United States Patent [19]

Roberts

[11] **3,926,081**

[45] **Dec. 16, 1975**

[54] **BACK GAUGE WARNING SYSTEM FOR SHEARS AND THE LIKE**

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[22] Filed: **Dec. 9, 1974**

[21] Appl. No.: **530,722**

[52] **U.S. Cl.** **83/96;** 83/61; 83/167; 83/268; 83/358; 83/395; 83/522

[51] **Int. Cl.**[2] **B26D 7/16;** B26D 7/22

[58] **Field of Search** 83/96, 167, 268, 358, 395, 83/522, 79, 61, 94, 212; 214/1.6

[56] **References Cited**

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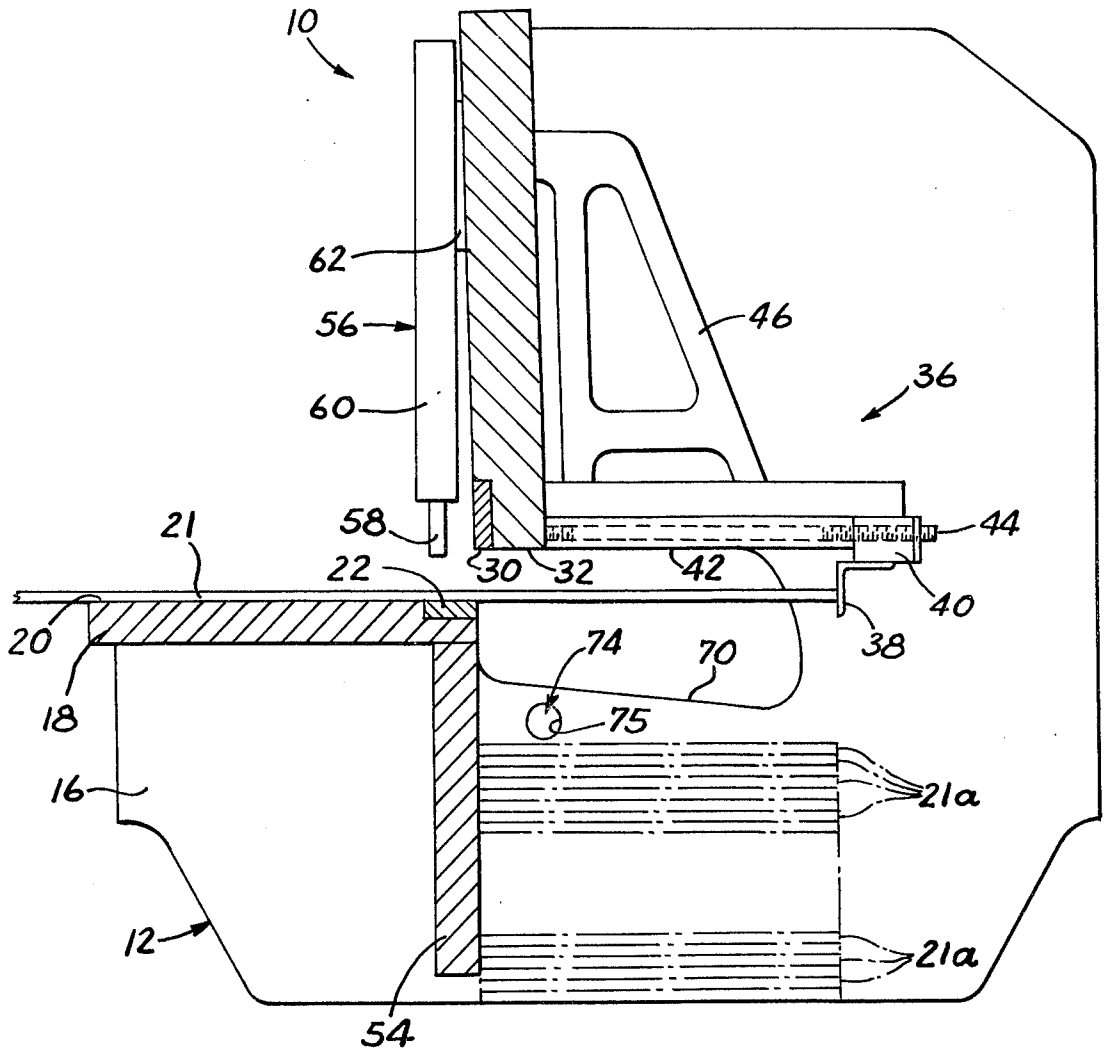
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Attorney, Agent, or Firm—Fitch, Even, Tabin & Luedeka

