March 27, 1934. E. L. CONNELL 1,952,908

PORTABLE FENDER TOOL

Filed Jan. 20, 1931 3 Sheets-Sheet 1

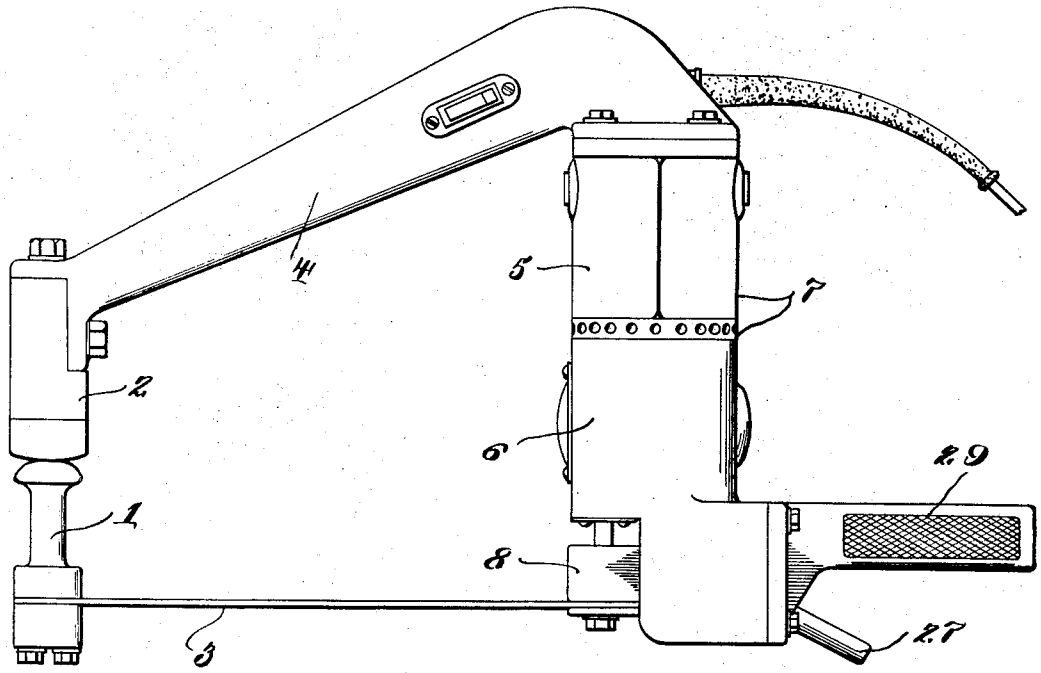


Fig. 1.

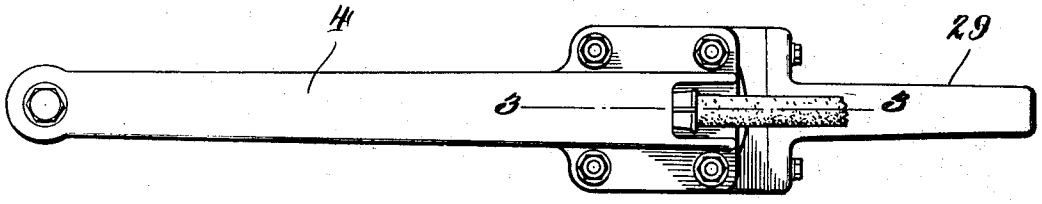


Fig. 2.

