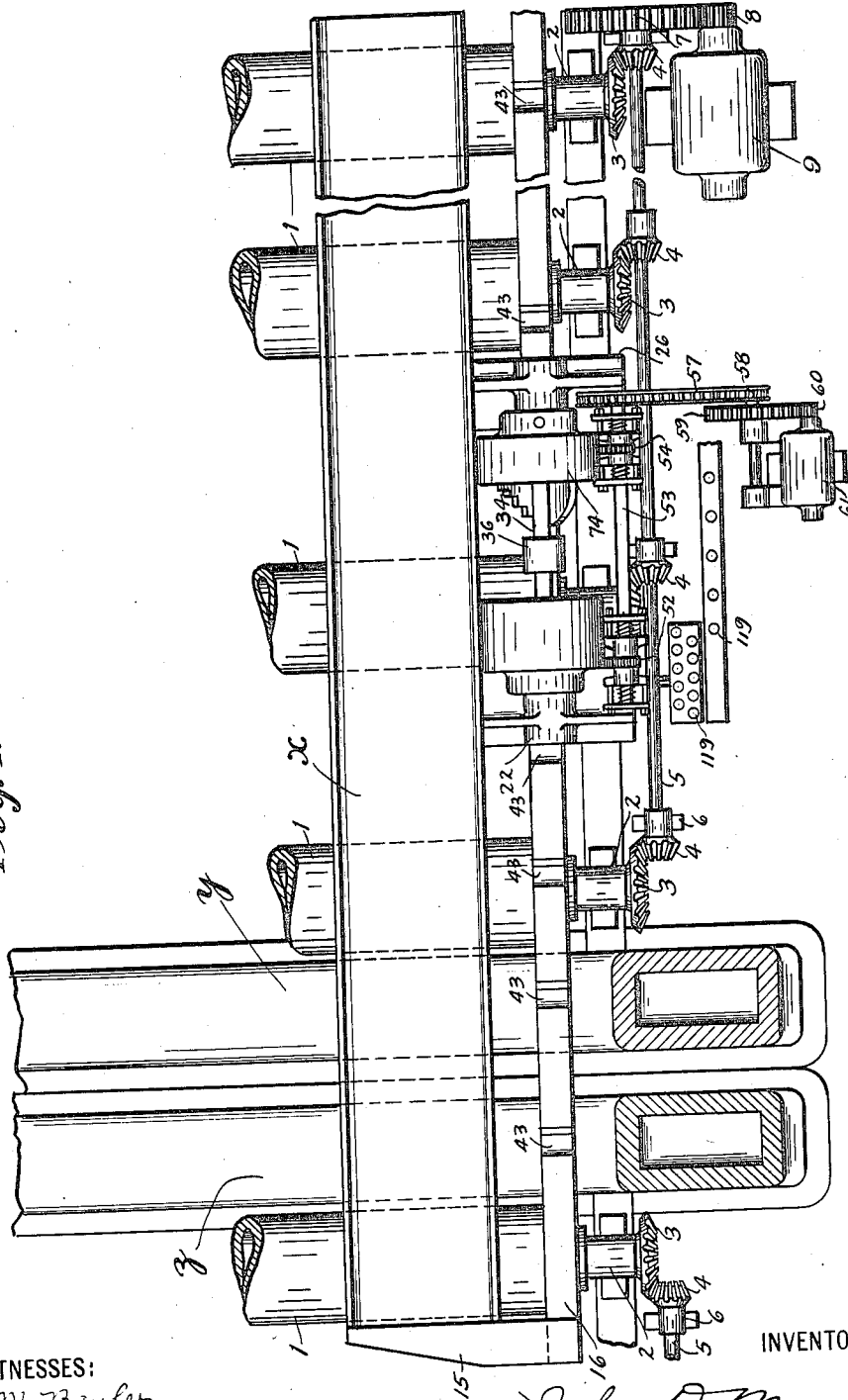


1,241,253.

J. D. MORGAN,
METAL WORKING MACHINE.
APPLICATION FILED APR. 25, 1914.

Patented Sept. 25, 1917.
8 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:
H. M. Bayler.
R. J. Berts

INVENTOR

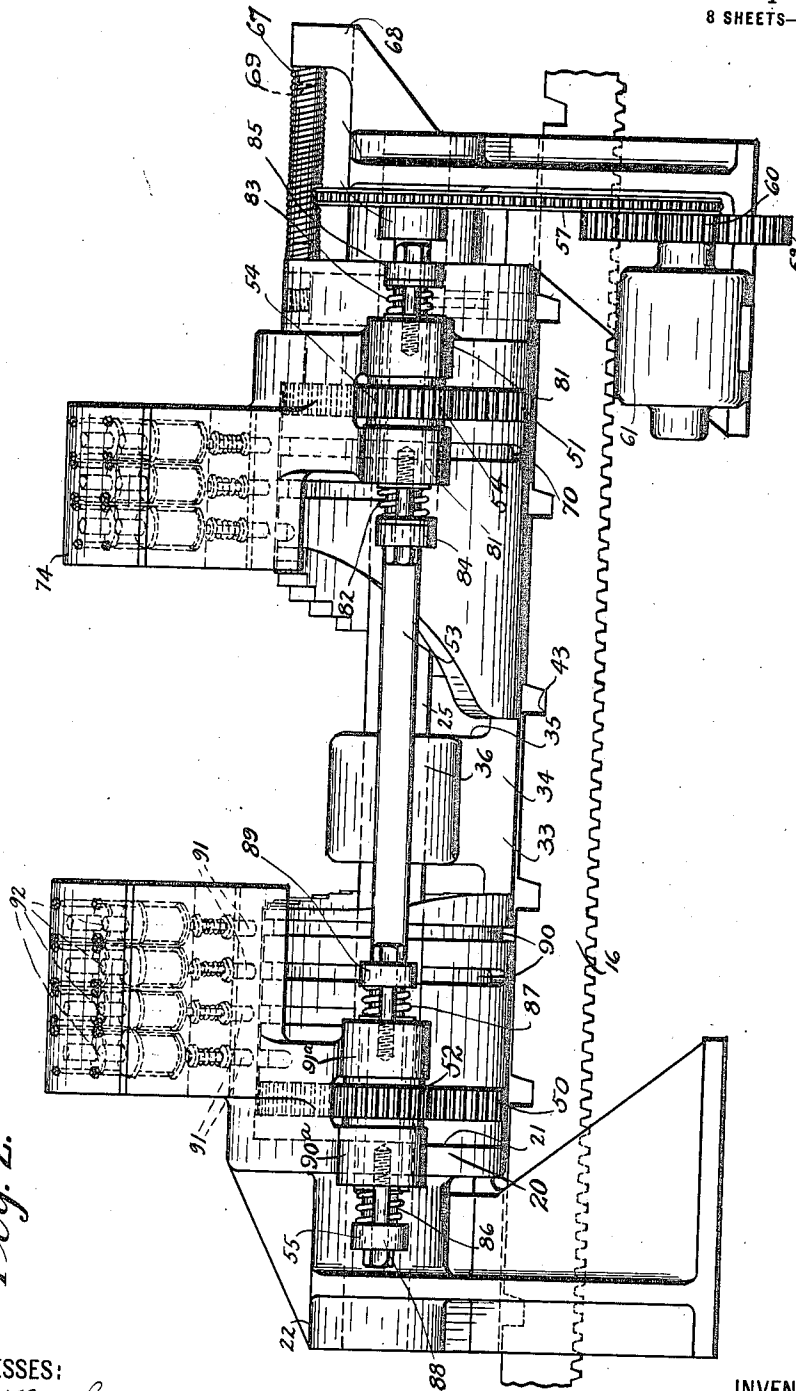
John D. Morgan

1,241,253.

J. D. MORGAN.
METAL WORKING MACHINE.
APPLICATION FILED APR. 25, 1914.

Patented Sept. 25, 1917.
8 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:
H. M. Bayles.
R. J. Pett

INVENTOR
John D. Morgan

1,241,253.

Patented Sept. 25, 1917.
8 SHEETS—SHEET 3.