[57] **ABSTRACT**

A safety warning system for use with a shear or the like is disclosed wherein a light beam source and photosensor means are mounted beneath the movable cutter knife and back gauge assembly of the shear to detect the stack up of sheared stock and effect a signal to the operator when a predetermined stack height is reached so that the sheared portions may be removed from the receiving area or the shear stopped to prevent the back gauge from striking the stacked stock with resulting damage to the back gauge.

5 Claims, 4 Drawing Figures



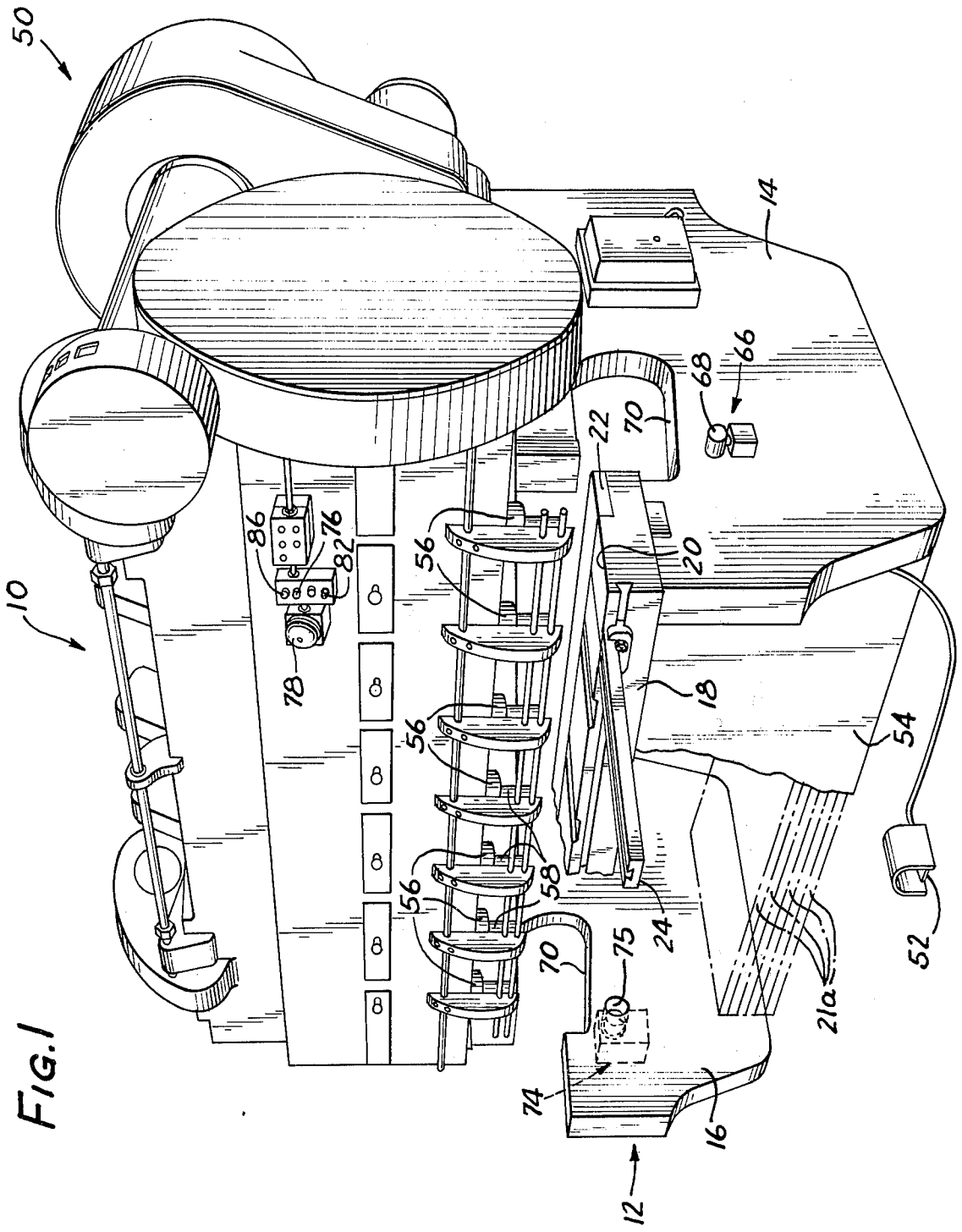

50
14
66
68
70
22
86
76
82
56
20
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24
52
70
75
21a
74
16
12

