2 Sheets--Sheet 1.

I. HAHN.

Machine for Shearing Metal.

No. 168,090. Patented Sept. 28, 1875.

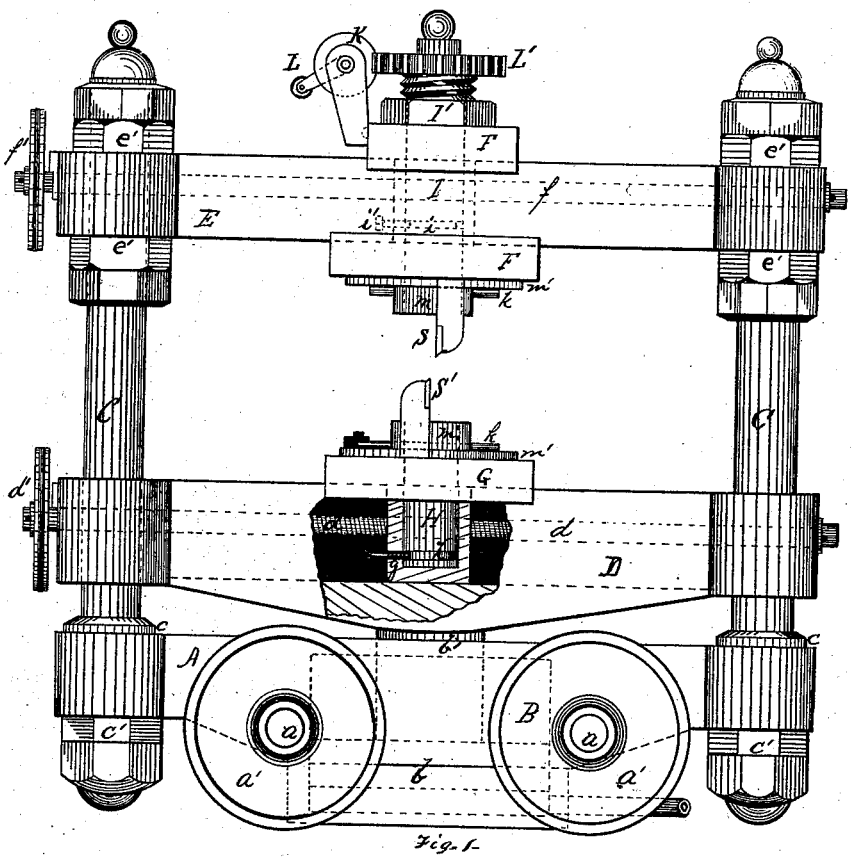

Fig. 1.

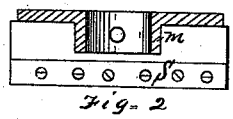

Fig. 2.

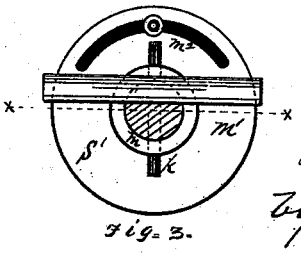

Fig. 3.

Witnesses.

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2 Sheets--Sheet 2.

I. HAHN.

Machine for Shearing Metal.

No. 168,090. Patented Sept. 28, 1875.

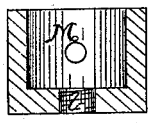


Fig. 6.

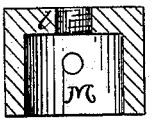


Fig. 8.

Fig. 9.

Fig. 7.

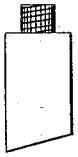
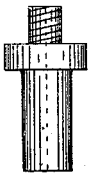


Fig. 10.



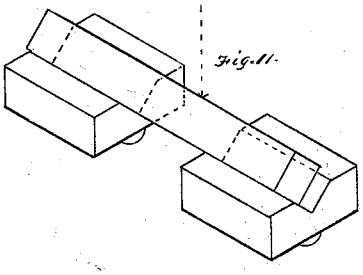


Fig. 11.

Fig. 12.

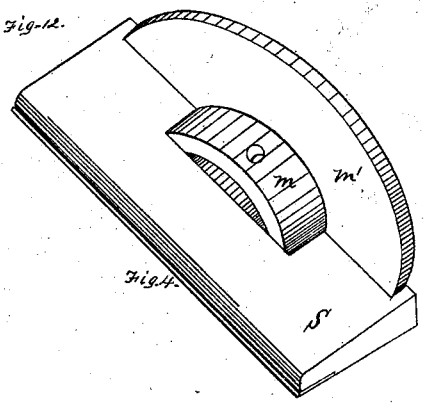


Fig. 4.

