Feb. 28, 1939. F. J. HAUSCHILD 2,148,943

PNEUMATIC METAL STRAIGHTENER

Original Filed Dec. 31, 1934 2 Sheets-Sheet 1

Fig. 1

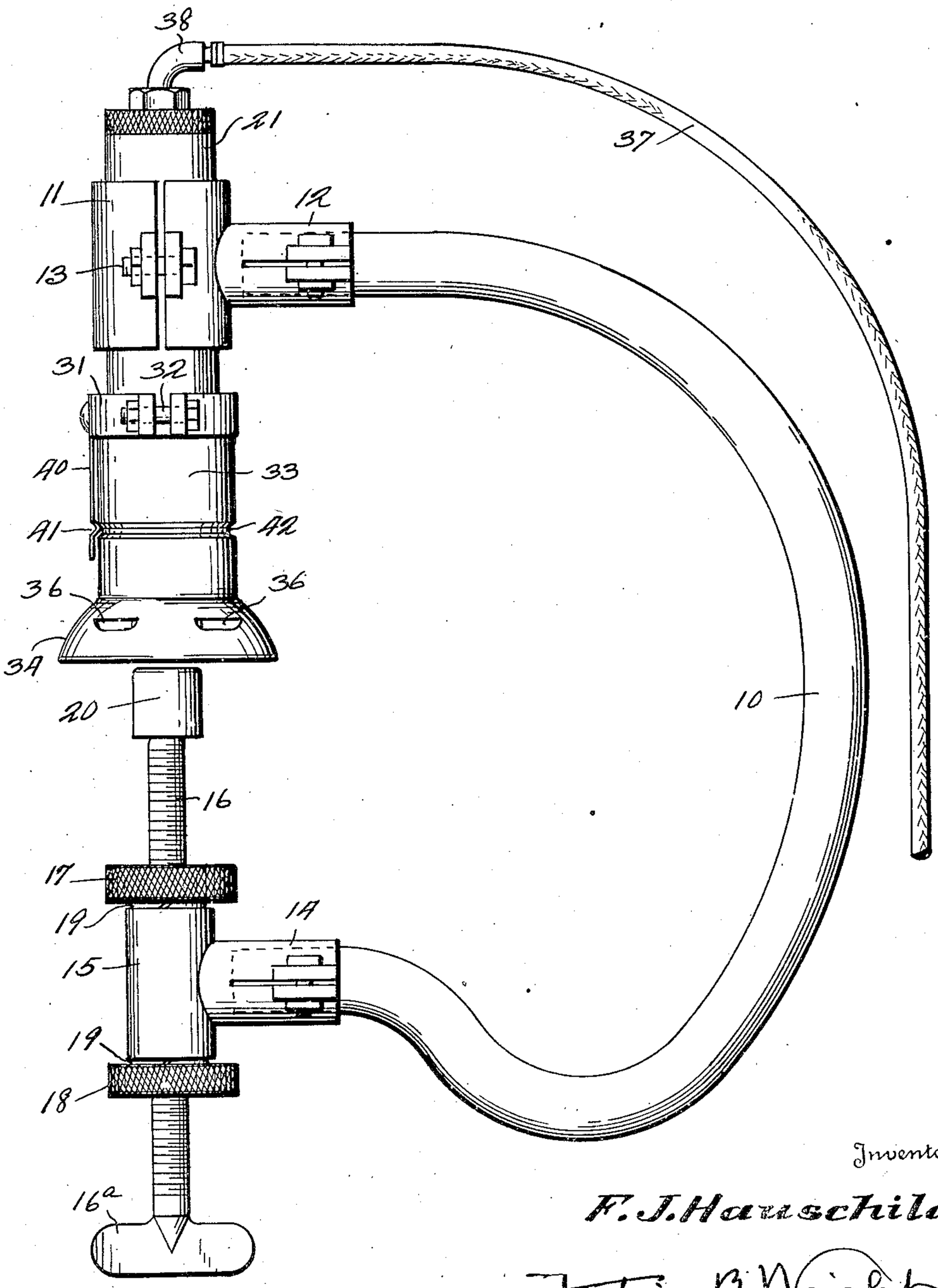

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Fig. 2

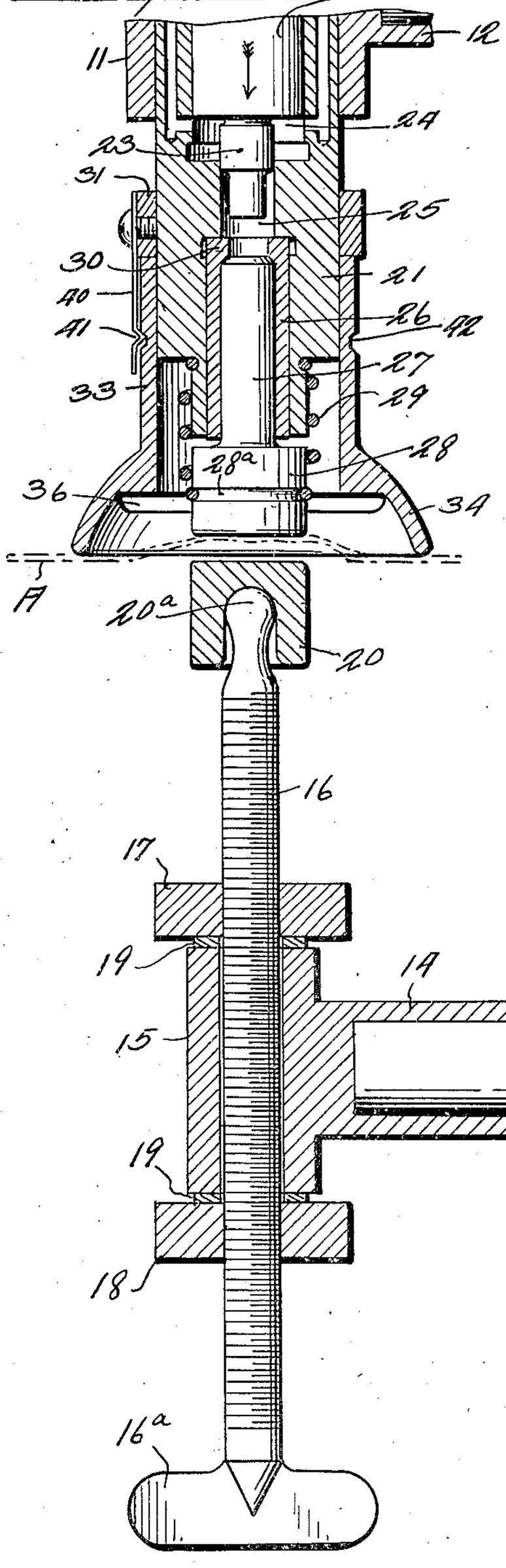

Fig. 3

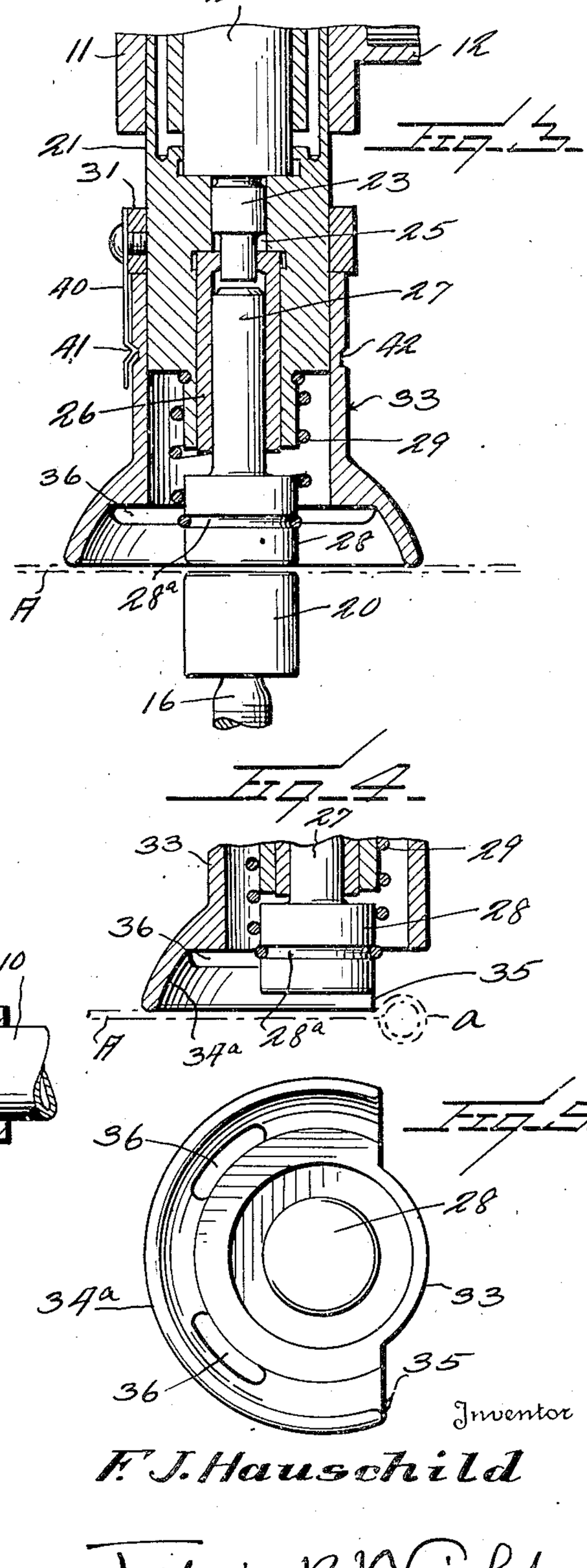

Fig. 4

Fig. 5

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2,148,943

PNEUMATIC METAL STRAIGHTENER

Frederick J. Hauschild, Oneonta, N. Y.

Application December 31, 1934, Serial No. 759,984
Renewed April 14, 1937

16 Claims. (Cl. 153—32)

This invention relates to devices for flattening out or straightening out sheet metal and particularly to devices for bringing back, to its normal condition, sheet metal parts of automobiles which may have been crumpled, bent or dented as by collision and the present application is a continuation in part of the application for patent, filed February 16, 1933, Serial No. 657,123.

It is common in straightening or flattening out fenders and like sheet metal work for the fender to be manually hammered back into shape but while this secures a general