June 3, 1941. R. H. BOARDMAN 2,244,638

SHEARS

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Fig. 1.

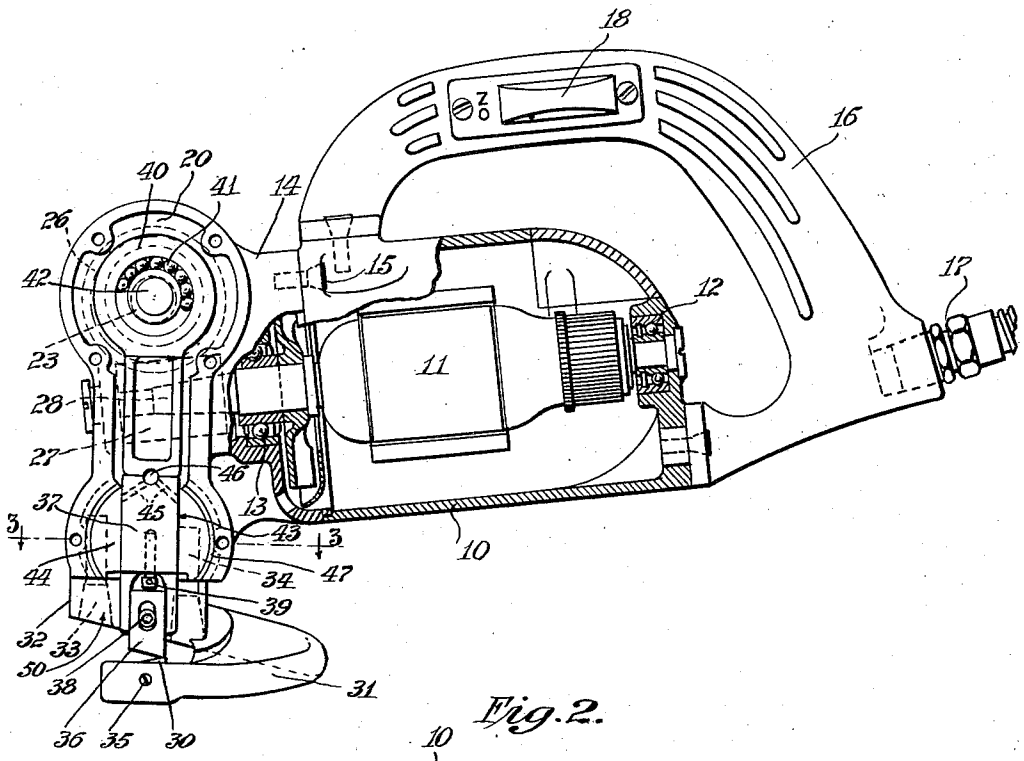


Fig. 2.

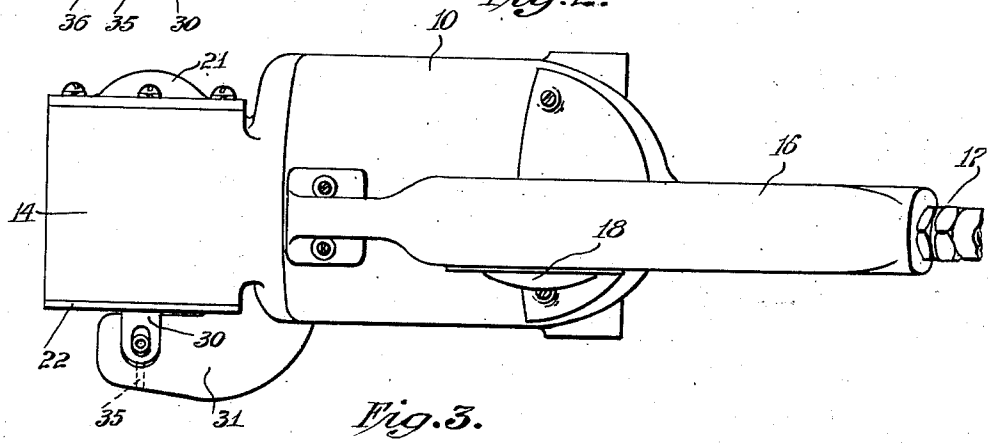
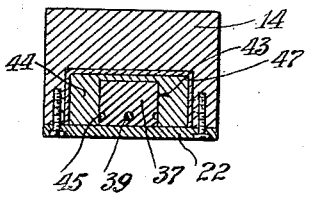


Fig. 3.



