A. Hardy.

Shearing Metal.

No. 40,034. Patented Sept. 22, 1863.

Fig. 1.

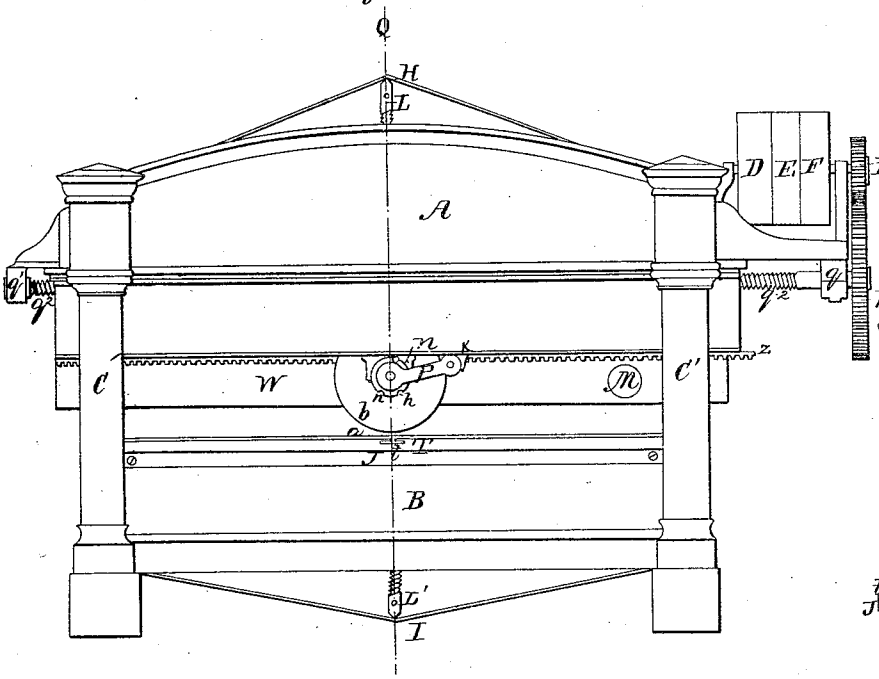


Fig. 3.

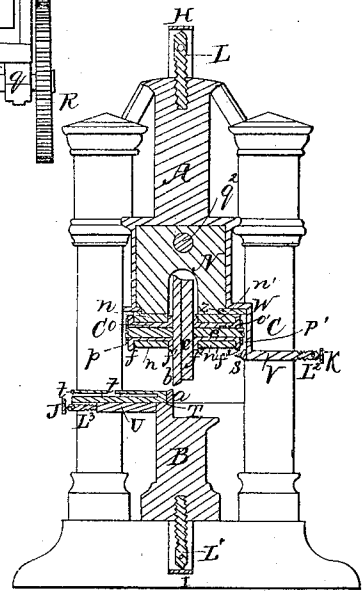


Fig. 2.

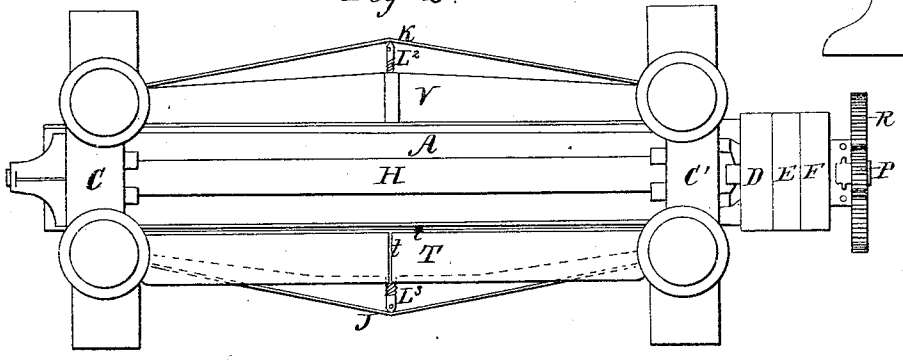


Fig. 4.

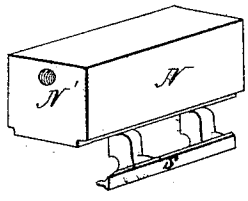
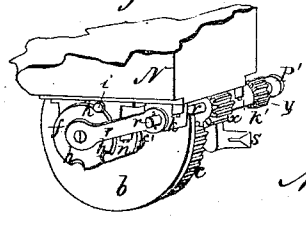


Fig. 5.



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UNITED STATES PATENT OFFICE.

ANSON HARDY, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN MACHINES FOR SHEARING IRON.

Specification forming part of Letters Patent No. **40,034**, dated September 22, 1863; antedated September 12, 1863.