Witnesses

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PORTABLE FENDER TOOL

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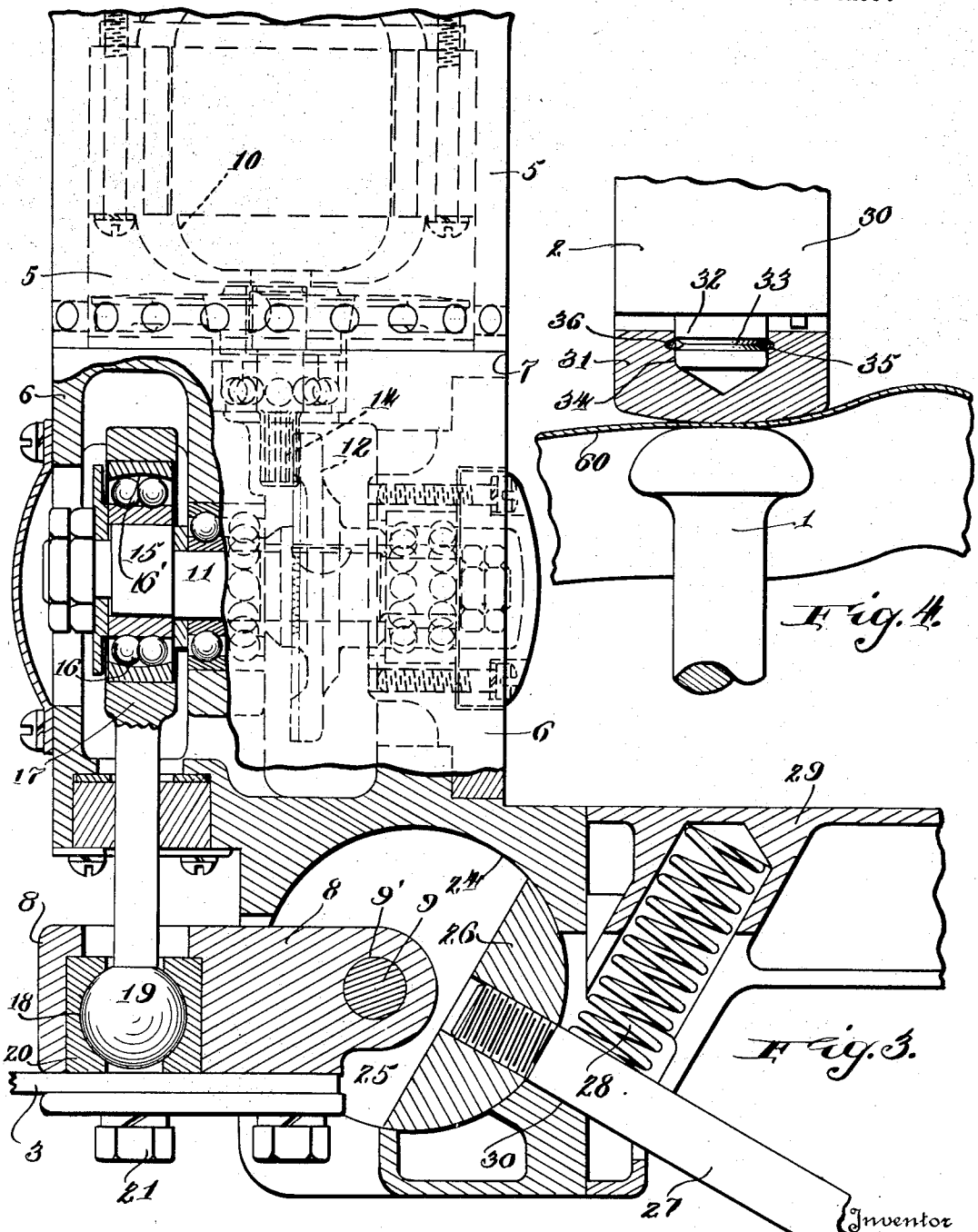


Fig. 4.

Fig. 3.

