United States Patent

Malmgren

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[45] **Oct. 31, 1972**

[54] **IRON AND METAL WORKING MACHINERY**

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[73] Assignee: **Excel Mfg. Ltd.,** Winnipeg; Manitoba, Canada

[22] Filed: **July 15, 1970**

[21] Appl. No.: **55,053**

[52] **U.S. Cl.** **72/404,** 72/324, 72/453, 83/518, 83/599

[51] **Int. Cl.** **B21j 9/12**

[58] **Field of Search** ..83/518, 599, 515, 598; 72/450, 72/453, 324, 404

[56] **References Cited**

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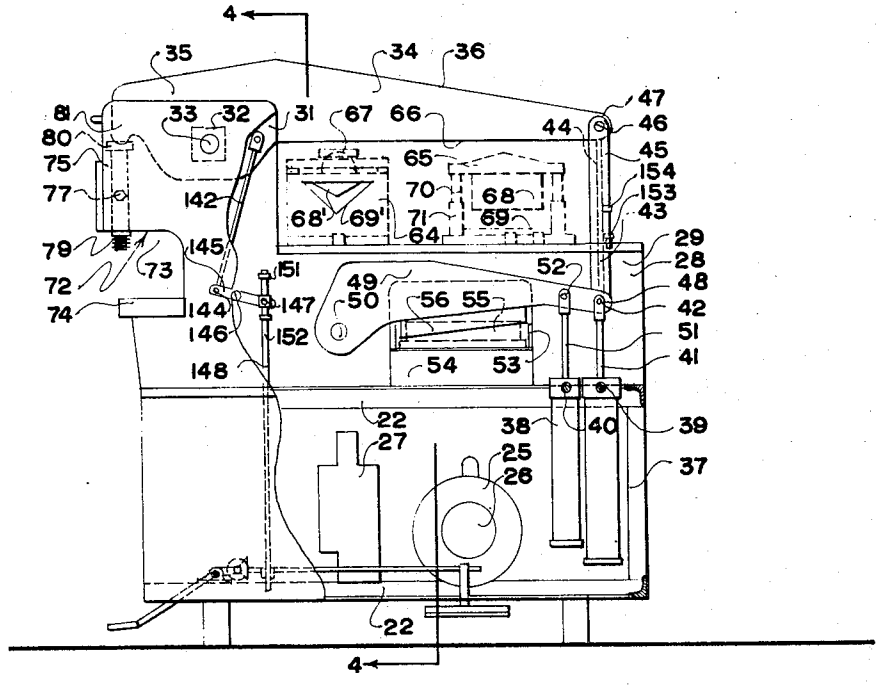
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Primary Examiner—Charles W. Lanham
Assistant Examiner—Gene P. Crosby
Attorney—Kent & Ade

[57] **ABSTRACT**

A main beam is pivoted between the ends and operates punch on the downward stroke of the shorter end and a plurality of detachable metal working tools on the down stroke of the longer end. A secondary beam operates a shear also on the down stroke of the longer end. Two piston and cylinder assemblies are connected to the beam and valving permits the larger of the cylinders to be used for most operations with the smaller cylinder returning the beam to the starting position rapidly. If more force is required both cylinders can be used together for the power stroke.

28 Claims, 20 Drawing Figures



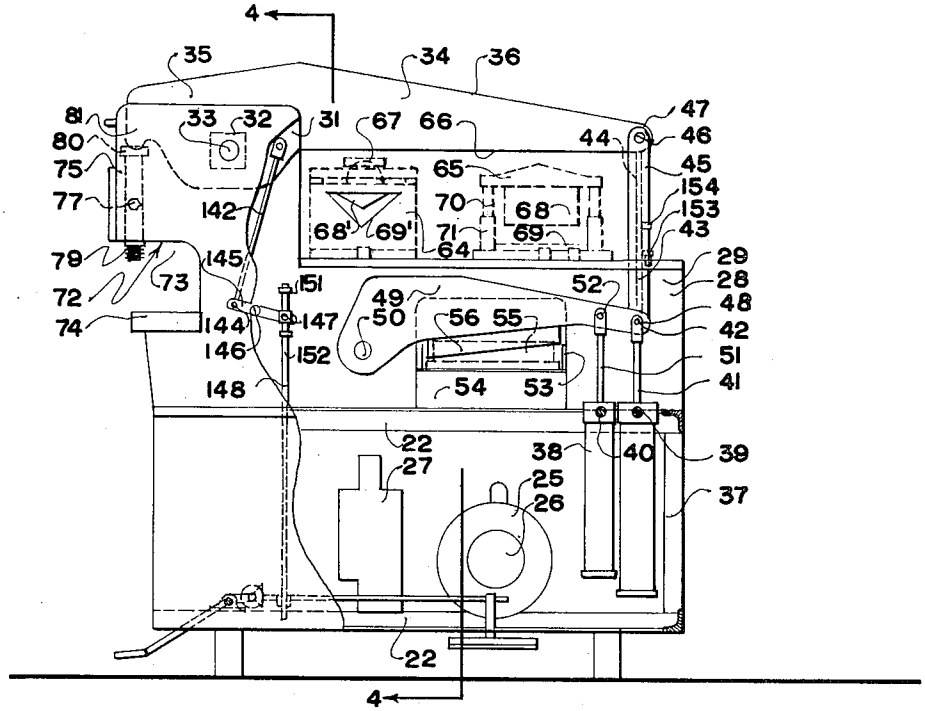


FIG. 1

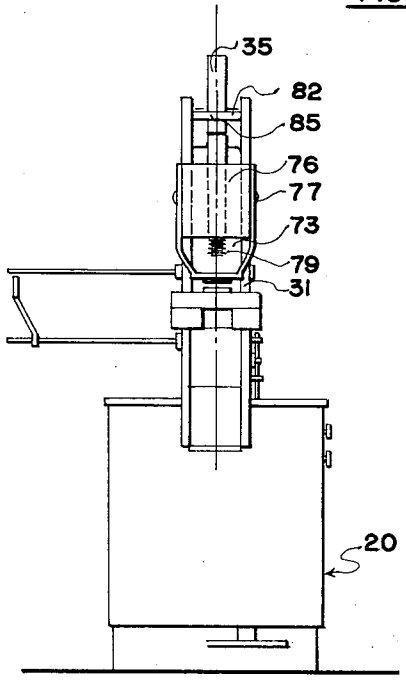


FIG. 2

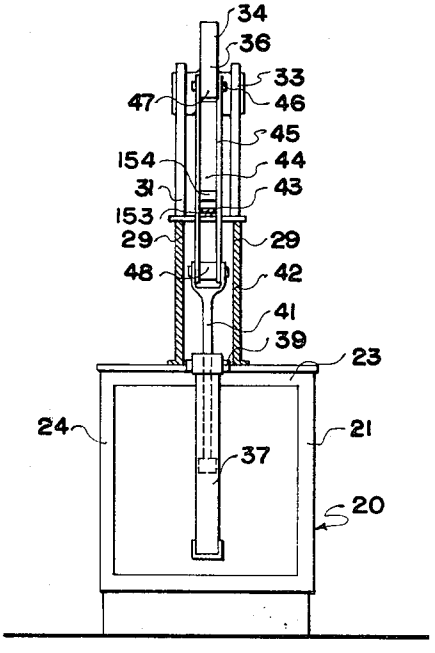


FIG. 3

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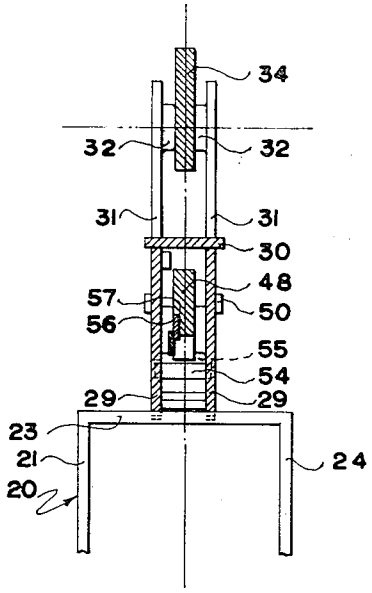


