

E. V. WURTS.
METAL WORKING MACHINE.
APPLICATION FILED JAN. 28, 1914.

Patented Feb. 6, 1917.

1,214,983.

5 SHEETS—SHEET 1.

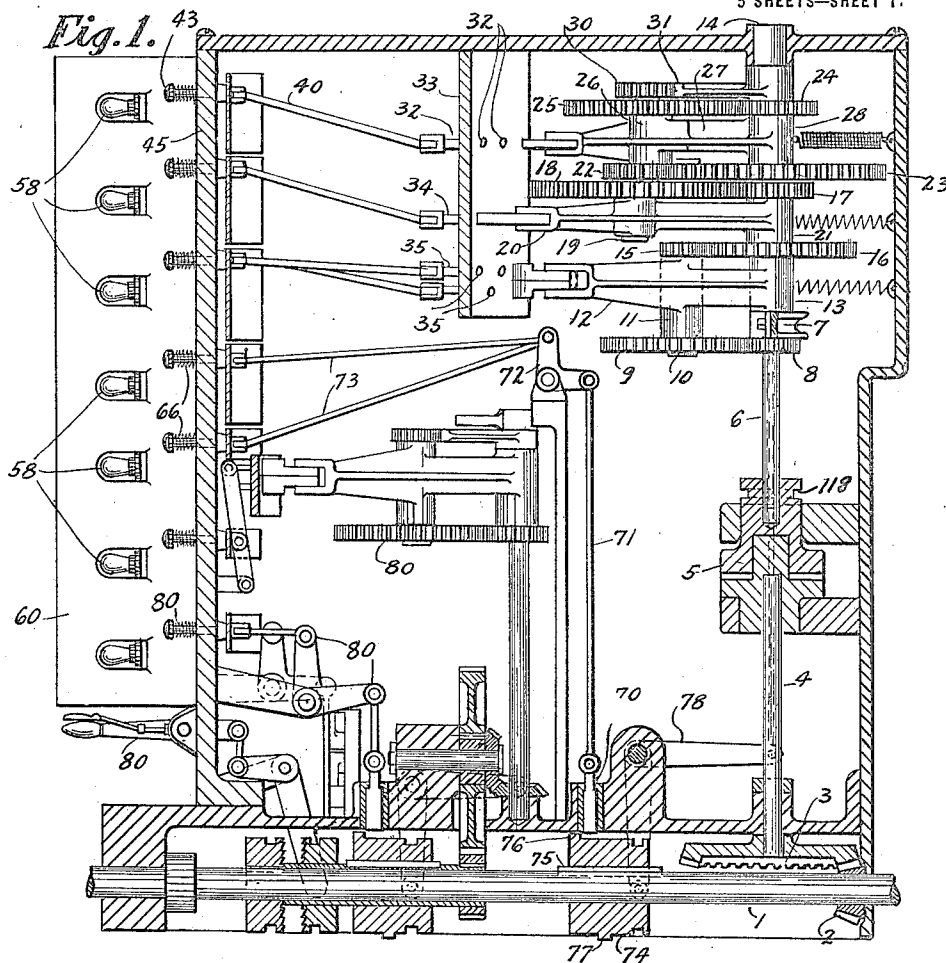
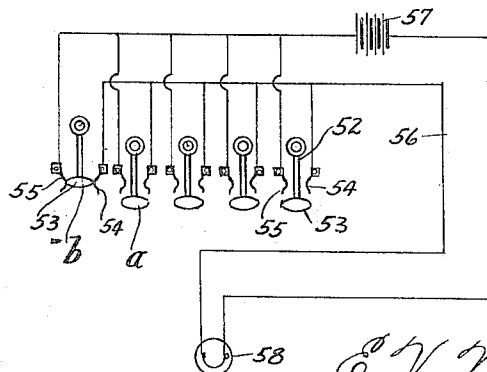


Fig. 8.



WITNESSES:

Alan P. Johnson
M. Halsey

INVENTOR

E. V. Wurts
BY *John D. Morgan*
ATTORNEY

1,214,983.

Fig. 2.

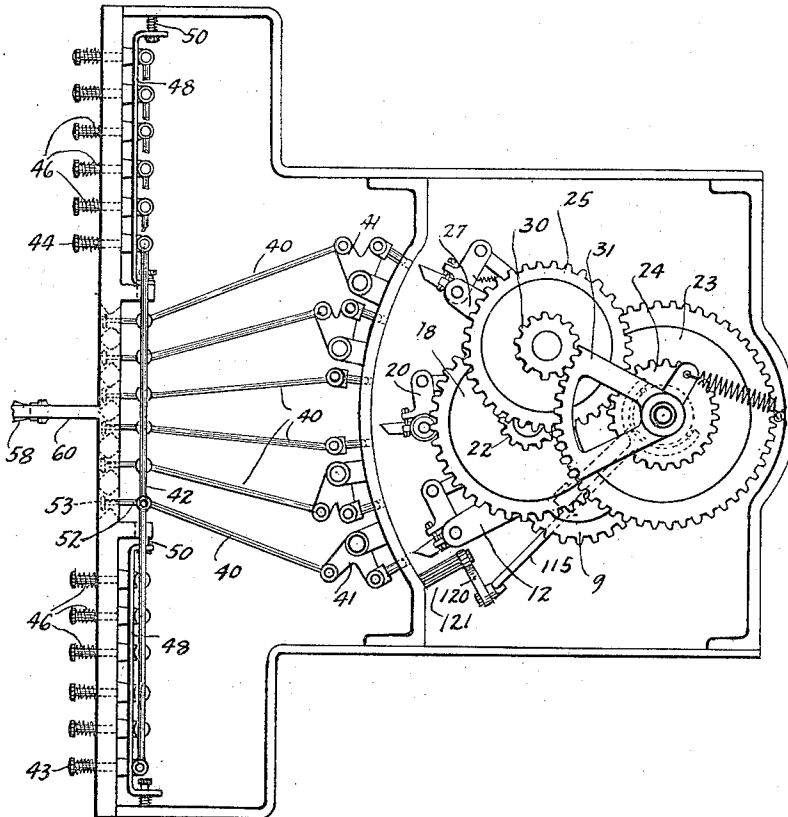
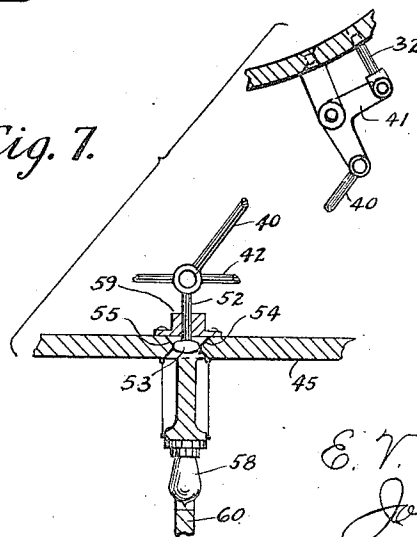


Fig. 7.



WITNESSES:
Alan H. Johnson
M. Walsh

INVENTOR
E. V. Wurts
BY
John D. Morgan
ATTORNEY

1,214,983.

Patented Feb. 6, 1917.