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Fig. 5.

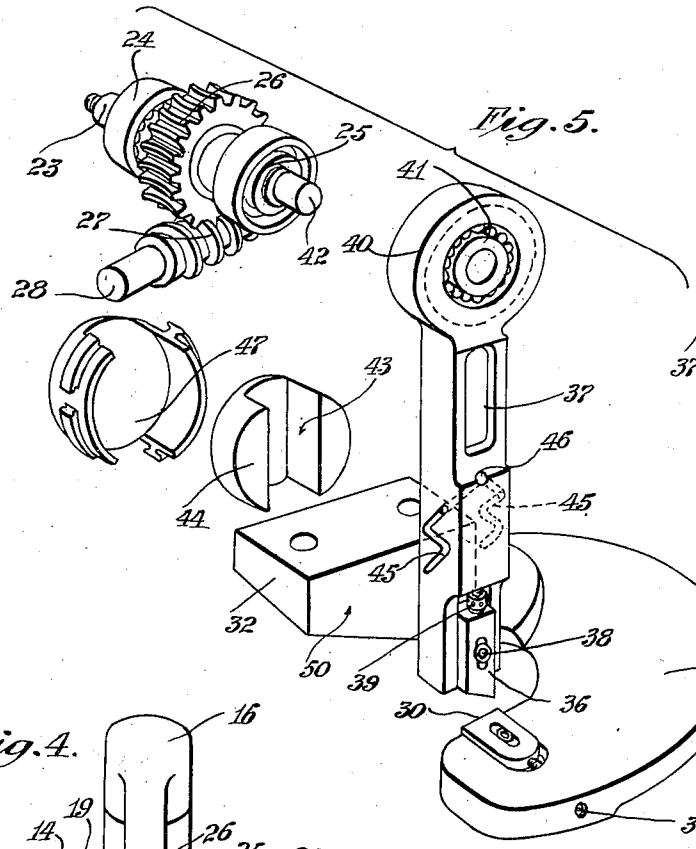


Fig. 7.

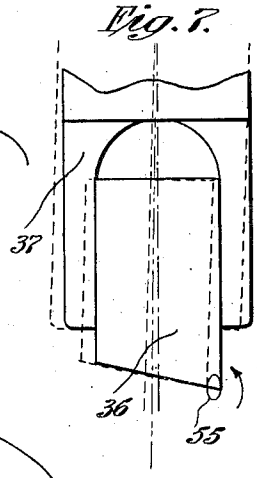
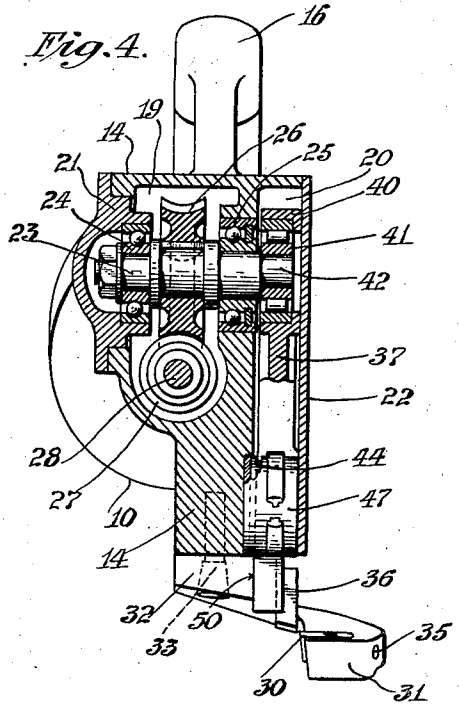


Fig. 4.