FIG . 4

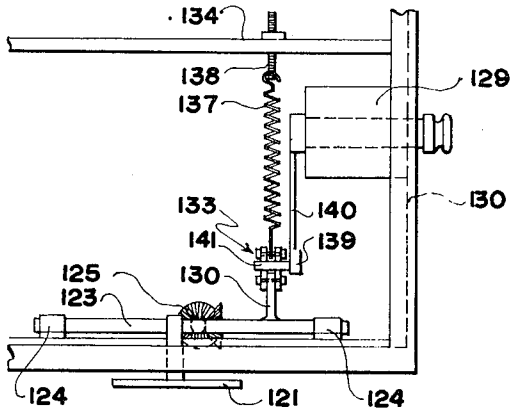


FIG . 6

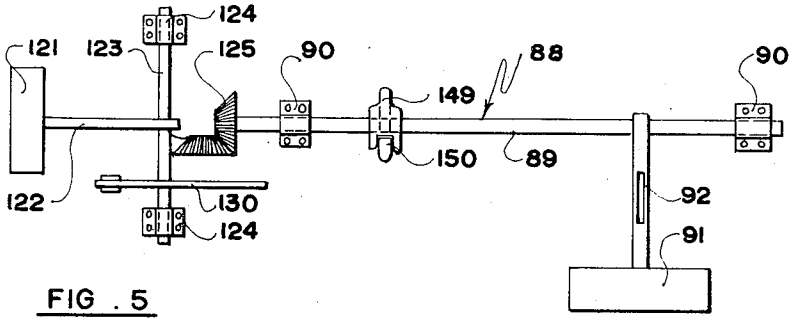


FIG . 5

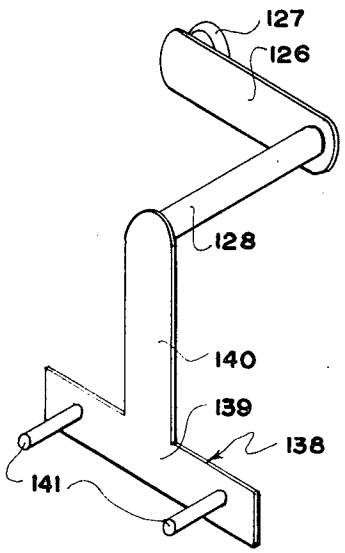


FIG. 7

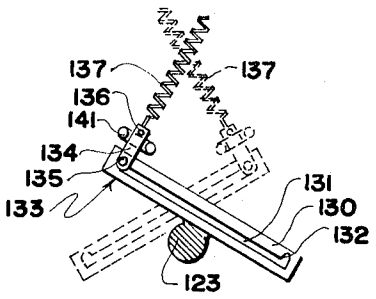


FIG . 8

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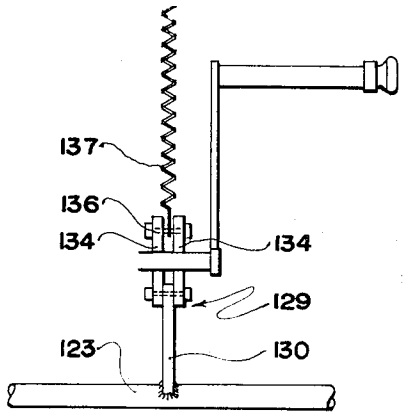


FIG. 9

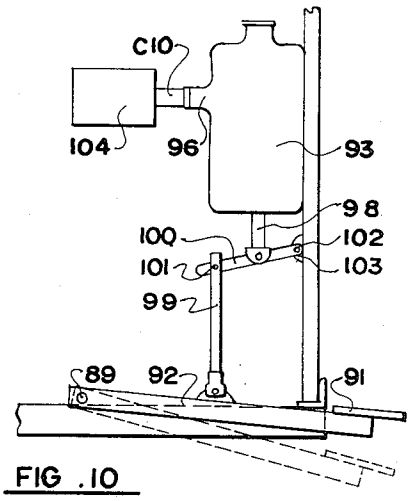


FIG. 10

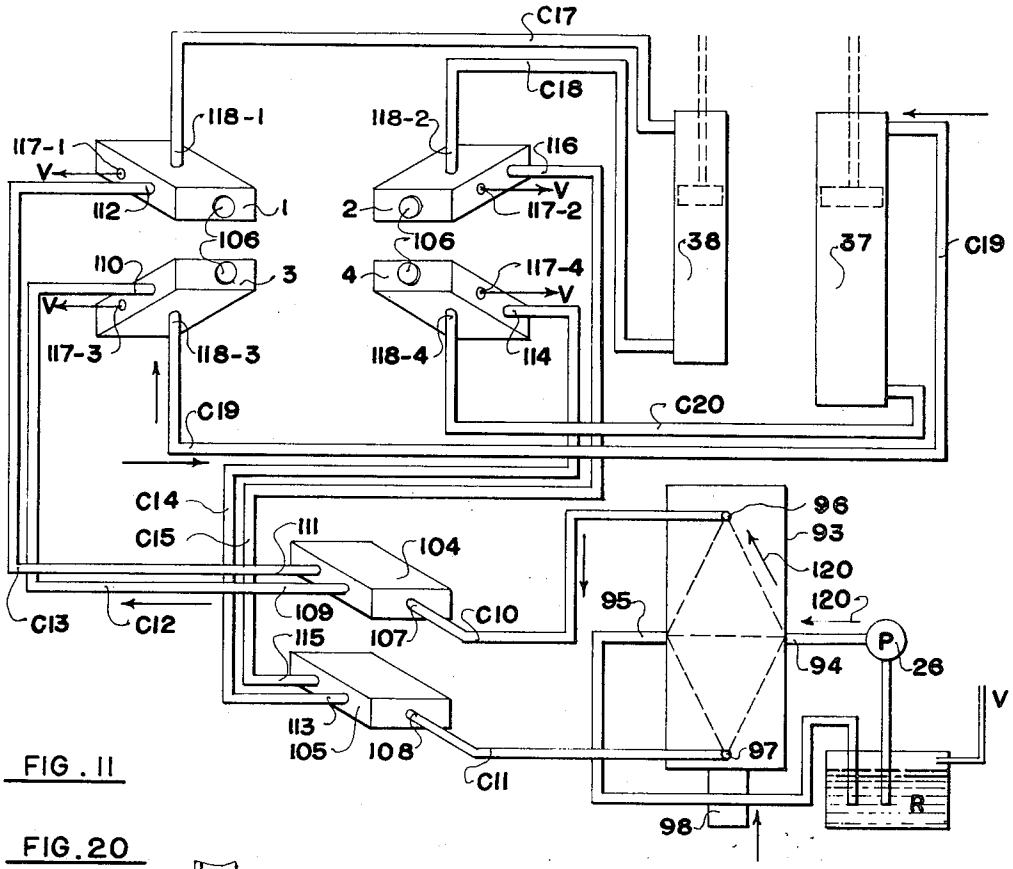
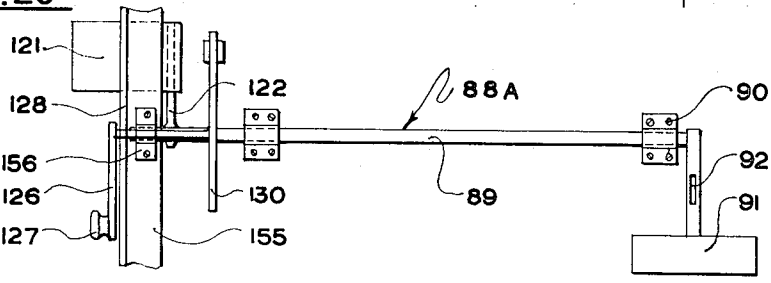