FIG. 1

FIG. 2

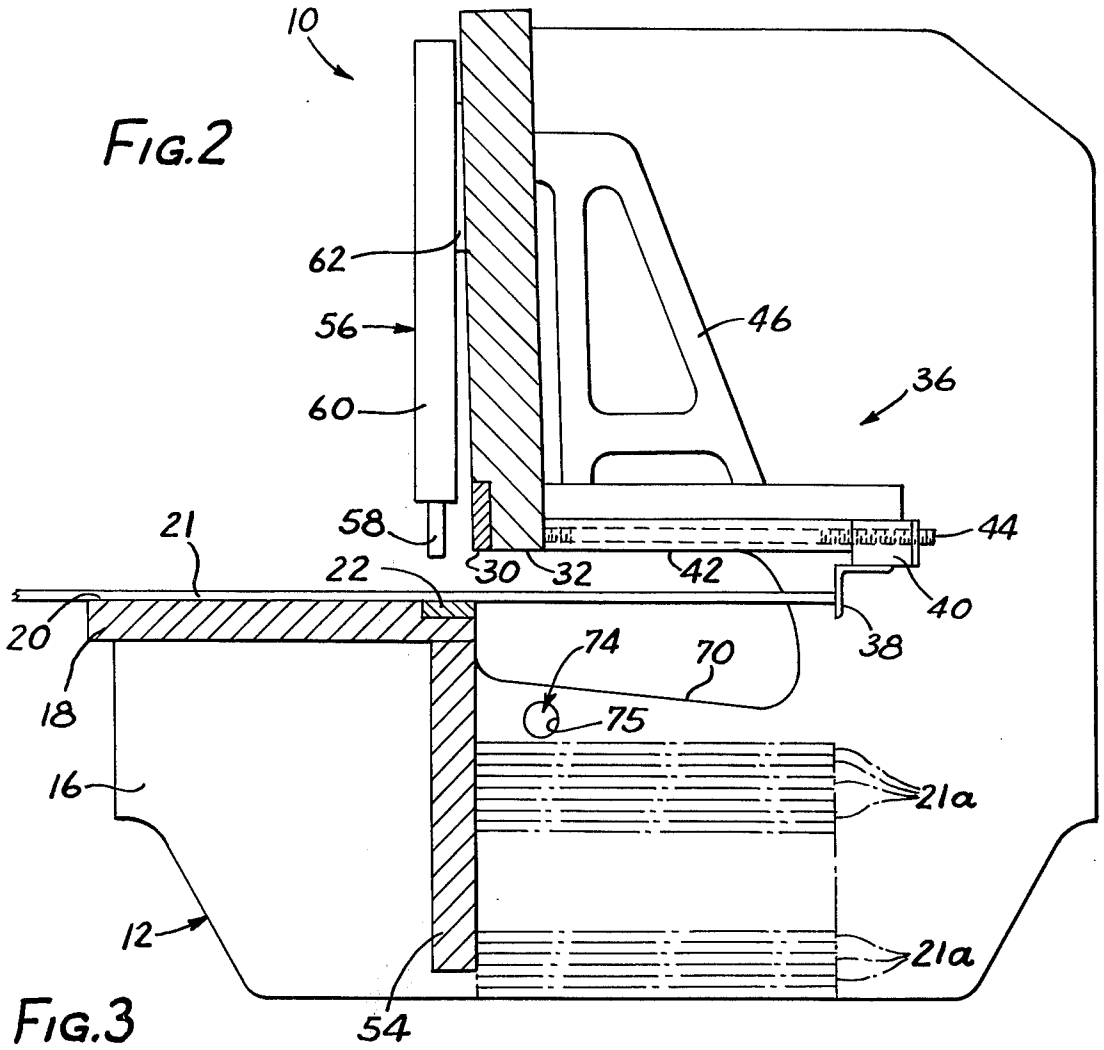


FIG. 3

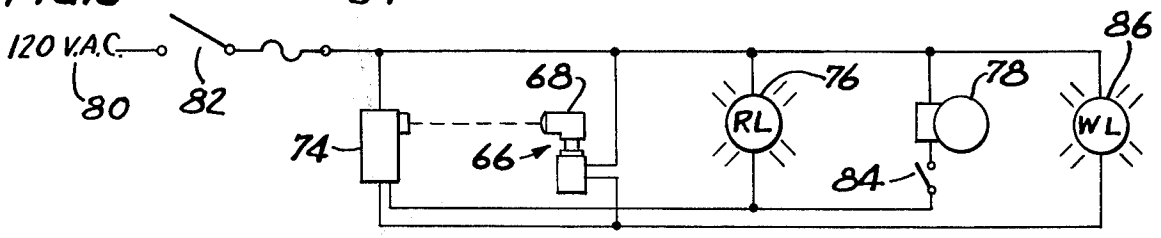
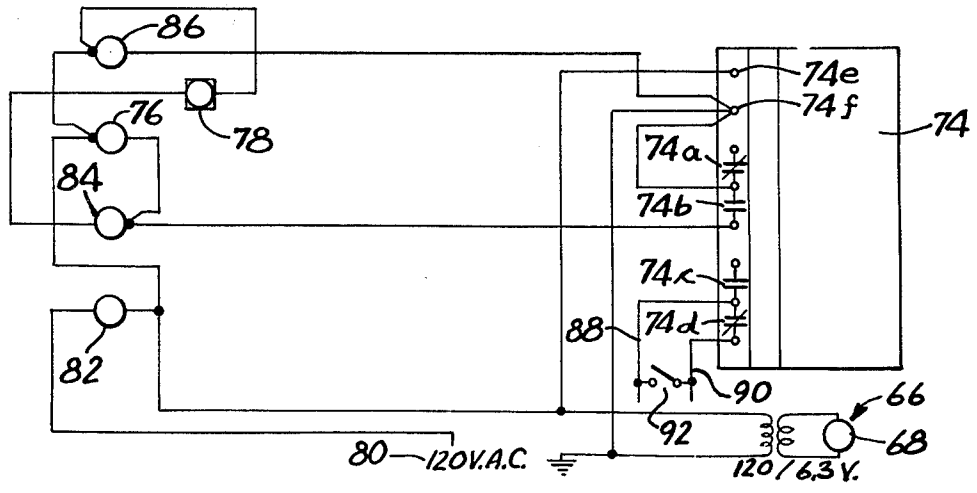


FIG. 4



BACK GAUGE WARNING SYSTEM FOR SHEARS AND THE LIKE

The present invention relates generally to safety systems for shears and the like, and more particularly to a novel safety system which is operative to warn an operator of a shear that the stack of sheared stock pieces has reached a height at which the stack could be engaged by the back gauge of the shear with resulting damage to the back gauge.

Conventional shears include base frames which have laterally spaced generally upstanding end plates. The end plates support a horizontal support table along with sheet stock to be sheared may be moved into position to underlie a cutter knife or shear blade. A back gauge is generally provided rearwardly of the cutter knife and serves as a stop against which the sheet stock may be positioned to establish aa predetermined size of the sheet stock to be sheared. The back gauge is vertically movable with the shear knife and always extends below the cutting edge of the shear knife. As the sheet stock is sheared, the sheared portions drop into a receiving area between the end plates and below the shear knife and back gauge to form a stack of sheared pieces. As the height of the stacked sheared pieces increases, it reaches a height at which, if the sheared portions are not removed, the back gauge may strike the stack which results in severe damage to the back gauge.