Witness

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PORTABLE FENDER TOOL

Filed Jan. 20, 1931 3 Sheets-Sheet 3

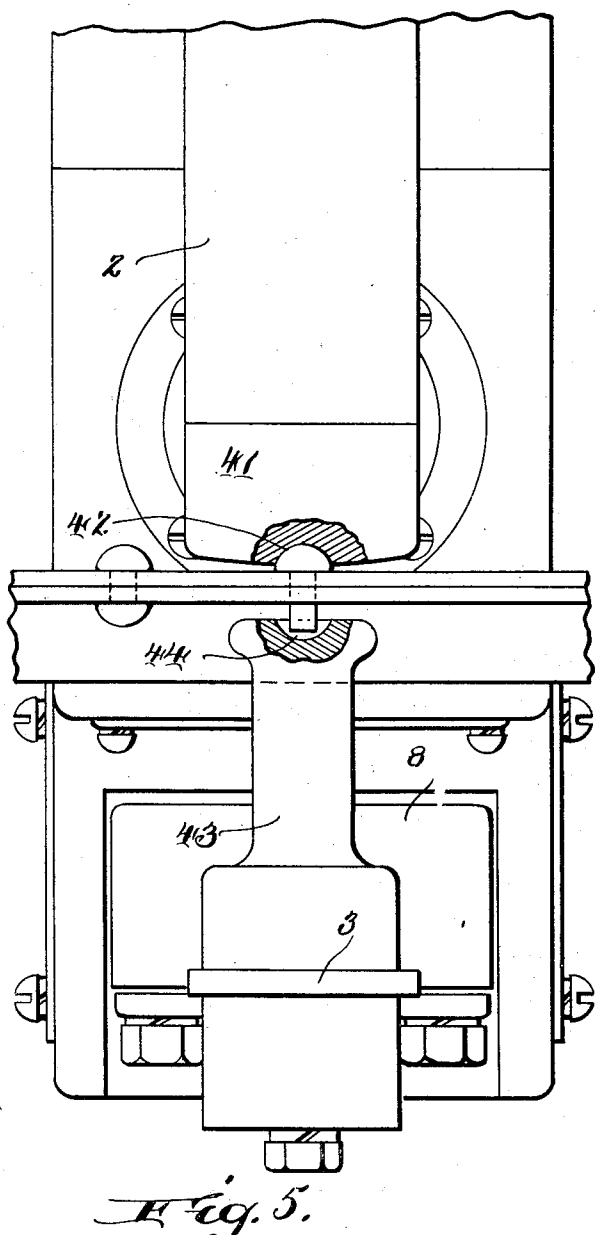


Fig. 5.

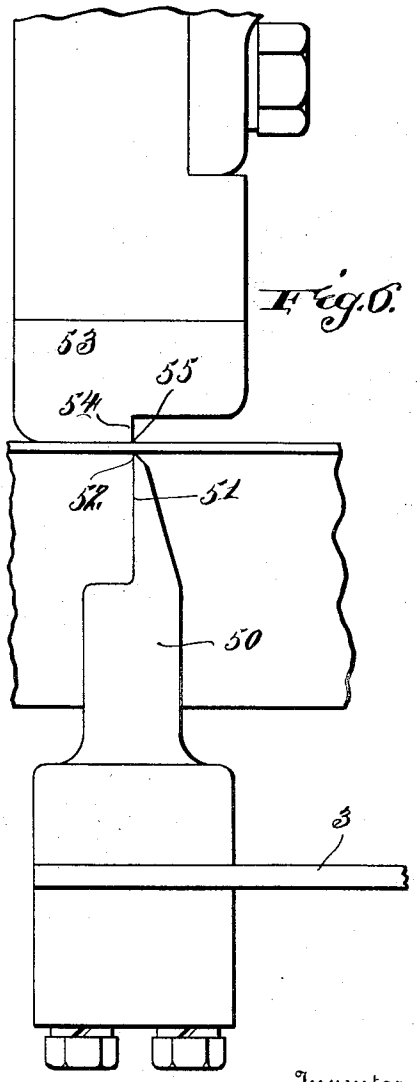


Fig. 6.

Witness
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Patented Mar. 27, 1934 1,952,908

UNITED STATES PATENT OFFICE

1,952,908

PORTABLE FENDER TOOL

Edwin L. Connell, Towson, Md., assignor to The Black & Decker Manufacturing Company, a corporation of Maryland

Application January 20, 1931, Serial No. 509,910

20 Claims. (Cl. 153—32)

The art of smoothing or straightening the damaged fenders of automobiles has developed a class of mechanics skilled in the practice of this art. Those not so skilled and practiced are not competent to produce results of the required degree of excellence, and satisfactory work is correspondingly expensive. As the average repair shop does not have sufficient of this work to maintain a mechanic skilled in this line, such shops are compelled either to turn out comparatively unsatisfactory work or to send their customers to other shops specializing in this line where they are apt to make other connections.

The hand operation consists in holding a hand anvil in one hand against one side of the work and striking the other side, usually the convex side, of the bump with a hammer. The ordinary motor-driven hammers are not suited to this operation and the average position in which the work is done is so cramped that the hammer and anvil must be operated in the minimum of space.