FIG. 11

FIG. 20



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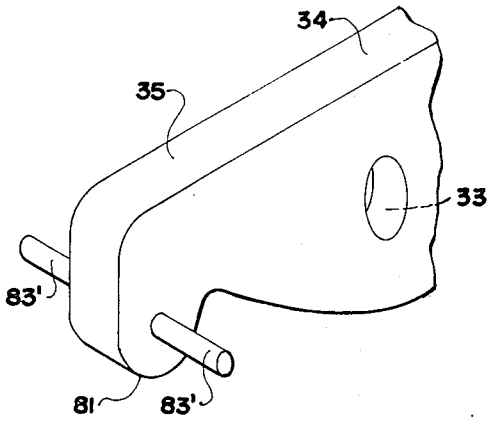


FIG. 12

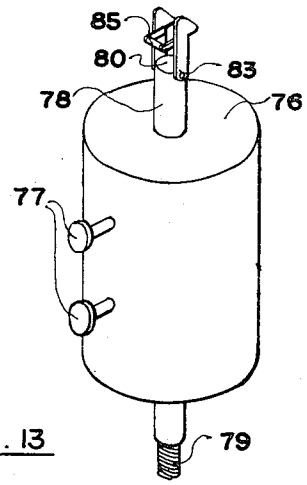


FIG. 13

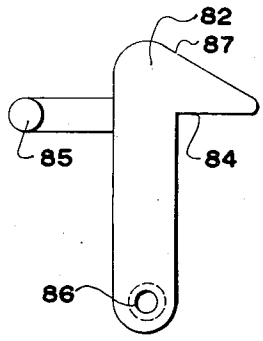


FIG. 14

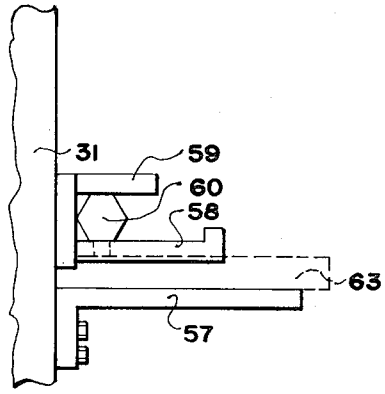


FIG. 15

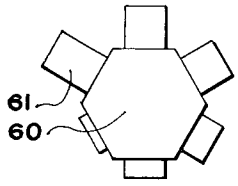


FIG. 16

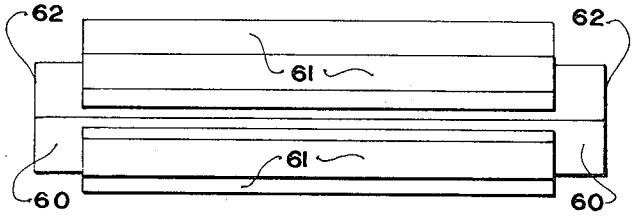


FIG. 17

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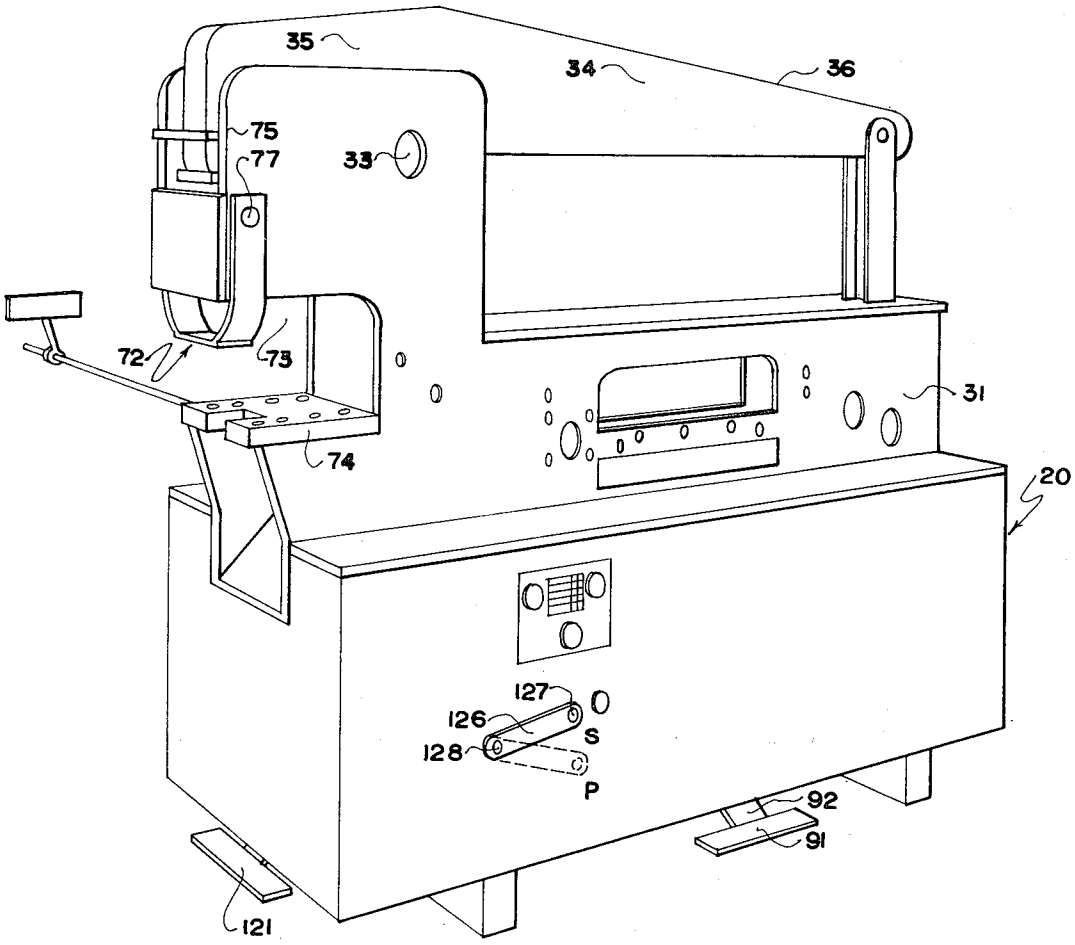
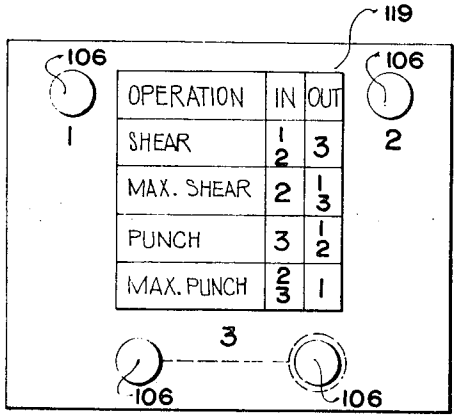


FIG . 18



OPERATION	IN	OUT
SHEAR	1/2	3
MAX. SHEAR	2	1/3
PUNCH	3	1/2
MAX. PUNCH	2/3	1

FIG . 19

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IRON AND METAL WORKING MACHINERY

This invention relates to new and useful improvements in metal working machines commonly known as "iron workers".

