the combination of a timing mechanism comprising a shaft carrying a plurality of ratchets continuously rotating therewith, and a plurality of loose disk wheels bearing pawls adapted to engage said ratchets, a setter frame, means for delivering pins in sets thereto, a sweeper, operative connections between said disk wheels and said setter frame, delivering means and sweeper, and means for controlling said pawls.

26. In a pin setting machine for bowling alleys the combination of a timing mechanism comprising two parallel shafts, carrying a plurality of ratchets continuously rotating therewith and a plurality of loose disk wheels adjacent said ratchets, and bearing pawls adapted to engage said ratchets, a setter frame, a distributor frame, an assembly shelf, a sweeper, operative connections between said disk wheels and said setter frame, distributor frame, assembly shelf and sweeper and means for controlling said pawls.

27. In a pin setting machine for bowling alleys the combination of a setter frame, timing units operatively connected to said setter frame to actuate the latter for "new set" and "deadwood" operations, said timing units comprising constantly driven ratchets, disk wheels adjacent said ratchets, and means for selectively connecting either of said disk wheels to their corresponding ratchets.

28. In a pin setting machine for bowling alleys the combination of a setter frame, a shaft, timing units on said shaft and adapted to be connected thereto, cams operating with the respective timing units, means co-operating with said cams and connected to said setter frame to actuate it in the "new set" or "deadwood" operations, and means to prevent operation of one of said units while the other is operating.

29. In a pin setting machine for bowling alleys the combination of a setter frame, a shaft, timing units on said shaft and adapted to be connected thereto, cams operating with the respective timing units, means co-operating with said cams and connected to said setter frame to actuate it in the "new set" or "deadwood" operations, means to prevent operation of one of said units while the other is operating, a sweeper, a unit on and adapted to be connected to said shaft, operative connections between said unit and sweeper, and means on said cams controlling the sweeper unit whereby said sweeper is timed to operate in proper relation to said setter frame.

30. In a pin setter for a bowling alley, a ball elevator comprising a fixed support, and a rotating element cooperating therewith and having a continuous raceway spaced from the support to frictionally engage the ball therebetween, whereby the ball is elevated by rolling along the surfaces of both the support and the raceway.

31. In a pin setter for a bowling alley, a ball elevator comprising a fixed support, and a rotating element having a surface formed symmetrically with respect to its

axis of rotation and disposed in cooperative relation with the fixed support to frictionally engage the ball therebetween, whereby the ball is elevated above both the surfaces of the support and the symmetrical surface of the rotating element.

32. In a pin setter for bowling alley, a ball elevator comprising a fixed support, a rotating element having a continuous raceway spaced from the support, and an intermediate element in cooperative relation with the raceway to frictionally engage the ball therebetween, said intermediate element being adjustable relative to said raceway for balls of different diameters, whereby the ball is elevated by rolling along the surfaces of the support, the raceway, and said adjustable element.

33. In a bowling alley apparatus, means for elevating a bowling ball by rolling the same, and comprising a fixed elevating member and a rotating elevating member, one of the elevating members having a raceway in cooperative relation with the other elevating member to receive a ball in frictional engagement between the raceway and the said other elevating member.

34. In a bowling alley apparatus, means for elevating a ball by rolling the same, and comprising a fixed elevating member and a rotating elevating member, one of the members having a continuous raceway extending around the axis of rotation of the rotating member and in cooperative relation with the other elevating member to receive a ball in frictional engagement between the raceway and the said other elevating member.

35. In a bowling alley apparatus, means for elevating a ball by rolling the same, and comprising a fixed elevating member and a rotating elevating member, one of the elevating members having a circular raceway concentric with respect to the axis of rotation of the rotating member and spaced with respects to said rotating member to receive a ball in frictional engagement with the raceway and the opposite elevating member.

36. In a bowling alley apparatus, means for elevating a ball by rolling the same, and comprising a fixed elevating member and a rotating elevating member, the adjacent faces of the members having cooperating ball-engaging portions constituting a raceway to receive the ball in frictional engagement therebetween.

37. In a bowling alley apparatus, means for elevating a ball by rolling the same, and comprising a fixed elevating member, and a rotating elevating member mounted upon a substantially horizontal axis and provided with a circumferential surface portion symmetrical with respect to the axis of rotation, the two members being spaced to receive a ball between them and in frictional engagement with the upright elevating member and with the symmetrical portion of the rotating member.

38. In a bowling alley apparatus, means for elevating a ball by rolling the same, and comprising a fixed elevating member, a rotating elevating member, and an intermediate ball-engaging member carried by one of the elevating members and adjustable with respect to the other elevating member and spaced therefrom to receive a ball between and in frictional engagement with said intermediate member and said other elevating member.

39. In a bowling alley apparatus, means for elevating a ball by rolling the same, said means including a fixed elevating member, and a rotatable elevating member mounted upon a substantially horizontal axis, the fixed member being provided with a ball-engaging portion which is elastically yieldable towards and away from the rotatable member and in the direction of the axis thereof, the rotatable member and the yieldable portion of the fixed member spaced to receive a ball between them and in frictional engagement therewith.