flattening out of the crumpled or dented portion, it substitutes for one very high dent or wrinkle a series of small dents or facets and the metal is never absolutely flattened so that it looks like new.

Another device for this purpose, and most generally used, includes two opposed rollers carried by a frame, which rollers are disposed on opposite sides of the sheet metal and then the crumpled or dented sheet metal is ironed out by these rollers. This device is unsatisfactory for heavy sheet metal or for anything except small and shallow dents because it requires the application of considerable strength in order to operate it and can only be operated manually. The stiffer the sheet, the more difficult it is to iron the wrinkle or dent out by this mechanism.

Another means attempted to be used for this purpose includes an electrically or mechanically operated hammer opposed to a dolly or anvil. In this case, the hammer is urged by a spring against the metal and retracted by a motor operated cam. This construction is impractical for the reason that the spring cannot be made strong enough to exert the requisite impact on the sheet metal. Furthermore, devices of this same general nature have never been provided with a support or guide resting upon the sheet metal itself and supporting the hammer in proper spaced relation to the sheet metal. As a consequence, the workman has been obliged to support the frame of the machine at the requisite distance and this requires a very great amount of strength and energy on the part of the workman. Furthermore, devices of this character, not provided with a supporting guide, must be held with the axis of the hammer or impact member exactly at right angles to the face of the sheet or otherwise a dent will be formed in the sheet metal rather than the dent removed as the hammer will strike obliquely down against the sheet metal. Furthermore, unless devices of this character having no supporting guide are held in exactly the right position, which holding must be accomplished by main strength on the part of the workman, the hammer will be either too far away from the work to exert the proper impact or it will be too close to the work and will be likely to cause a reverse dent to be formed.