To all whom it may concern:

Be it known that I, ANSON HARDY, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements on a Machine for Cutting Sheet Metal; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and the letters of reference marked thereon, making a part of this specification, in which—

Figure 1 is a front elevation of the machine. Fig. 2 is a top view. Fig. 3 is an elevation of a section of Fig. 1, cut through the center at the point indicated by the dotted line Q. Fig. 4 is the knife-carriage with the bearing-piece *s* attached to it. Fig. 5 is a drawing, on a different plan, showing a fragment of the knife-carriage, with the rotary knife and several other parts attached.

The drawings are in outline, and similar letters refer to the same parts in all the drawings.

My invention relates to improvements in the machine for cutting sheet metals by means of a rotary knife and a stationary straight knife, said rotary knife having a rotary motion on its axis, and also a motion parallel with said stationary straight knife.

The nature of my invention consists, first, in so attaching the rotary knife to the carriage which carries it that, without raising or lowering said carriage, said rotary knife may be raised or lowered for the purpose of increasing or diminishing the distance between the stationary straight knife, and said rotary knife, as the cutting of metal of different thicknesses may render desirable; second, in combining wrought-iron trusses with the upper and lower beams and side pieces of the machine, for the purpose of adding strength and rigidity to said upper and lower beams and side pieces, and also for the further purpose of causing said machine to do its work with a less expenditure of power, and with very much less risk of breaking said rotary knife; third, in suspending the knife-carriage to the lower side of the upper beam, and bracing it laterally by a bearing-piece extending vertically below the bottom of said carriage, and in a lateral direction, far enough to touch the inner surface of the rear side piece, for the purpose of obtaining a sufficient distance between the upper and lower beams to enable the workman to conveniently secure the sheet of metal to be cut in the exact position desired between the knives, and for the further purpose of enabling the workmen to see distinctly if said sheet of metal is accurately placed.

The want of some cheap and expeditious method for cutting thick plates of metal, especially iron, has long been felt, not only in private manufactories but in the great national workshops of this country and Europe. The first improvement made—many years ago—over the common "jaw" and "lever-shears" for cutting sheet metal consisted of a machine having a rotary and a stationary straight knife. Said machine was never patented, and as its knives could not be moved apart, so as to cut metals of different thicknesses, soon fell into disuse, except for cutting thin sheet metals and paper. On the 20th of August, 1850, a patent was granted to S. P. Ruggles for giving a "drawing cut" to the rotary knife on the cutting-machine, but said machine was designed only for thin metal and paper cutting. On the 30th of August, 1853, said S. P. Ruggles received another patent for another cutting-machine, having a device consisting of two eccentric bolts for moving the knives, by moving the beams of the machine apart, and retaining the patented novelty of the drawing cut; but the said machine had so many objectionable features in it that it never went into general use. The eccentric-bolts, employed for moving the beams apart, were found difficult to manage, and the little space between the upper and lower beams made it very inconvenient to fasten the sheet of metal to be cut on the table, and exceedingly difficult, if not quite impossible, even after the loss of much time in the effort, for the workman to see if the sheet to be cut was placed at the desired place between the knives. In addition to these objectionable qualities, the upper and lower beams of said machine, even when made of the enormous weight of ten tons, sprung or yielded so much under the strain of cutting iron only one-half of an inch thick that the rotary knife would very frequently break thus causing delay, disappointment, and ex-

pense. Said machine, therefore, entirely failed to meet the demand required, and the expectations based on its first appearance. After some years of study and laborious experiment, I believe I have succeeded in producing a machine for cutting sheet metals, which differs essentially from all others, and which is without any of the objectionable features attending the machines heretofore made.

Some of the principal advantages resulting from my invention may be briefly stated as follows: Raising or lowering the rotary knife on the knife-carriage with ease and expedition, instead of being compelled, as in the machines heretofore made, to raise or lower the upper beam, weighing several tons, to accomplish the same object, thus saving much time and much hard labor. The advantages derived from combining wrought-iron trusses with the upper and lower beams and side pieces are, that the said beams and said side pieces may be made of much less weight, at much less cost, and can be handled and transported at much less expense, and also that said beams and side pieces, in consequence of their being made more rigid by combining said trusses with them, render the rotary knife far less liable to break, for the main cause of the breaking of said knife is owing to the springing of the upper and lower beams and side pieces of the machine. A rotary knife is an expensive article, and the frequent breaking of one should be avoided, if possible. I have never known a well-made knife to break on a well-trussed machine, and, besides, so great an advantage have I found by combining said trusses with said beams and side pieces that I have been able to cut on a trussed machine, weighing only five tons, sheets of iron one-half of an inch thick, with less power and in a more perfect manner than I was able to cut the same one-half-inch iron on an untrussed machine weighing ten tons. Very great advantages are also derived from supporting the knife-carriage in such a manner as to enable the workman to see readily and distinctly if the sheet of metal to be cut is in the exact position desired. Much time is thus saved and many mistakes avoided, for by my device the sheet of metal can always be cut at the precise point intended, while in the machines heretofore made much time is wasted in attempts to place the sheet to be cut in the position desired, and much metal is wasted by being cut at the wrong point, in consequence of the inability of the workman, owing to the proximity of the upper and lower beams, to see if said sheet is accurately placed. By supporting the knife carriage according to my device I obtain a space between the upper and lower beams amply sufficient for the workman to put his whole head freely between the said beams and thus to bring his eye directly over the point in the sheet to be cut, and also over the edge of the stationary straight knife.