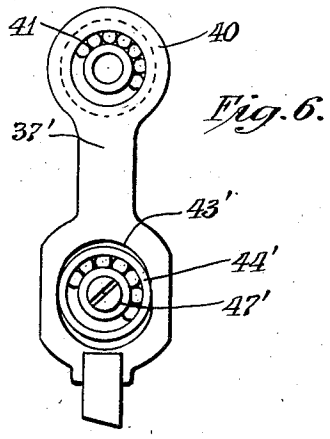


Fig. 6.

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UNITED STATES PATENT OFFICE

2,244,638

SHEARS

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Application August 2, 1940, Serial No. 349,893

8 Claims. (Cl. 30—228)

This invention relates to automatic or power driven cutting tools commonly called shears suitable especially for cutting sheet metal.

One object is to provide a form of mechanism which is strong but compact, simple, of few parts and relatively inexpensive to construct and maintain. Simplicity of construction and ease of assembly and repair tend to long life.

Another object is to secure smoothness, ease of operation and freedom from unnecessary vibration. This latter feature also tends to minimize wear and permits a maximum amount of work because of a minimum loss of time in break downs and because of a minimum strain on the operator.

Another object is to provide a tool which can be used effectively to cut along curved as well as straight lines, either near the edge or near the center of a sheet.

Another object is to provide a construction embodying an efficient electric motor drive.

Another object is to provide reliable mechanism well balanced and suitable for being conveniently held in the hand while operating.

Another object is to secure adequate lubrication without damage to the motor.

Another object is to so arrange the parts that the operator can clearly see the line of cutting.

Such mechanism should be relatively light in weight and well balanced when in use.

Details of the preferred form of the device will be found shown in the accompanying two sheets of drawings.

Fig. 1 is a side view and partial section of the preferred form of the invention.

Fig. 2 is a plan view of the same.

Fig. 3 is a horizontal section of the device on the plane of the line 3—3 of Fig. 1.

Fig. 4 is a vertical section and end view of the device.

Fig. 5 is a perspective view of parts of the device.

Fig. 6 is a face view of a modified form of movable cutter carrier.

Fig. 7 is an enlarged view showing the path of movement of a point on the movable cutting blade.

The invention is especially adapted for a hand held tool driven by a suitable electric or pneumatic motor. The casing 10 contains a suitable motor 11 with bearings 12 and 13. One end 14 of the casing is preferably detachably secured to the main part of the casing by a number of screws or bolts 15 and carries one of the motor bearings.

The casing has a handle member 16 with means at 17 for connection with a source of power and a switch or start and stop member 18 in a convenient location so that the tool can be held in a balanced position and when so held the switch actuator is readily accessible.

The head end 14 of the casing encloses the reduction gear train and the movable cutter carrier in two chambers 19 and 20 closed by cover plates 21 and 22, respectively. A transverse drive shaft 23 is supported in ball bearings 24 and 25 and has a worm gear 26 which meshes with a worm 27 on the lower end of the motor shaft 28 beneath the shaft 23. It will be noted that the motor shaft is inclined downwardly and forwardly relative to the vertical axis of the head of the casing and that the bearing 13 is interposed between the motor chamber and the gear chamber. As a result there is little chance of the lubricant in the gear casing working back into the motor casing where it is likely to injure the motor.

The stationary cutter 30 is carried by the free end of a hook-shaped yoke or anvil 31. The other end 32 is secured to the lower end of the head by two screws or bolts 33 and 34. The cutter is laterally adjustable by a screw 35.

The reciprocable cutter 36 is carried by the bar 37 being clamped to it by a screw 38 and backed up by a screw 39. The upper end 40 of the bar 37 has a ball bearing unit 41 mounted in it and supported on the eccentric end 42 of the drive shaft 23 in the chamber 20. The lower end of the bar 37 is slidably guided in a channel 43 in the cylindrical oscillator bearing member 44. The edges of the bar 37 preferably have oil grooves 45 fed from a hole 46 which is above the upper edge of the oscillator 44. The grooves 45 lead to the edges of the channel 43. The oscillator is supported in a cup-like bearing 47 which can be cast in the head of the casing and finished inside in a suitable manner so as to provide a smooth and wear resisting surface for the oscillator.