The general object of my invention is to provide a sheet metal flattening machine or straightener which is easily handled, which is applicable to a large range of work, which may be used not only for taking the dents and wrinkles out of fenders and like parts but can also be applied to the doors and sheet metal bodies of cars and which eliminates the exertion of great muscular effort and strength on the part of the operator.

A further object is to provide a mechanism of this character in which a pneumatic hammer is used to cause the projection of a ram whereby an elastic stroke is secured whose amplitude depends on the height of the dent or wrinkle and to provide in connection with the pneumatic hammer a supporting guide carried on or formed with the casing of the hammer open at its lower end and having an internal diameter larger than the ram and whose open lower end rests on the sheet metal and supports the hammer casing thereon with the ram at a predetermined distance from the sheet metal when the ram is retracted.

A further object is to so form this supporting guide that the hammer casing will not be tilted with reference to the sheet metal but will be naturally supported in a position perpendicular to the plane of the work.

A further object is to provide means to support the sheet metal substantially all around the dolly and the ram so that the metal may be hammered down to the plane of the support.

My invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a side elevation of the tool;

Figure 2 is a longitudinal section through the hammer, dolly, and the upper and lower portions of the yoke or handle;

Figure 3 is a like section of the hammer and dolly showing the ram running downward;

Figure 4 is a fragmentary section of lower portion of the hammer and a sector-shaped bell or guide;

Figure 5 is a bottom plan view of the parts shown in Figure 4.

In the drawings, 10 designates an approximately U-shaped yoke or handle and 11 a split clamp having a socket 12 into which the upper end of the yoke is inserted. A bolt 13 holds the clamp in clamping position. The lower end of the yoke is inserted in a socket 14 which carries or is

formed with a sleeve 15. The ends of the yoke or handle may be held in the sockets 12 and 14 in any desired way and either detachably or by welding or brazing.

Extending upward loosely through the sleeve is a screw-threaded rod 16 carrying the knurled nuts 17 and 18 above and below the sleeve 15 and bearing against the spring washers 19 which act to jam the nuts and lock them in place. The lower end of screw 16 has a wing 16a and its upper end has a spherical head 20a carrying the dolly 20, constituting an anvil.

Carried within the clamp 11 is the cylindrical body 21 of a pneumatic hammer of any suitable type or make. Reciprocating within the body is the hammer or piston 22 having a head 23 projecting from its lower end. The hammer is limited in its downward movement by any desired means as by striking the bottom of the chamber 24 within which the hammer reciprocates. The lower end of the hammer body 21 has a relatively small bore 25, within which the head 23 operates, and this bore is enlarged toward the lower end to receive the bushing 26. Within this bushing is disposed the shank 27 of a ram, the head of which is designated 28. The body 21 is reduced in diameter at its lower end and surrounding this reduced portion is a coiled retractile spring 29, the upper convolution of which is engaged in a groove in the reduced portion of the body, the lower convolution being engaged in groove 28a formed in the head 28 of the ram. This spring urges the ram upward into sleeve 26, the upper end seating against a shoulder 30 on the sleeve 26.

Surroundng the body 21 is a split collar 31 held clamped in the body 21 by a bolt 32. This collar constitutes a stop for an element 33, which constitutes a guide and hammer support. The upper portion of this element 33 is tubular and snugly fits on the body 21 while the lower portion is flared outward at 34 like a bell, as shown in Figure 1. In Figure 1 this bell is circular in plan, but in Figures 4 and 5 the bell-shaped portion of the guiding and supporting element is not a complete circle, but has a lateral face, which is tangential, to the head 28. The bell-shaped portion 34 or 34a is preferably cut out at 36 to lighten it. The hammer body 21 and piston 22 are shown as constructed in accordance with Patent No. 711,859, granted October 21, 1902, to W. M. Holden and, therefore, I have not attempted to show the pneumatic tool in detail. It is to be distinctly understood, however, that other forms of pneumatic hammer may be used.