40. In a pin setter for a bowling alley, a ball elevator comprising a fixed support, and a rotating element spaced from the support a distance substantially equal to the diameter of a ball, said support and rotating element having similar concave faces along which the ball rolls.

41. In a pin setting machine for bowling alleys, a ball elevator comprising a fixed support upon which the ball rolls, a rotating element engaging the ball on the opposite side of its axis of rotation whereby the ball is moved along said support, and a resiliently biased member having a face adapted to engage the ball at an end of its axis of rotation.

42. In a pin setting machine for bowling alleys, a ball elevator comprising a fixed support having a face upon which the ball rolls, a rotating drum having a similar and oppositely disposed face engaging the ball in the opposite side of its axis of rotation whereby the ball is moved along said support, and a resiliently biased member adapted to engage the ball at one end of its axis of rotation.

43. In a pin setting machine for bowling alleys, a ball elevator comprising a fixed support having an annular face upon which the ball rolls, a rotating drum having a similar and oppositely disposed face engaging the ball on the opposite side of its axis of rotation whereby the ball is moved along said support and a member movable relatively to said support and drum, and having a face adapted to engage the ball at one end of the axis of rotation.

44. In a pin setting machine for bowling

alleys, a ball elevator comprising a fixed support forming an S-shaped guide along which the ball rolls, and two drums rotating in opposite direction and successively engaging the ball on the opposite side of its axis of rotation as it rolls along said guide.

45. In a pin setting machine for bowling alleys, a ball elevator comprising a fixed support forming an S-shaped guide along which the ball rolls, two drums rotating in opposite directions and successively engaging the ball on the opposite side of its axis of rotation as it rolls along said guide, and resiliently biased members movable relatively to said guide and drums and adapted to engage the ball at one end of its axis of rotation.

46. In a pin setting machine for bowling alleys, a ball elevator comprising a fixed support forming an S-shaped guide along which the ball rolls, two drums rotating in opposite directions and successively engaging the ball on the opposite side of its axis of rotation as it rolls along said guide, and resiliently biased members movable relatively to said guide and drums and adapted to engage the ball at one end of its axis of rotation, said drums being interchangeable and said support being adjustable to permit discharge of the balls at either side of the machine.

47. In a pin setting machine for bowling alleys, a ball elevator comprising shells forming together an S-shaped guide groove and means co-operating therewith to elevate a ball.

48. In a pin setting machine for bowling alleys, a ball elevator comprising shells forming together an S-shaped guide groove and two drums rotatable in opposite directions and adapted to co-operate with said shells to elevate a ball.

49. In a pin setting machine for bowling alleys, a ball elevator comprising shells forming together an S-shaped guide groove and two drums rotatable in opposite directions and adapted to co-operate with said shells to elevate a ball, said drums being interchangeable and said shells being adjustable to permit discharge of the ball on either side of the machine.

50. In a pin setting machine for bowling alleys, a ball elevator comprising vertically disposed shells forming together an S-shaped guide groove, a ball runway arranged to receive a ball from said groove and means cooperating with said shells to elevate the ball.

51. In a pin setting machine for bowling alleys, a ball elevator comprising two spindles, shells adapted to be secured in fixed relation on said spindles and forming together an S-shaped guide groove, rotatable drums on said spindles co-operating with said shells to elevate a ball and means for rotating said drums in opposite directions.

52. In a pin setting machine for bowling alleys, a ball elevator comprising two spindles, shells adapted to be secured in fixed relation on said spindles and forming together an S-shaped guide groove, rotatable drums on said spindles co-operating with said shells to elevate a ball and means for rotating said drums in opposite directions, said drums being interchangeable and said shells being adjustable to permit delivery of the ball from either side of the machine.

53. In a pin setting machine for bowling alleys, a ball elevator comprising two spindles, shells adjustably supported on said spindles and forming in either of two positions an S-shaped guide groove for a ball, a pair of rotatable drums co-operating with said shells to elevate the ball, and means for rotating said drums in opposite directions.

54. In a pin setting machine for bowling alleys, a pin elevator including a rotating annulus having pockets to receive the pins, a stack adapted to receive and guide the pins in their upward travel, means for elevating the pins in said stack, and an automatically controlled door near the base of said stack, said door being adapted to open to permit the pins to enter said stack and to close immediately thereafter to prevent the pins from over-turning during its upward travel.

55. In a pin setting machine for bowling alleys, a pin elevator including a rotating annulus having pockets to receive the pins, a stack adapted to receive and guide the pins in their upward travel, means for elevating the pins in said stack, a door near the base of said stack, a cam operating with said annulus and means connecting said cam and door whereby the latter is opened and closed in predetermined relation to the pin pockets on said annulus.