5 SHEETS—SHEET 3.

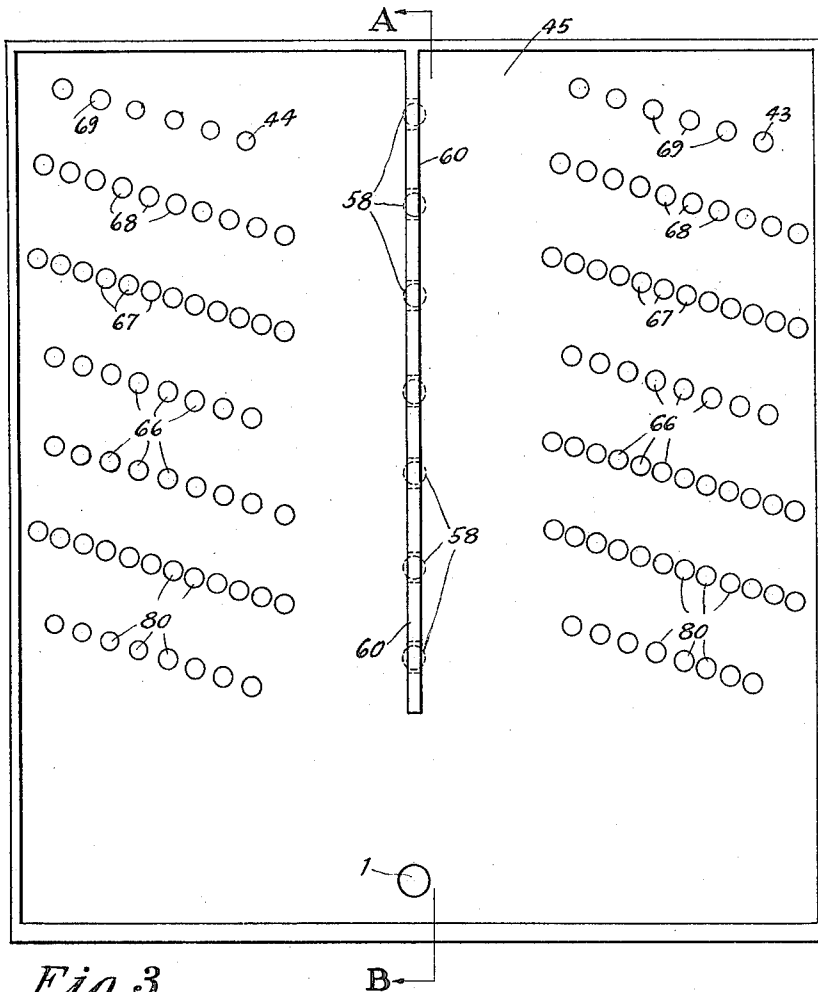
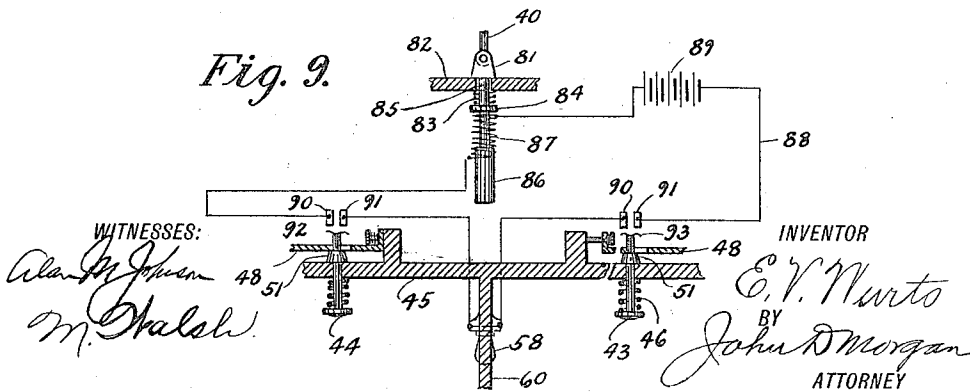


Fig. 3.



1,214,983.

Patented Feb. 6, 1917.

5 SHEETS—SHEET 4.

Fig. 4.

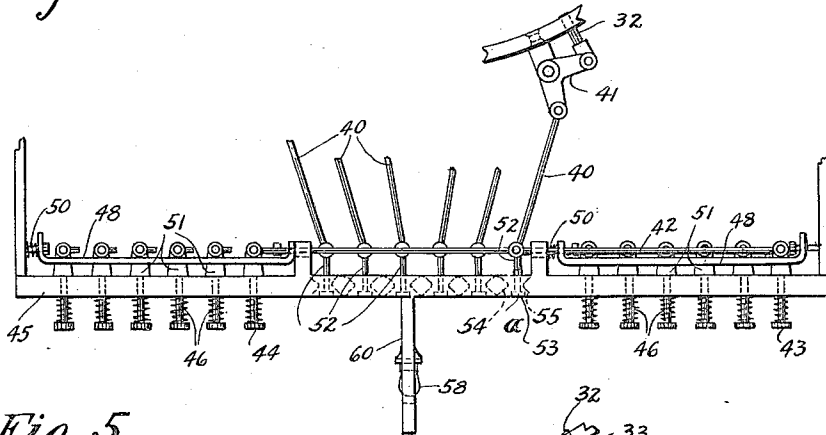


Fig. 5.

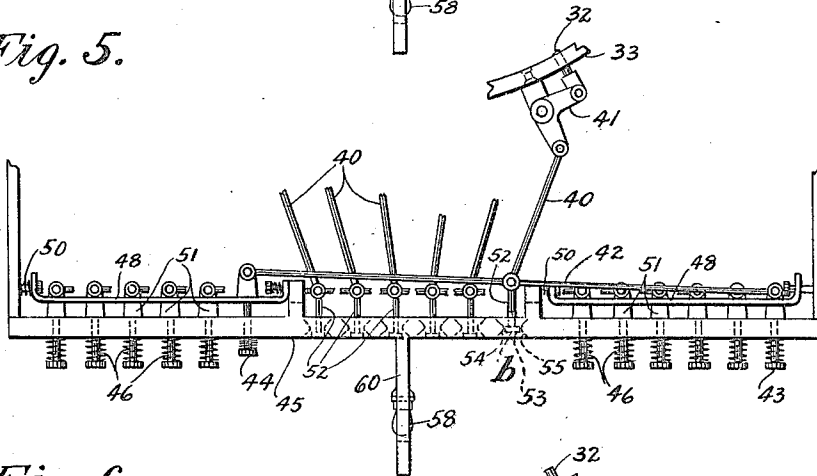
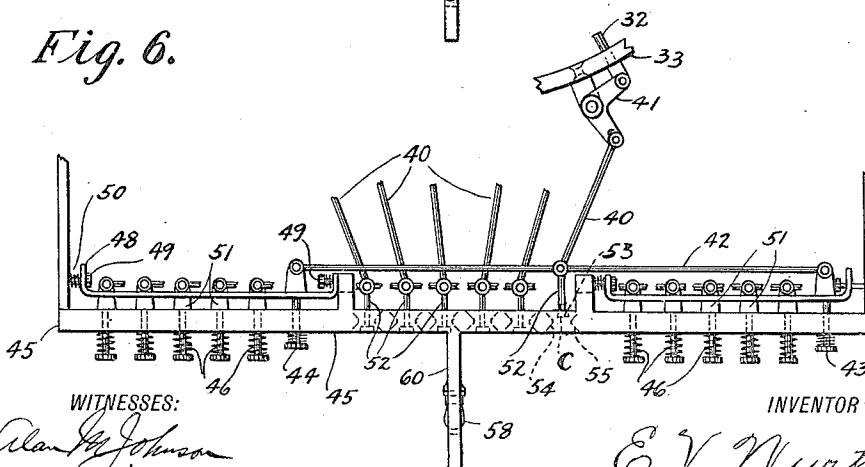


Fig. 6.