While I have illustrated the yoke or frame 10 as being of one piece, yet it is obvious it might be formed of several pieces and while I have illustrated it as being approximately C-shaped, it may be otherwise formed to embrace the work and hold the dolly and hammer in opposed relation.

Compressed air or, if the hammer be a steam hammer, steam may be admitted to the hammer body above the piston 22 through the flexible pipe 37. This is connected to the inlet pipe 38 and flow of air is controlled, preferably, by a foot valve not shown, resting on the floor and operated by the foot.

In using this machine, the bell-shaped support 34 is rested flat on the fender or other work to be flattened, then the nuts 17 and 18 are loosened and the dolly brought up against the under face of the work, whereupon the nuts 17 and 18 are tightened against the split locking washers 19, and the dolly held rigidly in position. Under these circumstances, the bell 34 rests upon the upper face of the work and supports the weight of the hammer and the frame or yoke 10 so that the workman may easily shift the dolly and bell 34 over the face of the work and particularly over the dents, depressions, crimps or other irregularities in the sheet metal which are to be flattened out.

The hammer 22 is constantly reciprocated under the control of the workman and when the hammer descends, it strikes its nose or extension 23 strikes a blow upon the ram 27—28, which moves downward after the hammer stops or reaches its lowermost position, leaves the hammer, as shown in Figure 3, and strikes a blow against the sheet metal. The hammer descends until its force is expended and then returns to the position in Figure 2, under the action of the spring 29.

The collar 31 is preferably provided with means detachably holding the element 33 in place against dropping off. For this purpose, I use a spring finger 40, which is attached to the collar 31 and adjacent its extremity a tooth 41 engaging in a circular groove 42 in the element 33. This construction permits the element 33 with its bell-shaped portion 34 (or 34a) to rotate freely around the hammer body 21 and over the work. This adds to the ease with which this implement may be manipulated over the work and permits the half bell 34a to follow along a bead *a* on the work A, which bead may have a curvature in its length which the end face 35 of the bell must follow. The half bell 34a is particularly designed for use on the beaded edge of a fender or in proximity to the bead which extends along a car body or across a car door.

By using a ram or impact member 27—28 and not striking the work directly by the hammer 22, I secure a blow which is akin to the blow given by a hand hammer. This is much superior to the solid, unyielding blow given by mechanically or electrically operated hammers or which would be given by a pneumatic, directly operating hammer. Thus the stroke of my ram is elastic and yet has a strength and power much greater than can be secured by the use of a spring. Thus the hammer will gradually work down a protuberance or flatten out an irregular surface gradually whereas if the hammer is operated mechanically with the same stroke at all times, either the protuberance or irregularity would be mashed down at one stroke or some part of the mechanism would have to break.

A further advantage of my mechanism resides in the provision of this supporting guide, that is, the bell 34 or 34a which forms an extension of the lower end of the hammer casing or cylinder, which at all times rests upon the surface of the work and which forms a gage limiting the movement of the pneumatic cylinder toward the work and holding the work in spaced relation to the ram when the latter is retracted. The ram has a stroke of approximately 3/8ths of an inch and the bell, constituting the support and guide, holds the work this distance from the hammer when the hammer is retracted, thus allowing a full play of the hammer and preventing the work from being crowded up against the hammer itself which might occur if the bell were not used.

Not only does the bell act as a gage preventing the work from being brought closer to the extremity of the impact member than 3/8ths of an inch but it also acts as a support for the frame,

hammer and allied parts when the work is disposed horizontally, thus taking the strain off the workman and making it an easy matter for him to shift the frame and carry the hammer back and forth over the work until the irregularity is entirely ironed out or hammered out.