56. In a pin setting machine for bowling alleys, a pin elevator including a rotating annulus having pockets to receive the pins, a stack adapted to receive and guide the pins in their upward travel, means for elevating the pins in said stack, a door near the base of said stack and automticlly opened and closed in predetermined relation to said pin pockets and means between said annulus and stack to insure delivery of the pins thereto with their butt ends foremost.

57. In a pin setting machine for bowling alleys, a pin elevator including a rotating annulus having pockets to receive the pins, a stack adapted to receive and guide the pins in their upward travel, means for elevating the pins in said stack, a door near the base of said stack and automatically opened and closed in predetermined relation to said pin pockets, and a chute adapted to receive the pins from said annulus and to deliver them to said stack, said chute having an opening into which the heads of the

pins drop whereby the pins are reversed, when delivered to the chute head end foremost, before they are delivered to said stack.

58. In a pin setting machine for bowling alleys, a pin elevator including a rotating annulus having pockets to receive the pins, a stack adapted to receive and guide the pins in their upward travel, elevating means in said stack, a pivoted door near the base of said stack, a cam rotating with said annulus and having a plurality of high points corresponding to the pockets in said annulus, and means connected to said door and engaging said cam whereby said door is lifted before a pin is discharged from said annulus into said stack.

59. In a pin setting machine for bowling alleys, the combination of a pin elevator and means controlled by the contour of the pin to effect the ejection of defective pins.

60. In a pin setting machine for bowling alleys, the combination of a pin elevator and means disposed in the path of a pin in said elevator and controlled by the contour of the pin to insure ejection of defective pins.

61. In a pin setting machine for bowling alleys, the combination of means disposed in the path of a pin as it passes through said machine and means controlled thereby to retain perfect pins and to eject defective pins.

62. In a pin setting machine for bowling alleys, the combination of electric contact means disposed in the path of a pin as it passes through the machine, and means actuated upon closure of a circuit through said contact means to retain the pins in the machine.

63. In a pin setting machine for bowling alleys, the combination of electric contact means disposed in the path of a pin through the machine, an oscillating gate in the path of the pin, and means controlled by the closure of a circuit through said contact means to lock said gate in closed position.

64. In a pin setting machine for bowling alleys, the combination of electric contact means disposed in the path of a pin as it passes through the machine, an oscillating gate, a latch therefor, and electro magnetic means in circuit with said contact means to actuate said latch.

65. In a pin setting machine for bowling alleys, the combination of electric contact means disposed in the path of a pin as it passes through the machine, an oscillating gate, a latch therefor and electro magnetic means in circuit with said contact means to actuate said latch, and means for holding said latch in operative position when said circuit is broken.

66. In a pin setting machine for bowling alleys the combination of electric contact means disposed in the path of a pin as it passes through the machine, an oscillating gate, a latch therefor and electro magnetic means in circuit with said contact means to actuate said latch, and means for subsequently releasing said latch.

67. In a pin seting machine for bowling alleys the combination of a stack, means operating therein to elevate a pin, circuit closing means disposed in the path of the pins in said stack, and means controlled by said circuit closing means to retain perfect pins in the machine.

68. In a pin setting machine for bowling alleys the combination of a stack, means operating therein to elevate a pin, circuit closing means projecting through openings in the side of said stack into the path of the pin, circuit closing means at the top of the stack in the path of the head of the pin, and means controlled by said circuit controlling means to retain perfect pins in the machine.

69. In a pin setting machine for bowling alleys the combination of a stack, means operating therein to elevate pins, a plurality of circuit controlling means arranged in the sides of said stack in the path of the pins, circuit controlling means at the top of said stack in the path of the heads of the pins, and means controlled by said circuit controlling means to retain perfect pins in the machine.

70. In a pin setting machine for bowling alleys the combination of a stack, means operating therein to elevate pins, a plurality of circuit controlling means arranged about and projecting through openings in the sides of said stack into the path of the pins, circuit controlling means at the top of said stack in the path of the heads of the pins, an oscillating gate in the path of the pins as they are discharged from said stack, and electro-magnetic means controlled by said circuit controlling means to lock said gate in closed position to retain perfect pins in the machine.

71. In a pin setting machine for bowling alleys the combination of a pin elevator, means in the path of the pins in said elevator and controlled by the contour of the pin to insure ejection of defective pins, and means for receiving the defective pins.

72. In a pin setting machine for bowling alleys the combination of means disposed in the path of the pins in said machine to register defective pins, a receiver for defective pins, and a gate controlled by said first mentioned means to prevent perfect pins from entering said receiver.

73. In a pin setting machine for bowling alleys the combination of means disposed in the path of the pins in said machine to register defective pins, a receiver for defective pins, and means controlled by said first mentioned means to prevent perfect pins from entering said receiver.

74. In a pin setting machine for bowling alleys the combination of means disposed in the path of the pins in said machine to register defective pins, a receiver for defective pins, an oscillating gate, and a latch controlled by said first mentioned means to lock said gate in closed position to prevent perfect pins from passing to said receiver.