The present invention provides a safety warning system for such a shear which signals the operator when the stack of the severed pieces reaches a predetermined height so as to allow the operator to stop the shear or otherwise reduce the stack sufficiently to prevent the back gauge from striking the stack of sheared pieces, and thereby prevent damage to the back gauge.. Alternatively, the safety system in accordance with the present invention may be employed to automatically stop the shear before the stack of sheared workpieces reaches a height which could damage the back gauge.

Accordingly, one of the primary objects of the present invention is to provide a novel safety warning system for use with a shear and the like, which system is operative to signal an operator prior to a stack of sheared workpieces reaching a height which could result in damage to the back gauge of the shear.

Another object of the present invention is to provide a novel warning system for a shear and the like wherein photosensor means are positioned adjacent a sheared workpiece receiving area of the shear and are connected in circuit to warning signal means so as to provide a warning to an operator when the stack of sheared workpieces reaches a predetermined height above which damage to the back gauge of the shear could result.

Further objects and advantages of the present invention, together with the organization and manner of operation thereof, will become apparent from the following detailed description of the invention when taken in conjunction with the accompanying drawings wherein like reference numerals designate like elements throughout the several views, and wherein:

FIG. 1 is a perspective view of a shear employing a safety warning system in accordance with the present invention, portions of the shear being broken away and a number of severed sheets being shown stacked between the end plates of the shear after shearing;

FIG. 2 is a somewhat schematic sectional view, taken generally transverse to the longitudinal axis of the shear of FIG. 1, illustrating the manner in which sheet stock is sheared and stacked between the end plates of the shear;

FIG. 3 is a schematic circuit diagram of the safety warning system in accordance with the present invention; and

FIG. 4 is a circuit diagram showing the receiver connected in circuit with the various warning system indicators.

Referring now to the drawings, and in particular to FIG. 1, a shear employing a safety warning system in accordance with the present invention is indicated generally at **10.** The shear **10,** to be briefly described hereinafter, is illustrative of but one type of shear or the like with which the safety warning system in accordance with the present invention may be employed. The shear **10** includes frame means, indicated generally at **12,** having a pair of laterally spaced generally identical upstanding end plates **14** and **16** which rest upon the floor or support surface underlying the shear **10.** A horizontally disposed support table **18** is supported by the end plates **14** and **16** and has an upper support or guide surface **20** upon which metallic sheet stock **21** (FIG. 2) may be positioned preparatory to shearing the sheet into smaller pieces of predetermined size.

The support table **18** has a stationary knife or shear block **22** secured thereon at the rearward upper edge of the support table, the shear block **22** having its upper surface coplanar with the guide surface **20.** In the embodiment of the shear **10** illustrated in FIG. **1,** extension support arms, one of which is indicated at **24,** are mounted on the support table **18** in a conventional manner to provide additional support for the sheet stock **21** as it is introduced into the shear **10** for shearing.

With particular reference to FIG. **2,** the shear **10** includes a movable shear knife or blade **28** which is supported between the end plates **14** and **16** for movement in a generally vertical direction in a known manner. The movable shear knife **28** has a shearing block **30** secured to the forward lower edge of the movable knife adjacent a lower end surface **32** thereof. The shearing block **30** defines a shearing edge which is cooperative with the stationary shear block **22** to effect shearing of the sheet stock **21.** To this end, the movable knife **28** is movable between an upper position, wherein the shearing block **30** is spaced above the plane of the upper guide surface **20** of the support block **18,** and a position wherein the shearing block **30** passes downwardly through the plane of the upper support surface **20** during a shearing operation, as is known.