In regard to the drawing cut given to the rotary knife in the machines heretofore built, I would say that I dispense with it altogether, for I have found from actual experiment said drawing cut, when thick sheet metal is cut, to be a positive disadvantage—requiring more power to move the knife, causing much friction, and not improving the quality of the work. For cutting thin sheets of any kind that are liable to rise up or "cockle" before the advancing knife, said drawing cut is useful and valuable.

Having stated the nature of my invention, and some of its more prominent advantages, I will now proceed to describe its construction and operation.

The upper beam, A, and the lower beam, B, are firmly fastened to the end pieces, C C′.

D E F are pulleys on the shaft of pinion P. D and F are loose pulleys. E is a tight pulley.

q q' are boxes in which the journals of the long screw-shaft q^2 turn.

R is a gear-wheel on the screw-shaft q^2, meshing in pinion P.

H is a truss on the upper beam. I is a truss on the lower beam. The ends of the trusses are fastened firmly to the parts to which they are attached.

J is a truss on the piece U, Fig. 3, which piece is attached to or a part of the lower beam, B. K is a truss on the rear side piece, V, Figs. 2 and 3.

L L′ L^2 L^3 are set-screws, used for keeping the trusses tight.

V is the rear side piece, and a part of it is made to ascend vertically, as denoted at W, Figs. 1 and 3, till it meets the lower portion of the upper beam, A, as seen in Fig. 3.

M is an opening in the vertical part of the rear side piece, made to allow the workman to reach in with his hands to adjust any part of the machinery connected with the knife-carriage.

N is the knife-carriage (see Fig. 4) with the bearing-piece s attached to it. Said bearing-piece s is also shown in Fig. 3 and in Fig. 5.

N′, Fig. 4, denotes the female screw cut through the knife-carriage, through which passes the long screw-shaft q^2, Fig. 3 and Fig. 1.

T is the table on which the sheets of metal to be cut are fastened. t t, Figs. 1, 2, 3, denote undercut grooves in the table T. Said grooves are for the purpose of receiving bolts, clamps, or clutches for holding the metal to be cut firmly in its place.

U is a piece fastened firmly to the lower beam, B, and the end pieces, C C′.

The rear side piece, V, isfastened at each end to the end pieces, C C′.

a, Figs. 1 and 3, is the straight knife bolted to the lower beam, B.

b, Figs. 1, 3, and 5, is the rotary knife fastened on the knife-shaft e, Fig. 3.

c, Figs. 3 and 5, is the gear-wheel fastened on the knife-shaft e. (Shown in Fig. 3.) Said knife-shaft e is held in two eccentric spools, o

o', (shown in Fig. 3,) and said eccentric spools are held in boxes n n', Figs. 3 and 5, said boxes n n' being bolted to the bottom of the knife-carriage, as shown in Figs. 3 and 5.

p p' are connections which connect the shaft r, Fig. 5, with the knife-shaft e.

k k' are boxes which hold the shaft r, said boxes being bolted to the bottom of the knife-carriage, as shown in Fig. 5.

x y are pinions fastened on the shaft r, the pinion x meshing in the gear wheel c, and the pinion y meshing into the rack z. (Shown in Figs. 1 and 3.)

f, Figs. 3 and 5, and f' f^2 f^3, Fig. 3, are flanges on the eccentric spools o o', which embrace the knife-shaft e.

h h h, Fig. 5, denote semicircular nicks cut in the flange f. Similar corresponding semicircular nicks are also cut in the flange f^3 of the eccentric spool o', Fig. 3.

i, Fig. 5, is a steady-pin passing into a semicircular nick in flange f of the eccentric spool o, and into a hole made in the side of box n. Said steady-pin i serves to hold said flange and said spool in the position desired. Another steady-pin, like steady-pin i, is made to pass into the semicircular nick in flange f^3, Fig. 3, and into a hole in the side of the box n' to hold said flange f^3 and the eccentric spool o' in the position desired.

It is obvious that the holes made in the boxes n and n' to receive the steady-pins, which pass into said holes, and also into the nicks in the flanges f and f^3, should be made directly opposite to each other. The nicks, also, in the flanges should be opposite each other, and bear the same position, relatively, to the eccentric position of the spools o and o'.