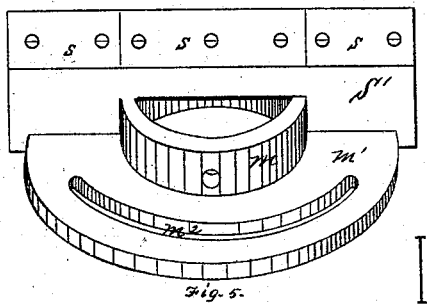


Fig. 5.

WITNESSES.

R. C. Winslow

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UNITED STATES PATENT OFFICE.

IGNATIUS HAHN, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN MACHINES FOR SHEARING METAL.

Specification forming part of Letters Patent No. **168,090**, dated September 28, 1875; application filed April 24, 1875.

To all whom it may concern:

Be it known that I, IGNATIUS HAHN, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Hydraulic Universal Machine for Shearing, &c.; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is an elevation, partly in section, of a machine embodying my improvement. Figs. 2 and 3 are plan and sectional views of shears and shear-collar. Figs. 4 and 5 are enlarged perspective views of the same; Fig. 6, detachable collars; Fig. 7, devices for forming rivets; Fig. 8, devices for riveting; Fig. 9, devices for making bolts; Fig. 10, devices for slotting; Fig. 11, perspective of devices for testing strength of materials, showing the manner of using the same; and Fig. 12, device for straightening and curving metals.

Like letters refer to like parts wherever they occur.

My invention relates to the construction of a hydraulic universal metal-working machine for cutting, straightening, riveting, heading, testing strength of metals, &c.; and it consists, first, in the combination of two or more tool-carriers, one of which has a vertical adjustment, and is operated by means of hydraulic power; second, in the combination of two or more tool-carriers, each capable of revolution around a central axis, and both of the carriers capable of lateral motion on the main frame; third, in the combination of two or more tool-carriers, one or both of which are operated by hydraulic power attached to the main frame, the whole being mounted upon a truck or wheels; fourth, in arranging shearing-knives upon a revolving carrier, so that they may be revolved around a central axis for the purpose of cutting metals to any desired angle.

Heretofore, for cutting, trimming, and splitting plates, &c., three separate machines have been required, and for straightening, riveting, slotting, and testing the strength of metals still other machinery was necessary, all of which, being expensive, involved an extensive outlay of capital not warranted by the work to be performed, which is seldom sufficient to keep the several machines continuously employed for any considerable length of time.

The object of the present invention is to produce a simple portable machine, which, by employing interchangeable tools with the tool-carriers, may be made to take the place of the several machines above recited.

I will now proceed to describe my invention so that others skilled in the art to which it appertains may apply the same.

In the drawings, A represents the lower part of the main frame, having a hydraulic cylinder, B, cast or formed therein or secured thereto, and also provided with axles *a*, by which it can be mounted on wheels *a'* *a'*, so that the lower frame forms a truck for transporting the machinery secured thereon. Rising from the main frame A, and secured thereto by collars *c* and nuts *c'*, or in other suitable manner, are rods or columns C C, which act as guides for cross-head D, and support the upper frame E, which is, in turn, secured by nuts *e'* *e'*, and may, if desired, be made vertically adjustable on the rods C C. B is a hydraulic cylinder, cast or formed in, or secured to, the main frame A, and *b* is a piston working in the cylinder, the stem *b'* being connected to or formed in one piece with the cross-head D, which it actuates. D is a slotted or forked cross-head, provided at each end with openings for the passage of rods C C, which act as guides for the cross-head in its vertical movements, and traversed longitudinally by a screw, *d*, which passes through a nut or threaded opening in tool-carriage G, said screw *d* being provided with a hand-wheel, *d'*, or other suitable device for operating it.