The present invention relates to the provision of a power-driven portable hammer or fender tool which is adapted to the conditions presented in that it may be operated in the minimum of space in the direction of the stroke or blow requiring much less space in this way due to the short rapidly repeated strokes, and less time than a hand hammer and very much less space than any known type of portable power-driven hammer. Further it can be operated by unskilled labor or by an ordinary mechanic without special experience, to produce work equal to that of the most highly skilled operator on fender repairs.

The operation of smoothing or straightening damaged fenders ordinarily requires heavy blows for the roughing and light blows for the final smoothing operation. The invention therefore includes means for controlling and regulating the force of the blow, which adjustment or controlling means is within easy reach of the operator in holding and working the tool and is so arranged that the control of the blow is performed so easily and conveniently by the operator with even a slight degree of skill and experience with the tool that it is in effect automatic.

In order that the tool which engages the work by means of a hammer and anvil as in the hand operation may be operated in the minimum of space in the direction of the stroke, each of these members, i. e., the hammer and the anvil, is supported on an arm, each of said arms extending laterally to the direction of the stroke and in the same general direction, being therefore substantially parallel.

In the preferred form of the invention the hammer member or hammer head is supported on a cantilever spring, which is the arm referred to in this connection, the arm which carries the anvil in accordance with the preferred form of the invention being relatively rigid.

In the operation of the tool the cantilever spring which supports the hammer head is vibrated by means of an electric or other suitable motor and at a frequency which bears a predetermined relation to the natural frequency of vibration of the spring and head so that the energy of the motor may be stored as spring deflection on the back stroke and delivered to the work on the forward stroke. In this connection it should be borne in mind that any considerable vibration of the anvil in the preferred form of the invention is regarded as undesirable, and for that reason the anvil and support should ordinarily be of a different period of vibration from that of the spring and hammer, which latter period corresponds to an efficient speed of the motor which in the form of the invention shown is reduced by suitable gearing before it is transmitted to the hammer arm.

In order to control the speed and energy of the blow which seems to be necessary to the efficient operation of such a tool, in accordance with the preferred form of the invention the relative position of the hammer head at which it encounters the work is adjustable. It has been determined that the maximum blow is obtained when the hammer head strikes the work with the spring in the natural or unflexed position and the force decreases more or less uniformly as the point of impact is changed, wherefore it is feasible to vary and determine the weight and energy of the blow by changing the point in the stroke at which the hammer encounters the work.

This may be done either by moving the anvil in the direction of the stroke to and from the mid-position of the hammer or by changing the position of the hammer path relatively to the anvil to accomplish the same result.

By intercepting the hammer head before or after this point of maximum velocity is reached we can regulate the power of the blow. Such an adjustment could be accomplished by moving the anvil to or from the mean position of the hammer, or by an equivalent method of changing the center of action of the hammer itself. The latter method is the one employed in this device.

The following is a résumé of the theory behind this hammer from a mathematical and physical viewpoint.

Fig. 1

A cantilever beam will deflect under a load W at its free end acording to the following law:

(1) w—load
l—length
b—width of beam
h—depth beam
E—modulus of elasticity (steel 30,000,000)
e—deflection

$$e=\frac{4wl^3}{bh^3E}$$

The deflection will be increased slightly by the weight of the beam itself w'.

$$e'=\frac{3}{2}\frac{w'l^3}{bh^3E}$$

Whence e' can be treated as a deflection due to an additional load at the end equal to 3/8 weight of the beam. W in (1) should contain this additional load to give the true deflection.

This beam will vibrate with a harmonic motion according to the law

$$T=\frac{2\pi}{\sqrt{\frac{k}{m}}}\text{ seconds}$$

$$k=\frac{w}{e}=\frac{bh^3E}{4l^3}$$

$$m=\text{mass}=\frac{w}{386}$$

Whence

$$T=\frac{2\pi}{\sqrt{\frac{bh^3E\times 386}{4l^3w}}}$$

For steel E=30,000,000

$$T=\frac{2\pi}{\sqrt{\frac{bh^3}{l^3w}\times 2{,}900{,}000{,}000}} \qquad (2)$$

$$\text{Cycles per minute}=\frac{60}{T}$$

If the fixed end of the above beam be subjected to a harmonic vibration in the plane of its natural vibration, the beam will vibrate with a harmonic motion and a maximum deflection determined by the relation between the frequency of the forcing vibration and the natural frequency of the system.