75. In a pin setting machine for bowling alleys the combination of a pin elevator, a plurality of contact arms arranged about and disposed in the path of the pins in said elevator, electrical contacts controlled by said arms, a contact lever disposed in the path of the head of the pins in said elevator, electrical contacts controlled by said last mentioned lever, a circuit including all of said contacts, and means controlled thereby to retain perfect pins in the machine.

76. In a pin setting machine for bowling alleys the combination of a pin elevator, a plurality of circuit closing devices in the path of a pin in said elevator, means for temporarily locking said circuit controlling devices when closed by the passage of a pin, a circuit closing device in the path of the head of the pin, a gate controlling the movement of the pin after it leaves said elevator, and electro-magnetic means in the circuit of said circuit closing means to control said gate.

77. In a pin setting machine for bowling alleys the combination of a pin elevator, a plurality of circuit closing devices in the path of a pin in said elevator, means for temporarily locking said circuit controlling devices when closed by the passage of a pin, a circuit closing device in the path of the head of the pin, a gate controlling the movement of the pin after it leaves said elevator and electro-magnetic means in the circuit of said circuit closing means to control said gate, and means to release said circuit closing means after operation of said electro-magnetic means.

78. In a pin setting machine for bowling alleys the combination of a receptacle to receive defective pins, means engageable with the sides of the pins as they pass through the machine, means engageable by the heads of the pins as they pass through the machine, and means controllable by the two last mentioned means to retain perfect pins and to permit defective pins to pass to said receptacle.

79. In a pin setting machine for bowling alleys an assembly shelf embodying a plurality of independent, movable sections normally arranged in a plane, means for supporting said sections, means for withdrawing said supporting means, and means for stopping the separate sections at predetermined points when said supporting means is withdrawn.

80. In a pin setting machine for bowling alleys, an assembly shelf embodying a plurality of independent, swinging sections normally arranged in a plane, a universal bar supporting said sections, means for withdrawing said universal bar to permit said sections to swing downwardly, and means to limit the movement of the separate sections.

81. In a pin setting machine for bowling alleys, an assembly shelf embodying a plurality of independent, swinging sections normally arranged in a plane, a universal bar supporting said sections, means for withdrawing said universal bar, a partition in front of said sections and having a plurality of openings, and stops under the respective openings in said partition to limit downward travel of said sections.

82. In a pin setting machine for bowling alleys, an assembly shelf embodying a plurality of independent, swinging sections normally arranged in a plane, a universal bar supporting said sections, means for withdrawing said universal bar, a partition in front of said sections and having a plurality of openings and stops under the respective openings in said partition to limit downward travel of said sections, and shields between the respective sections to prevent side-wise movement of the pins thereon while said sections are swinging.

83. In a pin setting machine for bowling alleys, an assembly shelf comprising a plurality of movable sections each adapted to support a single pin, and means for advancing pins along said shelf as each pin is delivered thereto until a full set of ten pins has been accumulated.

84. In a pin setting machine for bowling alleys, an assembly shelf comprising a plurality of movable sections each adapted to support a single pin, means for advancing pins along said shelf as each pin is delivered thereto until a full set of ten pins has been accumulated, and means permitting said sections to drop to different levels to deliver the set of pins therefrom.

85. In a pin setting machine for bowling alleys, an assembly shelf comprising a plurality of movable sections, each adapted to support a single pin, a conveyer operating as each pin is delivered to said shelf to advance the pins along said shelf, a universal bar supporting said sections, and means for withdrawing said bar when ten pins have been assembled on said shelf to permit said sections to drop and deliver pins therefrom.

86. In a pin setting machine for bowling alleys, the combination of an assembly shelf comprising a plurality of separate lowering doors, means for maintaining said sections in a common plane, and means for releasing said last mentioned means to permit said sections to drop to different planes, a dis-

tributor frame, and chutes communicating with said distributor frame into which the pins are delivered from said lowering doors.

87. In a pin setting machine for bowling alleys the combination of an assembly shelf, a distributor frame, electrically controlled means for advancing pins along said shelf, and means permitting delivery of the pins from said shelf to said distributor frame when a full set of ten pins have been accumulated on said shelf.

88. In a pin setting machine for bowling alleys the combination of an assembly shelf, a distributor frame, a conveyer for advancing pins along said shelf, electrically controlled means actuated by the individual pins to drive said conveyer, and means for delivering said pins from said shelf to said distributor frame.

89. In a pin setting machine for bowling alleys the combination of an assembly shelf comprising a plurality of lowering doors normally arranged in a common plane, an assembly shelf, a conveyer for advancing pins along said shelf, electrically controlled means actuated by the individual pins to drive said conveyer, means for permitting said lowering doors to drop to different levels when ten pins have been accumulated on said shelf, and means for conducting the pins to said distributor frame.