WITNESSES:

Alan M. Johnson
M. Stalsh

INVENTOR

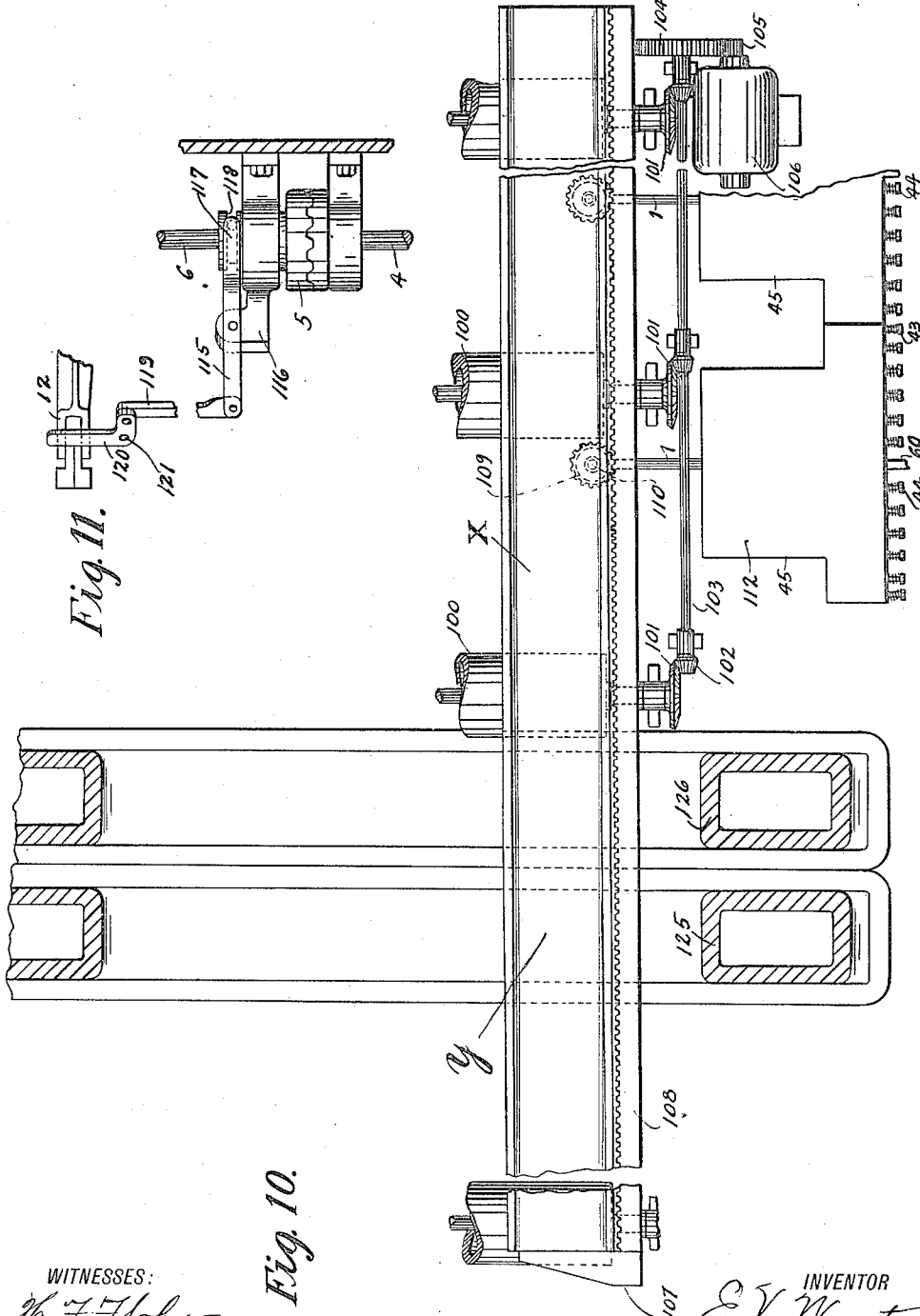
E. V. Wurtz
BY *Johnd Morgan*
ATTORNEY

E. V. WURTS.
METAL WORKING MACHINE.
APPLICATION FILED JAN. 28, 1914.

1,214,983.

Patented Feb. 6, 1917.

5 SHEETS—SHEET 5.



WITNESSES:
H. F. Fisher
M. Stalsh

Fig. 10.

INVENTOR
E. V. Wurts
BY
John D. Morgan
ATTORNEYS

UNITED STATES PATENT OFFICE.

EDWARD V. WURTS, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO STEEL UTILITIES, INCORPORATED, A CORPORATION OF NEW YORK.

METAL-WORKING MACHINE.

1,214,983.

Specification of Letters Patent.

Patented Feb. 6, 1917.

Application filed January 23, 1914. Serial No. 814,890.

To all whom it may concern:

Be it known that I, EDWARD V. WURTS, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Metal-Working Machines, of which the following is a specification.

The invention relates to machines for perforating structural shapes for fabrication and more especially to such machines wherein the shapes are automatically traveled and positioned relatively to the punches or like tool-equipped means under the control or governance of settable distance determining devices.

Objects of the invention are to provide for correct setting of the distance determining devices and to prevent incorrect settings and resulting erroneous travel and positioning of the work relatively to the tool equipped means; to provide for independent setting or control of the machine by a plurality of operators to insure correct travel and positioning of the work relatively to the tool equipped means; to prevent operation of the machine until the distance determining devices are correctly set, and more particularly, until identical settings of the distance determining devices have been made by a plurality of independent operators; to provide sensory warning of failure by any operator to make a correct setting; to provide a visual signal of the kind indicated; to provide coöperating devices and instrumentalities coöperating together to effect these various objects. These and other objects of invention will be in part obvious and in part will be set forth hereinafter.

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

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

The accompanying drawings, etc.

Of the drawings:—

Figure 1 represents a machine embodying the principles of the invention and is a central vertical section substantially on the line A—B of Fig. 3 and shows the keyboard, the error signals, and parts of the distance determining mechanism;

Fig. 2 is a view looking at Fig. 1 from the top but showing the full width of the machine, and with the top of the casing removed;

Fig. 3 is an elevation looking at Figs. 1 and 2 from the left;

Fig. 4 is a fragmentary plan of the keyboard showing no setting of the corresponding or duplicate keys;

Fig. 5 is a view similar to Fig. 4 showing one of the corresponding keys set, and the corresponding distance stop partly moved into operative position;

Fig. 6 shows both corresponding keys set and their stop in engaging or operative position;

Fig. 7 is an enlarged fragmentary detail of the keyboard signaling device;

Fig. 8 is a diagrammatic view of the wiring for the keyboard signaling device;

Fig. 9 is a fragmentary view, more or less diagrammatic, of an electrically operated keyboard;

Fig. 10 is a plan partly in section of the general arrangement of the machine; and

Fig. 11 is a fragmentary detail of the safety device.