This law is:

$$\text{Deflection}=\frac{1}{1-\frac{w^2}{q^2}A} \qquad (3)$$

A=Amplitude of the forcing vibration

W—Frequency of forcing vibration

C—Material frequencies

$$\frac{w}{q}=\frac{\text{Frequency of forcing vibration}}{\text{Natural frequency}}$$

The system will be critical when

$$\frac{w}{q}=1.$$

The deflection increases to infinity but long before this point is reached the beam fails. We must design for a condition which will not stress the material beyond practical limits. The safe deflection can be calculated for the practical value of stress, as follows:

$$M=S\frac{I}{C}$$

$$\frac{I}{C}\text{ for above type beam}=\frac{bh^2}{6}$$

$$M=Pl=\frac{Sbh^2}{6l}$$

Deflection corresponding to P will be

$$D=\frac{4Pl^3}{bh^3E}=\frac{2sl^2}{3hE}$$

Since A equals amplitude of forcing vibration

$$D\pm A=\frac{1}{1-\frac{w^2}{q^2}}A$$

$$D-\frac{w^2}{q^2D}+A-\frac{w^2}{q^2A}=A$$

$$D=\frac{w^2}{q^2}(A+D)$$

$$\frac{w^2}{q^2}=\frac{D}{A+D}$$

$$\frac{w^2}{q^2}=\frac{\frac{2sl^2}{3hE}}{\frac{A+2sl^2}{3hE}}=\frac{3sl^2}{3hAE+2sl^2}=\frac{1}{1+\frac{3hAE}{2sl^2}}$$

$$\frac{w}{q}=\sqrt{\frac{1}{1+\frac{3hAE}{2sl^2}}}$$

An important characteristic of the construction described is that blows of considerable force and fully adequate to the purpose in hand are applied by the hammer to the anvil or the work thereon, the length of the stroke and the length of the tool in the direction of the stroke being exceedingly short so that the tool being engaged with the work in the numerous relatively cramped positions in which this work must be done, can be operated with full and sufficient effect to produce the desired result to much better advantage and in a much smaller space than can a hand hammer, producing more satisfactory and uniform results much more expeditiously and with less expenditure of human labor.

While the tool is described in connection with the treatment of fenders to which it is particularly adapted, it may also be used for body work and on other sheet-metal work. It should also be understood that the terms anvil and hammer are used in a general way as indicating a suitable support for the work and any striking member.

The invention relates to the features thus outlined and to other features and details of applicant's hammer or fender tool as hereinafter described.

In the accompanying drawings I have illustrated a fender tool or hammer embodying the features of the invention in the preferred form.

Figure 1 is a side elevation of the complete tool.

Figure 2 is a top plan view of the same.

Figure 3 is a view on an enlarged scale showing a fragment of the motor and motor casing, also the gear casing and the pivot pin on which the cantilever spring is mounted, a portion of the casing being broken away, showing these parts in section on the line 3—3 in Figure 2.

Figure 4 is a fragmentary view on an enlarged scale showing the hammer and anvil in engagement with a fragment of fender being straightened.

Figure 5 is a corresponding view looking from the left in Figure 1 showing the hammer equipped with riveting tools and performing a riveting operation.

Figure 6 is still another view taken at right angles to Figure 5, showing a chisel substituted for the hammer and a shouldered anvil substituted for the one used in straightening fenders, whereby the hammer is turned into a cutting tool for sheet metal and the like.