90. In a pin setting machine for bowling alleys the combination of a distributor frame, an assembly shelf comprising a plurality of separate lowering doors normally arranged in a common plane, a plurality of chutes communicating with said distributor frame, a partition between said shelf and chutes, said partition having a plurality of openings registering with the ends of said chutes, and means permitting said lowering doors to descend to different levels corresponding to said openings whereby the pins are delivered there-through.

91. In a pin setting machine for bowling alleys the combination of a distributor frame, an assembly shelf comprising a plurality of separate lowering doors normally arranged in a common plane, a plurality of chutes communicating with said distributor frame, a partition between said shelf and chutes, said partition having a plurality of openings registering with the ends of said chutes, means permitting said lowering doors to descend to different levels corresponding to said openings whereby the pins are delivered there-through, and means for advancing pins along said shelf until ten pins have been accumulated thereon.

92. In a pin setting machine for bowling alleys the combination of a distributor frame, an assembly shelf comprising a plurality of separate lowering doors normally arranged in a common plane, a plurality of chutes communicating with said distributor frame, a partition between said shelf and chutes, said partition having a plurality of openings registering with the ends of said chutes, means permitting said lowering doors to descend to different levels corresponding to said openings whereby the pins are delivered there-through, means for advancing pins along said shelf until ten pins have been accumulated thereon, and means for elevating the pins and delivering them to said shelf.

93. In a pin setting machine for bowling alleys the combination of a means for setting pins on an alley bed, means for delivering pins in sets thereto, and means for ejecting broken pins from the machine.

94. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for assembling a set of pins and delivering them to said setter frame, and means for ejecting broken pins before they are assembled with a set of pins.

95. In a pin setting machine for bowling alleys the combination of a setter frame, a distributor frame, an assembly shelf, means for assembling a set of pins on said assembly shelf and for delivering the sets of pins successively to said distributor and setter frames, and means for ejecting broken pins from the machine before they have been assembled with a set of pins.

96. In a pin setting machine for bowling alleys the combination of means for setting pins on an alley bed, means for assembling and delivering pins in sets thereto, an elevator for lifting the pins and delivering them to said assembling means, and means influenced by the pins while on said elevator for insuring retention of perfect pins and rejection of imperfect pins.

97. In a pin setting machine for bowling alleys, a distributor frame comprising a plurality of pairs of semi-casings arranged to receive a set of pins in reclining position, and means for righting and separating said semi-casings to deliver the pins therefrom.

98. In a pin setting machine for bowling alleys, a distributor frame comprising a plurality of pairs of semi-casings arranged to receive a set of pins in reclining position, a pair of shafts, means connecting the respective shafts to the opposite members of each pair of semi-casings, and means for oscillating said shafts whereby said semi-casings are swung to substantially vertical position and subsequently separated to deliver the pins therefrom.

99. In a pin setting machine for bowling alleys, a distributor frame comprising a plurality of pairs of semi-casings arranged to receive a set of pins in reclining position, a pair of shafts, means connecting the respective shafts to the opposite members of each pair of semi-casings, and means for oscillat-

ing said shafts to swing said semi-casings to substantially upright position and for subsequently reversing the direction of movement of one of said shafts while the other continues in the same direction whereby the pins are delivered therefrom.

100. In a pin setting machine for bowling alleys the combination of a distributor frame comprising a plurality of semi-casings arranged to receive a set of pins in reclining position, a setter frame beneath said distributor frame, and means for swinging said semi-casings to upright position and subsequently separating them to deliver the pins to said setter frame.

101. In a pin setting machine for bowling alleys the combination of a distributor frame comprising a plurality of semi-casings arranged to receive a set of pins in reclining position, a setter frame beneath said distributor frame, a plurality of chutes for delivering pins to said distributor frame, and means for swinging said semi-casings to upright position and for subsequently separating them to deliver the pins to said setter frame.

102. In a pin setting machine for bowling alleys the combination of a distributor frame, a plurality of chutes for delivering the pins thereto, means for actuating said distributor frame to deliver pins therefrom, and means on said distributor frame to close the ends of said chutes when said distributor frame is in other than pin receiving position.

103. In a pin setting machine for bowling alleys the combination of a distributor frame comprising a plurality of pairs of semi-casings arranged in reclining position, means for swinging said semi-casings to upright position, chutes leading to each pair of semi-casings, and a fin on the semi-casing contiguous to the end of each chute and adapted to be projected therein when said semi-casings are swung to deliver pins.

104. In a pin setting machine for bowling alleys the combination of a distributor frame comprising a plurality of swinging elements, a plurality of chutes for delivering pins thereto, means for actuating said swinging elements to deliver pins therefrom, and a fin on the element contiguous to the end of said chute and adapted to be projected therein when the elements are swung to limit the further descent of pins in said chutes until said elements return to normal position.