The anvil member 31 of course must be very strong to resist the stresses to which it is subjected. Preferably the upper part of this anvil provides a side bearing wall 50 against which the lower end of the movable cutter carrier 37 travels. This ensures an accurate lateral relationship between the two cutter blades which is essential for satisfactory operation especially at the high speeds for which these tools are designed.

It will be noted that the movable cutter not

only moves up and down but rocks or oscillates somewhat. This produces a peculiar shearing action and thus minimizes the force necessary to feed the tool relative to the work. The tool does not drag the sheet into the bight of the cutter but the upper cutter reciprocates so rapidly with a rocking motion that it requires only a very slight forward movement of the tool to accomplish a smooth and rapid cut. The cutters are so located that the cutting point is always in full view allowing for unobstructed view of the line to be followed, and there is but little chance of the sheet jamming in the tool. Also the cutting point is outside of the housing area to allow for trimming close to the vertical sheet of material.

This arrangement of the eccentric connection of the cutter carrier with the drive shaft and the oscillating support and guide closely adjacent the cutting point ensures very smooth operation with but little vibration thus minimizing the strain on the operator and on the tool.

In Fig. 6 is shown a modified form of cutter carrier bar **37'**. The upper end **40** is mounted on the eccentric end of the drive shaft as previously described. The lower part is provided with an elongated opening **43'** which constitutes a guideway for the ball or roller bearing unit **44'** which is supported on a stud or bearing **47'** in the head of the tool.

Inside the cover plate **22** is preferably placed a bronze wear plate about .050" in thickness and of the same area and shape as this cover plate **22** and held in place by the cover plate screws.

The enlarged view, Fig. 7, shows the direction and path **55** of movement of a point on the movable cutting blade **36** whereby a slicing action takes place rather than a straight line shear action. The dotted line position of the cutter is substantially 180° removed from the full line position.

To better balance the tool against troublesome vibration at high speed, the worm gear **26** may be provided with a counterweight to at least partially offset the inertia of the cutter carrier bar. Such effect is easily attained by cutting a recess or groove in the part of gear **26** which is angularly alined with this crank or eccentric **42**. Both the stationary and movable parts are made as light in weight as is consistent with the work to be performed. The motor and gear housings are preferably of some light weight metal or material such as aluminum or Dow metal.

Although this invention has been shown embodied in a portable hand tool, certain features of the broad invention may be applied also to bench and pedestal types of machines. The portable tool illustrated may be mounted in a cradle for use as a stationary or bench type machine and such cradle may be supported on a table or bench or hung from above to place the stationary cutting blade below the moving blade. The cradle will of course be designed to provide clearance for the handle which longitudinally overlaps the motor casing.

Other modifications in details may be made within the scope of this invention except where the claims are especially limited to the preferred form of the invention. The cutting blades may be laterally offset a greater amount than is shown by Fig. 4 of the drawings. For example, the line of cutting may be substantially flush with the side of the gear housing so as to be visible from above this housing, or these blades may be laterally offset still further and beyond the housing. As shown in Fig. 2 the handle **16** is laterally offset from the axis of the motor until it is substantially alined with the center of gravity of the tool, the lateral offset of the handle being desirable because the lateral offset of the anvil and cutting blades causes the center of gravity to be moved to one side of the motor axis.

It has been found desirable to have the motor located close to the work to facilitate cutting and for this reason the worm **27** is located below the worm gear **26**. However in order to provide additional chip clearance when the motor is located close to the work, that is clearance sufficient to allow strips of cut material to roll up, the rear end portion of the motor is raised by giving the motor axis the upward inclination illustrated away from the worm and gear. Such an upward inclination to the motor shaft of between 10° to 20° to the horizontal is believed to facilitate cutting and reduce the strain on the operator.

