March 25, 1941. M. W. HAZELTON 2,236,192

SHEARING MACHINE

Filed July 12, 1940 2 Sheets-Sheet 1

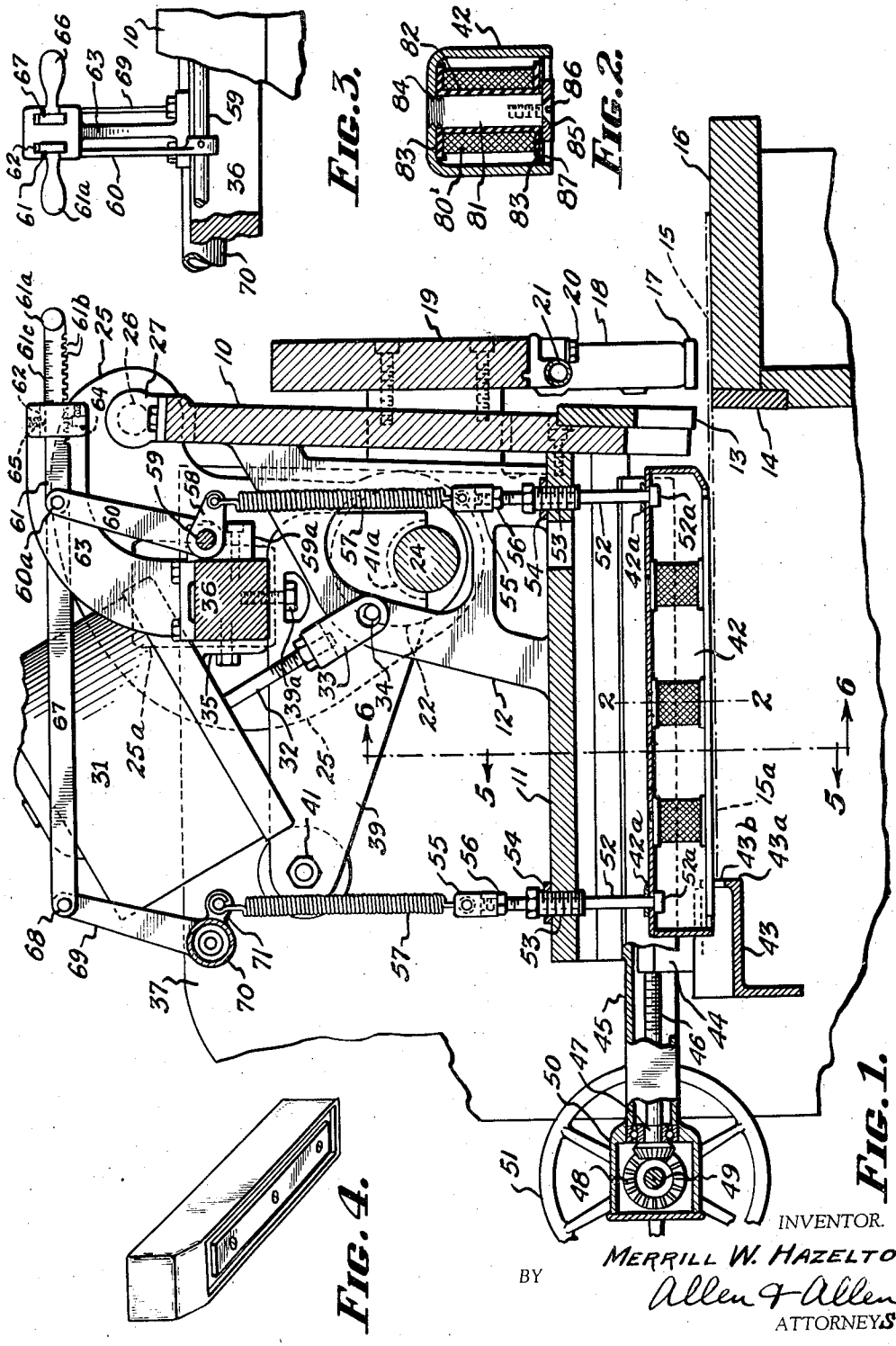


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

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FIG. 5.