105. In a pin setting machine for bowling alleys the combination of a setter frame for delivering pins to the alley bed, a distributor frame comprising a plurality of pairs of semi-casings arranged to receive a set of pins in reclining position, and means for swinging said semi-casings to upright position and for subsequently separating them to deliver pins to said setter frame including two shafts, connections between the respective shafts and the opposite members of each pair of semi-casings, and means for oscillating said shafts, said means being controlled to operate in predetermined relation to said setter frame.

106. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of pairs of pin grippers supported thereon, a rod extending through said frame and adapted to engage the alley bed when said frame is lowered, and toggle means controlled thereby to positively move said pin grippers into and out of pin gripping relation.

107. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of shafts supported thereon, a plurality of pairs of pin grippers secured to said shafts, and toggle means for oscillating said shafts to separate said pin grippers.

108. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of shafts supported thereon, a plurality of pairs of pin grippers secured to said shafts, means for oscillating said shafts to separate said pin grippers, and toggle means for locking said oscillating means to hold said grippers in pin gripping relation.

109. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of pairs of shafts supported thereon, a plurality of pairs of pin grippers secured to said shafts, means connecting corresponding shafts of each pair to cause them to operate in unison, a rod adapted to engage the alley bed when said frame is lowered, and toggle means controlled thereby for oscillating said shafts.

110. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of pairs of parallel shafts supported thereon, a plurality of pairs of pin grippers secured to said shafts, means connecting corresponding shafts of each pair to cause them to operate in unison, levers on each of one pair of said shafts, a spring connecting the ends of said levers, and means for compressing said spring and holding said grippers in pin gripping relation.

111. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of pairs of parallel shafts supported thereon a plurality of pairs of pin grippers, secured to said shafts, means connecting corresponding shafts of each pair to cause them to operate in unison, levers on each of one pair of said shafts, a spring between said levers tending to oscillate said shafts and separate said grip-

pers, and a toggle connecting said levers to lock the mechanism with said grippers in pin gripping relation.

112. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of pairs of parallel shafts supported thereon, a plurality of pairs of pin grippers secured to said shafts, means connecting corresponding shafts of each pair to cause them to operate in unison, levers on each of one pair of said shafts, a spring between said levers tending to oscillate said shafts and separate said grippers, a toggle connecting said levers to lock the mechansim with said grippers in pin gripping relation, and means for breaking said toggle.

113. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of pairs of parallel shafts supported thereon, a plurality of pairs of pin grippers secured to said shafts, means connecting corresponding shafts of each pair to cause them to operate in unison, levers on each of one pair of said shafts, a spring between said levers tending to oscillate said shafts and separate said grippers, a toggle connecting said levers to lock the mechanism with said grippers in pin gripping relation, and a rod adapted to engage the alley bed when said frame is lowered and connected to said toggle whereby said spring is permitted to oscillate said shafts and separate said grippers.

114. A pin setter comprising a frame adapted for movement toward and from an alley bed, a plurality of pairs of shafts supported on said frames, pin grippers mounted on said shafts, arms on said shafts, links connecting corresponding shafts of each pair, levers on one pair of shafts, a toggle connecting said levers, a spring between said levers tending to oscillate said shafts and separate said grippers, and a rod connected to said toggle and adapted to engage the alley bed when said frame is lowered to break said toggle and permit said spring to separate said grippers.

115. In a pin setting machine for bowling alleys the combination of a setter comprising a frame, a plurality of pin grippers thereon, means for raising and lowering said frame, means on said frame adapted to engage the alley bed when the frame is lowered, and means actuated thereby to separate said grippers, a distributor frame above said setter, and means for delivering pins from said distributor frame to said setter when the latter is empty.

116. In a pin setting machine for bowling alleys, a sweeper supported above the alley bed, and means for moving said sweeper in a curved path to which the alley bed is tangent when said sweeper contacts therewith.

117. In a pin setting machine for bowling alleys, a sweeper supported above the alley bed, means for moving said sweeper downwardly and rearwardly along said alley bed, and means for controlling said movement to prevent forcible engagement of said sweeper with said alley bed.

118. In a pin setting machine for bowling alleys, a sweeper supported above the alley bed, means for moving said sweeper downwardly and rearwardly along said alley bed, a pair of fixed cams, and means cooperating therewith and with said sweeper to control the movement of the latter.

119. In a pin setting machine for bowling alleys, a sweeper supported above the alley bed, a pair of fixed cams, levers supporting said sweeper, arms pivotally supporting said levers, means for swinging said arms, and links connected to said levers and engaging said cams to control the movement of said sweeper.

120. In a pin setting machine for bowling alleys, a sweeper supported above the alley bed, means for moving said sweeper downwardly and rearwardly along said alley bed, and cams controlling said sweeper as it moves downwardly to prevent forcible engagement of said sweeper with said alley bed, said sweeper moving independently of said cams after engagement with said alley bed.

121. In a pin setting machine for bowling alleys the combination of a sweeper, and means for moving said sweeper downwardly and rearwardly along the alley bed, including a shaft carrying a ratchet, a disk wheel carrying a pawl adapted to engage said ratchet, means for normally holding said pawl out of engagement with said ratchet, means for releasing said holding means and driving connections between said disk wheel and sweeper.