Such machines usually incorporate mechanically operated crank and toggle systems which in turn operate accessories such as shear devices, braking devices, notchers, copers, rod shearing devices and punch presses.

Iron working machines normally available suffer from many disadvantages, the principal one of which being poor mechanical advantage and lack of rigidity in the operating parts.

These conventional machines which utilize a crank arm principal can easily be overloaded during use with subsequent damage occurring to linkage and bearing. The present device eliminates the crank and the use of hydraulics prevents overloading from occurring.

Furthermore such machines are not flexible in that they do not provide for a great variety of attachments to be used therewith.

The principal object and essence of the invention is to provide an iron or metal working machine which can first be placed in what I define as a shear or accessory mode or, laternatively, can be placed in a punch press mode. When in the punch press mode, the mechanical advantage is such that punch press operating pressures can be extremely high.

Another advantage of the present device is the fact that a secondary beam is incorporated therewith which includes a shear secured thereto.

Another object of the invention is to provide a device of the character herewithin described in which various accessories can be operated by the device in the accessory or shear mode, any one of which can readily be placed in position or removed from the machine without extensive bolting or unbolting being required.

One of the principal objects of the present invention is the fact that a pair of hydraulic piston and cylinder assemblies are utilized one of which is of a greater volumetric capacity than the other. The relatively large piston and cylinder assembly is normally used for punch press operations or shear and accessory operations while the smaller cylinder is used for return stroke operations, it being understood that with a constant displacement pump, the smaller piston and cylinder assembly makes the return stroke faster than the power stroke.

However, if additional power is required, simple valving can be actuated so both piston and cylinder assemblies can be used on the power stroke either for the punch press mode or the accessory and shear mode with the smaller piston and cylinder assembly still being used for the faster return stroke.

A yet further object of the invention is to provide a device of the character herewithin described which includes a novel hold-down device for the material being used with the shear component.

Finally a still further object of the invention is to provide a relatively compact heavy duty iron or metal working machine which is extremely versatile in operation, is provided with flexibility inasmuch as power requirements are concerned and which is otherwise well suited for the purpose for which it is designed.

With the foregoing in view, and such other or further purposes, advantages or novel features as may become

apparent from consideration of this disclosure and specification, the present invention consists of, and is hereby claimed to reside in, the inventive concept which is comprised, embodied, embraced, or included in the method, process, construction, composition, arrangements or combination of parts, or new use of any of the foregoing, of which concept, one or more specific embodiments of same are herein exemplified as illustrative only of such concept, reference being had to the accompanying figures in which:

FIG. **1** is a front elevation of the machine broken away in part for clarity.

FIG. **2** is an end elevation of FIG. **1** taken from the left hand side thereof.

FIG. **3** is an end elevation of FIG. **1** taken from the right hand side thereof.

FIG. **4** is a sectional view substantially along the line **4—4** of FIG. **1**.

FIG. **5** is a plan of the pedal assembly per se.

FIG. **6** is a partial end view of the pedal assembly.

FIG. **7** is an isometric view of the pedal assembly selector component per se.

FIG. **8** is an enlarged fragmentary front elevation of the pedal assembly selector fork.

FIG. **9** is an end view of FIG. **8**.

FIG. **10** is a fragmentary end view of the shear mode pedal and main valve assembly.

FIG. **11** is a schematic view of the hydraulic layout.

FIG. **12** is a fragmentary isometric view of the punch press end of the main beam.

FIG. **13** is an isometric view of the punch mechanism per se.

FIG. **14** is an enlarged side view of the attaching linkage of the punch mechanism.

FIG. **15** is a fragmentary side view of the shear press hold-down mechanism.

FIG. **16** is an enlarged end view of the hold-down bar per se.

FIG. **17** is a front elevation of the hold-down bar per se.

FIG. **18** is an isometric view of the machine.

FIG. **19** is an enlarged view of the plate giving the selector valve positions.

FIG. **20** shows an alternative embodiment of the pedal assembly.

In the drawings like characters of reference indicate corresponding parts in the different figures.

Proceeding therefore to describe the invention in detail, reference character **20** indicates generally supporting framework consisting of a lower substantially cubical frame **21** composed of angle irons including longitudinal members **22**, transverse members **23** and vertical members **24**.

Situated within this base framework is a source of power taking the form of an electric motor **25** driving a constant displacement pump **26** which is connected to a fluid reservoir **27** as will hereinafter be described.

Further supporting structure **28** extends upwardly from the base supporting structure **20** and takes the form of two relatively heavy duty spaced and parallel plates **29** surmounted by a transverse plate **30**.

At one end of these plates they extend upwardly to form main beam support plate portions **31** as shown in FIGS. **1**, **4** and **18**.

A trunion support pad **32** is welded to the inside of the main beam support plates **31** to support a trunion bearing **33** upon which the main beam **34** is mounted for reciprocal movement in a vertical plane. This main beam is relatively heavy and is journalled upon the trunion **33** between the ends thereof but towards one end **35** which is defined as the punch press end or the relatively short end of the main beam.

The other end **36** of the main beam is defined as the relatively long portion thereof or the accessory operating or shear operating portion and these two portions are of course defined by the position of the trunion **33**.

A pair of hydraulic piston and cylinder assemblies **37** and **38** are supported within the lower base framework **20**. One piston and cylinder assembly **37** is supported by a transverse trunion mounting **39** between the two plates **29** and the other piston and cylinder assembly **38** is also supported by means of a trunion bearing assembly **40** between the plates **29** but inboard of the first piston and cylinder assembly **37**.

Also of note is the fact that the volumetric capacity of the piston and cylinder assembly **37** is greater than the volumetric capacity of the piston and cylinder assembly **38**, the reasons for which will hereinafter become apparent.

The piston rod **41** of the piston and cylinder assembly **37** extends upwardly and is connected by means of pivot pin **42** to the lower ends of a pair of link plates **43** maintained in spaced and parallel relationship by means of web **44**.

The upper ends **45** of these link plates are connected by means of a pivot pin **46** to adjacent the end **47** of the relatively long portion **36** of the main beam as clearly shown in FIGS. **1**, and **3**.

Pivot pin **42** also extends through one end **48** of a secondary beam **49** which is pivoted or journalled between plates **31** by means of trunion **50** and the purpose of this secondary beam will be explained later.

The piston rod **51** of the other piston and cylinder assembly **38** is connected by means of pivot pin **52** to the secondary beam **49** but inboard of the end **48** as clearly shown in FIG. **1**.

The plates **31** are apertured as at **53** to form a shear accessory in association with the secondary beam **49**. A shear bed **54** extends through the apertured plates **31** and a shear block **55** is mounted upon the bed.

A shearing blade **56** is bolted within a recess **57** formed upon the underside of the secondary beam towards the trunion **50** and vertical reciprocation of the secondary beam as will hereinafter be described, will operate the shearing blade **56** in the conventional manner.