The shear **10** includes a back gauge assembly, indicated generally at **36,** which is of known construction and is movable with the movable shearing knife **28** between its upper and lower positions. The back gauge assembly **36** includes an inverted L-shaped stop member **38** which is secured to the bottom surfaces of a pair of laterally spaced identical support blocks, one of which is shown at **40.** As is known, the support blocks **40** are supported by and adjustably movable longitudinally along the lengths of associated guide bars **42** by means of screw shafts, one of which is shown at **44.** Means (not shown) are provided for rotating the screw shafts **44** to effect selective movement of the support blocks **40** and associated stop member **38** along the

lengths of the guide bars **42.** In this manner, the stop member **38** may be moved to a selected position relative to the cutting plane defined by the shear blocks **22** and **30** so as to establish a predetermined length of sheet stock which will be sheared from the sheet **21** when the inner edge of the sheet is positioned against the stop **38** during a shearing operation. The guide bars **42** and associated support blocks **40** and stop member **38** are secured in rigid relation to the movable knife **28** through suitable attaching bracket means **46.**

During a shearing operation, a piece of sheet stock **21** is placed on the support surface **20** of the support table **18** and is moved to a position wherein its inner end abuts the stop member **38** which has previously been adjusted to establish a predetermined width of sheet stock to be sheared. The shear **10** includes drive mechanism, indicated generally at **50** in FIG. **1,** of known design which is operatively associated with the movable shear knife **28** to effect downward movement thereof to a shearing position through the operation of a foot pedal actuator **52** by the operator of the shear. The drive mechanism means **50** is operative to effect downward movement of the movable shear knife **28** to a position wherein the shear block **30** cooperates with the stationary shear block **22** to shear the sheet stock **21.** As the sheet stock **21** is sheared, the severed sheet portion, such as indicated at **21a** in FIGS. **1** and **2,** will drop down into a receiving area defined between the laterally spaced upstanding end plates **14** and **16** of the shear **10.**

To assist in generally uniform positioning and stacking of the severed workpiece portions **21***a*, a generally vertically disposed guide plate **54** is secured in depending normal relation to the support block **18** and provides a guide surface for the adjacent forward edges of the sheared workpieces. It will be understood that the operator may continue to feed sheets of stock **21** into the shear **10** to shear a plurality of pieces **21a** which will drop downwardly into the receiving area defined between the end plates of the shear **10** in stacked relation with preceding sheared workpiece portions to provide a stack of sheared workpieces.

To facilitate operation of the shear **10,** a plurality of hold-down members **56** are provided along the transverse width of the shear **10** to engage the sheet stock **21** above the stationary shear block **22** as the movable shear knife **28** is moved downwardly to shear the sheet stock. Each of the hold-down members **56** is of conventional known design and may include a generally cylindrical pressure foot **58** which may be slightly resiliently biased outwardly from an associated cylinder **60,** the lower end of each cylindrical pressure foot **58** being disposed below the lower surface **32** of the movable knife **28** so that the pressure feet **58** engage the sheet stock **21** prior to shearing. The hold-down members **56** may be carried by the movable shearing knife **28** as through attaching brackets **62** (FIG. **2**).

It will be seen from FIG. **2** that the lowermost edge of the stop member **38** is disposed below the lower surface **32** of the movable knife **28** and will therefore always be disposed below the shearing edge defined by the movable shear block **30** during movement of the shearing knife **28.** It has been found that when the sheared workpieces **21***a* drop down into the receiving area between the end plates **14** and **16** of the shear **10,** they do not always stack uniformly; that is, the forward edges of the severed stacked pieces do not always abut the plate **54,** with the result that the rear edges of some of the stacked pieces may extend rearwardly beyond a vertical plane vertically aligned with the stop member **38.** As a result, if the stack of sheared workpieces **21***a* is allowed to become too high, the stop member **38** may engage the stack during downward movement of the back gauge assembly **36** with resulting damage to the stop member **38** and associated back gauge assembly.