Referring to the accompanying drawings, illustrating by way of example one embodiment of the invention, there is provided in connection with the tool equipped means, with the means for traveling and positioning the shape relatively to the punching device or like tool equipped and with the distance determining devices, a keyboard or like device whereby the settings or designations for the distances of travel of the structural beam or other work are made by two operators; that is, no setting of the distance determining devices becomes operative until it has been made or selected by each of two operators working independently of each

other. Means are provided, in accordance with one feature of the invention, for concealing from either operator the settings made by the other, so that each operator is
 5 compelled to work independently of the other, and in making the readings for his settings to rely solely upon his own drawing, blueprint, schedule or other source, while so far as the operation of the machine is concerned, precisely the same setting must be made by both operators before
 10 the machine will feed and position the work relatively to the punching device or like tool equipped means. In addition to the foregoing, a sensory signal is provided for the purpose of attracting the attention of both
 15 operators to an erroneous setting by either, the signal ceasing immediately upon a correction of the erroneous setting. Thus, not only is attention called to an erroneous setting, but its immediate correction is possible
 20 by the operator making the mistake without delay to the work and without any conference or communication being necessary between the operators and each operator is
 25 apprised as soon as the error is corrected.

Thus practically all possibility of erroneous setting of the machine and resulting displacement of the perforations or other or
 30 like operations in the work is eliminated, all back-feeding of the work due to such errors is avoided, together with all resulting delays, confusion, and damage to or destruction of the work being operated upon.

35 As exemplified in the illustrated embodiment, the invention is shown applied to or utilizing distance determining devices the same or similar in the general features of construction to those shown and described
 40 in copending application Serial No. 704,819 of Theodore P. Payne filed June 20, 1912, although it will be understood that in many of its features the invention is applicable to other forms and embodiments of distance
 45 determining devices.

Referring more particularly to the drawings, the distance determining devices comprise generally a member or mechanism traveling in a definite relation to the work.
 50 and members settable by the operator and which represent distances and multiples or sub-multiples thereof, or distance denominations or the like. Said members are settable to cooperate with such member or
 55 mechanism which travel in definite relation to the work, in order to control or determine the travel of the work relatively to the tool-equipped means. In the drawings, the shaft 1 connects by suitable gearing to a
 60 shaft 110 (Fig. 1) later described. A clutch 5 connects shaft 4 to a shaft 6, which clutch will be later described more fully in connection with its functions or offices in the machine. The shaft 6 has the end away
 65 from the clutch 5 journaled in a bearing 7.

Fixed on the shaft 6 to rotate therewith is a pinion 8. Meshing with the pinion 8 is a gear 9 fixed on a shaft 10 journaled in a bearing 11 formed in a swinging arm 12.
 70 The arm 12 has a hub 13 journaled or sleeved to rotate or move relatively to a supporting shaft 14. Fixed also to the shaft 10 is a pinion 15. The gear 9, shaft 10, and pinion 15 rotate together in the hub or bearing
 75 11 carried by the swinging arm 12. Meshing with the pinion 15 is a gear 16 fixed to a sleeve (not shown) which sleeve is carried upon, but free to rotate relatively to the supporting shaft 14. Fixed also to said sleeve is a pinion 17, the gear wheel 16 and pinion
 80 17 thus rotating together. The pinion 17 meshes with a gear 18 carried on a stub shaft 19, which shaft 19 is journaled in a suitable bearing in the arm 20. The arm 20 has a hub 21 freely sleeved to rotate upon
 85 and relatively to the sleeve connecting gear 16 and pinion 17, already referred to.

Fixed to and concentric with the gear 18 is a pinion 22. The pinion 22 meshes with a gear 23. The gear 23 connects to a pinion
 90 24 by a suitable sleeve (not shown) rotatably carried upon supporting shaft 14, all in a similar manner to the gear 16 and pinion 17. The pinion 24 meshes with a gear 25 carried by a stub shaft journaled in a
 95 bearing 26 in the arm 27. The arm 27 has a hub 28 loosely sleeved upon the sleeve connecting gear 23 and pinion 24, similarly to the hub 21 of the arm 20. Fixed to and concentric with the gear 25 is a pinion 30,
 100 which pinion is in mesh with and adapted to roll upon a stationary, segmental geared rack 31.

Coöperating with each of the swinging arms 12, 20, and 27, respectively, are series
 105 32, 34 and 35 of settable devices, representing distance denominations, or multiples or sub-multiples thereof, which stops control the travel of the corresponding arms in accordance with the settings made by the operators to effect and determine a corresponding travel of the shape relatively to the tool-equipped means. Such settable devices as embodied comprise stops interposable into the path of the arm to stop it at a
 110 corresponding point in its travel. An arcuate series of stops 32 are slidably mounted in apertures in the plate 33 and are selectively projectable into the path of the arm 27 to stop it at various points in its travel.
 115 A similar arcuate series of stops 34 are likewise mounted in the plate 33, and are likewise selectively projectable into the path of the arm 20. Another similar series of stops 35 coöperate with the arm 12 in the manner
 120 just described.

As embodied, the various features of invention designed to protect the machine and the work against the errors of operators are connected to or incorporated with the mech-
 130

anism for setting the various stops just described. In the embodied form, and referring first to the stops 32, the stops of this series have severally pivotally connected thereto rods 40, said rods being connected directly to the stop or are connected by means of bell-crank levers 41, which levers 41 are pivoted conveniently upon the plate 33. These rods 40 are actuated or set from a suitable keyboard.

As embodied the keys of the keyboard are in duplicate, that is there are two complete keyboards, each of which is designed to have an operator of its own. In accordance with certain features of the invention, there is no setting made of the distance determining devices until there has been an identical setting of distances on the two keyboards. Referring to Fig. 3 the group of keys at the right and the group of keys at the left correspond one to the other and a particular key in the right-hand key board, referring to Fig. 3, has a corresponding key in the left-hand keyboard. Referring now to Figs. 2 to 6 inclusive, the pivoted rods 40 are pivotally connected medially to a rod 42. The rod 42 is pivotally connected both to a key 43 in one keyboard and to a key 44 in the other keyboard. These keys are shown mounted to slide or move longitudinally in suitable apertures in a bearing plate or frame-piece 45.

Suitable locking devices and releasing devices for the keyboard are provided and the illustrated form thereof is substantially the same as that shown in copending application Serial No. 704,819 already referred to. Described briefly and referring only to the principal features, each key of the keyboard is acted on by a spring 46 in compression between the frame plate 45 and the head of the key. Within the frame plate 45 is a sliding plate 48, slidably mounted upon pins 49 and impelled in one direction by a spring 50. The plate 48 is apertured to permit the passage of conoidal portions 51, fixed on the various key stems within the frame plate 45. The smaller parts of the conoidal portions of the key stems rest within the apertures formed in the plate 48 when all of the keys are in the outward or retracted position but the spring 50 presses the plate to one side. When a key is pressed inwardly, its conoidal portion 51 passes farther into and through the aperture in the plate 48 and thus forces the plate 48 longitudinally against its spring 50 into register with said conoidal portion as it passes through the aperture. When the key is pushed all the way in the conoidal portion 51 has passed entirely through the aperture in the plate 48, and the spring 50 again draws the plate to one side, thus locking the key in the inward or set position by reason of the aperture in the plate 48 passing out of register

with the large end of the conoidal portion 51 of the set key (see keys 43 and 44 in Fig. 6). It will be seen that a new setting by another key will release the set key when the plate 48 is moved by the newly actuated key so that the aperture therein corresponding to the set key comes into registry with the conoidal portion 51 of such key, at which juncture such previously set key is retracted by its spring 46.