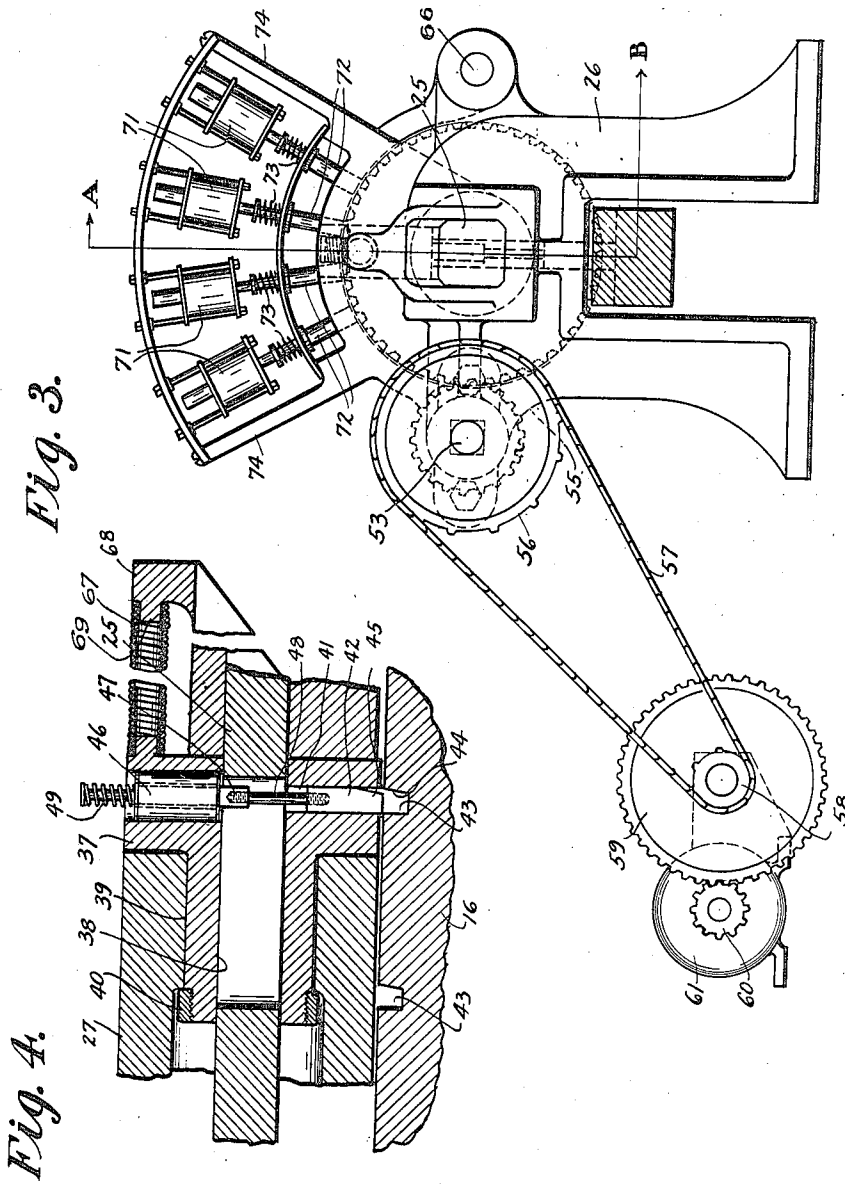


Fig. 4.

Fig. 3.

WITNESSES:
H. M. Bayles
R. J. Betts

INVENTOR
John D. Morgan

1,241,253.

Patented Sept. 25, 1917
8 SHEETS—SHEET 4.

Fig. 5.

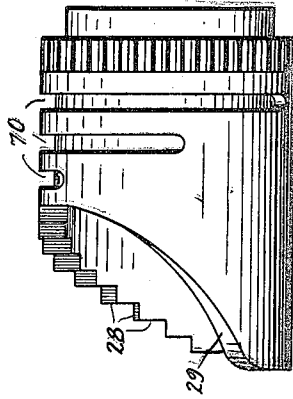


Fig. 8.

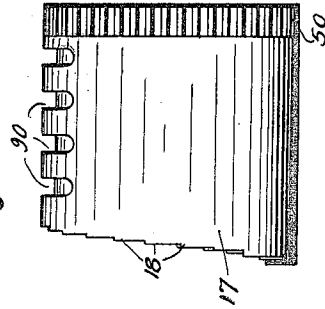


Fig. 7.

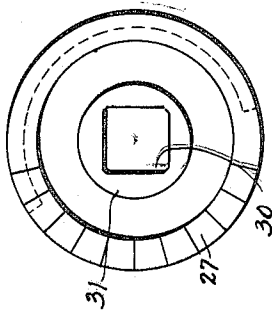


Fig. 10.

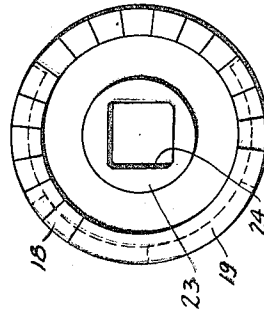


Fig. 6.

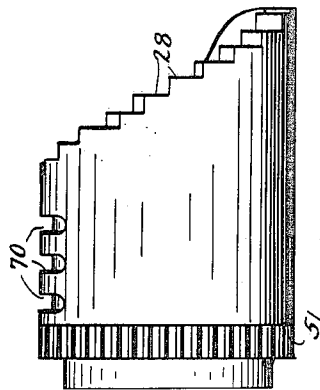
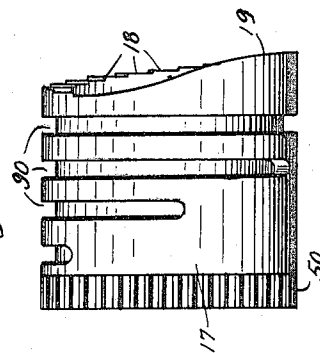


Fig. 9.



WITNESSES
Edw. C. Winters.
H. F. Fisher

INVENTOR
John D. Morgan

1,241,253.

Patented Sept. 25, 1917.

8 SHEETS—SHEET 5.

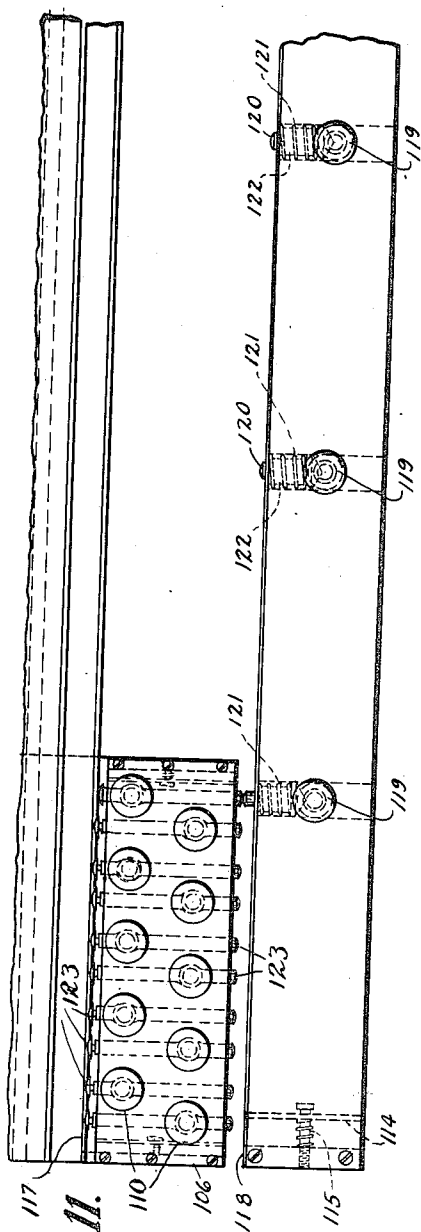


Fig. 11.

WITNESSES
H. M. Bayles
R. J. Pett

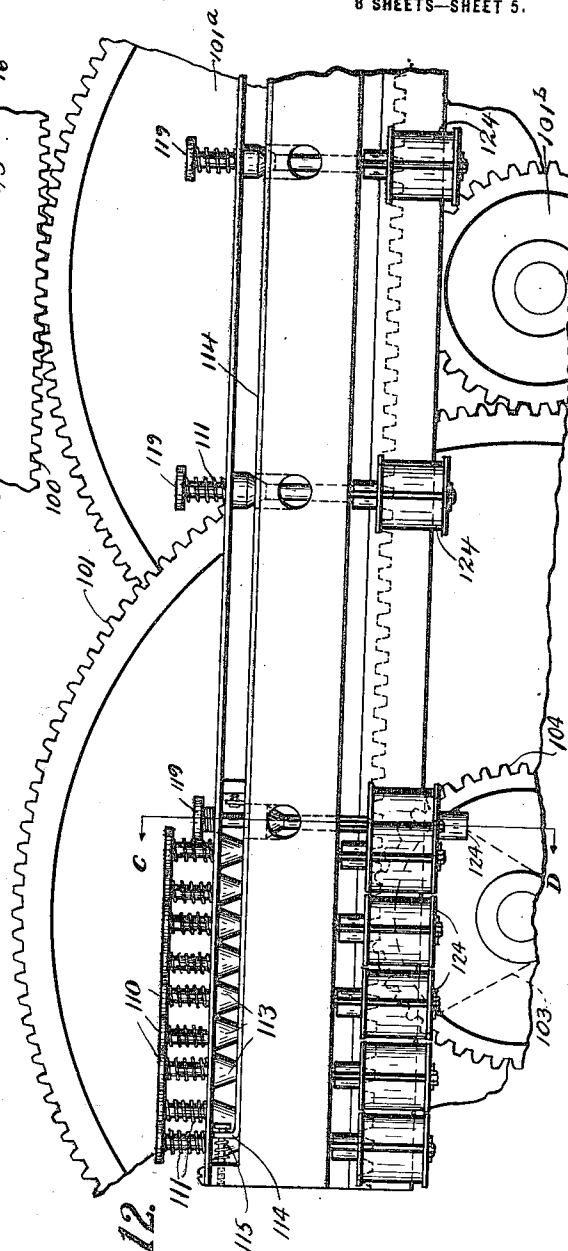


Fig. 12.