The present invention is concerned with providing a safety warning system which is operative to provide a visual and/or audible signal to the operator when the height of the stacked sheared workpieces **21***a* reaches a predetermined height which is safely below the lowermost position of movement of the stop member **38** during a shearing operation. To this end, the safety warning system in accordance with the present invention includes light source means, indicated generally at **66,** supported by the frame means **12** and adapted to project a light beam between the spaced end plates **14** and **16** through the receiving area which receives the severed workpieces **21***a*. In the illustrated embodiment, the light source means **66** includes a conventional electric eye **68** which is suitably mounted on the end plate **14** adjacent a recessed throat area **70** formed in the end plate **14.** The electric eye **68** is mounted adjacent a suitable opening (not shown) in the end plate **14** so as to project a light beam across the area defined between the spaced end plates **14** and **16** of the frame means **12.**

Light receiver means of conventional design, indicated generally at **74,** are mounted on the end plate **16** in alignment with the light beam produced by the electric eye **68** so as to receive the light beam projected by the electric eye when the light path between the end plates **14** and **16** is unobstructed. To this end, the light receiver means **74,** which might alternatively be defined as photosensor means, is mounted outwardly of the end plate **16** with its photocell lens adjacent an opening **75** through the end plate **16.** It can be seen that with the electric eye **68** and associated light receiver **74** mounted as described to project and detect a light beam across the receiving area defined between the spaced end plates **14** and **16** of the shear **10,** and by positioning the electric eye **68** and light receiver **74** at a predetermined height above the floor surface upon which the shear **10** is supported, means are provided to detect an obstruction of the projected light beam at a predetermined height above the floor surface.

With particular reference to FIGS. **3** and **4,** the light source means **66** and light receiver **74** are connected in circuit with a visual indicator and an audible signal producing device to produce signals to the operator of the shear **10** when the stack of sheared workpieces **21***a* reaches a predetermined height so that the operator can remove the sheared workpieces **21a** before the stack reaches a height at which it could be engaged by the stop member **38** of the back gauge assembly **36** during a shearing cycle with resulting damage to the back gauge assembly. An indicator or signal light **76,** which preferably comprises a conventional red light and is mounted on the forward upper portion of the shear **10** as shown in FIG. **1,** and a conventional audible sound device **78,** such as a conventional bell, are connected in parallel with the receiver **74** between ground and a 120 volt A.C. voltage source, indicated at **80.** The voltage source **80** may comprise the power supply for the main drive motor of the shear. A single pole, double throw, key-operated selector switch **82** of conventional design is connected between the power

source **80** and the remainder of the warning circuit, as shown in FIG. **3,** to allow selective enabling or disabling of the warning system. A conventional on-off switch **84** is connected in series with the bell **78** to allow selective connection of the bell in circuit for enabling or disabling the bell **78** as a signal producing means. A white light **86** is connected in parallel with the light source **66** and the receiver **74** and provides an indication of whether the warning signal circuit of FIG. **3** is connected to the voltage source **80** through the switch **82.** The light **86** and bell **78** are also preferably mounted on the upper forward portion of the shear **10.**

The receiver **74** is of conventional design and includes a built-in time delay so that momentary interruption of the light beam received from the light source **66,** as during dropping of sheared pieces **21a** onto the stack between the end plates **14** and **16,** will not produce a signal such as desired when the stack reaches a height to endanger the back gauge. FIG. **4** schematically illustrates the receiver **74** and its relay contacts which include a pair of normally closed contacts **74***a*, a pair of normally open contacts **74***b*, a pair of normally open contacts **74***c*, and a pair of normally closed contacts **74d.** The pairs of relay contacts **74***a–d* are disposed in their "normal" positions when the receiver **74** receives or detects a light beam from the light source **66.** The receiver **74** is connected to the power supply **80** and ground through contact terminals **74***e* and **74***f*. It will be noted that the indicator light **76** and bell **78** are connected to the negative or ground polarity of the relay of the receiver **74.** This prevents damage to the relay of the receiver **74** if the light **76** or bell **78** should short out. As shown in FIG. **4,** conductors **88** and **90** are connected to the pair of relay contacts **74***d*. The conductors **88** and **90** may be connected to the control circuit (not shown) for the shear **10** such that interruption of the light beam to the receiver **74** for a period of time in excess of the built-in time delay of receiver **74** will deactivate the shear **10,** as well as cause the alarm bell **78** and red light **76** to be energized. The conductors **88** and **90** may be used for other functions in connection with operation of the shear **10** as desired. To this end, a by-pass switch **92** may be connected between the conductors **88** and **90** to bypass the relay contacts **74***d*.