I claim:

1. Power driven shears comprising a housing, a transverse drive shaft rotatably supported therein and having an eccentric, a stationary cutter carried by the housing, an oscillator rotatably supported in the housing between said cutter and said shaft, and a movable cutter carrier having one end mounted on said eccentric and a portion slidably supported in said oscillator adjacent the stationary cutter.

2. Power driven shears comprising a housing, a drive shaft rotatably supported therein and having an eccentric, a stationary cutter carried by the housing, an oscillator rotatably supported in the housing between said cutter and said shaft and having an open channel cut in one face, a movable cutter carrier having one end mounted on said eccentric and a portion slidably supported in the channel of said oscillator adjacent the stationary cutter and a cover plate holding the cutter carrier in place in said channel.

3. A shearing device comprising a housing having a cavity, with an opening at one side, a detachable cover plate for said opening, a transverse shaft having spaced bearings in the upper part of the housing cavity, a substantially vertical cutter carrier bar having a cutter blade at its lower end and having an eccentric connection with the end of the shaft adjacent the upper end of said opening, a motor having a shaft inclined downwardly and forwardly beneath said transverse shaft, a worm and gear connection between said shafts, a stationary cutter blade supported by the housing and cooperating with the cutter blade, and a guide member for the carrier bar mounted in the lower end of the cavity in the housing adjacent the cutter blade and permitting the carrier bar to move up and down in the cavity and to tilt about the axis of said guide, said cutter carrier bar and said guide being readily removable when the cover plate is removed, said cavity being adapted to hold lubricant for the transverse shaft, the cutter carrier bar and the guide member.

4. Power driven shears comprising a housing, a transverse drive shaft in the upper end of the housing and having an eccentric, a stationary cutter on the lower end of the housing, an elongated vertically disposed movable cutter carrier having its upper end mounted on the eccentric and carrying a cutter at its bottom end, and a guide member freely engaging the lower part of the movable cutter carrier whereby a limited vertical and horizontal motion of the cutter is permitted.

5. Power driven shears comprising a housing, a transverse drive shaft in the upper end of the housing and having an eccentric, a stationary cutter on the lower end of the housing, an elongated vertically disposed movable cutter carrier having its upper end mounted on the eccentric and carrying a cutter at its bottom end, and a cylindrical member mounted in the lower end of the housing and having a central channel in its face extending from edge to edge thereof and adapted to guide smoothly a portion of the lower end of the carrier whereby limited vertical and horizontal motion of the cutter is permitted.

6. In a power driven shears of the type for cutting either straight or curved lines, actuating means, a gear housing, a reciprocating carrier bar for a movable blade, an eccentric for actuating said carrier, an oscillator guide for said carrier bar constituting the pivotal axis about which said carrier bar oscillates, a guide opening in said oscillator in which the carrier bar slides, said oscillator guide having arcuate bearing surfaces laterally of said guide opening and within said gear housing.

7. A shears comprising a motor and shaft, a stationary cutting blade and support therefor located at one side of the motor shaft, a second shaft located transversely of the motor shaft and the opposite side from the stationary blade, spaced bearings for said second shaft, means between said bearings for driving the second shaft from the motor shaft, an overhanging crank, a connecting rod actuated by said crank and carrying a movable blade cooperating with the stationary blade, a rocking cross-head or guide located between the crank and movable blade and adjacent the latter, and means on the second shaft for counterbalancing the thrusts of said connecting rod.

8. A power driven shears comprising a motor and housing therefor, a motor shaft having on the forward end portion thereof a worm, a worm gear driven by the worm and mounted on a transverse shaft, bearings for said shaft, an eccentric on said shaft, a rod mounted on said eccentric and carrying a movable cutting blade, a stationary cutting blade attached to the motor housing, the improvement which enables the motor to be located close to the work to facilitate cutting and which comprises locating said worm below said worm gear.

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