At this time reference should be made to FIGS. **15**, **16** and **17** which show the novel hold-down assembly for the shearing component.

A work support table **57'** is bolted to one of the plates **31** and extends outwardly at right angles therefrom adjacent the shear block **55**.

A pair of hold-down bar support brackets **58** extend outwardly one upon each end of the opening **53** and a pair of relatively short brackets **59** also extend outwardly but spaced above the lower brackets **58**.

The hold-down bar is hexagonal and is indicated by reference character **60** in FIGS. **16** and **17** and upon each face of the hexagonal bar is welded longitudinal strips **61** of steel of varying thicknesses. These strips terminate short of the ends **62** of the bar so that these ends can be rested upon the lower supports **58** and then moved inwardly under the supports **59**. By rotating the bar **60** prior to engaging same under the supports **59**, the relevant strip **61** can be moved to the lowermost position so that it engages the work piece **63** (see FIG. **15**) and holds same firmly upon the bed **57** during the shearing operation. The operation of the hold-down bar is simple, quick and efficient.

The transverse plate **30** acts as a bed for various accessories such as those shown in phantom in FIG. **1** and identified by reference characters **64** which indicates an angle shear accessory or **65** which indicates a brake accessory. Many other accessories can be rested upon this bed for operation by the main beam, such accessories including rod shearing devices, notches, copers, and various forms of brakes and the like. All of these are operated by the engagement of the under side **66** of the main beam upon the upper sides of the accessories thus moving same downwardly to actuate same.

For example, the accessories include the upper member **67** which is engageable by the underside **66** of the main beam. This upper member carries the brake or shear **68** or **68'** respectively which moves same downwardly to the work surface **69** or **69'** respectively. Rods **70** move downwardly within bearings **71** to guide the work component downwardly and springs (not illustrated) return them to the uppermost position after the operation is complete. However, the construction of these accessories does not form part of the present invention.

The other end **35** of the main beam **34** operates a punch press assembly collectively designated **72**.

The plates **31** are cutaway as at **73** on the far side thereof to form the float for the punch press and a bed **74** spans the lower edges of this cutaway portion as clearly shown.

Reference should be made to FIGS. **12**, **13** and **14** relative to the assembly of the punch press portion.

Situated between the portions **75** of the plates **31** is a cylindrical bearing component **76** secured in position by means of bolts **77** extends through the plates and into the cylindrical bearing **76**. A mandrel **78** is bearably supported for reciprocation within the bearing cylinder **76** and a screw threaded lower end **79** receives the punch press tools in the usual way.

The upper end **80** of the mandrel is engaged by the lower rounded surface **81** of the punch press end **35** of the main beam **34** as same is moved downwardly around trunion **33**.

Due to the fact that the trunion is relatively close to this rounded end **81**, the mechanical advantage given by the main beam is considerable.

Means are provided to detachably secure the mandrel to the main beam punch press end **35** and take the form of a pair of link plates **82** pivoted to the upper end of the mandrel **78** by means of pivot pin **83**. A detent **84** is formed upon the link plates **82** and these normally engage over spindles **83'** extending from each side of the end **35** of the main beam under which circumstances the rounded portion **81** is in contact with the upper end **80** of the mandrel through the slide block **80'**.

To detach the mandrel from the main beam, a handle **85** is secured between the two link plates **82** so that they can be moved around pivot pin **83** to disengage them from the spndles **83'**. Coil springs **86** normally maintain the link plates in the upright position as shown so that when the end **35** of the main beam moves downwardly, the spindles strike the cammed surfaces **87** on the link plates, move outwardly against pressure of springs **86** and then snaps them into position as soon as the detents **84** can engage over the spindles **83'**. This means that the mandrel is automatically raised from the work when the end **35** of the main beam is raised after the punching operation.

It will be appreciated that when the accessory end or the shear component is being operated, the relatively long end **36** of the main beam should normally be in the uppermost position, should move downwardly upon the power stroke and then should return to the uppermost position.

However when the punch press is being operated, the reverse situation occurs. In the punch press operation the relatively short end **35** is normally in the uppermost position which means that the end **36** will be in the lowermost position. During the punching operation or power stroke, the end **35** moves downwardly and then returns to the uppermost position at the end of the stroke.

I therefore provide means for routing the hydraulic fluid to the required sides of the pistons of the piston and cylinder assemblies **37** and **38** as desired.

A pedal assembly collectively designated **88** is shown in FIG. **5**. It consists of a shaft **89** mounted within the base supporting framework **20** and being journalled within bearings **90** situated either end thereof and secured to the supporting structure.

An accessory or shear operating pedal **91** is secured to the end of a bar **92** which in turn is secured to shaft **89** and extends therefrom. This pedal extends beyond the base of the machine as clearly shown in FIGS. **1**, **10** and **18**.

A main shuttle valve **93** (see FIGS. **10** and **11**) is secured within the framework and is provided with an inlet port **94** connected to pump **26**, a return port **95** connected to the reservoir **97**, and upper port **96** and a lower port **97'**.

This valve is conventional in construction and is operated by means of a shuttle valve element **98** extending from the lower side thereof. When in the midway position, the shuttle valve is in neutral so that fluid is pumped from pump **26** straight through the shuttle to the discharge **95** and back to the reservoir.

When in the lowermost position, fluid is routed from the inlet **94** to the outlet **96** and when in the uppermost position, fluid is routed from the inlet **94** to the lower outlet **97'**.

This shuttle valve is operated by a link **99** (see FIG. **10**) pivoted by one end thereof to intermediate the ends of the pedal bar **92** and by the other end thereof to one end of a transverse link **100** by means of pivot pin **101**. The other end of link **100** is pivoted by means of pin **102**, to a bracket **103** secured to the supporting structure and the lower end of the shuttle element **98** is pivotally connected intermediate the ends of link **100** all of which is clearly shown in FIG. **10**.

Therefore when the pedal **91** is depressed by the operator, the shuttle element **98** is moved to the lowermost position and the fluid is routed from **94** through the upper outlet **96**.

Reference to the hydraulic schematic diagram shown in FIG. **11** indicates an upper manifold **104** and a lower manifold **105** and four manually operated selector valves designated **1**, **2**, **3** and **4**.

Each of these selector valves is a conventional form of shuttle valve manually operated by means of plungers **106** situated on one end thereof.

Various conduits are shown and these are prefixed by the letter "C" for clarity.

Conduit C**10** extends from the upper outlet **96** of the main shuttle valve **93** to the inlet **107** of the upper manifold **104**. Conduit C**11** extends from the lower outlet **97'** of the main shuttle valve to the inlet **108** of the lower manifold **105**.

Outlet **109** of the upper manifold is connected by conduit C**12** to one side **110** of actuator valve **3** and outlet **111** from the upper manifold **104** is connected by conduit C**13** to one connection **112** of actuator valve no. **1**.

Outlet **113** of the lower manifold **105** is connected by conduit C**14** to the second outlet **114** of actuator valve no. **4** and the other outlet **115** of the lower manifold is connected via conduit C**15** to the other connection **116** of actuator valve no. **2**.

Connection **117–1**,**–2**, **–3**, and **–4** show venting connections to the four actuator valves which vent back to the reservoir **97** as indicated by conduit C**16** and it should be observed that connecting conduits C**12** and C**13** attached to the same side of valve **1** and **3** and vents **117–1** and **117–3** also connected to the same side of these valves whereas these connections are reversed in valves **2** and **4**.