122. In a pin setting machine for bowling alleys the combination of means for setting pins on the alley bed, a sweeper, and means for controlling said sweeper including a driven shaft, timing units mounted on and adapted to be connected to said shaft, one of said units being operatively connected to said setting means and the other to said sweeper, and means actuated by the timing unit of said setting means for setting the timing unit of said sweeper in operation.

123. In a pin setting machine for bowling alleys the combination of means for setting pins on the alley bed, a sweeper, and means for controlling said sweeper including a driven shaft, two independent timing units for said setting means and a timing unit for said sweeper all on and adapted to be connected to said shaft, connections between said units and said setting means and sweeper, and means adapted to be actuated

when either timing unit of said setting means is operating to set the timing unit of said sweeper in operation.

124. In a pin setting machine for bowling alleys, a bowler's box comprising a plurality of keys, a plurality of switch bars connected thereto, contacts adapted to be actuated by said switch bars, means for locking said switch bars after they have been actuated, and electromagnetic means for releasing said locking means at the conclusion of an operation initiated by the actuation of said switch bars.

125. In a pin setting machine for bowling alleys, a bowler's box comprising a plurality of keys, a plurality of switch bars connected thereto, contacts adapted to be actuated by said switch bars, means for locking said switch bars after they have been actuated, a solenoid and connections between said solenoid, and locking means for releasing the latter at the conclusion of the operation initiated by the actuation of said switch bars.

126. In a pin setting machine for bowling alleys, a bowler's box including "new set" and "deadwood" keys, circuit closing means actuated thereby, and means for preventing simultaneous actuation of both keys, including two bars having shoulders and cam faces at opposite ends disposed in the path of said keys whereby when one key is depressed engagement with the cam face of the corresponding bar moves the shoulder thereon into the path of the other key.

127. In a pin setting machine for bowling alleys, a bowler's box including "new set" and "deadwood" keys, circuit closing means actuated thereby and means for preventing simultaneous operation of both keys, including two bars each having a cam face at one end and a shoulder at the other, the bars being arranged each with the cam face thereone in the path of one of said keys and a spring between said bars adapted to be compressed when either key is depressed.

128. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood," and a plurality of numbered keys, sliding bars actuated by said keys, and means for blocking said bars when either the "new set" or "deadwood" keys are depressed.

129. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood," and a plurality of numbered keys, sliding bars actuated by said keys, and a plurality of pivoted latches adapted to be actuated when either said "new set" or "deadwood" keys are depressed to block all of said keys.

130. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood," and a plurality of numbered keys, sliding bars actuated by said keys, and means for blocking said "new set" key when one or more of said numbered keys is depressed.

131. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood," and a plurality of numbered keys, sliding bars actuated by said keys, and means for blocking said "new set" key when one or more of said numbered keys is depressed, said blocking means being operable to block all of said keys when the "deadwood" key is subsequently depressed.

132. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood" and a plurality of numbered keys, sliding bars actuated by said keys, a plurality of pivoted latches adapted to be moved into the path of said bars, the latch corresponding to the "new set" key having a longer shoulder than the remaining latches whereby a partial movement of said latches when one or more numbered keys is depressed results in blocking the "new set" key.

133. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood" and a plurality of numbered keys, sliding bars actuated by said keys, a plurality of pivoted latches adapted to be moved into the path of said bars, the latch corresponding to the "new set" key having a longer shoulder than the remaining latches whereby a partial movement of said latches when one or more numbered keys is depressed results in blocking the "new set" key, said latches being movable when the "deadwood" key is subsequently depressed to block all of said keys.

134. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood," and a plurality of numbered keys, an "error" key, sliding bars actuated by said keys, means for locking said bars as each key is depressed, and means actuated by the "error" key to release said locking means when only the numbered keys have been depressed.

135. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood," and a plurality of numbered keys, an "error" key, sliding bars actuated by said keys, means for locking said bars as each key is depressed, means actuated by the "error" key to release said locking means when only the numbered keys have been depressed, and means for blocking all of said keys when either the "new set" or "deadwood" keys have been depressed.

136. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood," and a plurality of numbered keys, an "error" key, sliding bars actuated by said keys, means for locking said bars as each key is depressed, means actuated by the "error" key to release said locking means

when only the numbered keys have been depressed, and means for blocking the "new set" key only when one or more of said numbered keys are depressed.

137. In a pin setting machine for bowling alleys, a bowler's box including "new set," "deadwood," and a plurality of numbered keys, an "error" key, sliding bars actuated by said keys, means for locking said bars as each key is depressed, means actuated by the "error" key to release said locking means when only the numbered keys have been depressed, means for blocking the "new set" key only when one or more of said numbered keys are depressed, and means for blocking all of said keys when the "deadwood" key is subsequently depressed.