The shaft r, Fig. 5, works in boxes k k', which have slots in them, through which the bolts pass to fasten said boxes to the knife-carriage. This is a common device, and is for the purpose of moving the shaft r nearer to or farther from the knife-shaft, when, by raising or lowering the knife by turning the eccentric spools, it becomes necessary to move the shaft r to keep the pinion x on said shaft properly in gear with the gear-wheel c, Fig. 5.

That part of the inner surface of the rear side piece, V, against which the bearing-piece s presses, must be, throughout the entire distance through which the knife-carriage moves, perfectly parallel with the stationary straight knife a.

In all the machines heretofore built, the knife-carriage has been supported wholly in and upon the upper beam. Consequently, in order to protect said carriage from the great lateral strain, produced by the knife while cutting, the space between the upper and lower beam could never be more than four or five inches; but, by my device of the bearing-piece s, extending below the bottom of said carriage and bearing against the rear side piece, V, as shown in the drawings, I am enabled to obtain a space of fifteen or sixteen inches or more between said upper and lower beams, or a space amply sufficient to allow the workman to see distinctly if the sheet of metal to be cut is in the position desired.

The operation of the machine is as follows: Supposing all parts of the machine to be well made and adjusted, and the knife-carriage to be at the head of the machine—and by that I mean the end nearest gear-wheel R—and that a sheet of metal to be cut has been fastened on the table T. Now, by means of a belt, by giving motion from right to left to the tight pulley E, the pinion P and gear-wheel R will revolve and turn the screw-shaft q^2 in the female screw N′ in the knife-carriage N, which will cause said carriage to move toward the opposite end of the machine. As said carriage moves, the pinion y on shaft r, meshing in the rack z, will cause said shaft r to revolve, and at the same time put in motion the pinion x on shaft r, and said pinion x, meshing in the gear-wheel c on the knife-shaft e, will cause said shaft e and the rotary knife b to revolve at the same time that said rotary knife moves in a direction parallel with the straight knife a. These movements may be kept up until the knife-carriage reaches the other end of the machine or until the sheet of metal on the table has been cut by the passage of the rotary knife. Then the driving-belt on pulley E may be shipped to the loose pulley D, and another sheet of metal may now be placed upon the table T. An opposite motion is now given to the driving-belt on pulley D, and said belt is then shipped again onto the tight pulley E. The knife-carriage will now return to the point from which it started, cutting another sheet of metal in its passage, and the belt may now be shipped to loose pulley F, when all these operations may be repeated.

Whenever it is desired to raise or lower the rotary knife for the purpose of increasing or diminishing the distance between said rotary knife and the straight knife a, the knife-carriage may be brought to a position where the flange f^3 on the rear side of said carriage will be opposite the opening M in the rear side piece, V. The steady-pin i may now be removed from the nick h in the flange f and from the hole in the side of the box n, and the eccentric spool o may then be readily turned so as to raise or lower the rotary knife to any point desired, the same operation being performed on the eccentric spool o' and flange f^3 and the steady-pin in the side of the box n'. The rotary knife being elevated or depressed to the distance desired, said steady-pins are again put into the holes in the sides of said boxes, and into the nicks (in the respective flanges) which have been placed opposite said holes, and the machine is now again ready to work.

While the above operations of cutting are going on the trusses on the upper and lower beams keep said beams from yielding materially to the pressure against them, and the trusses on the side pieces keep said side

pieces from yielding materially to the lateral pressure against them, thus holding and keeping the rotary knife and the straight knife "firmly and steadily up to their work."

The rotary knife could be raised or lowered by means of screws, lifts, or wedges, operating on the boxes of the journals of the knife-shaft, but at present I much prefer the eccentric spools.

I do not claim raising or lowering the rotary knife, as that has been done before; but

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. So attaching the rotary knife to the carriage which carries it that, without raising or lowering said carriage, said rotary knife may be raised or lowered for the purpose of increasing or diminishing the distance between the stationary straight knife and the said rotary knife, in the manner substantially as herein described.

2. The combination of wrought-iron trusses, in the manner substantially as herein shown, with the upper and lower beams and side pieces and the rotary knife of the machine, for the purpose of adding rapidity to said upper and lower beams and side pieces, and also for the further purpose of causing said machine to do its work with a less expenditure of power and with very much less risk of breaking said rotary knife.

3. Suspending the knife-carriage to the lower side of the upper beam and bracing it laterally against the rear side piece below the lower side of the carriage, in the manner substantially as herein described, so as to obtain a much greater distance than has ever before been obtained between the upper and lower beams, for the purpose of enabling the workman conveniently to secure the sheet of metal to be cut in the exact position desired between the knives, and for the further purpose of enabling said workman to see distinctly if said sheet of metal is accurately placed.

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Witnesses:
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