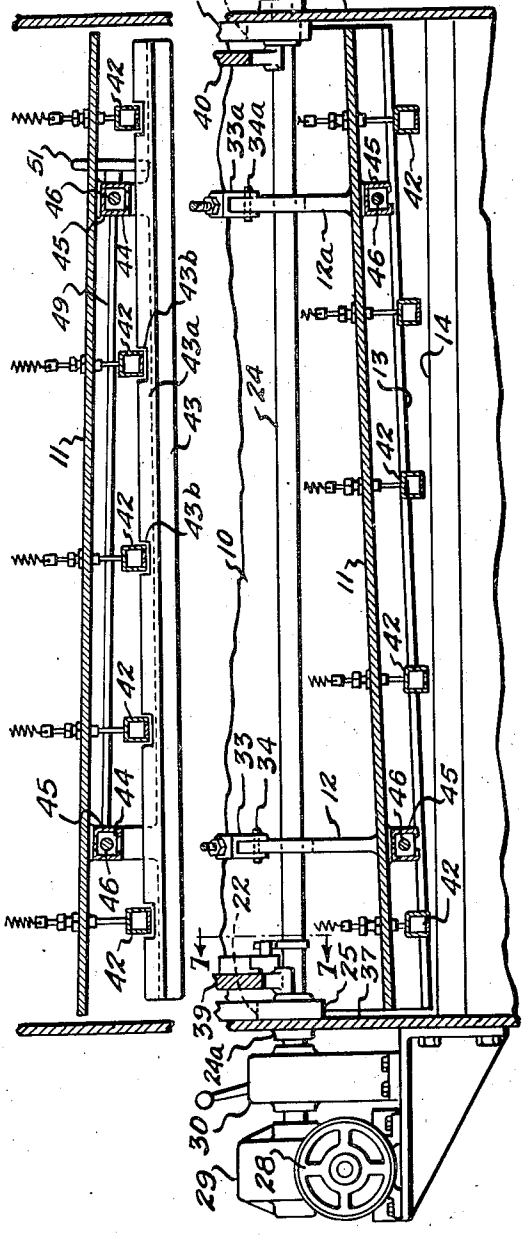


FIG. 6.

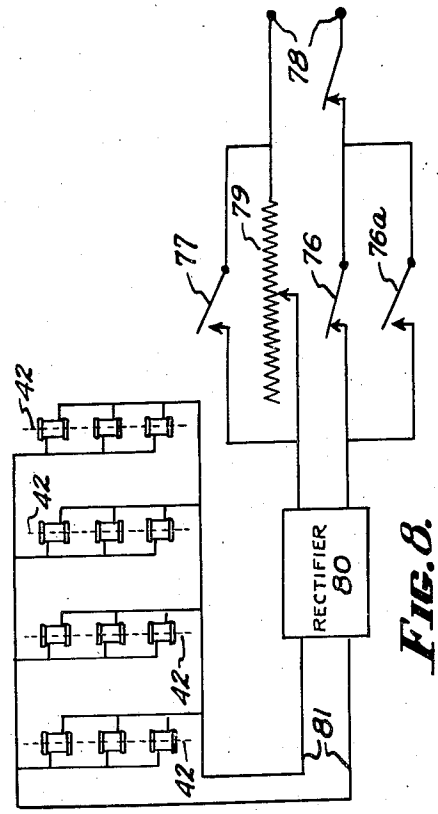


FIG. 8.

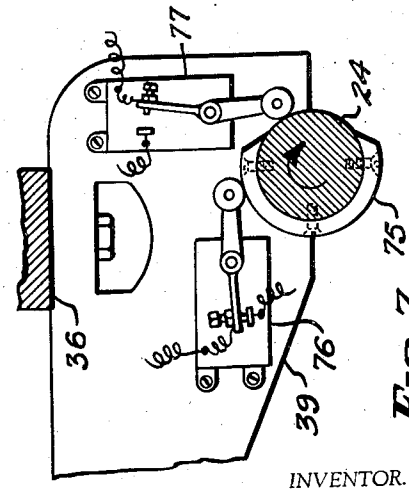


FIG. 7.