Referring to the drawings by numerals, each of which is used to indicate the same or similar parts in the different figures, the hammer or fender tool which is the subject of the invention in the preferred form as shown in Figures 1 to 4, comprises a hammer or hammer member 1, and an anvil 2, the hammer member 1 having a cantiliver support 3 which is preferably in the form of a plate or leaf spring of any suitable construction. The anvil 2 is supported on an arm 4; and both the cantilever spring 3, which may be a spring or other suitable supporting arm, and the arm 4 are laterally disposed as to the direction of the stroke of the hammer 1 relatively to the anvil 2 as hereinafter described, and extend in the same general direction so that they may be referred to as substantially parallel, though the arm 4 as shown is somewhat deflected from exact parallelism with the cantilever 3 principally on account of the length of the motor casing 5 and gear casing 6 which form the rigid body or casing 7 of the tool to be further discussed.

On examination of Figures 1 and 2, it will be noted that the anvil supporting arm 4 is rigidly secured at its end remote from the anvil 2 to the upper end of the motor casing 5, which is the upper end of the rigid casing 7 already referred to, and the cantilever arm 3 shown in the form of a spring arm extends laterally from the lower end of this casing, being secured at its end remote from the hammer to a bearing block 8 which contains a bearing 9' for the pivot pin 9 of the arm or cantilever 3.

The hammer or fender tool as shown is driven from any suitable source of power, here shown as an electric motor 10 mounted in the upper half of the machine casing 7 hereinbefore referred to as the motor casing 5, the lower end of which is secured to the gear casing 6 in which is suitably mounted a crank shaft or eccentric shaft 11, which is driven from the motor 10 by means of a relatively large gear 12 secured to said shaft 11 and engaged and driven by a pinion 14 on the motor shaft. This shaft 11 is provided with a crank pin or eccentric 15 engaged by a bearing 16, operating connecting rod 17 which at its opposite end engages bearing block 8 by means of a universal joint 18. This universal joint in the form of the invention shown consists of a ball 19 formed on the end of the connecting rod 17 and engaging a suitably lined socket bearing 20 seated in the block 8 in any suitable manner and spaced away from pin 9. As already pointed out, the bearing block 8 is mounted to rock about the pivot pin 9 driven by connecting rod 17 and imparting the desired vibrations to the cantilever spring 3 which is shown as secured to the block 8 by means of cap screws 21.

To provide for the rocking of this block 8, the bearing 16 is shown as having spherically concave bearing surfaces 16' adapted to permit a rocking motion of the connecting rod 17 at right angles to the radial plane of rotation of the shaft 11, and particularly of the crank pin or eccentric 15.

It will be noted that the motion of the connecting rod due to the eccentricity of the eccentric or crank pin 15 imparts to the bearing block 8 a rocking motion or swing which is communicated to the cantilever arm or cantilever spring 3 in the form of vibrations which are in turn communicated to the hammer 1 and that the stroke of the hammer is proportioned to the stroke of the crank as the lever arm 9—1 is to the lever arm 9—19. The hammer is thus vibrated with a frequency which corresponds to the natural frequency of vibration of the spring and hammer head, the motor selected being of a speed and the gearing of a proper ratio to give this result. It will also be understood that the maximum force of the blow is delivered when the work is so located that the hammer head strikes the work with the spring in the natural or nonflexed position just before the spring reverses its direction of deflection, at which point it would begin to store kinetic energy due to the motion of the hammer head.

To provide the desired adjustment of the force of the blows or as it is sometimes termed, the weight of the blows, so that heavy blows may be applied in roughing and light blows in the final smoothing operation, it is found most convenient to change the location of the path of the hammer relatively to the position of the anvil and hence the position of the work so that the point in the path of the hammer head or hammer at which it is arrested by contact with the work is changed and this point is varied relatively to the point at which the spring is in its natural position, i. e., is undeflected, reducing the force of the blow from the maximum to an extent corresponding to the extent of the adjustment of the position of the path of the hammer thus provided.

This adjustment is accomplished by changing the position of the pivot pin 9 and hence the position of the cantilever 3, at the beginning of the stroke and at every point in the stroke.

In this connection it will be noted that in performing this adjustment there is a tendency to vary and change the position of the point on the anvil which is struck by the hammer, as the position of the path of the hammer is thus changed in the direction of the stroke. It is found that when the pivot pin 9 is moved downward, the hammer has a tendency to locate the blow outside the center of the anvil, i. e., to the left, in Figure 1 and vice versa.