Still another function of the bell, which it will be noted forms an extension of the hammer casing or cylinder, is that it naturally supports the hammer casing at right angles to the surface of the work. The larger the mouth of the bell, the more perfectly does this bell act to support the hammer at right angles to the work and impede any slight tilting movement of the hammer with relation to the work. If there is no extension of the hammer cylinder or casing below the hammer and extending more or less around the hammer so that this extension will rest upon the work, then the operator would have to take great care to hold the hammer cylinder always in a vertical position or at right angles to the work. In view of the weight of the frame and parts thereof, and, if there was no support for the hammer cylinder or frame 10, the operator's arms would quickly weary and with the slightest inattention, the frame would be tilted, causing the hammer to strike an oblique blow against the metal and the hammer and dolly would, therefore, form an oblique dent in the sheet metal being treated instead of getting out the old dent or irregularity. The guide or support constituted by the bell on the lower end of the cylinder slips easily over the face of the sheet metal while it acts as a support for the frame and allied parts. The weight being off the operative's arms, the operator can readily slide the device in all directions over the dented or crumpled portion with great ease and with no particular attention except to see whether or not the surface has been brought down evenly and every ridge flattened out. Furthermore, and most importantly, by supporting the hammer on the work, vibration is not transmitted to the operator's hands and arms.

In this mechanism, of course, the dolly crowds the dents upward from the bottom while the hammer sets the crimps or kinks downward level with the dolly, thus leaving a flat surface. The shape of the dolly depends upon the shape of the metal to be straightened and the dolly may be readily removed and a new dolly put in place whenever it is necessary to change the shape of the dolly.

Though I have illustrated the bell as being engaged with the body of the hammer casing by the collar 31 and spring 40, yet other means of engagement might be used and yet secure the adjustment which is desirable and necessary.

While I have illustrated the supporting and guiding bell as having a large diameter at its lower end relative to the hammer, yet I do not wish to be limited in this matter as obviously the bell might be made of smaller diameter and yet function as a support for the hammer cylinder and the frame and thus achieve particularly the functions of my bell. The larger the bell is in diameter, however, the greater the extent to which the bell will act as a guide preventing tilting of the hammer casing, hammer and dolly with relation to the work.

The machine in actual practice makes about 7000 strokes per minute. It is to be understood that the bell is not initially placed directly over the dents to be flattened but the machine works in gradually from the side. The machine then starts beating out the dent as it comes to the dent. At 7000 strokes per minute the ram has no time to spring back the full three-eighths of an inch, and as a consequence the ram and dolly exert more of a vibrating or pressing action on the dented metal which prevents the metal from stretching. This is particularly important in metal straightening. When the machine is dragged over the dented or deformed surface, strain is placed on yoke 10, but because this yoke has some inherent springiness, the yoke will resiliently spread under this strain and the bell can climb over the dents.

I claim:

1. A sheet metal flattener including a casing, a hammer therein, and an impact element separate from the hammer and adapted to be struck by the hammer, a dolly, means for holding the casing and dolly in opposed relation, the casing having a longitudinally rigid downwardly flared extension extending downward and outward below the hammer a distance approximately equal to the stroke of the impact element and adapted to contact with the work and support the casing a predetermined distance from the work and from lateral tilting movement, the free extremity of the extension being spaced from the impact element a substantial distance whereby to support the casing at a fixed distance from the work, at right angles thereto and against tipping movement.

2. A mechanism for flattening sheet metal including a substantially U-shaped frame, a member carried upon one end of the frame and supporting a dolly, a hammer body carried upon the other end of the frame in axial alinement with the dolly, the hammer body and the dolly being relatively adjustable toward or from each other, a hammer therein, an impact member separate from the hammer disposed within the body and adapted to be struck by the hammer, and a bell-shaped, rigid extension on the casing of the hammer extending toward the dolly and concentric therewith, the lower edge of said extension being disposed in a plane spaced from the retracted position of the impact member a distance equal to the stroke of the impact member, the lower portion of said extension being spaced a substantial distance from the impact member.

3. A sheet metal flattener including a yoke, a dolly carried at one end of the yoke, a pneumatic hammer body carried on the other end of the yoke and axially opposed to the dolly, the dolly and hammer body being relatively adjustable toward or from each other, a hammer within the body, a ram carried by the lower end of the body, struck by the hammer, and impelled outward free from the hammer, means for retracting the ram into its initial position when the force of the blow has been spent, and a work-engaging element, carried by the body, and at its lower end flaring outward in substantial spaced relation to the ram whereby to provide a large area of support for the casing upon the work and to resist tipping movement.