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Patented Mar. 25, 1941

2,236,192

UNITED STATES PATENT OFFICE

2,236,192

SHEARING MACHINE

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Application July 12, 1940, Serial No. 345,196

15 Claims. (Cl. 164—47)

This invention relates to shearing machines and particularly to work supporting means for the back side of the shear. In the conventional shearing machine there is a lower fixed shear blade and an upper reciprocating shear blade. In front of the machine there is usually a table upon which the material to be sheared is supported. At the back of the machine there is usually a back gauge against which sheets to be sheared are butted for gauging purposes. In cases where thin sheets are being sheared, the sheets sag in the unsupported region adjacent the back gauge and gauging becomes extremely difficult. In this connection it is an object of my invention to provide means for supporting the overhang of the sheet so that normal gauging can easily be carried out.

Where heavy sheets are being sheared, and particularly where there is a small scrap on the table and therefore a heavy overhang, it is impossible to shear in this position, and it has been necessary in the past to change to a front gauge arrangement. In this connection it is an object of my invention to provide means for holding up the overhang of the sheet so that even with heavy sheets and small scrap on the table, it will be unnecessary to change to a front gauge.

If long sheets are to be cut, the back angle or back gauge must be removed, which is inconvenient and takes considerable time. In this connection it is an object of my invention to provide an arrangement for opening the supporting means with respect to the back gauge so that long sheets may be easily fed over the back angle to a supplementary back gauge.

It is another object of my invention to provide control means conveniently accessible to the operator for accomplishing this object.

These and other objects of my invention which will be described more in detail hereinafter, or which will be apparent to one skilled in the art upon reading these specifications, I accomplish by that certain construction and arrangement of parts of which I shall now describe an exemplary embodiment.

Reference is made to the drawings forming a part hereof, and in which

Figure 1 is a vertical cross section through the head of a typical shearing machine, showing my magnet sheet support as incorporated therein.

Fig. 2 is an enlarged sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary front elevation showing the magnet bar control levers as seen from the right in Fig. 1.

Fig. 4 is a detailed perspective view showing the magnet bar according to Figs. 1 and 2 detached from the machine.

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 1, showing on a reduced scale the arrangement of the magnet bars and the back gauge bar.

Fig. 6 is a sectional view taken along the line 6—6 of Fig. 1.

Fig. 7 is a sectional view taken along the line 7—7 of Fig. 6.

Fig. 8 is a wiring diagram.

Briefly in the practice of my invention, I provide means at the back of the shearing blades for holding up the overhang of a sheet to be sheared. The holding means are electro-magnetic in character, as will be described in more detail hereinafter.

Referring to Figs. 1 and 6, the shearing head consists of a ram 10, a brace plate 11, and a pair of brackets 12 and 12a. These members are securely joined together and are of substantial mass to impart great rigidity to the assembly. The upper shear blade 13 is carried at the lower edge of the ram 10, and cooperates with a fixed shear blade 14 mounted in the frame and arranged to shear a sheet 15.

A table 16 extends forwardly from the plate 14 for convenience of the operator in handling the work, and a series of hydraulic plungers 17 are arranged to descend and grip the sheet automatically just previous to the operation of the shear, thus clamping the sheets 15 securely against the table 16. Each of the plungers 17 is contained in a cylinder 18, the cylinders being fixed to the frame member 19 by means of screws 20. The entire series is actuated simultaneously, and automatically in response to movement of the ram 10, by means of fluid supplied through a pipe line or tube 21, from some suitable source of hydraulic pressure. The hydraulic clamping arrangement forms no part of this invention, and is therefore not described in detail.

Movement of the ram assembly is accomplished by means of a pair of eccentrics 22 and 23 mounted on the main shaft 24, at opposite sides of the machine. The shaft 24 is journaled in the side frames of the machine at 24a and 24b. Each of the eccentrics engages a link 25 which is pivoted to the ram 10 by a bracket 27 as indicated at 26. It will now be clear that a complete revolution of the shaft 24 will produce a complete cycle of operation of the ram assembly, that is, the ram will be moved to its extreme downward position and returned to the position of Fig. 1. The

shaft 24 may be driven in any convenient manner although in Fig. 6 I have indicated a motor 28, speed reducer 29 and single revolution clutch 30, since this equipment will be sufficient for a complete understanding of this invention.