It should also be appreciated from reference to FIGS. **18** and **19** that the actuators **106** of valves **3** and **4** are connected together so that they are both either in or out at the same time.

Each of the actuator valves **1**, **2**, **3** and **4** is provided with an outlet or further connection **118–1**, **118–2**, **118–3** and **118–4**. A conduit C**17** extends from **118–1** to upper end of the cylinder of the piston and cylinder assembly **38**. A conduit C**18** connects **118–2** to the lower end of the cylinder of this piston and cylinder assembly **38**.

A conduit C**19** connects **118–3** to the upper end of the cylinder of the piston and cylinder assembly **37** and a conduit C**20** connects **118–4** to the lower end of the cylinder of the piston and cylinder assembly **37**.

The actuators **106** extend through a mood selector panel **119** situated on the front of the machine and illustrated in detail in FIG. **19**. When it is desired to use the machine in the shear or accessory mode, and using normal power, the actuators **106** of the valves **1** and **2** are pushed inwardly and the actuator **106** of valve **3** is pulled out and this of course pulls out the actuator of the valve **4** as hereinbefore described. Under these conditions, when the pedal **91** is depressed by the operator, fluid is routed from the pump **26** through the main shuttle valve **93** to the upper outlet **96** and the direction of the fluid in this particular phase of the operation is indicated by arrows **120** in FIG. **11**.

Fluid then passes through conduit C10 to the upper manifold 104 and from there it passes through conduits C12 to actuator valve no. 3. The position of the shuttle of this valve routes the fluid through conduit C19 to above the piston within the piston and cylinder assembly 37 and this supplies the main power stroke or downward movement of the portion 36 of the main beam thus operating the accessories or the shear component.

As this piston moves downwardly, fluid is exhausted from the underside thereof to conduit C20, to valve 4 and from then through 117–4 back to the reservoir.

The downward movement of the portion 36 of the main beam also moves the piston downwardly of the piston and cylinder assembly 38 but due to the fact that the actuator 106 of valve no. 1 is moved inwardly under these circumstances, air is drawn in from conduit C16 (which enters the reservoir above the fluid level) and passes through conduit C17 to above the piston so that fluid is not utilized under these circumstances.

Means are provided which will hereinafter be described, to reverse the movement of the shuttle component 98 when the portion 34 of the beam reaches the lowermost position. This causes fluid to flow from conduit 94, through the lower outlet 97 of the main shuttle valve to the lower manifold 105. It then travels through conduit C15 to the actuator valve no. 2 and from there via conduit C18 to the underside of the piston in the piston and cylinder assembly 38. Due to the fact that the volumetric capacity of this piston and cylinder assembly is smaller than that of the piston and cylinder assembly 37 and due to the fact that pump 26 is a constant displacement type, the piston moves upwardly more rapidly than the piston moves downwardly on the power stroke thus giving a fast return stroke. Fluid, of course, is expelled from the upper end of the cylinder of the piston and cylinder assembly 37, back through conduit C19 to valve no. 3 and thence back through conduit C12 to the upper manifold to the reservoir.

If, however, maximum power is required then piston and cylinder assembly 38 can be coupled with piston and cylinder assembly 37 to give a double power actuation to the power stroke. Under these circumstances the actuator 106 of the valve 2 is left in the innermost position and the actuator of valve 1 is moved outwardly. This reverses the action so that fluid flows through C17 to the upper end of the cylinder 38 thus adding its power to piston and cylinder assembly 37.

In order to operate the punch press portion of the device it will be appreciated that the fluid flow has to be reversed which means that the pedal 91 is normally in the lowermost position thus ensuring that portion 36 of the main beam is at the lowermost position and portion 35 is in the uppermost. Furthermore a further pedal has to be provided adjacent the punch press end in order to operate same.

This pedal is identified by reference character 121 and is situated upon the end of a bar 122 which in turn is fixed to a cross shaft 123 mounted within support bearing 124 in a manner similar to the support of shaft 89 hereinbefore described.

This shaft 123 is situated at right angles to shaft 89 and the two shafts are interconnected by bevel pinion segments 125 as shown in FIG. 5. The segment 125 off standing from shaft 123 engages the segment 125 secured to the end of shaft 89 so that partial rotation of shaft 123 will also cause partial rotation of shaft 89. The bar 122 is secured to shaft 123 as here and before described and with pedal 91 in the lowermost position, it will be appreciated that pedal 121 is in the uppermost position so that depression of this pedal 121 will actuate the shuttle valve component 98 in a manner opposite to that hereinbefore described. It is not believed necessary to describe the routing of the hydraulics under these circumstances as it is believed that they can be followed from FIG. 11.

Suffice to say that when pedal 121 is depressed, fluid is fed to the underside of the piston of the piston and cylinder assembly 37 thus moving the piston upwardly and raising the portion 36 of the main beam upwardly which, of course, lowers the portion 35 to operate the punch press.

When the pedal is released, the shuttle valve reverses and fluid is fed to the upperside of the piston of the piston and cylinder assembly 38 thus moving same downwardly and acting as the return stroke for the main beam 34.

Under normal punch press operations, the actuator of valve no. 3 is in the innermost position and the actuators of valves 1 and 2 are in the outermost position.

However if maximum power is required, then the actuator of valve 2 is moved inwardly and this causes fluid to flow to the underside of the piston of the piston and cylinder assembly 38 thus giving additional power to the power stroke of the punch press.

Means are provided to switch the machine from the accessory or shear mode to the punch press mode and vice versa and details of this are shown in FIGS. 6 to 9 inclusive.

A lever 126 with an actuating handle 127 upon one end thereof, is secured to shaft 128 which in turn is supported within a bearing 129 secured to a vertical member 130 of the framework, it being understood that lever 126 is external of the machine as clearly shown in FIG. 18.

This lever is movable between an upper position indicate by the letter "S" and the lower position indicated by the letter "P." It should be understood that the letter S represents the shear or accessory mode and the letter P indicates the punch press mode of the machine.

This lever is adapted to operate a rocker assembly collectively designated 129. This rocker assembly includes an elongated plate 130 welded intermediate the ends thereof to shaft 123 and at right angles thereto. An elongated closed ended slot 131 is formed within the plate and each end of this slot is provided with an enlarged portion 132 as shown in FIG. 8.

An overcenter slide component 133 consists of a pair of plates 134 one upon each side of the slotted plate 130 with a pin 135 joining the two plates together and passing freely through the slot 131 within which it is slidable lengthwise. When at one end or the other, this pin engages the enlarged ends 132 of the slot 131.

A further pin 136 joins the upper ends of these plates 134 together and holds the lower end of the tension spring 137 which extends upwardly to be secured to an adjusting bolt 138 (see FIG. 6) engaging a frame member 139. The spring anchor or adjusting bolt 138 is situated substantially vertically above shaft 123 so that

the spring **137** extends outwardly to the plates **134** when these plates are in the position shown in FIG. **8**. The spring therefore biasses the plate in this position which means that shaft **123** has been rotated so that pedal **121** is in the uppermost position and pedal **91** is in the lowermost position. Under these conditions the machine is in the punch press mode and pedal **121** will actuate the main shuttle valve component **98** as hereinbefore described.

If, however, the slide component **133** is moved along the slot **131** to the opposite end, the spring **137** will bias this other end upwardly so that the slotted plate **130** takes the position shown in in phantom in FIG. **8**. This rotates shaft **123** anti-clockwise and causes pedal **121** to lower and pedal **91** to raise. This reverses the main shuttle valve **93** so that the machine is now in the accessory or shear mode.