4. A sheet metal flattener including a yoke, a dolly carried at one end of the yoke, a pneumatic hammer body carried on the other end of the yoke and axially opposed to the dolly, a hammer within the body, the hammer body and the dolly being relatively adjustable toward or from each other, a ram carried by the lower end of the body, struck by the hammer, and impelled outward free from the hammer, means for retracting the ram into its initial position when the force of the blow has been spent, and a work-

engaging element carried by and fitting around the body and freely rotatable thereon, and at its lower end flaring outward and downward with the inside face of its lower portion in substantial spaced relation to the ram whereby to afford a large area of support for the casing on the work and prevent tipping movment of the casing.

5. A sheet metal flattener including a yoke, a dolly carried at one end of the yoke, a pneumatic hammer body carried on the other end of the yoke and axially opposed to the dolly, a hammer within the body, the dolly and the hammer body being relatively adjustable toward or from each other, a ram carried by the lower end of the body, struck by the hammer, and impelled outward free from the hammer, means for retracting the ram into its initial position when the force of the blow has been spent, and a work-engaging element, carried by the body, and at its lower end flaring outward and down in substantial spaced relation to the ram, the element being adjustable longitudinally on the body.

6. A sheet metal flattener including a yoke, a dolly carried at one end of the yoke, a pneumatic hammer body carried on the other end of the yoke and axially opposed to the dolly, the hammer body and the dolly being relatively adjustable toward or from each other, a hammer within the body, a ram carried by the lower end of the body, struck by the hammer, and impelled outward free from the hammer, means for retracting the ram into its initial position when the force of the blow has been spent, a work-engaging element, carried by the body, and at its lower end flaring outward and downward into substantial spaced relation to the ram to afford a relatively large area of support for the casing upon the work, the element at its upper portion surrounding the body, and a collar adjustably engaging the body and constituting a stop against which the element engages.

7. A sheet metal flattener including a yoke, a dolly carried at one end of the yoke, a pneumatic hammer body carried on the other end of the yoke and axially opposed to the dolly, the hammer body and the dolly being relatively adjustable toward or from each other, a hammer within the body, a ram carried by the lower end of the body, struck by the hammer, and impelled outward free from the hammer, means for retracting the ram into its initial position when the force of the blow has been spent, a work-engaging element, carried by the body, and at its lower end flaring outward and downward into substantial spaced relation to the ram whereby to afford a large area of support for the casing, the element at its upper portion surrounding the body, and a collar adjustably engaging the body and constituting a stop against which the element engages, said collar having a resilient finger engaging an annular groove in the element.

8. A sheet metal flattener including a dolly, a fluid operated hammer opposed to the dolly and including a casing and an impact member within the casing, and a sheet metal engaging element constituting a support for the hammer upon the work and forming a longitudinally rigid downwardly expanding extension of the casing at its lower end, the diameter of the extension at its lower end being substantially greater than the diameter of the hammer casing and extending a substantial distance around the axis of the casing, said extension at its lower end being spaced from the impact member when the latter is projected against the work and affording a wide support for the casing against the work and impeding any tilting movement of the casing relative to the work.

9. A sheet metal flattener including a casing, a fluid operated hammer therein and an impact element in the casing operated by the hammer, a dolly opposed to the hammer and its casing, a frame for holding the dolly and the hammer casing in opposed fixed relation, the casing having a longitudinally rigid extension extending radially outward and downward beyond the hammer impact element a distance equal to the stroke thereof and adapted to contact with the work and support the hammer casing at a fixed distance from the work, the free extremity of the extension substantially surrounding the impact element when the latter is projected against the work, said extension at its lower end having its inner face spaced from the impact element when the latter is projected against the work a distance such as to afford a relatively wide support for the casing against the work and impeding any tilting movement of the casing.