The weight of the ram assembly is counterbalanced in a known manner, and I have illustrated only so much of the counterbalance mechanism as will be necessary to an understanding of the invention. The device comprises a cylinder 31 containing a plurality of heavy coil springs of the compression type (not shown). These springs are nested one within the other and bear against an abutment on the upper end of the rod 32, thus urging the rod 32 upward. A clevis 33 is provided at the lower end of the rod 32, and engages a pin 34 fixed in the member 12 of the ram assembly. The spring housing 31 is mounted by means of a bracket 35 to a cross bar 36, which extends substantially across the machine and supports other devices which will be described hereinafter.

A second counterbalance device similar in all respects to the one just described is mounted at the other side of the machine and engages the member 12*a* of the ram assembly. Clevis 33*a* and pin 34*a* of this counterbalancing device are shown in Fig. 6. The links 25 have cut out portions 25*a* through which the cross bar 36 extends, the bar being secured in any suitable manner to the side frame members 37 and 38. As seen in Fig. 1, a bracket 39 is bolted to the frame at 41 and to the cross bar 36 at 39*a*. The bracket has a half bearing 41*a* against the shaft 24 to counterbalance upward bending of the shaft. A similar bracket 40 is supplied at the other end of the shaft.

Suitable guide members are of course provided for directing the movement of the ram assembly, but these have been omitted from the drawings in order to avoid undue complication. Since the precise details of these guide members and also the details of the above described mechanical elements form no essential part of the present invention, and are only incidental to a complete description thereof, I have not described them in great detail.

Supported, as will be described in more detail hereinafter, beneath the brace plate 11, are a series of magnet bars 42 which serve to support the portion 15*a* of the sheet 15, which extends beyond the fixed shear blade 14. A back gauge bar 43 is fixed near each end to nuts 44, which are adapted to slide in guides 45, which guides in turn are fixed to the under side of the brace plate 11. Screws 46 are suitably mounted within the guides 45 and engage the nuts 44. Each of the screws 46 as is clearly shown in Fig. 1, is provided with a bevel gear 47 meshing with a bevel gear 48 fixed on the shaft 49. The shaft 49 is journaled in gear boxes 50, which are integral with the guides 45, and a hand wheel 51 is fixed on one end of the shaft, whereby the position of the back gauge may be shifted. The front face 43*a* of the back gauge against which the sheet 15 abuts, is cut away as at 43*b* to make room for the rear ends of the magnet bars 42.

Each of the magnet bars is supported by a pair of rods 52 which pass through portions 42*a* into magnet bars and are headed at their lower ends at at 52*a*. The rods 52 are slidable in bushings 53 which are threaded into the brace plate 11 and are provided with lock nuts 54. The upper ends of the rods 52 are threaded to receive the spring couplers 55 which are retained in desired position of adjustment by means of the lock nuts 56. The spring couplers 55 are supported from the arms 58 and 71 by means of springs 57. These springs are wound with an initial tension ample to support the magnet bars. In their contracted position as shown in Fig. 1, the convolutions of the springs are one against the other so that each spring functions substantially as a rod, and the vertical position of the magnet bars is determined by the point of support provided by the arms 58 and 71.

It is desirable in cutting different thicknesses of sheets that the magnet bars be capable of adjustment to various heights above the level of the table 16. To this end each of the springs 57 at the front end of the magnet bars is attached to a lever arm 58, which lever arms are fixed at appropriate intervals to a shaft 59. The shaft 59 is journaled in bearings 59*a*, at each side of the machine. A lever 60 is fixed to the shaft 59, and has pivoted to it as at 60*a*, a link 61 which extends forwardly through a slot 62 in the bracket 63. A handle 61*a* is provided at the outer end of the link 61 and a plurality of notches 61*b* are provided in the lower edge thereof. These notches are arranged to engage a pointed screw 64 in the bracket 63 to hold the link 61 in any desired position. A small spring 65 bearing against the upper edge of the link 61 and contained in the bracket 63 serves to normally hold the notches 61*b* in engagement with the screw 64. Thus by simply raising the handle 61*a* and moving the link 61 to a new position the height of the front ends of the magnet bars may be adjusted. The link 61 may be graduated as shown at 61*c* to indicate the exact height of the front ends of the magnet bars with respect to the table 16.