138. In a pin setting machine for bowling alleys, a bowler's box including a key, contacts controlled thereby and a pair of sliding bars, one connected to said key and the other to one of said contacts, and connections between said bars whereby the second bar is released and caused to actuate said contacts when the first has been moved through a predetermined distance.

139. In a pin setting machine for bowling alleys, a bowler's box including a key, contacts controlled thereby and a pair of sliding bars, one connected to said key and the other to one of said contacts, a spring between said bars adapted to be compressed when the first bar is actuated, a latch for maintaining the second bar inoperative, and means on the first bar for lifting said latch when said key has been fully depressed.

140. In a pin setting machine for bowling alleys, a bowler's box including a key, contacts controlled thereby and a pair of sliding bars, one connected to said key and the other to one of said contacts, a spring between said bars adapted to be compressed when the first bar is actuated, a latch for maintaining the second bar inoperative and means on the first bar for lifting said latch when said key has been fully depressed, and means adapted to engage and hold the second bar when it has been advanced under the actuation of said spring.

141. In a pin setting machine for bowling alleys, a bowler's box including a key, contacts controlled thereby and a pair of sliding bars, one connected to said key and the other to one of said contacts, a spring between said bars adapted to be compressed when the first bar is actuated, a latch for maintaining the second bar inoperative and means on the first bar for lifting said latch when said key has been fully depressed, means adapted to engage and hold the second bar when it has been advanced under the actuation of said spring, and means for releasing said holding means at the conclusion of the operation initiated by the engagement of said contacts.

142. In a pin setting machine for bowling alleys, a bowler's box including an insulating block having a plurality of fixed contacts, and a plurality of movable contacts, and means for actuating said movable contacts including a plurality of slidable bars and keys operatively connected to said bars.

143. In a pin setting machine for bowling alleys, a bowler's box including an insulating block bearing two spaced combs having contact fingers, a plurality of spring contacts normally engaging one of said combs, and means for individually actuating said spring contacts to engage the other comb.

144. In a pin setting machine for bowling alleys, a bowler's box including an insulating block bearing two spaced combs having contact fingers, a plurality of spring contacts normally engaging one of said combs, and means for individually actuating said spring contacts to engage the other comb, said means comprising slidable bars connected to said spring contacts and keys operatively connected to said bars.

145. In a pin setting machine for bowling alleys, a bowler's box including an insulating block bearing spaced combs having contact fingers, a plurality of spring contacts normally engaging one of said combs, means for individually actuating certain of said spring contacts, and means for actuating one of said spring contacts when any of the others are actuated.

146. In a pin setting machine for bowling alleys, a bowler's box including an insulating block bearing spaced combs having contact fingers, a plurality of spring contacts normally engaging one of said combs, manually operable means for actuating certain of said spring contacts to engage them with the other comb, and means automatically operable when any of said manually operable means are employed to actuate one of said spring contacts to engage the other comb.

147. In a pin setting machine for bowling alleys, a bowler's box including an insulating block bearing spaced combs having contact fingers, a plurality of spring contacts normally engaging one of said combs, a plurality of sliding bars for actuating said spring contacts to engage the other comb, means for manually actuating certain of said bars, and means for automatically actuating one bar when any of the others are manually actuated.

148. In a pin setting machine for bowling alleys, a pin elevator, a pivoted lever bearing a cap in the path of the head of a pin in said elevator, and circuit controlling means adapted to be actuated by said lever when a pin engages said cap.

149. In a pin setting machine for bowling alleys, a pin elevator, a pivoted lever bearing a cap in the path of the head of a pin in

said elevator, circuit controlling means adapted to be actuated by said lever when a pin engages said cap, and means for locking said circuit controlling means in circuit closing position when so actuated.

150. In a pin setting machine for bowling alleys, a pin elevator, a pivoted lever bearing a cap in the path of the head of a pin in said elevator, circuit controlling means adapted to be actuated by said lever when a pin engages said cap, means for locking said circuit controlling means in circuit closing position when so actuated, and means on said lever for releasing said locking means when the pin passes from said elevator.

151. In a pin setting machine for bowling alleys, a pin elevator, a pivoted lever bearing a cap in the path of the head of a pin in said elevator, circuit controlling means adapted to be actuated by said lever when a pin engages said cap, and including an insulating support, spaced semi-cylindrical contacts on said support, and a dished bridge in the path of said lever and adapted to connect said contacts.

152. In a pin setting machine for bowling alleys, a pin elevator, a pivoted lever bearing a cap in the path of the head of a pin in said elevator, circuit controlling means adapted to be actuated by said lever when a pin engages said cap, and including an insulating support, spaced semi-cylindrical contacts on said support, and a dished bridge movable toward and from said contacts and rotatable about the axis thereof, said lever carrying a plunger adapted to move said bridge into engagement with said contacts.

HOWARD A. REDFIELD.

Witnesses:
BERGEN R. SUYDAM,
E. H. MERCHANT.