As already indicated, the invention provides also a sensory warning of an incorrect setting at the keyboard, and in the embodied form a visual warning or signal is used. Referring especially to Figs. 1 and 3 to 6, and Fig. 8, at or adjacent to the pivotal connection with its rod 40, each rod 42 is also pivotally connected to a rod 52. The rods 52 work in apertures in the frame plate 45, and are provided with bridge or circuit closing pieces 53. Mounted in such apertures in the frame plate 45 (see especially Fig. 7) are contact plates 54 and 55. Each bridge-piece 53 and the corresponding contact pieces 54 and 55 constitute a make-and-break in the corresponding circuit 56. Each circuit 56 is provided with a suitable source of electric energy and connects with a lamp 58. The rod 52 is guided by a suitable collar 59, (shown in Fig. 7) and the contact piece 53 may be either in the circuit closing position shown in Fig. 7 and at the left in Fig. 8, or it may be a circuit interrupting position by its longitudinal movement to either side of the circuit closing position. Preferably all the keys for a given distance denomination or a given multiple or sub-multiple thereof are on a single circuit and have a single lamp or other signaling device, the circuit make and break for the various keys being in parallel, as shown in Fig. 8. This gives one signal-lamp 58 for each bank of keys, that is, for each setting required, and thus not only is an error in setting indicated but the particular distance denomination or bank of keys in which it exists is also indicated.

In connection with the foregoing, there is provided in the embodied form means for shielding each keyboard from the observation of the operator at the other keyboard, and as embodied a partition 60 is interposed between the two keyboards, the lamp 58 being mounted in an aperture therein. Thus each operator is compelled to rely upon his own blueprint, schedule or other source for the dimensions to be set, and at the same time he is immediately apprised of any error in the setting, and without necessity of consulting with the other operator is warned to examine his last previous setting, to determine whether it is correct or erroneous.

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

Each operator is posted at his keyboard

and prevented from observing the other keyboard by the partition 60. Referring to his blueprint, schedule, or other copy or source for the dimension, he pushes in all the required keys in the various rows or banks for the next succeeding dimension or distance. For simplicity in explanation the keys representing a single denomination alone will be considered. Referring especially to Figs. 4, 5 and 6, Fig. 4 shows the mechanism in the position of no setting of the illustrated stop 32 and corresponding keys 43 and 44. In Fig. 5, the operator at the left has pushed key 44 and the rod 42 pivoting about its connection with the key 43 has rocked bell crank lever 41 to the position shown in Fig. 5, but the stop 32 has not been projected sufficiently to engage the arm 27. When the operator at the right pushes the corresponding key 43 the rod 42 again moves out transversely, rocking bell-crank lever 41 farther in the same direction and projecting the stop 32 into the path of the arm 27. It will thus be seen that there is no operative setting of the machine until the two corresponding distance keys have been pushed by the two independent operators. Should one of the operators make an error, instead of the completed setting shown in Fig. 6 there would be two incomplete settings like the one shown in Fig. 5, but with their positions reversed with respect to the two keyboards. There would be two stops partly projected or set but as they were not the same stop in each keyboard, neither one is set sufficiently far to engage the arm 27. The light 58 being thus turned on, the attention of both keyboard operators is directed to the fact of an erroneous setting and each refers to his copy or source of dimension or distance readings. Upon the mistaken operator correcting his error by actuating the correct key, the corresponding correct or desired stop 32 would assume the position shown in Fig. 6 and be operative to stop the arm 27, and the work would be traveled and stopped in accordance with the correct setting. The actuation or setting of the correct key would automatically release the incorrectly actuated key, which would thus be restored to the position shown in Fig. 4 and the corresponding stop 32 completely retracted.

In connection with the visual or other sensory signal, and bearing in mind the electrical devices described, it will be seen that when the two companion keys are in the retracted or unoperated position, the bridge-piece 53 is in the circuit interrupting position shown at *a* in Fig. 4, and correspondingly in Fig. 8. When only one of the two corresponding keys are actuated, the bridge piece 53 for that key is in the circuit closing position shown at *b* in Fig. 5 and correspondingly in Fig. 7 and at the left in Fig. 8. When both the corresponding keys are

actuated, that is when both operators make a correct setting, the bridge piece 53 is in the circuit interrupting position shown at *c* in Fig. 6.

It will thus be seen that an incorrect setting by either operator would close the circuit 56 and light the lamp 58, the lamp continuing to glow until the setting is corrected. Usually in practice the operators will make their settings simultaneously, and the bridge-piece would pass its contacts without appreciably affecting the lamp, but should either operator lag behind the other the lamp will flash briefly and thus serve as a warning to him to complete his setting at once, and to keep up with the other operator.

In practice one signal will be used for each denomination or bank of keys. Thus if the machine be constructed to measure or operate in feet and inches, one bank of keys could represent tens of feet, another bank of keys could represent feet, another bank inches, and another bank submultiples of an inch. The various banks or series of keys are shown in Fig. 3 arranged in diagonal order or position to secure simplicity of connection between the corresponding keys of the two keyboards, each rod 42 extending straight across horizontally between its keys.

In Fig. 1 of the drawings the successive banks or series of keys are shown with corresponding lights or light signals, and the mechanism need not be described in fuller detail. The banks 69 may be regarded as for tens of feet, the banks 68 for feet, and the banks 67 for inches. Likewise the details of the mechanism and connections between the keyboard and the shaft 1 will not need to be described in detail, reference being had for an understanding of such details to my copending application, Serial No. 704,819.

The fractions of an inch (assuming the use of feet and inches) are set or obtained by the series of stops 70, which series of stops either directly or indirectly are connected by pivoted rods 71, bell crank lever 72 and pivoted rods 73 to corresponding series or banks of keys 66, and may be substantially the same in construction and operation as described in my above mentioned copending application. The stop member or cylinder 74 by means of spline 75 rotates with the shaft 1 but is slidable therealong to bring either tooth 76 or tooth 77 into registry or alinement with a projected stop 70. This sliding movement of the member 74 is effected from arm 12, through suitable connections to bell crank lever 78 substantially in the manner shown and described in my copending application.

The automatic repeat mechanism may be used or not as desired, so far as concerns

most of the features of my invention, and is shown herein of substantially the same form as in my said copending application and is designated generally by reference numeral 80.