The position of the rear ends of the magnet bars is similarly controlled by a handle 66 fixed to the link 67 which may also be graduated and provided with a notched latching device similar to that described in connection with the link 61. The link 67 is pivoted as at 68 to the arm 69, which is fixed on the shaft 70. The shaft 70 extends across the machine and has fixed to it at appropriate intervals a series of short arms 71 similar to the arms 58. The upper ends of the rear supporting springs 57 are attached to the respective arms 71.

By reference to Fig. 6, it will be noted that the cutting edge of the shearing blade 13 is angularly disposed with respect to the blade 14 and that the brace plate 11 is parallel to the blade 13. The magnet bars 42 however lie in a plane parallel to the table 16. The rods 52 are of such length that the distances from the magnet casings to the under sides of the sleeves 53 are progressively greater from the left to right, as seen in Fig. 6.

As the ram assembly starts to descend the bushings 53 slide downwardly upon the rods 52 until the lower faces of the bushings come into contact with the magnet casings. From this point on, the magnet casings will be carried downward with the ram assembly against the tension of the springs 57. By virtue of the construction shown and the progressive lengths of the rods 52, the magnet bars will be carried downward with their sheet supporting faces in alignment with the cutting edge of the blade 13; thus the cut-off portion of the sheet will be carried along and the sheet will be subjected to no unnecessary strains or bending.

In Fig. 7 I have shown a limit switch arrange-

ment, and in Fig. 8 a wiring diagram. At **78** there is indicated a source of alternating current to which the magnets are connected through a rectifier **80**. A rheostat **79** is provided for varying the voltage supplied and therefore the pull of the magnets. A switch **77** is disposed in parallel to the rheostat **79** so that the latter may be bypassed. The reason for this construction is that it is desirable to have only just enough magnetism to support the sheet while adjusting and gauging so that the sheet may be moved even though it is held up by the magnet bars. At the moment the shearing action starts however, it is desirable to clamp the sheet more tightly and therefore the switch **77** is arranged to be closed as the ram starts to descend. The switch **76** is normally closed and is arranged to be opened by means of the cam element **75**, when the movable shear blade reaches the bottom of its stroke, thus cutting off the current to the magnets and permitting the sheet to drop on to a pile, conveyor or delivery chute. A switch **76***a* normally open, is provided in parallel with the switch **76** in case it is desired to have the magnets continuously operative as when shearing in a reverse direction, that is with the main body of the sheet held by the magnets. It will be clear that if the switch **76***a* is closed the sheet will be continuously held and will not be dropped at the end of the stroke.

It will be clear from the above description that the cam **75** may be varied to suit the particular exigencies of the occasion, and that if it is desired to have the magnetism exerted over a longer or shorter period of time, this can easily be accomplished by varying the length of the cam plate **75**.

Coming now to a description of the magnetic bars, I have shown in Figs. 1, 2 and 4 an electromagnetic type in which a plurality of electromagnets are provided.

Reference is made to my co-pending application Serial No. 345,197, filed of even date herewith, in which I have disclosed and claimed other types of magnet bars, involving permanent magnets.

The windings indicated generally at **80'** are mounted upon a stud **81**, which is provided with an insulating wrapping as at **82**, the ends of the coil may be insulated as at **83**. The stud **81** is threaded into the U shaped housing as indicated at **84**. An armature **85** is screwed to the respective studs **81** as by means of screws **86**, which may also serve to hold in position a thin piece of any suitable material **87** for the purpose of closing the U shaped member and keeping out dirt and the like.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination with a shear having blades for cutting sheet metal, electro-magnetic means for holding up the unsupported portion of a sheet beyond the blades, and means to render said electro-magnetic means effective in holding up a sheet while permitting movement of the sheet in its plane.

2. In combination with a shear having blades for cutting sheet metal, electro-magnetic means for holding up the unsupported portion of a sheet beyond the blades, and means to render said electro-magnetic means effective in holding up a sheet while permitting movement of the sheet in its plane, said electro-magnetic means comprising a plurality of magnet bars disposed side by side transversely of said shear blades.