An actuator fork **138** comprises a horizontal plate **139** situated on the bottom of a crank **140** which depends from shaft **128** (see FIG. **7**). A pair of pins **141** extend outwardly from plate **139** and engage freely around the edges of the plates **134** of the slide component **133**.

Movement of the lever **126** will therefore move the actuator fork from left to right thus moving the slide component **133** from one end of the slot **131** to the other and vice versa thus accomplishing the mode selection hereinbefore described.

It should be stressed that the normal operation of the accessory or shear mode or the punch press mode is accomplished by the piston and cylinder assembly **37** with piston and cylinder assembly **38** acting as the fast return for either mode. However, when additional power is required in either mode, piston and cylinder assembly **38** can be cut in to reinforce the action of piston and cylinder assembly **37** but under these circumstances it should be appreciated that piston and cylinder assembly **38** still acts as the fast return for either mode.

Means are provided to control the upper and lower limits of the power strokes of the main beam whether it is in the accessory or shear mode or in the punch press mode.

A link **142** is pivotally secured by the upper end thereof by means of pivot pin **143** to the main beam on the portion **36** but close to the trunion **33**. This link extends downwardly and is pivotally secured by the other end thereof by means of pivot pin **144** to one end of a lever **145** pivoted intermediate the ends thereof upon pivot pin **146**. This lever **145** is externally of the machine as shown in FIG. **18**.

An apertured sleeve **147** is mounted upon the other end of the lever **145** and this apertured sleeve is pivotally secured to said other end so that it can move up and down a control rod **148** situated vertically externally of the machine and extending downwardly towards the pedal assembly **88**.

The lower end of this control rod is pivotally secured by means of pivot **149** to a lug **150** offstanding from shaft **89** (see FIG. **5**). The upper end of this control rod is screw threaded and knurled adjustors **151** and **152** engage this screw threaded portion above and below the sleeve **147** respectively.

Assuming for the purposes of explanation that the machine is in the accessory or shear mode, the pedal **91** is depressed thus causing the portion **36** of the main beam to move downwardly. This moves link **142** downwardly and pivots lever **145** upon pivot **146** thus raising sleeve **147** upwardly along the screw threaded portion of the control rod **148**. When it strikes the upper adjustor **151**, the control rod **148** is lifted and this rotates shaft **89** and raises pedal **91** thus moving the shuttle valve element **98** to the neutral position thus causing the pump to unload directly to reservoir **27** and stopping the action precisely. This means that the downward movement of the main beam is controlled by adjusting the upper adjustor **151** upon the screw threaded portion of the control rod **148**. When the pedal **91** is released further by the operator spring **37** its moves the spool of valve **98** to the reverse position thus returning the main beam to the uppermost position ready for the next stroke. When in this position the control rod actuates the valve spool and moves the valve back to the neutral position until the pedal is once again depressed.

By the same token, when in the punch press mode, lever **145** moves in the opposite direction thus causing sleeve **147** to move downwardly and engage the lower adjustor **152** which once again rotates shaft **89** in the opposite direction due to the fact that the hydraulic systems have been reversed for this mode. The adjustors **151** and **152** therefore give extremely accurate control of the movement of the accessories or shear component or punch press, such control not being available by conventional overload valves. This adds to the precision operation of the machine in all phases of its operation and enables the operator to adjust, quickly, either the upper and/or the lower position and consequently the stroke length and position.

Referring back to the mandrel **78**, it will be noted that a slide block **80'** is fitted between the upper end **80** of the mandrel and the rounded surface **81** of the main beam to take care of the slight sideways movement occurring at this high stress point due to the fact that the end of the beam is moving through an arc during operation. A similar slide block can be used in reverse on accessory **67** as shown in phantom in FIG. **1**.

Although the mandrel has been described as being engaged by the spindle **85'** it should be appreciated that normally the mandrel is raised and lowered as the beam reapproaches. However when setting up the punch press operation it is sometimes desirable to lower the mandrel independently for positioning purposes and it is under these circumstances that the automatic engagement takes place as described.

Note should be taken of the adjusting bolt and lock nut **153** extends upwardly from the place **30** adjacent the web **44** between link plates **43** connected to one end of the main beam. A block **154** is welded between the link plates and when the bolt **153** is adjusted, the downward movement of this portion of the main beam is controlled in a positive fashion. This is used when air breaking is required or when it is desired to terminate the downward movement of the break at the same position each time. It is not possible to be this accurate relying only on the valve arrangement but with positive stop, the physical position of the beam is exactly the same on each stroke with the hydraulic system unloading the relief valve.

FIG. **20** shows an alternative embodiment of the mechanism **88**, identified **88A** in this figure.

In this embodiment, a support member **155** is situated above one end of shaft **89** and extends at right angles thereto and the lever **126** together with the control knob **127** is journalled within a bearing **156** by means of the shaft **128**, upon this support member **155**.

This means that the lever **126** extends beyond the machine adjacent the pedal or treadle **121** rather than at the front which makes for more convenient operation.

Pedal **121** is connected to shaft **89** by means of member **122** as hereinbefore described except that the member is at right angles to the pedal and connects directly to shaft **89** rather than through bevel gears **125**.

The member **130** is connected to the lever **126** in a manner similar to that in the previous embodiment and this member operates shaft **89** as shown in FIG. **8**.

The advantages of this embodiment are twofold. First the bevel gears **125** are eliminated together with any backlash which might be generated therebetween and secondly the operating lever **126** is adjacent the pedal **121** at one end of the machine rather than in the front as in the previous embodiment.

Various modifications can be made within the scope of the inventive concept which is herein disclosed and/or claimed.

What I claim as my invention is:

1. An iron and metal working machine comprising in combination a supporting framework, a main beam pivoted between the ends thereof to said supporting framework thereby defining a relatively short punch press side and a relative long accessory operating side, a pair of hydraulic piston and cylinder assemblies mounted on trunions in said framework below said relatively long side, said piston and cylinder assemblies being operatively connected to adjacent the end of said relatively long side, a source of hydraulic power operatively connected to said piston and cylinder assemblies, and valve means on said framework selectively engageable between said piston and cylinder assemblies and said source of hydraulic power whereby hydraulic fluid can be routed to either side of the piston of one of said piston and cylinder assemblies and to either side of the piston of the other said piston and cylinder assemblies, either singlely or together, said source of power including a constant displacement pump, said one piston and cylinder assembly having a larger volumetric capacity than said other piston and cylinder assembly, thereby providing a faster movement to said main beam when operated singlely and providing additional power to said to main beam when operated together with said other piston and cylinder assembly.

2. The machine according to claim **1** which includes a pedal assembly on said framework operatively connected to said valve means, said assembly having a punch press operating pedal and an accessory operating pedal, and means mounted on said framework operatively connected between said valve means and said pedal assembly whereby either said punch press operating pedal is in the operative position or said accessory operating pedal is in the operative position.

3. The machine according to claim **2** in which said valve means includes a main shuttle valve operatively connected to said pedal assembly and a plurality of manually operated selector valves operatively connected between said shuttle valve and said hydraulic piston and cylinder assemblies.

4. The machine according to claim **2** in which said means mounted on said framework operatively connected between said valve means and said pedal assembly includes a shaft mounting said pedal assembly, a lever movable between a first accessory mode position and a second punch press mode position, and an over center rocker assembly between said lever and said shaft.