G is the lower tool-carriage, movable along the slotted or forked cross-head D, and containing the lower tool post or carrier H, said carrier H being grooved, as at *h*, to receive the projecting end of a screw or bolt, *g*, which secures the tool post or carrier to the traveling-carriage in such a manner that the tool post or carrier, which is preferably round, can revolve upon its axis without becoming displaced or detached from the carriage. E is the upper frame, secured to the vertical rods C C (two or more) in any suitable manner, and is slotted, or composed of two side bars,

to permit the travel of the upper tool-carriage F, which is operated by a screw, *f*, and hand-wheel *f'*, as specified for the lower carriage G. I is the upper tool post or carrier, which passes centrally through the upper carriage F, is grooved at *i*, and held in position by a screw or bolt, *i'*, similar to the lower tool-carrier; and upon the upper part of said tool post or carrier I is formed a thread, upon which works a nut, I', employed for jamming or rendering the post I rigid when desired. Secured to the carriage F is a worm, K, which may be operated by a crank, L, or other suitable means, said worm meshing into a worm-wheel, L', secured to tool-carrier I, whereby the tool-carrier may be caused to revolve at such times as it is not held by the jam-nut.

The devices thus far described constitute those which are constantly employed, and those which I shall now proceed to describe are to be understood as interchangeable, according to the work to be done.

S and S', Figs. 2, 3, 4, and 5, represent the upper and lower shear-blades, which, when long, are preferably formed in two or more sections, *s s*, as it is quite difficult to harden successfully such long blades so as to obtain uniformly good edges. The sections *s s* are bolted or otherwise secured to a bar or projection crossing the center of the collar *m*, said collar being provided with a flange or circle plate, m^1, which rests upon the tool-carriage, the collar *m* surrounding the tool post or carrier, and being secured thereto, when in use, by means of a key, *k*. The circle plate or flange m^1 of the lower blade is provided with a curved slot, m^2, which works over a pin on the carriage, and serves to guide and steady the shear, a nut upon the threaded end of said pin being made to jam or fix the circle-plate when the shear is in the desired position.

The same devices may be used with the upper-shear circle-plate, if desired.

For other purposes to which the machine is applicable, a simple collar or nut, such as shown at M, Fig. 6, may be employed instead of a flanged collar, said collar M being keyed to the tool-carrier, and threaded below, as at *l*, for the reception of such tools as those for forming rivets, Fig. 7, riveting, Fig. 8, heading and forming bolts, Fig. 9, slotting, Fig. 10, testing the strength of metals, Fig. 11, straightening and curving metal, Fig. 12, and various other tools which will readily suggest themselves to the mind of the skilled mechanic.

I will now proceed to describe the operation of the machine, supposing the shears to be in use and secured to the tool-carriers, as in Fig. 1. If a square cut is to be made, the knives are turned parallel with the screws *d f*, the bar or plate is shifted forward the desired distance and allowed to rest on the lower knife, the supply-valve is opened, establishing communication between the plunger and the hydraulic pump or accumulator, and the cross-head carrying the lower shear is forced up until the bar or plate is cut off. The supply-valve is then closed, and the waste-pipe opened permitting the cross-head and plunger to sink until the shears have separated sufficiently to permit the bar or plate to be again fed forward, which may be little more than the thickness of the metal being operated on, when the waste-valve is closed and the supply-valve opened, and a second cut made.

It is obvious from the above that the rapidity of operation will be greater where thin metallic plates are cut than when thick plates are operated upon, and also that the stroke of the shear can be readily and accurately controlled.

If the cutting is to be done at an angle, I set the knives as follows: First, force up the cross-head and plunger until the sides of the shears are in contact; then shut off the supply and waste valves, allowing the plunger to rest on the water, and the knives to retain the position specified; next loosen nut I', on tool post or carrier I, and turn tool-carrier I by means of the worm and worm-wheel, which will cause the upper knife to carry the lower knife around with it, until the desired angle is reached, which can be determined by graduations on the upper frame. When the desired angle is obtained the nut I' is screwed down to fix the upper tool-carrier and shear, and the lower shear is fastened by a nut upon the end of the pin, which works through the curved slot m^2 of the circle-plate. The shears are now ready to cut the plate at the desired angle, and the plate or bar may be fed forward as before until it comes in contact with a stop or guide, which will determine the length of the material cut off, whereby the previous marking of the metal and careful adjustment with relation to the knives heretofore required is avoided, much time saved, and less room required than where the plate has to be swung.

For trimming and splitting, the nut I' is loosened, and, the lower knife having been raised, the knives are adjusted in the manner before specified, until they stand at right angles to the screws *d f*, after which they are fixed in that position, and are ready for trimming and splitting, as required. By this arrangement of the machine trimming, cross-cutting, and splitting of plates, bars, &c., are accomplished by a single machine, while heretofore three separate machines have been required, one or more of which were constantly idle from lack of work.