3. In combination with a shear having blades for cutting sheet metal, electro-magnetic means for holding up the unsupported portion of a sheet beyond the blades, and means to render said electro-magnetic means effective in holding up a sheet while permitting movement of the sheet in its plane, said electro-magnetic means comprising a plurality of magnet bars disposed side by side transversely of said shear blades, said last mentioned means comprising means for controlling the attractive force of said magnets.

4. In combination with a shear having blades for cutting sheet metal, electro-magnetic means for holding up the unsupported portion of a sheet beyond the blades, said means comprising a plurality of magnet bars disposed side by side transversely of said shear blades, said magnet bars being supported from a part of the shear frame, means for causing individual of said magnet bars to descend with the movable shear blade from the time when such portion of said blade which is aligned with such magnet bar is substantially coplanar with the bottom of said magnet bar.

5. In a shear having a fixed blade and a movable blade the cutting edge of which is non-horizontal, a plurality of magnetic bars arranged side by side normal to said shear blades with the bottoms of said magnet bars in a common horizontal plane, and means for causing said magnet bars in sequence from one side of the shear to the other to descend with the blade progressively as that portion of the movable shear blade which is aligned with such magnet bars is coplanar with the bottom of such magnet bar.

6. In a shear having a fixed blade and a movable blade, a pair of transverse shafts disposed parallel to the line of cut of said shear, a plurality of levers fixed to each of said shafts, a plurality of magnet bars arranged side by side transversely of said shear with the bottoms thereof in a common horizontal plane the front ends of the respective magnet bars being suspended from the levers on one of said transverse shafts, the rear ends of said magnet bars respectively being suspended from the levers on the other said transverse shaft, and means for rocking each of said transverse shafts in order to adjust the vertical position of said magnet bars.

7. A shear according to claim 6 in which said magnet bars are yieldably suspended from said levers and lost motion means in connection with the individual magnet bars and connected to the movable shear blade whereby when the shear blade, at a point where it is aligned with a magnet bar is coplanar with the bottom of said magnet bar, said magnet bar will descend with the shear.

8. A shear according to claim 6 in which the means for rocking said transverse shafts comprise levers accessible from the front of the machine.

9. A shear according to claim 6 in which the means for rocking said transverse shafts comprise levers accessible from the front of the machine, said levers being calibrated in terms of the height of the bottom of the magnet bars above the fixed shear blade.

10. A shear according to claim 2 in which there is provided a back gauge having cut-out portions to accommodate the magnet bars and means for adjusting the position of said back gauge with respect to the shear blades.

11. In the combination according to claim 1, an electric circuit including a source of electric current for said electromagnetic means, a rheostat in said circuit for adjusting the voltage supplied

to said electromagnetic means, and means for short circuiting said resistance.

12. In the combination according to claim 1, an electric circuit including a source of electric current for said electromagnetic means, a rheostat in said circuit for adjusting the voltage supplied to said electromagnetic means, and means for short circuiting said resistance, the means for short circuiting said resistance being operative in response to the initial movement of said shear.

13. In the combination according to claim 1, an electric circuit including a source of electric current for said electromagnetic means, a rheostat in said circuit for adjusting the voltage supplied to said electromagnetic means, and means for short circuiting said resistance, said circuit including also a normally closed switch and a normally open switch connected in parallel with said normally closed switch.

14. In the combination according to claim 1, an electro circuit including a source of electric current for said electromagnetic means, a rheostat in said circuit for adjusting the voltage supplied to said electromagnetic means, and means for short circuiting said resistance, said circuit including also a normally closed switch and a normally open switch connected in parallel with said normally closed switch, said normally closed switch arranged to be opened at the completion of the cut and said normally open switch permitting the maintenance of the circuit at the completion of the cut, when desirable.

15. In combination with a shear having blades for cutting sheet metal, a main shaft, electromagnetic means for holding up the unsupported portion of a sheet beyond the blades, an electric circuit including said electro-magnetic means and a source of electric current therefor, a rheostat in said circuit and a switch for short circuiting said rheostat, said circuit including also a normally closed switch and a normally open switch in parallel therewith, a cam on said main shaft, said cam arranged to close said rheostat short circuiting switch upon initiation of movement of the shear, and said cam arranged also to open said normally closed switch upon completion of the cut, said normally open switch permitting the electric circuit to be maintained at the completion of the cut if desired.

MERRILL W. HAZELTON.