INVENTOR
John D. Morgan

1,241,253.

J. D. MORGAN.
METAL WORKING MACHINE.
APPLICATION FILED APR. 25, 1914.

Patented Sept. 25, 1917.
8 SHEETS—SHEET 6.

Fig. 14.

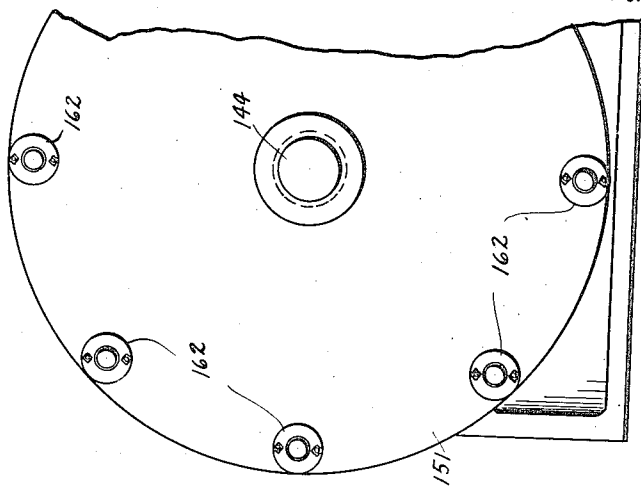
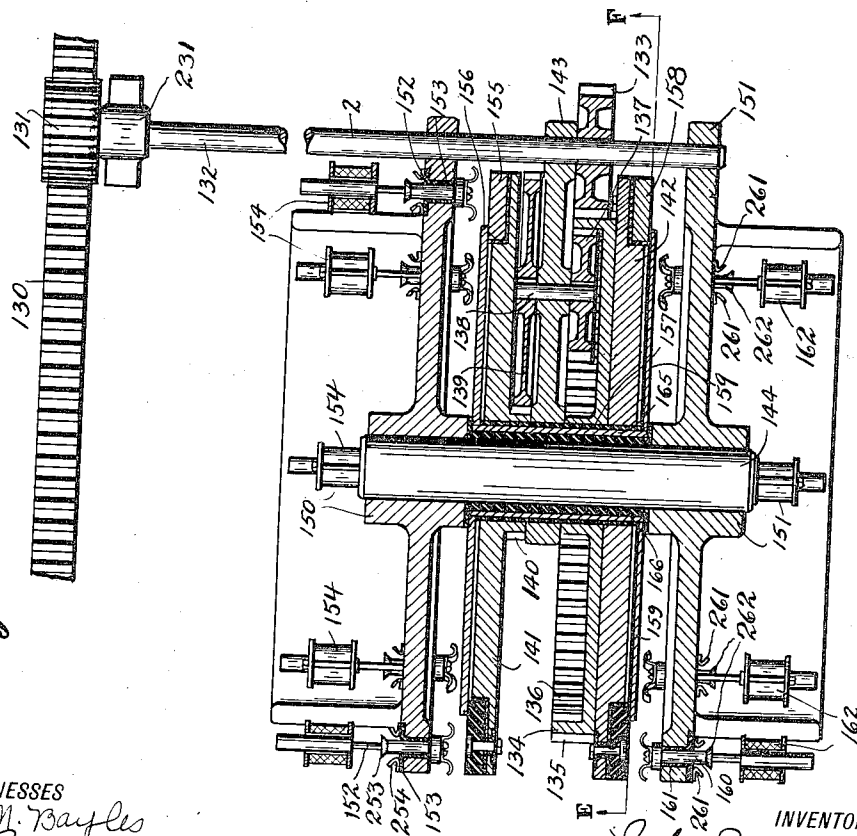


Fig. 13.



WITNESSES
H. M. Bayles
R. J. Berts

INVENTOR
John D. Morgan

1,241,253.

J. D. MORGAN.
METAL WORKING MACHINE.
APPLICATION FILED APR. 25, 1914.

Patented Sept. 25, 1917.
8 SHEETS—SHEET 7.

Fig. 16.

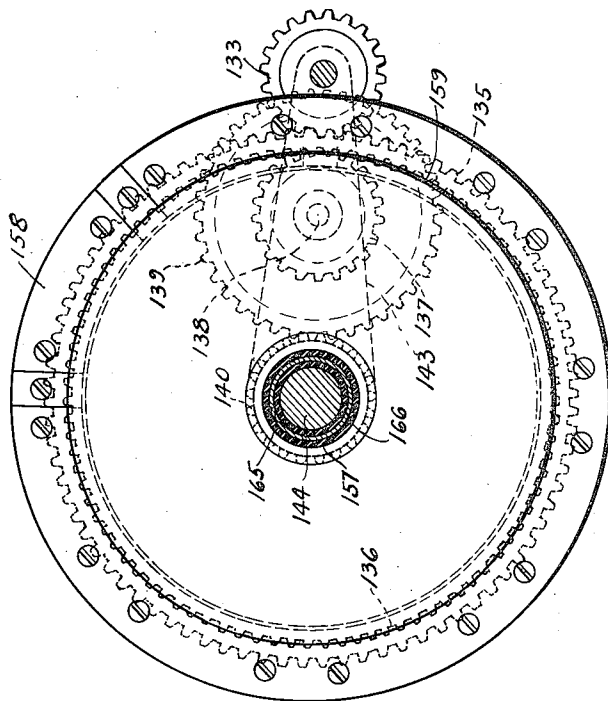
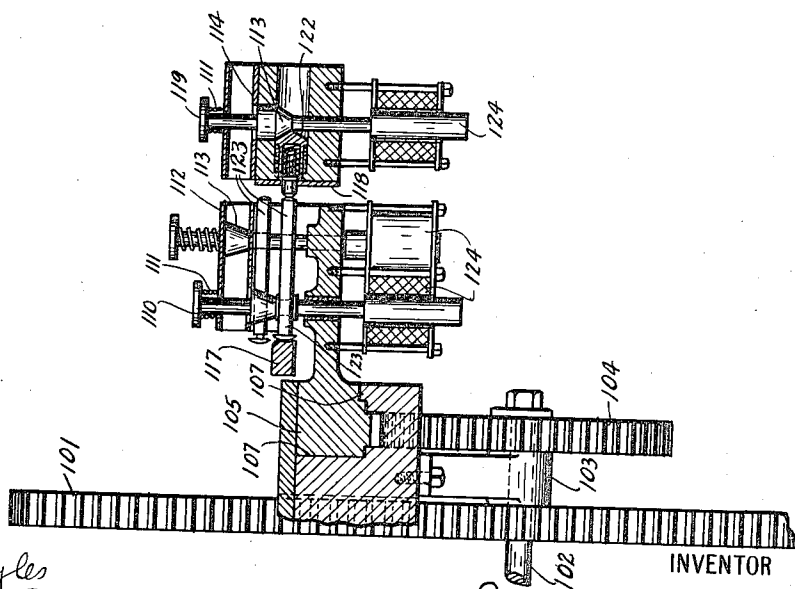


Fig. 15.



WITNESSES:

H. M. Bayles
R. J. Best

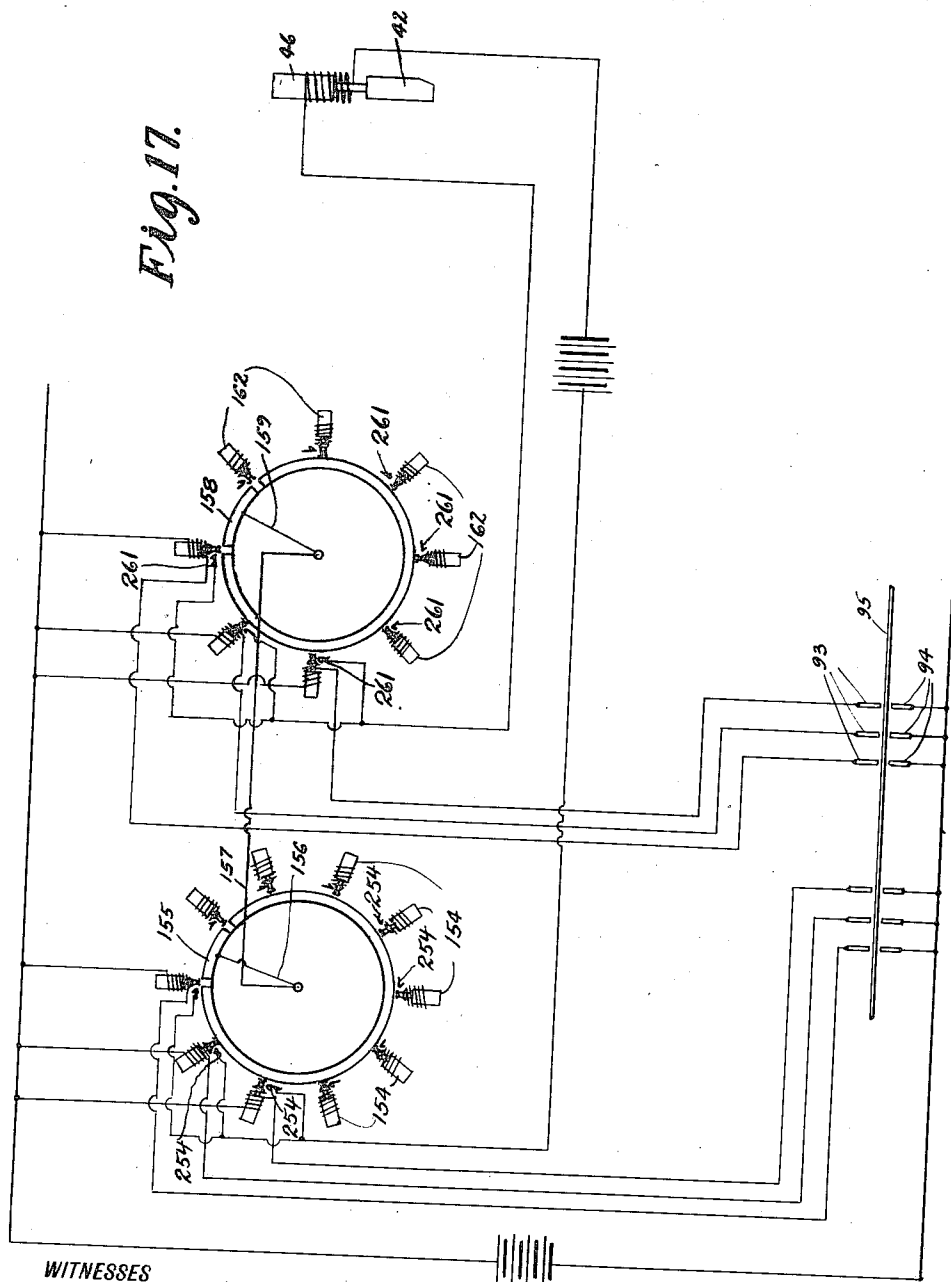
INVENTOR

John D. Morgan

1,241,253.

J. D. MORGAN.
METAL WORKING MACHINE.
APPLICATION FILED APR. 25, 1914.

Patented Sept. 25, 1917.
8 SHEETS—SHEET 8.



WITNESSES
H. M. Bayles
R. J. Bates

INVENTOR
John D. Morgan

UNITED STATES PATENT OFFICE.

JOHN D. MORGAN, OF SUMMIT, NEW JERSEY, ASSIGNOR TO STEEL UTILITIES,
INCORPORATED, A CORPORATION OF NEW YORK.

METAL-WORKING MACHINE.

Specification of Letters Patent. Patented Sept. 25, 1917.

1,241,253.

Application filed April 25, 1914. Serial No. 834,332.

To all whom it may concern:

Be it known that I, JOHN D. MORGAN, a citizen of the United States, and a resident of Summit, New Jersey, have made new and useful Improvements in Metal-Working Machines, of which the following is a specification.

The invention relates to machines for punching structural shapes, and more particularly to machines for traveling and successively stopping the shape in position to be punched at the desired points; and further, the invention provides for the precise stopping of the shape so that the punched rivet holes may be in the precise desired position; and further provides novel mechanism, for so traveling and stopping the shape. Further objects of the invention will in part be obvious, and in part will be set forth hereinafter.

The invention consists in the novel parts, constructions, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and forming a part hereof, illustrate one embodiment of the invention and, together with the description, serve to explain the principles thereof.

Of the drawings:

Figure 1 is a fragmentary plan of a machine embodying the invention;

Fig. 2 is a side elevation, on an enlarged scale, of a part of the distance determining device;

Fig. 3 is an end elevation looking to Fig. 2 from the right;

Fig. 4 is a fragmentary central section on the line A—B of Fig. 3.

Fig. 5 is a detail elevation of the cam side of the inch measuring or determining cylinder;

Fig. 6 is a side elevation of the step side of the inch measuring or determining cylinder;

Fig. 7 is an elevation looking at Fig. 5 from the right or Fig. 6 from the left;

Fig. 8 is a side elevation of the step part of the sixteenth-of-an-inch measuring or determining cylinder;

Fig. 9 is a side elevation of the cam side of the sixteenths-of-an-inch measuring or determining cylinder;

Fig. 10 is an end elevation, looking at Fig. 8 from the right or Fig. 9 from the left;

Fig. 11 is a fragmentary top plan of the feet and tens-of-feet control;

Fig. 12 is a side elevation looking at Fig. 11 from the foot, and showing additional parts;

Fig. 13 is a fragmentary horizontal central section of a rotary control for the feet and tens-of-feet;

Fig. 14 is a fragmentary elevation looking at Fig. 13 from the foot;

Fig. 15 is a transverse section on the line C—D of Fig. 12;

Fig. 16 is a section on the line E—F of Fig. 13; and

Fig. 17 is a wiring diagram for the feet and tens-of-feet determining mechanism controlled by a distance record sheet.

Referring to the accompanying drawings, illustrating by way of example one embodiment of the invention, means are provided for traveling and stopping structural shapes, such as an I-beam x , accurately in position with reference to the beam punching mechanism, so that the holes may be punched in the beam in positions corresponding to the settings or readings of the distance determining means. The punching mechanisms may be one or more in number, and as embodied, two punching mechanisms y and z are indicated generally by their housings, and are arranged longitudinally or in tandem along the pathway of the structural shape.

The invention is also embodied in connection with mechanism whereby the beam is urged or impelled forward, and is permitted or prevented from forward travel by the action of the distance determining means, although in its broader aspects it is applicable to other forms of forwarding means. In the embodied form of such means, a series of forwarding or progressing rollers 1 are arranged in a substantially horizontal series, (Fig. 1), the beam resting lengthwise thereon, and being propelled or impelled forward by its frictional and gravitational contact with the rolls. The rolls 1 are mounted in bearings 2. Fixed to the shafts of the rolls 1 are beveled gears 3, and intermeshing therewith are beveled pinions 4. Said pinions are fixed upon a shaft 5, rotatably mounted in bearings 6. The shaft 5 is driven in a suitable manner, as by a gear 7 fixed to the shaft 5, said gear being driven

by a pinion 8 on the shaft of a motor 9. So far as concerns many features of the invention, the motor 9 may be continuously run, or it may be started and stopped in suitable relation to the operation of the distance determining means, the stopping devices operating from the distance determining means, or manually by an operator, or being controlled from a distance record sheet.

The embodied form of means for permitting and preventing the progression of the shape x and the consequent successive positioning thereof relative to the tool equipped means to be punched thereby, comprises a head 15, against which the forward end of the beam x presses. The head 15 is fixed to a long, horizontally arranged rail or bar 16, extending backwardly alongside the shape or beam x . The present embodiment of the invention will be regarded as being arranged to operate for feet, inches and sixteenths of an inch.

In accordance with one feature of the invention, means are provided whereby the distance determining means operates between a surface in fixed permanent relation to the punching means and the rail or members traveling in definite relation to the work. In accordance with one aspect of the invention, distance determining means are provided engaging means on the rail or other traveling member or in other definite relation to the work, which distance determining means varies in size or extension in distance units. In accordance with one feature of the invention, such means are employed for the smaller distance units. In the embodied form said means varies by inches and sixteenths of an inch.

Further, in accordance with one feature of the invention, the member traveling with the shape or beam is provided with engaging devices spaced apart in distances equal to the larger distance values or denominations, and an interponent or stop is projected into the path of travel of such engaging means at such time as to engage a particular one of said engaging means to permit of the right distance, or degree of travel of the work corresponding to the particular setting or reading of the distance determining means. In accordance with one feature of the invention, not only is such interponent operated in such timed relation with respect to the travel of the engaging means, but the location of the interponent longitudinally of the travel of the beam is varied by the distance determining means to effect or provide for the lesser distance denominations or values of the particular reading or setting of the distance determining means.

In the embodied form of such means, and in accordance with one aspect of the invention, rotary means are provided, settable to vary the degree of extension of the distance

determining device to record or put into effect the inches and sixteenths of the particular setting or reading of the distance determining means. In the embodied form of such means, and considering first the cylinder for sixteenths of an inch, said cylinder 17 is provided upon its edge with a series of steps 18 varying in depth progressively by sixteenths of an inch. The edge of said cylinder is provided also with a cam surface 19 extending from the last or least step to the first or greatest, for the purpose of restoring the device as will be later described in detail. The opposite end of the cylinder 17 is formed in a true surface 20, which works against a bearing plate 21 in fixed relation to the abutment 22, the abutment 22 being firmly anchored in fixed position relatively to the punching means, or it may be fastened directly to or form a part of the housing for the punching mechanism. The cylinder 17 has a central cylindrical aperture. Within such cylindrical central aperture is a sleeve or bushing 23, externally of cylindrical form but having internally and longitudinally thereof a square aperture 24, the cylinder 17 thus being rotatable on the bushing 23. The square aperture 24 fits a squared shaft 25, which shaft is supported at one end in the bracket or abutment 22 and at the other end in a suitable bracket or abutment 26.