The warning circuit, as shown in FIG. **3** and including the light source **68** and receiver **74,** is operative to maintain the circuit through the light **76** and bell **78** is an open condition when the light beam from the source **68** is received by the receiver **74.** When the stack of sheared workpieces **21***a* reaches a predetermined height so as to interrupt the light beam from the electric eye **68** to the receiver **74** for a predetermined time period as established by the built-in time delay of the receiver, the normally open relay contacts **74***b* of the receiver **74** are closed to energize the light **76** and alarm bell **78,** assuming switch **84** to be closed, whereby to provide both visual and audible signals to the operator indicating that pieces should be removed from the stack **21***a* to prevent the back gauge stop **38** from striking the stack of sheared pieces with possible damage to the back gauge.

Thus, in accordance with the present invention, a back gauge warning safety system for a shear or the like is provided which warns the operator when the stack of sheared workpieces reaches a height at which it would cause damage to the back gauge of the shear. The operator can then reduce the stack sufficiently to prevent damage to the shear **10** and preclude possible endangerment of the operator.

While a preferred embodiment of the invention has been illustrated and described, it will be obvious to those skilled in the art that changes and modifications may be made therein without departing from the invention in its broader aspects. For example, the receiver **74** may alternatively comprise a light reflector, with the light source means **66** having means responsive to light reflected by the reflector from the light source means **66** to effect energizing of light **76** and bell **78** when the light path is interrupted. The light receiver **74** is preferred because it is less susceptible to coating with oil or other contaminants during operation of the shear **10.**

Various features of the invention are defined in the following claims.

What is claimed is:

1. In a shear or the like having frame means, means defining a generally horizontal support surface along which a workpiece may be moved preparatory to shearing the workpiece, cutter means supported by said frame means and having a cutting edge movable between a first position spaced above the plane of said support surface and a second position spaced below the plane of said support surface so as to shear a workpiece underlying said cutting edge when moved from its said first to its said second positions, back gauge means disposed rearwardly of said cutter means and movable with said cutting edge, said back gauge means being disposed to provide a stop against which the leading edge of a workpiece may abut to establish a predetermined length of the workpiece to be sheared by said cutting edge, said frame means defining a receiving area below said cutter means and said back gauge means to receive severed portions of workpieces which may progressively stack up, and drive means operative to effect selective movement of said cutter means and back gauge means between their said first and second positions; the combination therewith comprising safety means operatively associated with said frame means and adapted to detect the presence of stacked severed workpiece portions at a predetermined height in said receiving area below said cutter means and said back gauge means, said safety means including means for providing a signal when the stack of severed workpiece portions in said receiving area reaches said predetermined height such that an operator is notified to remove severed workpiece portions from below said cutting means and back gauge means before said stack reaches a height sufficient to be engaged by said back gauge means.

2. The combination as defined in claim **1** wherein said frame means includes a pair of laterally spaced upstanding end plates which define said receiving area therebetween, and wherein said safety means includes light source means adapted to project a light beam across said receiving area at a predetermined position relative to the path of travel of said back gauge means, and photosensor means adapted to detect the passage of said light beam across said receiving area, said light source means and said photosensor means being in circuit with said signal means to provide said signal when the stack of severed workpiece portions within said receiving area reaches a predetermined height.

3. The combination as defined in claim **1** wherein said means for providing a signal comprises a visually observable light.

4. The combination as defined in claim 2 wherein said safety means includes an audible sound producing means connected in circuit with said photosensor means and operative to produce an audible signal when said light beam is interrupted by stacked severed workpieces.

5. The combination of claim 1 wherein said means for providing a signal includes both audible sound producing means and a visual indicator.

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