10. A mechanism for flattening distorted sheet metal including a substantially U-shaped frame, a member carried upon one end of the frame and supporting a dolly, a fluid operated hammer body carried upon the other end of the frame in axial alinement with the dolly, the hammer body and dolly being mounted for relative adjustment toward or from each other, a hammer therein, an impact member disposed within the body and adapted to be struck by the hammer, and a bell-shaped rigid extension on the lower end of the casing of the hammer extending toward the dolly and concentric therewith, the lower edge of said extension being disposed in a plane spaced from the retracted position of the impact member a distance equal to the stroke of the impact member, the lower end of the bell-shaped extension being spaced radially a substantial distance from the impact member when the latter is projected and affording a relatively wide support for the casing upon the work and impeding any tilting movement of the casing.

11. A sheet metal flattener including a yoke, a dolly carried on one end of the yoke, a pneumatic hammer body carried on the other end of the yoke and axially opposed to the dolly, a hammer within the body, a ram carried by the lower end of the body struck by the hammer and impelled outward free from the hammer and a work engaging element carried by the body, the lower end of the work engaging element having the form of a segment of a circle, the work engaging element at its lower end flaring outward laterally and rearwardly with relation to the hammer and in substantial spaced relation to the ram whereby to provide a large area of support for the body upon the work and resist lateral tipping movement, the work engaging element being cut away on its front face whereby its forward edge may be applied against a rib on the metal to be flattened and may be guided along this rib with the ram closely approximating the rib.

12. A sheet metal flattener including a yoke, a dolly carried on one end of the yoke, a pneumatic hammer body carried on the other end of the yoke and axially opposed to the dolly, a hammer within the body, a ram carried by the lower end of the body struck by the hammer and impelled outward free from the hammer, a work engaging element swivelled upon the lower end of the body for free rotational movement concentric thereto, the lower end of the work engaging element hav-

ing the form of a segment of a circle, the work engaging element at its lower end flaring outward laterally and rearwardly with relation to the hammer and in substantial spaced relation to the ram whereby to provide a large area of support for the body upon the work and resist lateral tipping movement, the work engaging element being cut away on its front face whereby its forward edge may be applied against a rib on the metal to be flattened and may be guided along this rib with the ram closely approximating the rib.

13. A sheet metal flattener including a pneumatic hammer having a body, a member in which the hammer body is supported for vertical adjustment, means for clamping the hammer in said supporting member against movement after adjustment, a work engaging element carried by and extending downward from the lower end of the body and at its lower end extending outward in a plurality of radial directions in substantially spaced relation to the hammer whereby to provide a large area of support for the hammer body upon the work and to resist tipping movement.

14. A metal flattener of the character described, including a pneumatic hammer body, a member in which the hammer body is supported, a work engaging member carried by the hammer body and extending below the same and extending outward in a plurality of radial directions from the hammer body, the lower edge of the work engaging member being disposed in substantially spaced relation to the hammer operating within said body whereby to provide a large area of support for the body upon the work and resist lateral tipping movement, the work engaging element being adjustable upon the hammer body and being freely rotatable around the longitudinal axis of the hammer body.

15. A shaping device as set forth, comprising a frame having a pair of spaced apart arms, an anvil, threaded means engaging one of the arms and the anvil to adjustably support the anvil, locking means for said threaded means, a movable hammer, operating means for said hammer above the same, clamping means for securing the operating means to the other arm, and a work engaging element adjustably carried by the operating means and extending downwardly from the operating means, and at its lower end extending outwardly in a plurality of radial directions in spaced relation to the hammer to support the device upon the work.

16. A sheet metal flattener, including a substantially U-shaped resiliently yieldable yoke, a hammer casing mounted on one arm of the yoke for adjustment toward and from the other arm of the yoke, means for clamping the casing in adjusted position in the yoke, an impact member disposed within the casing and extending below the same, a freely rotatable work engaging element carried by the hammer casing and normally projecting below the lower end of the impact element and adjustable longitudinally of the hammer casing, and a dolly carried on the other arm of the yoke and confronting the work engaging element.

FREDERICK J. HAUSCHILD.