When the machine is to be used other than for cutting metals I remove the knives and their collars, and substitute in place thereof plain collars M, securing thereto the tools to be employed; as, for instance, in forming bolts, I screw the tools shown in Fig. 9 into the collars M, set the hot metal into the cavity of the lower tool, allowing sufficient to project to form the head of the bolt. I then operate the plunger in the manner described in shearing metal, when the metal contained between the tools will be compelled to assume

the shape of the interior of the tool whether round, square, or hexagonal.

For making rivets these tools may be replaced by those shown in Fig. 7, and for riveting, slotting, or straightening those shown in Figs. 8, 10, and 12 will be substituted. In slotting or straightening, after each stroke, the tool or the article may be made to travel laterally or change position by means of the screws *d f*.

In testing metals to ascertain their capacity to resist tensile strain, I fasten one end of the piece to be tested to a fixed point on the frame or hydraulic cylinder, and the other end to the movable cross-head; next set the weight on the graduated lever of safety-valve (common to hydraulic apparatus) to the required mark; then open the supply-valve, and permit the plunger to rise slowly, watching carefully the material to be tested, and shifting the weight farther out upon the graduated valve-lever, until rupture of the metal takes place, when the pressure that existed at the time may be read off, and computations made in the usual manner.

For compressive strains fasten the metal between the fixed and movable frames, and proceed as above.

For testing the capacity of an article to resist compound strains, I employ the devices shown in Fig. 11, the upper tool being attached to the upper tool-carrier, and the two lower rests being secured to the bottom frame, one on each side, and equidistant from the upper tool. The article is then placed across the rest, the power applied, and the deflections and corresponding pressure noted and computed in the usual manner. It is also evident that the last-named devices may be used in bending and straightening metals.

With reference to the shears it is evident that, instead of adjusting the lower knife to the thickness of the metal to be cut, such adjustment may be made by changing the height of the upper knife, and it is also evident that the upper tool post or carrier may be the one operated by the hydraulic piston, or that both upper and lower carriers may be so operated.

Instead of using the rods *c c*, the several parts of the frame may be connected by solid connections at one or more sides or ends, which, together with the preceding exceptions, are mere mechanical changes, not avoiding the invention.

For very long cuts at each stroke, a knife formed of one or more sections, acted upon by several plungers, may be employed, and for cross-cutting very thick and wide plates may be moved across the plate after each cut by means of screws *d f*, or else the plate may be held stationary and the whole machine moved by means of wheels *a' a'*, upon which it is mounted.

In addition to the advantages before specified may be cited economy of room—as, for instance, heretofore where plates fifty feet or more in length and weighing several tons have been cut it has required a space equal to twice the width of the sheet multiplied by its length to permit the turning and cross-cutting, while by my improvements the plate is always fed in a straight line, and the position of the knives changed to give the desired cut, so that once the length and width of the sheet is all the space ever required to operate the machine.

Owing to the great power and the direct action obtainable by hydraulic pressure, the several parts of my machine can be made comparatively light, and the whole mounted upon wheels, so as to be moved from point to point as desired. A hydraulic pump or accumulator may be arranged upon the frame, or the force obtained from a series of underground pipes and plugs arranged at different points in the works, this also being so common a manner of obtaining hydrostatic force as to simply require suggestion.

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

1. In combination with the main or supporting frame two tool-posts or carriers, one of which is operated by a hydraulic piston, substantially as and for the purpose specified.

2. The combination of two carriers, each capable of revolution around a central axis, and both capable of lateral movement in the main frame, substantially as and for the purpose specified.

3. The combination of two tool-carriers, each capable of revolution around a central axis, and one or both operated by a hydraulic piston secured to the main frame, substantially as and for the purpose specified.

4. The combination of two tool posts or carriers, one or both of which are operated by hydraulic pistons attached to the main frame, the whole being mounted so as to be portable, substantially as and for the purpose specified.

5. The combination of two tool-carriers, each of which is capable of revolution around a central axis, two shear-blades, and suitable mechanism for operating the shears, substantially as and for the purpose specified.

In testimony whereof I, the said IGNATIUS HAHN, have hereunto set my hand.

IGNATIUS HAHN.

Witnesses:

F. W. RITTER, Jr.,

T. B. KERR.