In Fig. 9 of the drawing is shown an electrically operated keyboard, the rod 40 in said figure corresponding generally to the rod 40 in the other figures of the drawings. Said rod 40 is shown pivotally connected to a member 81 having a shouldered head adapted to rest against plate 82 and having a rod 83 slidably mounted in an aperture in the plate 82. Fixed to the rod 83 is a collar 84, a spring 85 being shown in compression between the collar 84 and the plate 82. Fixed to the rod 83 is a solenoid core 86. The winding 87 of the solenoid is shown in a circuit 88 provided with a suitable source of energy 89. For the sake of clearness only one key of each of the duplicate keyboards is shown in this figure, the keys corresponding to the same dimension or distance. In cooperative relation to each of these keys 43 and 44 (Fig. 9) is a set of contact pieces 90 and 91. Each key 43 is provided with a bridge piece 93 and the corresponding key 44 with a bridge piece 92 for closing the circuit at the corresponding contact pieces 90 and 91. The two sets of contact pieces 90 and 91 are in series, and a corresponding lamp 58 is in circuit therewith.

In this arrangement and construction the actuation of both keys is necessary to close the circuit and energize the solenoid 87 and thus actuate the rod 40 to set the corresponding stop in the path of the traveling arm. In this case the lamp 58 when used in the same circuit glows to indicate a correct setting.

In the embodied form the distance determining devices are shown as part of the machine in which permissive travel is given to the structural beam or other work in accordance with the setting of the distance determining devices. As embodied the beam x is carried upon a series of driven rolls 100, which may be constantly driven if desired and thus tend to continuously travel the work forward. To drive the rolls 100, their shafts are provided with beveled gears 101 intermeshing with corresponding gears 102 on a shaft 103. Fixed to said shaft 103 is a gear 104 meshing with a pinion 105 connected to a motor 106.

The means for positioning the shape relatively to the tool equipped means comprises a head 107 against which the forward end of the beam x rests or presses. Fixed to the head 107 is a geared rack 108, which rack extends back alongside the beam x . Meshing with the rack 108 is a pinion 109 fixed to rotate with a shaft 110. Said shaft 110 connects to the shaft 1 of the distance

determining devices which in their entirety are indicated in this figure by reference numeral 112.

The motor 106 may drive the rolls 100 either continuously or intermittently, urging the beam x forward. The beam is thus always in definite relation with the head 107 which head is in definite relation with the distance determining devices, and can have a travel only in accordance with the setting of said devices, as such settings are successively made. Thus when the beam is at rest and has been operated upon by the tool-equipped means, indicated generally by y , a new setting of the distance determining devices for a given distance will permit a corresponding travel of the head 107 and of the beam x which is thus positioned for the next operation by the tool equipped means precisely in accordance with the setting of the distance determining devices.

In Fig. 10 of the drawings there is shown a plurality of tool-equipped means located along the path of travel of the shape x , and in conjunction therewith plurality of distance determining devices, one for the purpose of locating the beam with reference to one punching mechanism or like tool-equipped device, and the other of said distance determining devices for locating or positioning the shape relatively to the other of said tool-equipped means.

It will be understood, however, that in many of the broader aspects of the invention it is immaterial whether one or more tool-equipped means be used or whether one or more distance determining devices be employed therewith or whether the distance determining devices be applied to traveling and positioning the beam, or the punching mechanism or other tool-equipped means longitudinally or transversely, or both, to properly locate the shape or beam and the tool-equipped mechanism with respect to each other in order to perforate the shape or beam at the proper desired points for which the distance determining devices are set.

In said embodied form one punching mechanism may be regarded as located centrally or in other desired relation with respect to the frame or housing 125, and another punching or like mechanism may be regarded as mounted upon and located centrally or in other convenient location with respect to the housing 126, one of the distance determining devices 112 shown in Fig. 10 may be used to locate the shape x with respect to one tool-equipped means and the other distance determining device shown in Fig. 10 to locate and position the shape with reference to the other tool-equipped means, although so far as concerns many features of the invention, and in accord-

ance with certain features thereof the control, travel and stopping of the beam with reference to a plurality of punching mechanisms or like tool-equipped means may be effected by one or more distance determining devices.

A suitable safety device is provided for the distance determining means to throw same out of action in case of any failure of the mechanism to effect a complete or perfect setting. In the embodied form of such means there is connected to one half of clutch 5 a lever 115 said lever being suitably pivoted upon the bracket 116, and having a yoked end 117 straddling a grooved collar 118. Said collar 118 is slidable upon the shaft 6 to throw in and out the clutch 5. Pivotally connected to the other arm of said lever 115 is a link 119, to the other end of which link 119 is pivotally connected a lever 120, said lever 120 being pivoted at the point 121. The other end of said lever 120 is in the path of one of the traveling arms of the distance determining device, such as the arm 12. In case no pin is set to stop the traveling arm, it will contact with the lever 120, throw out the clutch 5 and stop the distance determining device. If desired, such a device may be applied to each one of the traveling arms, and thus throw out the distance determining device on or within the distance denomination or submultiple thereof where the error or failure in setting has occurred.

In view of the statements of operation previously given herein in connection with the description of the different mechanisms and cooperating instrumentalities, the manner of operation of the entire machine and mechanism herein shown and described will be understood without a further general description.

It will be understood that a machine has been provided embodying the principles of the invention, and realizing the objects and advantages herein stated together with other objects and advantages.

The invention in its broader aspects is not limited to the precise structures shown or described, nor to any specific structure, but changes may be made therefrom within the limits of the appended claims without departing from the principles of the invention or sacrificing its chief advantages.

I claim—

1. A machine for operating upon structural shapes including in combination tool equipped means, means for traveling and positioning a shape relatively to said tool equipped means to be operated upon thereby, said means including settable distance devices and cooperating devices for preventing erroneous positioning of the shape relatively to the tool equipped means.

2. A machine for operating upon structural shapes including in combination tool equipped means, means for traveling and positioning a shape relatively to said tool equipped means to be operated upon thereby, said means including devices for preventing erroneous positioning of the shape relatively to the tool equipped means, and an error indicating signal cooperating therewith.

3. A machine for operating upon structural shapes including in combination tool equipped means, means for traveling and positioning a shape relatively to said tool equipped means to be operated upon thereby, said means including devices for preventing erroneous positioning of the shape relatively to the tool equipped means, and a sensory error indicating signal cooperating therewith.

4. A machine for operating upon structural shapes including in combination tool equipped means, means for traveling and positioning a shape relatively to said tool equipped means, said means including settable distance determining devices and devices cooperating therewith for preventing erroneous positioning of a shape relatively to said tool equipped means.

5. A machine for operating upon structural shapes including in combination tool equipped means, means for traveling and positioning a shape relatively to said tool equipped means, said means including distance determining devices and devices cooperating therewith for preventing erroneous positioning of a shape relatively to said tool equipped means, and error indicating means cooperating therewith.

6. A machine for operating upon structural shapes including in combination tool equipped means, means for traveling and positioning a shape relatively to said tool equipped means, said means including distance determining devices and devices cooperating therewith for preventing erroneous positioning of a shape relatively to said tool equipped means and sensory error indicating means cooperating therewith.

7. A machine for operating upon structural shapes including in combination tool equipped means, means for traveling and positioning a shape relatively to said tool equipped means, said means including distance determining devices and automatic devices cooperating therewith preventing erroneous positioning of a shape relatively to said tool equipped means and sensory error indicating means cooperating therewith.