Mounted on the squared shaft 25, and longitudinally slidable thereon, is the inch cylinder 27. The cylinder 27 in its edge facing toward the sixteenths of an inch cylinder is provided with a series of inch steps 28, and has also formed in said edge a cam surface 29, said cam surface extending from the least or lowest step up to the first or highest step, for the purpose of restoring the mechanism to position. The cylinder 27, like the cylinder 17, is internally cylindrically apertured at 30. Within such cylindrical aperture is the sleeve or bushing 31 of cylindrical form externally, but being squarely apertured internally and longitudinally thereof to fit the squared shaft 25. The cylinder 27 is rotatable on bushing 31, and they both together are movable along shaft 25.

Between the cylinders 17 and 27 there is interposed, mounted on the shaft 25, a spacing device 33 for the purpose of maintaining clearance between the moving cylinders in all positions thereof. Said spacing device 33 comprises a longitudinal member 34, in endwise position between the steps 18 on the sixteenths of-an-inch cylinder and the steps 28 on the inch cylinder, and transmitting the thrust from the rack in a parallel line to the frame and with practically a negligible offset or leverage. From the longitudinal member 34 extends a supporting web 35, connected to a boss or enlarged

portion 36, embracing the squared shaft 25, and apertured to fit the shaft, so that the spacing device may have movement longitudinally of the shaft but not rotatably about the shaft.

The interponent carrying means, in its embodied form, comprises a ring 37, having a squared aperture 38 therein, which fits and embraces the squared shaft 25. Extending laterally or horizontally from the ring 37 is a part 39 exteriorly cylindrically shaped and internally having a squared aperture fitting the shaft 25. The inch cylinder 27 has its forward end internally cylindrically apertured to embrace and fit closely about the cylindrical part 39 of the interponent carrying member 37. A threaded ring or bushing 40, holds the inch cylinder and the interponent carriers firmly in exact position upon the shaft. Within the interponent carrying member 37 is an aperture 41 transversely of the direction of the shaft 25. Mounted within the aperture 41 is an interponent 42, slidable to and fro, whereby it may be withdrawn within the member 37, or projected therefrom to engage the rail 16.

The embodied form of engaging means of the rail 16 consists of recesses 43 cut in or formed in the upper surface of the rail 16. In the embodied form these recesses 43 are one foot apart. The contacting surface in the direction of travel 44 is beveled sufficiently to facilitate the withdrawal of the interponent, and the interponent 42 is shown correspondingly beveled at 45. In the embodied form of actuating means for the interponent, a solenoid 46 has its core 47 connected to the interponent 42 by a rod 48, and has a suitable restoring spring 49. The shaft 25 is shown slotted, and rod 48 extending through said slot. The solenoid 46 is controlled by settable means, which energize the solenoid at the proper time to project the interponent 42 into the proper recess 43 to give the right amount of travel to the rack 16 to correspond to the distance setting. A rod 69 slidable in bearings 68 and acted on by a spring 67 keeps the cylinders together.

Means are provided for controlling the rotation of the cylinders 17 and 27 to bring the proper steps 18 and 28 into line with the spacer 33 to give the proper distance or spacing between the face 21 and the interponent 42, that is required by the setting or reading of the distance determining means, the interponent 42 being then in such position longitudinally of the bar or rail 16, that when the interponent is projected in a recess 43 corresponding to the number of feet, the longitudinal position of the interponent along the path of travel of the rail 16 and of the work will give the correct position for the inches and sixteenths desired.

In the embodied form of means for rotating and stopping the cylinders 17 and 27, cylinder 17 is provided with a ring of gear teeth 50 extending circumferentially about the cylinder, and cylinder 27 is provided with a ring of gear teeth 51 likewise extending circumferentially about the cylinder. Meshing with the gear ring 50 is a pinion 52 splined on a shaft 53. Meshing with the gear ring 51 is a pinion 54 splined on the shaft 53. The shaft 53 is carried in brackets 55 fixed on the supports or journal blocks 22 and 26. The shaft 53 is driven in a suitable manner, the embodied form comprising a sprocket 56 carried by shaft 53 and driven by a sprocket chain 57 from a pinion 58. Fixed to rotate with pinion 58 is a gear 59 driven by a pinion 60 from the shaft of a motor 61.

The embodied form of means for controlling the degree or amount of rotation of the two cylinders 17 and 27 to position them for the required measurements is arranged to be operated from a distance record sheet, although so far as concerns many features of the invention, other forms of controlling means may be used.

As embodied there are provided in the external surface of the cylinder 17 a series of arcuate grooves 70 shown three in number. Coöperating with each of the grooves 70 is shown a series of four solenoids 71, the core of each solenoid being connected to a pin 72 arranged in line circumferentially along the corresponding grooves 70 and about the cylinder 27. Suitable restoring springs 73 are provided for retracting a projected or set pin 72. The solenoids are carried in a suitable supporting structure 74, mounted to travel with the cylinder 27 and the interponent ring, and having bearings on a shaft 66 and on the shaft 53.

The pinion 54 is held between bosses or lugs 81 extending out from the frame 74 and embracing the shaft 53 on either side of the pinion. A friction drive is provided for the pinion 54 comprising disks splined on shaft 53 and held to the pinion by springs 82 and 83, which embrace shaft 53 and act between heads 84 and 85 and the disks. Pinion 52 is similarly provided with a friction drive, comprising disks splined to shaft 53 and held to the pinion by springs 86 and 87 embracing shaft 53 and working between the disks and heads 88 and 89 fixed to the frame. Bosses or lugs 90^a and 91^a extend from the frame to hold pinion 52 in position. Thus each pinion 52 and 54 receives friction drive from shaft 53 independently of the other pinion, and each gives the proper amount of rotation to its cylinder, irrespective of the amount of rotation required for the other cylinder.

Suitable devices for positioning the cylinder 17 for the various successive distances

required are provided, and the embodied form thereof comprises means whereby the cylinder may be automatically controlled and set from the distance record sheet. In such embodied form four arcuate grooves 90 are formed circumferentially in the cylinder 17, and cooperating with each of the four grooves is a group of four solenoid-operated stop pins 91, the solenoids being indicated generally by reference numeral 92. The general form of these may be the same as for the inch cylinder 27 and further detailed description thereof is unnecessary.

The solenoids 71 and 92 may be regarded as being in circuit with pairs of contacts 93 and 94, between which runs the distance record or controlling sheet 95 (as shown in Fig. 17 for the mechanism illustrated in Figs. 13 and 14). One of the pins 72 on the inch cylinder and one of the pins 91 on the sixteenths-of-an-inch cylinder may be regarded as normally projected into the corresponding slots and thus maintaining the two cylinders in a rotational position corresponding to the maximum size or extension of the device as shown in Fig. 2. When the solenoid for the desired dimensions is operated, the corresponding pin is projected into its slot, and the holding pin previously referred to is retracted.

This releases the cylinder for a partial rotation corresponding to the set solenoid, through the action of the friction drive from shaft 53 through pinion 54. When the set or projected pin 72 reaches the end of its slot, the cylinder 27 is brought to rest with one of the steps 28 in line with the spacing piece 34. If the distance setting involves sixteenths of an inch, cylinder 17 has been rotated and set in like manner by the solenoids 92, bringing the desired step into alignment with the spacer 34. The interponent 42 is thus moved forward or back along the direction of travel of the shape x and so positioned as regards the inches and fractions thereof of the required distance reading, and it is projected in timed relation to the proper notch or recess 43 in the rail 16 by mechanism and in a manner hereafter to be described. Successive settings are effected in the same way, and when a successive setting passes the foot mark or unit, the rotation of the cylinders brings the cam faces 19 and 29 in contact with the spacing piece 34. The cylinder 17 need have no longitudinal movement along the shaft 25, but the cam 19 will move the spacer 33 along shaft 25 substantially a distance of one inch. The cam 29 acting upon the end of the spacer 33 will shift cylinder 27 to the right (Fig. 2) a distance of substantially thirteen inches, against the spring 67. The rotation may continue past such point, if required by the reading or setting to the proper inch and sixteenths.