To overcome this difficulty and keep the point of contact of the hammer with the anvil or with the work at the center of the anvil or otherwise to avoid changing this point of contact of the hammer with the work as the location of the path of the hammer is changed in the direction of the length of the stroke, means is provided for supporting the pivot pin 9 whereby it is caused to move or swing at an angle to the direction of the hammer stroke as this adjustment is performed, compensating for the tendency to change the location of the point at which the anvil is struck by the hammer so that the location of this point is maintained constant without regard to the adjustment.

To this end the pivot pin 9 is mounted on a rotary member 24, the axis of which is parallel to the axis of said pivot pin 9, the pin 9 being spaced outwardly from the center of this rotary member 24 by a radial distance corresponding to the desired degree or extent of the adjustment. This rotary adjusting member 24 consists in the form of the invention shown of a plurality of disks 25 spaced apart to provide a slot in which

the end of the block 8 is inserted, the pivot pin 9 extending across the slot and through the disks, the two disks 25 being joined by the cross hatched segmental section 26, which provides a convenient point of support for the controller arm 27, which is threaded therein and in the form of the invention shown engaged from above by a compression spring 28 seated in the handle 29, by which the tool is guided. The spring has a tendency to hold the rotary support 24 in the position of the maximum weight of blow in which the parts are located by a suitable stop surface 30 on the frame which is shown as engaged by the controller arm 27 in said position of maximum blow, or the stop may be otherwise located.

In the operation of the tool of the preferred design to obtain the maximum of efficiency, the cantilever spring 3 with the hammer head or hammer member 1 carried at its outer and unsupported end is vibrated by the operation of the motor suitably spaced and designed for the purpose at a frequency which has a predetermined relation to the natural period or frequency of vibration of the spring and hammer head. According to the preferred operation one period or frequency is a factor of the other so that the maximum vibration results with the least expenditure of energy. The anvil and support should preferably be of quite a different period of vibration so as to have the least possible vibrating action when the hammer is operating. As already pointed out, the maximum blow results when the hammer contacts the work or anvil at the center of motion of the spring, i. e., when it is unflexed, and adjustment of the hammer to reduce or increase the force of the blow is accomplished by varying the actual point of interception of the hammer by the work relatively to the said center of motion.

It will be clearly understood from the foregoing that by counterclockwise rotation of the member 24, which is easily accomplished by pressure of the finger on the controller arm 27 in opposition to the tendency of the spring 28, the pivot pin 9 is lowered tending to swing the cantilever spring 3 upwardly about the bearing 18, 19 at the end of the connecting rod 17 which may be said to correspond to a wrist pin. This change of position of the pivot pin 9 and the cantilever spring arm 3 has the effect of transferring the path of the hammer member moving it upwardly in the direction of the stroke, also altering in the same direction the point at which the spring 3 is unflexed and at which it would therefore deliver the maximum blow being at its center of motion as aforesaid. However, as the normal position of the pivot pin 9 illustrated in Figure 3 in which the controller arm 27 rests on the stop surface 30 has been chosen as the position of maximum weight of blow, i. e., the position in which the hammer is brought in contact with the anvil with the spring 3 unflexed, the traverse which takes place due to the lowering of the pivot pin 9 has the effect of reducing the force of the blow assuming the position of the anvil is not changed.

If the pivot pin 9 were moved in a direction parallel to the path of the hammer at the time of the maximum blow, as shown in Figure 1, there would be a tendency to move the point of contact of the hammer with the anvil outwardly, i. e., to the left, in Figure 1. This is overcome in the form of the invention shown by the deflection of the path of the pivot pin 9 from a line parallel to the direction of the hammer at the time of applying the maximum blow, such deflection being due to the swing of said pin 9 about the center of the member 24 whereby the cantilever spring 3 and the hammer member 1 are withdrawn very slightly to the right in Figure 1, compensating for the tendency of the point of contact between the hammer and the anvil to move slightly to the left as the force of the blow is reduced by moving the pivot pin downwardly in the operation of the adjustment thus described and thus keeping the point of impact or contact of the hammer with the anvil or work constant relatively to the anvil at all points of said adjustment.