8. A machine for operating upon structural shapes including in combination tool equipped means, means for traveling and positioning a shape relatively to said tool equipped means, said means including dis-

5 tance determining devices and devices co-
operating therewith preventing erroneous
positioning of a shape relatively to said tool
equipped means, and visual error indicating
means operated thereby.

9. A machine for operating upon struc-
tural shapes including in combination tool
equipped means, and means for traveling
and positioning a shape relatively to said
10 tool equipped means, said means including
settable distance determining devices and
devices for preventing erroneous setting of
said distance determining devices.

10. A machine for operating upon struc-
15 tural shapes including in combination tool
equipped means, and means for traveling
and positioning a shape relatively to said
tool equipped means, said means including
settable distance determining devices and
20 devices for indicating erroneous setting of
said distance determining devices.

11. A machine for operating upon struc-
tural shapes including in combination tool
equipped means, and means for traveling
25 and positioning a shape relatively to said
tool equipped means, said means including
settable distance determining devices and
devices for indicating and preventing erro-
neous setting of said distance determining
30 devices.

12. A machine for operating upon struc-
tural shapes including in combination tool
equipped means, and means for traveling
and positioning a shape relatively to said
35 tool equipped means, said means including
settable distance determining devices and
devices and means for indicating a failure
to make a correct setting of said distance
indicating devices.

13. A machine for operating upon struc-
40 tural shapes including in combination tool
equipped means, and means for traveling
and positioning a shape relatively to said
tool equipped means said means including
45 settable distance determining devices and
sensory means coöperating therewith for in-
dicating a failure to make a correct setting
of said distance determining devices.

14. A machine for operating upon struc-
50 tural shapes including in combination tool
equipped means, and means for traveling
and positioning a shape relatively to said
tool equipped means, said means including
settable distance determining devices and
55 devices and visual means coöperating there-
with for indicating a failure to make a cor-
rect setting of said distance determining
devices.

15. A machine for operating upon struc-
60 tural shapes including in combination tool
equipped means, and means for traveling
and positioning a shape relatively to said
tool equipped means, said means including
settable distance determining devices and

devices and sensory means for automatically 65
indicating a failure to make a correct setting
of said distance determining means.

16. A machine for operating upon struc-
tural shapes including in combination tool
equipped means, and means for traveling 70
and positioning a shape relatively to said
tool equipped means, said means including
settable distance determining devices and
means for indicating a failure to make a
correct setting of said distance determining 75
devices and for indicating when such cor-
rect setting is subsequently made.

17. A machine for operating upon struc-
tural shapes including in combination tool
equipped means, means for traveling a shape 80
along a pathway past said tool equipped
means, and for stopping said shape after
variable amounts of travel to position the
shape relatively to the tool equipped means,
and means for preventing erroneous posi- 85
tioning of the shape relatively to the tool
equipped means.

18. A machine for operating upon struc-
tural shapes including in combination tool
equipped means, means for traveling a shape 90
along a pathway past said tool equipped
means, and for stopping said shape after
variable amounts of travel to position the
shape relatively to the tool equipped means,
means for determining the amount of such 95
travel and means coöperating therewith to
prevent erroneous positioning of the shape
relatively to the tool equipped means.

19. A machine for operating upon struc-
tural shapes including in combination tool 100
equipped means, means for traveling a shape
along a pathway past said tool equipped
means, and for stopping said shape in any
desired point in its travel to be operated
upon by said tool equipped means, key- 105
board equipped means controlling said stop-
ping means, and means for insuring the
stopping of the shape at the desired point.

20. A machine for operating upon struc-
tural shapes including in combination tool 110
equipped means, means for traveling a shape
past said tool equipped means, settable
means for stopping said shape in various
desired positions relatively to said tool
equipped means and means for preventing 115
an incorrect setting of said settable means.

21. A machine for operating upon struc-
tural shapes including in combination tool
equipped means, means for traveling a shape
past said tool equipped means, settable 120
means for stopping said shape in various
desired positions relatively to said tool
equipped means and means for preventing
an incorrect setting of said settable means
and means for indicating a failure to make 125
a correct setting thereof.

22. A machine for operating upon struc-
tural shapes including in combination tool

equipped means, means for traveling a shape past said tool equipped means, settable means for stopping said shape in various desired positions relatively to said tool equipped means and sensory means for indicating a failure to make a correct setting thereof.

23. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a substantially horizontal pathway past said shape, means for traveling a shape past said shape perforating means, settable means for stopping a shape in said pathway in various desired positions relatively to said perforating means, and means insuring the correct desired setting of said settable means.

24. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a substantially horizontal pathway past said shape, means for traveling a shape past said shape perforating means, settable means for stopping a shape in said pathway in various desired positions relatively to said perforating means, and means for preventing incorrect stopping of said shape relatively to said perforating means.

25. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a substantially horizontal pathway past said shape, means for traveling a shape past said shape perforating means, settable means for stopping a shape in said pathway in various desired positions relatively to said perforating means, and means for indicating failure to make correct setting of said settable means.

26. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a pathway past said perforating means, means settable to correspond to distance denominations and values for stopping a traveled shape in positions corresponding to such distance settings and means for insuring the making of correct settings of said settable means to represent a desired distance.

27. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a pathway past said perforating means, means settable to correspond to distance denominations and values for stopping a traveled shape in positions corresponding to such distance settings and means for preventing incorrect setting of said settable means.

28. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means,

means for traveling a shape along a pathway past said perforating means, means settable to correspond to distance denominations and values for stopping a traveled shape in positions corresponding to such distance settings and means for indicating failure to make a correct setting of said settable means to indicate a desired distance.

29. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a pathway past said perforating means, means settable to correspond to distance denominations and values for stopping a traveled shape in positions corresponding to such distance settings, said settable devices including members corresponding to distance denominations and values and arranged in duplicate groups, the members of such different groups being set by different operators and being operative to position the shape relatively to the perforating means only when such groups are given the same setting.

30. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a pathway past said perforating means, means settable to correspond to distance denominations and values for stopping a traveled shape in positions corresponding to such distance settings, said settable devices including members corresponding to distance denominations and values and arranged in duplicate groups, the members of such different groups being set by different operators, an identical distance setting in each group being required to give a distance setting operative to position said shape relatively to the perforating means.

31. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a pathway past said perforating means, means settable to correspond to distance denominations and values for stopping a traveled shape in positions corresponding to such distance settings, said settable devices including members corresponding to distance denominations and values and arranged in duplicate groups, the members of such different groups being set by different operators and being operative to position the shape relatively to the perforating means only when such groups are given the same setting, and means for indicating to each operator when an error has been made.

32. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a pathway past said perforating means, means set-

table to correspond to distance denominations and values for stopping a traveled shape in positions corresponding to such distance settings, said settable devices including members corresponding to distance denominations and values and arranged in duplicate groups, the members of such different groups being set by different operators and being operative to position the shape relatively to the perforating means only when such groups are given the same setting, and means for indicating to each operator when an error made has been corrected.

33. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape along a pathway past said perforating means, means settable to correspond to distance denominations and values for stopping a traveled shape in positions corresponding to such distance settings, said settable devices including members corresponding to distance denominations and values and arranged in duplicate groups, the members of such different groups being set by different operators, an identical distance setting in each group being required to give a distance setting operative to position said shape relatively to the perforating means, and means for indicating to each operator when an error has been made.

34. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, a member traveling in definite relation with the shape, a plurality of settable members cooperating therewith to stop the travel of the shape to position it to be operated upon by said perforating means, and means for insuring correct setting of said settable members.

35. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, a member traveling in definite relation with the shape, a plurality of settable members cooperating therewith to stop the travel of the shape to position it to be operated upon by said perforating means including a signal, and means for indicating failure to make a correct setting of said settable means.

36. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, a member traveling in definite relation with the shape, a plurality of settable members cooperating therewith to stop the travel of the shape to position it to be operated upon by said perforating means, and means for indicating when a failure to

make a correct setting has been rectified and a subsequent correct setting made.

37. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, a member traveling in definite relation to said shape, a plurality of settable devices corresponding to distance denominations or values settable to cooperate with said traveling member at different points in its travel to stop the travel of the shape and means for insuring correct setting of said settable means.

38. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, distance determining devices including a member traveling in definite relation with said shape, a plurality of devices representing distance denominations or values and being settable to stop said traveling member to position said shape relatively to said perforating means, said devices being partially set by one operator and partially by another.

39. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, distance determining devices including a member traveling in definite relation with said shape, a plurality of devices representing distance denominations or values and being settable to stop said traveling member to position said shape relatively to said perforating means, said devices being partially set by one operator and partially by another, and means for indicating an incomplete setting.

40. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, distance determining devices including a member traveling in definite relation with said shape, a plurality of devices representing distance denominations or values and being settable to stop said traveling member to position said shape relatively to said perforating means, said devices being completely set by a plurality of operators making settings for the same distance value or denomination, and means for indicating failure to make a complete setting and for indicating when such failure has been rectified.

41. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, distance determining devices including a member traveling in definite re-

lation with said shape, and a plurality of devices representing distance values and selectively movable into position to cooperate with said member to stop the shape in
 5 corresponding desired position relatively to said perforating means, and means whereby a selected device is partially movable into such operative position by one operator and partially by another.

42. A machine for operating upon structural shapes including in combination tool
 10 equipped means, shape perforating means, means for traveling a shape past said perforating means, distance determining devices
 15 including a member traveling in definite relation with said shape, and a plurality of devices representing distance values and selectively movable into position to cooperate with said member to stop the shape in cor-
 20 responding desired position relatively to said perforating means, and means whereby one operator partially moves a selected distance value device and another operator partially moves said device to bring it into
 25 operative relation with said traveling member to correspondingly position the shape relatively to the perforating means.

43. A machine for operating upon structural shapes including in combination tool
 30 equipped means, shape perforating means, means for traveling a shape relatively to said perforating means and stopping it to be perforated thereby, said traveling and
 35 stopping means including duplicate keyboards the keys of which represent distance values and identical settings thereof being necessary to effect a desired travel and stop-
 40 ping of the shape relatively to the perforating means, and means for shielding one keyboard from observation by the operator of another keyboard.

44. A machine for operating upon structural shapes including in combination tool
 45 equipped means, shape perforating means, means for traveling a shape relatively to said perforating means and stopping it to be perforated thereby, said traveling and
 50 stopping means including duplicate keyboards the keys of which represent distance values and identical settings thereof being necessary to effect a desired travel and stop-
 55 ping of the shape relatively to the perforating means, and means for indicating a failure to make identical distance settings on said duplicate keyboards.

45. A machine for operating upon structural shapes including in combination tool
 60 equipped means, shape perforating means, means for traveling a shape relatively to said perforating means and stopping it to be perforated thereby, said traveling and
 stopping means including duplicate key-
 boards the keys of which represent distance
 values and identical settings thereof being

necessary to effect a desired travel and stop- 65
 ping of the shape relatively to the perforating means, and means for indicating a failure to make identical distance settings on
 said duplicate keyboards and for indicating
 when said failure has been rectified. 70

46. A machine for operating upon structural shapes including in combination tool
 75 equipped means, shape perforating means, means for traveling a shape relatively to said perforating means and stopping it to be perforated thereby, said traveling and
 80 stopping means including duplicate keyboards the keys of which represent distance values and identical settings thereof being necessary to effect a desired travel and stop-
 ping of the shape relatively to the perforating means, and a sensory signal for indicat-
 ing a failure to make identical distance set-
 tings on said duplicate keyboards.

47. A machine for operating upon struc- 85
 tural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perfo-
 rating means, distance determining means for controlling the travel and stopping of 90
 the shape relatively to the perforating means, including a plurality of selectively settable devices representing distance val-
 ues and a plurality of groups of keys, 95
 each group having keys representing the same distance values as said settable de-
 vices, and connections whereby the selec-
 tion and setting of a desired settable device is effected only by the actuation of the cor- 100
 responding key in each group of keys.

48. A machine for operating upon struc-
 tural shapes including in combination tool
 105 equipped means, shape perforating means, means for traveling a shape past said perfo-
 rating means, distance determining means for controlling the travel and stopping of
 the shape relatively to the perforating
 means, including a plurality of selectively
 110 settable devices representing distance values and a plurality of groups of keys, each group having keys representing the
 same distance values as said settable de-
 vices, and connections whereby the selec-
 tion and setting of a desired settable device is effected only by the actuation of the cor- 115
 responding key in each group of keys, and means for indicating to the operators of all
 the key groups a failure to make such cor-
 responding settings of the various groups
 of keys. 120

49. A machine for operating upon struc-
 tural shapes including in combination tool
 125 equipped means, shape perforating means, means for traveling a shape past said perfo-
 rating means, distance determining means for controlling the travel and stopping of
 the shape relatively to the perforating
 means, including a plurality of selectively

settable devices representing distance values and a plurality of groups of keys, each group having keys representing the same distance values as said settable devices, and connections whereby the selection and setting of a desired settable device is effected only by the actuation of the corresponding key in each group of keys, and means for shielding each group of keys from the observation of the operator of another group of keys.

50. A machine for operating upon structural shapes including in combination tool equipped means, shape perforating means, means for traveling a shape past said perforating means, distance determining means for controlling the travel and stopping of the shape relatively to the perforating means, including a plurality of selectively settable devices representing distance values and a plurality of groups of keys, each group having keys representing the same distance values as said settable devices, and connections whereby the selection and setting of a desired settable device is effected only by the actuation of the corresponding key in each group of keys, means for indicating to the operators of all the key groups a failure to make such corresponding settings of the various groups

of keys, and means for shielding each group of keys from the observation of the operator of another group of keys.

51. A machine for perforating structural shapes including in combination means for perforating the shape, means for traveling and stopping the shape relatively to said perforating means, said means including settable distance determining devices and means for throwing out said devices upon a failure to make a complete setting.

52. A machine for operating upon structural shapes including in combination a plurality of tool equipped means for operating upon the shape, means for traveling a shape along a pathway past said tool equipped means, a plurality of settable distance determining devices, one of said devices being settable to position the shape relatively to one of said tool equipped means and another of said distance determining devices being settable to position the shape relatively to another of said tool equipped means.

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

EDWARD V. WURTS.

Witnesses:

JOHN D. MORGAN,
H. R. LINDERMAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."