5. The machine according to claim **4** in which said rocker assembly includes a slotted plate secured to said shaft, an over center slide component mounted in the slot in said plate for endwise movement from one end to the other of said slot, slider component being spring loaded upwardly, and an actuator fork on said lever and engaging said slider component for moving same along said slot in said plate.

6. The machine according to claim **3** in which said means mounted on said framework operatively connected between said valve means and said pedal assembly includes a shaft mounting said pedal assembly, a lever movable between a first accessory mode position and a second punch press mode position, and an over center rocker assembly between said lever and said shaft.

7. The machine according to claim **6** in which said rocker assembly includes a slotted plate secured to said shaft, an over center slide component mounted in the slot in said plate for endwise movement from one end to the other of said slot, slider component being spring loaded upwardly, and an actuator fork on said lever and engaging said slider component for moving said slider along said slot in said plate.

8. An iron and metal working machine comprising in combination a supporting framework, a main beam pivoted between the ends thereof to said supporting framework thereby defining a relatively short punch press side and a relative long accessory operating side, a pair of hydraulic piston and cylinder assemblies mounted on trunions in said framework below said relatively long side, said piston and cylinder assemblies being operatively connected to adjacent the end of said relatively long side, a source of hydraulic power operatively connected to said piston and cylinder assemblies, valve means on said framework selectively engageable between said piston and cylinder assemblies and said source of hydraulic power whereby hydraulic fluid can be routed to either side of the piston of one of said piston and cylinder assemblies and to either side of the piston of the other said piston and cylinder assemblies, either singlely or together, and a secondary beam pivoted by one end thereof within said framework below said main beam, said secondary beam including a shear assembly connected thereto, said secondary beam being connected adjacent the other end thereof to said piston and cylinder assemblies.

9. The machine according to claim **8** which includes a pedal assembly on said framework operatively connected to said valve means, said assembly having a punch press operating pedal and an accessory operating pedal, and means mounted on said framework operatively connected between said valve means and said pedal assembly whereby either said punch press operating pedal is in the operative position or said accessory operating pedal is in the operative position.

10. The machine according to claim **9** in which said valve means includes a main shuttle valve operatively

connected to said pedal assembly and a plurality of manually operated selector valves operatively connected between said shuttle valve and said hydraulic piston and cylinder assemblies.

11. The machine according to claim 9 in which said means mounted on said framework operatively connected between said valve means and said pedal assembly includes a shaft mounting said pedal assembly, a lever movable between a first accessory mode position and a second punch press mode position, and an over center rocker assembly between said lever and said shaft.

12. The machine according to claim 11 in which said rocker assembly includes a slotted plate secured to said shaft, an over center slide component mounted in the slot in said plate for endwise movement from one end to the other of said slot, slider component being spring loaded upwardly, and an actuator fork on said lever and engaging said slider component for moving same along said slot in said plate.

13. The machine according to claim 3 in which said means mounted on said framework operatively connected between said valve means and said pedal assembly includes a shaft mounting said pedal assembly, a lever movable between a first accessory mode position and a second punch press mode position, and an over center rocker assembly between said lever and said shaft.

14. The machine according to claim 13 in which said rocker assembly includes a slotted plate secured to said shaft, an over center slide component mounted in the slot in said plate for endwise movement from one end to the other of said slot, slider component being spring loaded upwardly, and an actuator fork on said lever and engaging said slider component for moving same along said slot in said plate.

15. The machine according to claim 10 in which said means mounted on said framework operatively connected between said valve means and said pedal assembly includes a shaft mounting said pedal assembly, a lever movable between a first accessory mode position and a second punch press mode position, and an over center rocker assembly between said lever and said shaft.

16. The machine according to claim 15 in which said rocker assembly includes a slotted plate secured to said shaft, an over center slide component mounted on the slot in said plate for endwise movement from one end to the other of said slot, slider component being spring loaded upwardly, and an actuator fork on said lever and engaging said slider component for moving said slider along said slot in said plate.

17. The machine according to claim 3 in which said means mounted on said framework operatively connected between said valve means and said pedal assembly includes a shaft mounting said pedal assembly, a lever movable between a first accessory mode position and a second punch press mode position, and an over center rocker assembly between said lever and said shaft.

18. The machine according to claim 17 in which said rocker assembly includes a slotted plate secured to said shaft, an over center slide component mounted in the slot in said plate for endwise movement from one end to the other of said slot, slider component being spring loaded upwardly, and an actuator fork on said lever and engaging said slider component for moving same along said slot in said plate.

19. The machine according to claim 8 in which said other piston and cylinder assembly is connected to the other end of said secondary beam inboard of said one piston and cylinder assembly.

20. The machine according to claim 19 in which said source of power including a constant displacement pump, said one piston and cylinder assembly having a larger volumetric capacity than said other piston and cylinder assembly.

21. The machine according to claim 19 which includes a pedal assembly on said framework operatively connected to said valve means, said assembly having a punch press operating pedal and an accessory operating pedal, and means mounted on said framework operatively connected between said valve means and said pedal assembly whereby either said punch press operating pedal is in the operative position or said accessory operating pedal is in the operative position.

22. The machine according to claim 21 in which said valve means includes a main shuttle valve operatively connected to said pedal assembly and a plurality of manually operated selector valves operatively connected between said shuttle valve and said hydraulic piston and cylinder assemblies.

23. The machine according to claim 22 in which said means mounted on said framework operatively connected between said valve means and said pedal assembly includes a shaft mounting said pedal assembly, a lever movable between a first accessory mode position and a second punch press mode position, and an over center rocker assembly between said lever and said shaft.

24. The machine according to claim 23 in which said rocker assembly includes a slotted plate secured to said shaft, an over center slide component mounted in the slot in said plate for endwise movement from one end to the other of said slot, slider component being spring loaded upwardly, and an actuator fork on said lever and engaging said slider component for moving same along said slot in said plate.

25. An iron and metal working machine comprising in combination a supporting framework, a main beam pivoted between the ends thereof to said supporting framework thereby defining a relatively short punch press side and a relative long accessory operating side, a pair of hydraulic piston and cylinder assemblies mounted on trunions in said framework below said relatively long side, said piston and cylinder assemblies being operatively connected to adjacent the end of said relatively long side, a source of hydraulic power operatively connected to said piston and cylinder assemblies, valve means on said framework selectively engageable between said piston and cylinder assemblies and said source of hydraulic power whereby hydraulic fluid can be routed to either side of the piston of one of said piston and cylinder assemblies and to either side of the piston of the other said piston and cylinder assemblies, either singlely or together, and a pedal assembly on said framework operatively connected to said valve means, said assembly having a punch press operating pedal and an accessory operating pedal, and means mounted on said framework operatively connected between said

valve means and said pedal assembly whereby either said punch press operating pedal is in the operative position or said accessory operating pedal is in the operative position.

26. The machine according to claim **25** in which said valve means includes a main shuttle valve operatively connected to said pedal assembly and a plurality of manually operated selector valves operatively connected between said shuttle valve and said hydraulic piston and cylinder assemblies.

27. The machine according to claim **25** in which said means mounted on said framework operatively connected between said valve means and said pedal assembly includes a shaft mounting said pedal assembly, a lever movable between a first accessory mode position and a second punch press mode position, and an over center rocker assembly between said lever and said shaft.

28. The machine according to claim **27** in which said rocker assembly includes a slotted plate secured to said shaft, an over center slide component mounted in the slot in said plate for endwise movement from one end to the other of said slot, slider component being spring loaded upwardly, and an actuator fork on said lever and engaging said slider component for moving same along said slot in said plate.

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