The form of means for controlling the action of the interponent 42 illustrated in Figs. 11, 12 and 15 comprises a settable traveling device having settings representing feet, said device traveling proportionately to the travel of the shape x . As embodied, the rack or rail 16 is provided on the underside with gear teeth 100 meshing through suitable intermediates 101^a and 101^b with a gear wheel 101, having a shaft 102 supported in a bracket 103 upon the machine frame. Fixed to shaft 102 is a pinion 104, which pinion meshes with a rack 105. The rack 105 is supported in suitable guides and connects to the traveling device 106, which is supported in a guide-way 107 arranged longitudinally along the frame.

The device 106 is provided with a series of keys, ten in number, corresponding to the units of feet. Keys 110 are provided with restoring springs 111 coiled about the key stems between the key head and the top plate 112. Upon each key stem is a conoidal portion 113, having the smaller end thereof at the bottom. Just below the bottom of the conoidal portion on the retracted or unset key is a sliding spring-pressed plate 114 impelled to the right in Fig. 12 by springs 115. The plate 114 is provided with apertures through which the key stems project, said apertures being of a size sufficient to pass the large ends of the conoidal portions 113. Spring 115 pushes the plate 114 to one side so that the key stems are at one side of the aperture.

As a key is depressed, the conoidal portion entering the aperture in the plate 114 moves the plate against spring 115 until the large part of the conoidal portion 113 has passed therethrough. Thereupon springs 115 slide plate 114 again so as to catch the flat face above the conoidal portion 115 and hold the depressed keys in position. When another key is set, the small end of the conoidal portion thereof passing through the aperture in the plate 114 again moves the plate as the conoidal portion passes therethrough, and just as the large part of the stem of the key being set passes through the plate, the preceding set key is released by the aperture in plate 114 passing into register with the large end of its conoidal portion 113.

Along one side of the path of travel of the carrier 106 is a bus bar 117, in circuit with the solenoid 46 of the interponent 42. Upon the opposite side of the path of travel of the carrier 106 is another bus bar 118 likewise in circuit with the solenoid 46. Arranged along the bus bar 118 are a series of settable keys 119, representing in the embodied form tens of feet. The keys 119 may be generally similar in construction and manner of action to the keys 110 and corresponding reference numerals have been applied thereto. The

supports for the keys 119 are apertured and in said apertures are mounted slidable spring pressed contacts 120. Said contacts 120 are impelled to a retracted position by springs 121. The rear portion of the contact pieces 120 are beveled, as shown at 122, to cooperate with the conoidal portions of the key stems 119. The contacts themselves may have their contact points spring mounted within the body of the contact piece as shown in Fig. 15. When one of the keys 119 is depressed the conoidal portion 113 cams out the corresponding contact 120 so that it is in electrical contact with bus bar 118 and in position to engage a set contact on the traveling carrier 106. Each of the keys 110 is provided with a transversely extending contact piece 123 (Figs. 11 and 15), adapted when the key is set to pass into contact with bus bar 117 and so travel along as the carrier 106 progresses. Such set contact piece 123 also is in position to engage any set contact piece 120, and thus close the circuit and energize the solenoid 46 of the interponent 42.

The various keys are shown equipped with solenoids 124 which may be controlled through suitable circuits from the distance record sheet 95.

The manner of operation of the mechanism shown and described is substantially as follows:

The setting for inches and fractions of an inch have already been described. The desired key 110 and key 119 are depressed or set either manually, or automatically from the distance record sheet, to correspond to the desired or required distance. By such setting the corresponding transverse contact piece 123 has been moved downward into contact with the bus bar 117 and into alignment or level with the set contact 120. Thus when the carrier 106 in its travel brings contact piece 123 into contact with the set contact piece 120, the circuit will be completed, and solenoid 46 will be energized to throw the interponent 42 into the next notch 43. Thus the action of the interponent 42 is in such timed relation to the traveled beam or shape and the passing of recesses 43 that the proper recess 43 will be engaged by the interponent to correspond to the distance setting of the keys 110 and 119 of the distance determining device.

The setting of the keys 110 will represent the feet from zero to 9 and the keys 119 may each be regarded as representing tens of feet from zero to the desired maximum number. Thus, if the key for five units be set on the carrier 106, its contact piece 123 will connect with the bus bar 117. If the zero key of the keys 119 is not set the set key or carrier 106 will pass it after the work has traveled five feet (inches and fractions thereof being disregarded at present). If

the next key 119 is not set, as the carrier 106 passes along the circuit will not be closed at fifteen feet, and the work will continue traveling. If, however, the next succeeding key which would correspond to the "two" of the "tens of feet" denomination has been set, its contact 120 will be projected so as to close the circuit with the contact piece 123 of the set key for five units of feet, and thus after twenty-five feet of travel the solenoid 46 will be actuated and the interponent 42 set in accordance with the keyboard setting or reading of 25 feet. If on the carrier 106 the nine key had been set, the solenoid would be actuated four feet later or after twenty-nine feet of travel. The joint action of the inches and fractions herewith will be clearly understood without further explanation.

In Figs. 13 and 14 a rotary setting or controlling means for the feet and tens of feet is shown.

As embodied, a rack 130, which is moved forward by the beam or shape on the rolls, meshes with pinion 131 on shaft 132, said shaft rotating in bearing 231 and in bearings in housings 150 and 151. Pinion 133, also on shaft 132 meshes with external teeth 135 on an internally and externally toothed gear ring 134. Internal teeth 136 on gear ring 134 mesh with pinion 137 fixed on shaft 138, which shaft is carried on arm 143, which arm is supported on bushing 157 and on shaft 132. Gear 139 is fixed on the opposite end of shaft 138. Gear 139 meshes with teeth 140 on the hub of disk 141. Disk 141, gear 134 and disk 142 are rotatively mounted on, but electrically insulated by bushing 165 from shaft 144, which shaft is fixed in the housings 150 and 151. Housing 150 carries ten contact plungers or pins 152, mounted in insulating bushings 153. Plungers 152 are equally spaced circumferentially around the face of housing 150, and the spaces represent feet of travel of rack 130 and the shape x , as measured by travel of disk 141. On the insulating bushings 153 are a series of open contacts 254, which are closed by enlargements 253 on the plungers 152 (see especially Figs. 13 and 17).

The contact plungers or pins 152 are set by solenoids 154, which solenoids are supported on housing 150. On disk 141 is mounted a copper segment 155, insulated therefrom, but having electrical contact with disk 156 which is fixed to sleeve 157. Said sleeve 157 is internally insulated from shaft 144 by bushing 165, and externally insulated from disk 141, arm 143, gear 134 and disk 142 by bushing 166.

Disk 142 carries a copper segment 158 electrically connected with disk 159 which is fixed to sleeve 157.

Contact plungers or pins 160 are mounted in insulating bushings 161, carried in housing 151. Said pins 160 are actuated by

means of solenoids 162. On the insulating bushings 161 are a series of open contacts 261, which are closed by enlargements 262 on the plungers 160 (see especially Figs. 13 and 17.)

Contact plungers 160 are equally spaced circumferentially on face of housing 151 the spaces representing tens of feet of travel of rack 130.

Referring to Figs. 13 and 17, the operation of the timer is as follows:

Suppose a distance of thirty-three feet is to be traveled or measured before the circuit is closed for the interponent 42 or other distance determining device. The key representing the distance three of keys 152 and the key representing the distance thirty of keys 160 are set on the keyboard or the corresponding contacts are made by means of the perforated distance record strip 95, causing current to flow through one of the solenoids 154, which depresses or sets the three foot contact key or plunger 152, and one of the solenoids 162, which depresses or sets the thirty foot contact key or plunger 160. The closing of the contacts 254 and 261 corresponding to the set plungers 152 and 160, respectively, energizes the contact points carried by these respective plungers, in position to complete the circuit when the contact points on both set plungers 152 and 160 simultaneously are in contact with their respective rotating segments 155 and 158. The timer is now set and the rack 130 is made to move forward driving pinion 131, from which the movement is transmitted through the gearing already described, turning disk 141 one revolution for each ten feet of rack travel, and turning disk 142 one revolution for each one hundred feet of rack travel.

Disk 141 will make contact between the copper segment 155 and the three foot contact plunger when the rack 16 has moved three feet, when it has moved thirteen feet, twenty-three feet and thirty-three feet, and disk 142 whose copper segment 158 is electrically connected in series with segment or disk 141, will make contact when the rack 16 has moved thirty feet. When the three foot contact is made closing the gap in series with the thirty foot contact, the electrical devices are actuated to actuate interponent 42 by means of solenoid 46, or per-nated distance of thirty-three feet.

From all the foregoing it will be understood that a machine has been provided realizing and embodying the objects and advantages stated together with other objects and advantages. It will be understood also that changes may be made from the illustrated and described form within the scope of the accompanying claims without departing from the principles of the

invention and without sacrificing its chief advantages.

What I claim as my invention, and desire to secure by Letters Patent, is:—

1. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members varying in size by distance unit changes.

2. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including settable members variable in length by distance unit changes and means for setting said members for the desired distances.

3. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members varying in size by fractional distance unit changes.

4. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including settable members variable in length by fractional distance unit changes and means for setting said members for the desired distances.

5. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members varying in size both by distance units and fractions of a distance unit.

6. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members varying in length both by distance units and fractions of a distance unit.

7. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members varying in size both by distance units and fractions of a distance unit, and means for setting said members for the desired combination of distance units and fractional part of a distance unit.

8. A machine for punching structural shapes including in combination punching

means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members movable relatively to each other to change their size by distance unit changes.

9. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members movable relatively to each other to change their length by distance unit changes.

10. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members movable relatively to each other to change their length both by distance unit changes and a desired fraction of such distance unit.

11. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby said means including members movable relatively to each other to change their size by distance unit changes, and settable devices for controlling the relative movement of said members to effect the desired distance setting.

12. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby said means including members movable relatively to each other to change their size by distance unit changes, and settable devices, including a distance record device, for controlling the relative movement of said members to effect the desired distance setting.

13. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members movable relatively to each other to change their size also by distance unit changes, a desired fraction of such distance unit, and settable devices including a distance record device for controlling the relative movement of said members to effect the desired combined distance setting of unit and fraction of a unit.

14. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members movable relatively to each other to change their length both

by distance unit changes and a desired fraction of such distance unit, and settable devices including a distance record device for controlling the relative movement of said members to effect the desired combined distance setting of unit and fraction of a unit.

15. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including settable members variable in size by distance unit changes and electrically operated means for setting said members for the desired distances.

16. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members varying in size both by distance units and fractions of a distance unit, and electrically operated means for setting said members for the desired combination of distance units and fraction and fractional part of a distance unit.

17. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby said means including members movable relatively to each other to change their size by distance unit changes, and settable devices including a distance record device and electrical connections therefrom for controlling the relative movement of said members to effect the desired distance setting.

18. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their length by distance unit changes.

19. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their size both by distance units and fractions of a unit.

20. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their size and settable means for controlling such rotation.

21. A machine for punching structural shapes including in combination punching

means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their size and electrically operated settable means for controlling such rotation.

22. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their size and settable means including a distance record device for controlling such rotation.

23. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their size and settable means including a distance record device and electrical connections therefrom for controlling such rotation.

24. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their length both by distance units and a desired fraction of a distance unit and settable means for controlling such rotation.

25. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their length both by distance units and a desired fraction of a distance unit and electrically operated settable means for controlling such rotation.

26. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their length both by distance units and a desired fraction of a distance unit and settable means including a distance record device for controlling such rotation.

27. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including members rotatable relatively to each other to change their length

both by distance units and a desired fraction of a distance unit and settable means including a distance record device and electrical connections therefrom for controlling such rotation.

28. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby said means including a plurality of independently movable members which by their combined movement vary their length by distance units.

29. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby said means including a plurality of independently movable members which by their combined movement vary their size by distance units and a desired fraction of a distance unit.

30. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby said means including a plurality of independently movable members which by their combined movement vary their size by distance units, and settable means for controlling the movement of said members.

31. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby said means including a plurality of independently movable members which by their combined movement vary their size by distance units, and settable means including a distance record device for controlling the movement of said members.

32. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including a plurality of independently rotatable members which by their combined movement vary their size by distance values.

33. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including a plurality of independently rotatable members which by their combined movement vary their size by distance units and a desired fraction thereof, and settable means for controlling such rotation.

34. A machine for punching structural shapes including in combination punching

70

75

80

85

90

95

100

105

110

115

120

125

130

means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including a plurality of independently rotatable members which by their combined movement vary their size by distance values, and settable means including a distance record device for controlling such rotation.

35. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including a plurality of independently rotatable members which by their combined movement vary their size by distance units and a desired fraction thereof, and settable means including a distance record device and electric means cooperating therewith for controlling such rotation.

36. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device being variable in extension between said fixed surface and said engageable means traveling with the work.

37. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device being variable in extension by distance unit dimensions between said fixed surface and said engageable means traveling with the work.

38. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device being variable in extension between said fixed surface and said engageable means traveling with the work, and settable means for varying the extension of said device.

39. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said

means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device being variable in extension between said fixed surface and said engageable means traveling with the work, and settable means including a distance record device for varying the extension of said device.

40. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device being variable in extension by distance units and a desired fraction of a distance unit and settable means for varying the extension of said device.

41. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device being variable in extension by distance units and a desired fraction of a distance unit and settable means including a distance record device for varying the extension of said device.

42. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts movable relatively to each other to vary the extension of said device between said fixed surface and said engageable means traveling with the work.

43. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts movable relatively to each other to vary by distance unit intervals the extension of said device between said fixed

surface and said engageable means traveling with the work.

44. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts movable relatively to each other to vary by intervals of distance units and a desired fraction of a distance unit the extension of said device between said fixed surface and said engageable means traveling with the work.

45. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts movable relatively to each other to vary by distance unit intervals the extension of said device between said fixed surface and said engageable means traveling with the work, and automatic means for controlling the movement of said relatively movable parts.

46. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts movable relatively to each other to vary by distance unit intervals the extension of said device between said fixed surface and said engageable means traveling with the work, and settable means for controlling the movement of said relatively movable parts.

47. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts movable relatively to each other to vary by distance unit intervals the extension of said device between said fixed

surface and said engageable means traveling with the work, and settable means including a distance record device for controlling the movement of said relatively movable parts.

48. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts movable relatively to each other to vary by distance unit intervals the extension of said device between said fixed surface and said engageable means traveling with the work, including a distance record device and electrical devices cooperating therewith.

49. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts rotatable relatively to each other to vary the extension of said device between said fixed surface and said engageable means traveling with the work.

50. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts rotatable relatively to each other to vary the extension of said device between said fixed surface and said engageable means traveling with the work, and settable means for controlling the rotation of said parts.

51. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts rotatable relatively to each other to vary the extension of said device between said fixed surface and said engageable means traveling with the work, and auto-

matic means for controlling the rotation of said parts, including a distance record device.

52. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts independently rotatable to vary the extension of said device between said fixed surface and said engageable means traveling with the work, and means automatically controlling the rotation of said parts.

53. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts independently rotatable to vary the extension of said device between said fixed surface and said engageable means traveling with the work, and means automatically controlling the rotation of said parts, said controlling means comprising a distance record device.

54. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts, one of said parts representing units of one distance denomination and another of said parts representing fractions thereof, said parts being independently movable to vary the extension of said device between said fixed surface and said engageable means traveling with the work, and settable means controlling the movement of said parts.

55. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a

plurality of parts, one of said parts representing units of a distance denomination and another of said parts representing fractions thereof, said parts being independently rotatable to vary the extension of said device between said fixed surface and said engageable means traveling with the work.

56. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising a plurality of parts, one of said parts representing units of a distance denomination and another of said parts representing fractions thereof, said parts being independently rotatable to vary the extension of said device between said fixed surface and said engageable means traveling with the work, and means automatically controlling the rotation of said parts, said controlling means comprising a distance record device.

57. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device including a plurality of rotatable cylinders having graduated edges representing distance values and means for permitting and preventing the rotation of said cylinders.

58. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device including a plurality of rotatable cylinders having graduated edges representing distance values, and settable means for permitting and preventing the rotation of said cylinders.

59. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the shape, and a device in definite relation to a fixed surface for engaging said engageable means to position the shape relatively to the work, said device comprising

a plurality of parts having stepped edges, said steps representing units of a distance denomination on one part and fractions thereof on another part, said parts being independently movable to vary the extension of said device between said fixed surface and said engageable member traveling with the work.

60. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work, settable means corresponding to distance values, and an interponent engaging said engageable means at a point in its travel corresponding to the distance for which said settable devices were set.

61. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work, settable means corresponding to distance values, and an interponent engaging said engageable means at a time in its travel corresponding to the distance for which said settable devices were set.

62. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, settable means corresponding to distance values, and an interponent engaging selectively one of said spaced members at a point in the travel of said engaging means corresponding to the distance for which said settable means were set.

63. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, settable means corresponding to distance values, and an interponent engaging selectively one of said spaced members at a time in the travel of said engaging means corresponding to the distance for which said settable means were set.

64. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said

means including engageable means traveling with the work, settable means corresponding to distance values, and an interponent engaging said engageable means at a point in its travel corresponding to the distance for which said settable devices were set, and means representing distance values settable to determine the point at which said interponent shall engage said engaging means.

65. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work, settable means corresponding to distance values, and an interponent engaging said engageable means at a point in its travel corresponding to the distance for which said settable devices were set, and means representing distance values settable to determine the time at which said interponent shall engage said engaging means.

66. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work, and settable distance determining means comprising a fixed member, an interponent, means for varying the position of said interponent relatively to said fixed member, and means for causing said interponent to engage said engageable means at a point corresponding to the distance setting of the determining means.

67. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, and settable distance determining means comprising a fixed member, an interponent, means for varying the position of said interponent relatively to said fixed member, and means for causing said interponent to engage selectively one of said spaced members of said engageable means corresponding to the setting of the distance determining means.

68. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, and settable distance determining

means comprising a fixed member, an interponent, means for varying the position of said interponent relatively to said fixed member by distance unit degrees, and means for causing said interponent to engage selectively one of said spaced members of said engageable means corresponding to the setting of the distance determining means.

69. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, and settable distance determining means comprising a fixed member, an interponent, means for varying the position of said interponent relatively to said fixed member by distance unit degrees and fractions thereof, and means for causing said interponent to engage selectively one of said spaced members of said engageable means corresponding to the setting of the distance determining means.

70. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work, settable means corresponding to distance values, and an interponent engaging said engageable means at a point in its travel corresponding to the distance for which said settable devices were set.

71. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work, settable means corresponding to distance values, a distance record device automatically controlling said settable means, and an interponent engaging said engageable means at a point in its travel corresponding to the distance for which said settable devices were set.

72. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, and settable distance determining means comprising a fixed member, an interponent, means for varying the position of said interponent relatively to said fixed member, and means for causing said interponent to engage selectively one of said spaced members

of said engageable means corresponding to the setting of the distance determining means.

73. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, an interponent adapted to selectively engage said spaced members, a plurality of distance determining members movable relatively to each other to move said interponent parallel to the line of travel of the work amounts equal to the lesser distance units and fractions thereof, and means for causing the interponent to engage a selected spaced member on said engageable means.

74. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, an interponent adapted to selectively engage said spaced members, a plurality of distance determining members movable relatively to each other to move said interponent parallel to the line of travel of the work amounts equal to the lesser distance units and fractions thereof, and means for causing the interponent to engage a selected spaced member on said engageable means, and automatic means for controlling the movement of said distance determining members and the engagement of said interponent.

75. A machine for punching structural shapes including in combination punching means, and means for successively traveling and stopping the shape relatively to the punching means to be punched thereby, said means including engageable means traveling with the work and comprising a plurality of members spaced distance units apart, an interponent adapted to selectively engage said spaced members, a plurality of distance determining members movable relatively to each other to move said interponent parallel to the line of travel of the work amounts equal to the lesser distance units and fractions thereof, and means for causing the interponent to engage a selected spaced member on said engageable means, and automatic means including a distance record sheet for controlling the movement of said distance determining members and the engagement of said interponent.

76. A machine for punching structural shapes including in combination shape punching means and means for progressing and stopping a shape, said means comprising

ing a member in fixed relation to the punch, a member in fixed relation to the shape, and devices interposed therebetween variable in size to correspond to various distance settings.

77. A machine for punching structural shapes including in combination shape punching means and means for progressing and stopping a shape, said means comprising a member in fixed relation to the punch, a member in fixed relation to the shape, and devices interposed therebetween variable in size to correspond to various distance settings, and settable means for varying the size of said devices.

78. A machine for punching structural shapes including in combination shape punching means and means for progressing and stopping a shape, said means comprising a member in fixed relation to the punch, a member in fixed relation to the shape, and devices interposed therebetween variable in size to correspond to various distance settings, and automatically settable means for varying the size of said device.

79. A machine for punching structural shapes including in combination shape punching means and means for progressing and stopping a shape, said means comprising a member in fixed relation to the punch, a member in fixed relation to the shape, and devices interposed therebetween variable in fixed relation to said punch and said member in fixed relation to said shape, and means for varying said extension to correspond to different distance settings.

80. A machine for punching structural shapes including in combination shape punching means and means for progressing and stopping a shape, said means comprising a member in fixed relation to the punch, a member in fixed relation to the shape, and devices interposed therebetween variable in extension between said member in fixed relation to said punch and said member in fixed relation to said shape, and settable means for varying the extension of said device.

81. A machine for punching structural shapes including in combination shape punching means and means for progressing and stopping a shape, said means comprising a member in fixed relation to the punch, a member in fixed relation to the shape, and devices interposed therebetween variable in size to correspond to various distance settings and means automatically set by a distance record device for varying the size of said devices.

82. A machine for punching structural shapes including in combination shape punching means and means for progressing and stopping a shape, said means comprising a distance determining device acting di-

rectly between the shape and a member in fixed relation to said punch.

83. In a shape punching machine, punching mechanism and a distance determining device having a plurality of members traveling in fixed but different ratios to the travel of the work and cooperating to determine the position of the shape for punching.

84. In a shape punching machine, punching mechanism and a distance determining device having a plurality of members traveling in fixed but different ratios to the travel of the work and cooperating to determine the position of the shape for punching, and settable means for determining such point of cooperation.

85. In a shape punching machine, punching mechanism and a distance determining device having a plurality of members traveling in fixed but different ratios to the travel of the work, said ratios corresponding to the various distance denominations and cooperating to determine the position of the shape for punching and settable means for determining such point of cooperation.

86. In a shape punching machine, punching mechanism and a distance determining device having a plurality of circuit controlling devices connected in series and traveling proportionately to the shape and to the distance denominations to control the distance determining means.

87. In a shape punching machine, punching mechanism and a distance determining device having a plurality of circuit controlling devices traveling proportionately to the shape and to the distance denominations to control the distance determining means.

88. A machine for punching structural shapes, including in combination punching devices and means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member.

89. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape, and another member traveling with the shape and adapted to engage and disengage said first mentioned member, and means for causing such engagement of said members after a selected distance of travel of the shape.

90. A machine for punching structural shapes, including in combination punching devices and means for successively traveling and stopping the shape relatively to the punching devices, said means including a movable member not traveling with the

shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member while said first mentioned member is at rest.

5 91. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a movable member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member, and means for causing such engagement of said members after a selected distance of travel of the shape while said first mentioned member is at rest.

10 92. A machine for punching structural shapes, including in combination punching devices and means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage said first mentioned member after the shape has traveled a selected number of units of one distance denomination.

15 93. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member and means for controlling the engagement of said members.

20 94. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member and settable means controlling the engagement of said members.

25 95. A machine for punching structural shapes, including in combination punching devices, and means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member and a distance record device for controlling the engagement of said members.

30 96. A machine for punching structural shapes, including in combination punching devices and means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and

another member traveling with the shape and adapted to engage and disengage said first mentioned member, a distance record device, and connections therefrom for electrically controlling the engagement of said members.

35 97. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member, means for causing such engagement of said members after a selected distance of travel of the shape and means for controlling the engagement of said members.

40 98. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member, means for causing such engagement of said members after a selected distance of travel of the shape and settable means controlling the engagement of said members.

45 99. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member, and means for causing such engagement of said members after a selected distance of travel of the shape and a distance record device for controlling the engagement of said members.

50 100. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage and disengage said first mentioned member, and means for causing such engagement of said members after a selected distance of travel of the shape, a distance record device, and connections therefrom for electrically controlling the engagement of said members.

55 101. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member

not traveling with the shape and another member traveling with the shape and adapted to engage said first mentioned member after the shape has traveled a selected number of units of one distance denomination, and means for controlling the engagement of said members.

102. A machine for punching structural shapes, including in combination punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage said first mentioned member after the shape has traveled a selected number of units of one distance denomination and settable means controlling the engagement of said members.

103. A machine for punching structural shapes, including in combination, punching devices, means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage said first mentioned member after the shape has traveled a selected number of units for one distance denomination and a distance record device for controlling the engagement of said members.

104. A machine for punching structural shapes, including in combination punching devices and means for successively traveling and stopping the shape relatively to the punching devices, said means including a member not traveling with the shape and another member traveling with the shape and adapted to engage said first mentioned member after the shape has traveled a selected number of units of one distance denomination, a distance record device, and connections therefrom for electrically controlling the engagement of said members.

105. A machine for punching structural shapes at predetermined points, including in combination punching mechanism, a plurality of engageable devices arranged distance

units apart and traveling with the work, and a stationary engaging device, and selectively settable means for causing the stationary engageable device to engage a desired traveling engageable device.

106. A machine for punching structural shapes at predetermined points, including in combination punching mechanism, a plurality of engageable devices arranged distance units apart and traveling with the work, a stationary engaging device and means for timing such engagement to select the engaging device corresponding to the desired distance of travel of the shape, said stationary engaging device stopping the work by its engagement with the selected traveling engageable device.

107. In a punching machine, the combination with punching mechanism, of a distance-determining device having a plurality of selectively settable circuit-controlling devices in series in a circuit, means for closing the set circuit-controlling devices in harmony with the traveling work, all said set-controlling devices being simultaneously closed when the work has traveled the desired set distance.

108. In a punching machine, the combination with punching mechanism, of a distance-determining means having a plurality of groups of circuit-controlling devices, each group representing a distance denomination or a sub-multiple thereof, the circuit-controlling devices of the various groups being selectively settable and being in series, means for closing said selected circuit-controlling devices in harmony with the travel of the work, all the selected controlling devices simultaneously closing and completing the circuit when the work has traveled the desired selected distance.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

JOHN D. MORGAN.

Witnesses:

LOUISA LOEHR,
ALAN M. JOHNSON.