An important function of the construction shown for adjusting the force or impact of the blow will be understood when it is realized that the impulses imparted by the motor to the vibrating member 3 are transmitted almost directly to the pin 9, making it necessary to provide a substantial resistance to the movement of this pin. At the same time, to attain the desired adjustment during the operation of the tool, the pin must move easily under the finger of the operator. By mounting the pin 9 eccentrically of the relatively large disk member 24, the friction at the periphery of the eccentric is utilized in a large measure to overcome the tendency to rotation of the disk due to the reaction at pin 9 of the working impulses applied by the connecting rod to the arm 3, and the leverage of the handle 27 at the point of engagement by the fingers as compared to the eccentricity of the pin 9 is another important consideration. The tendency of the driving impulses to move the pin 9 is reduced at the lever 27 by the ratio of the radius of center of the pin from the center of the disk member 24, as compared to the length of the control lever 27 at the points of engagement, which ratio is approximately ten to one, to which resistance is added the friction at the periphery of the disk 24, the leverage or momentum of this frictional resistance about the center of disk 24 being an important element. The spring 28 engaging the control lever 27 has the effect of holding the eccentric in the position of maximum blow as aforesaid. The stop surface 30 and the spring 28 take up all appreciable tendency to vibration of the pin 9 about the center of disk 24, and at the same time the disk is moved freely and without noticeable difficulty by the fingers of the operator against the tension of the spring, the friction at the periphery of disk 24 and any opposite tendency which may result from the driving thrust at the connecting rod.

In the operation of the tool it is engaged with the fender or other sheet metal 60 to be treated, the anvil being preferably brought in contact with the concave side of the deflection or bump so that the hammer blows can be applied to the convex side, although the exact method of application of the tool to the work is not thus strictly limited. The switch being closed, the tool is moved over the defaced area, the controller lever 27 being at first permitted to remain in or near the position of the maximum blow, being most conveniently held in this position by the operation of the spring 28 as indicated in Figure 3. As the work progresses and the deflection of the sheet metal is flattened and caused to approach the normal contour of the fender or other work, the force of the blows is gradually reduced and the work is finished and smoothed with blows applied at or near the minimum force whereby any slight irregularities remaining after the initial operation are removed and the metal is in most instances

brought to a smooth and regular contour which can not be distinguished from the original condition of the fender. A suitable coating being then applied, the fender assumes its original appearance and the repair is complete.

For convenience in changing the configuration of the anvil or replacing any anvil which may become roughened, broken or otherwise of irregular shape, the anvil as shown in Figure 4 is provided with a base 30 from which the anvil or anvil head 31 is conveniently removable so that it may be interchanged, making it possible to change quickly from one type of anvil to another, enabling the operator to use at all times an anvil which conforms to the shape to the metal he is forming.

In accordance with the construction shown, the base 30 is provided with a central depending pin or stud 32 having near its lower end a peripheral groove 33, and the anvil proper or head 31 is formed with a socket 34 adapted to receive and substantially to fit the stud 32. This socket has an internal peripheral groove 35 in which is seated a spring ring 36 which normally protrudes from the internal groove 35 being normally of less inside diameter than the outside diameter of the stud 32, so that when the anvil proper or head 31 is placed in alignment with its operative position and pushed toward the base, the spring ring 36 enters partly into the groove 33 in the stud, still occupying part of the groove 35 in the socket and this serves to lock the parts in an assembled relation. The inclined walls of the groove as shown have the effect when stress is applied to the head 31, tending to move it, of forcing the ring outwardly into its seat in the groove 35 in the socket whereby the head is released.

Figure 5 shows a head or anvil proper 41 provided with a rivet cup 42 in the center of its work-engaging surface to engage the rivet heads, and the hammer member 43 is provided with a similar cup 44 to form the end of the rivet or vice versa, both said cups 42 and 44 being not only in alignment with each other in the direction of the blow, but preferably in the centers of the work-engaging surfaces of the anvil and hammer and at the point of contact.

Figure 6 shows a chisel 50 substituted for the hammer member or head, the chisel having a flat surface 51 extending rearwardly from the cutting edge 52 and in or parallel to the direction of the stroke, and the anvil head or anvil proper 53 has a shoulder 54 with which the flat surface 51 of the chisel has sliding contact near the forward portion of each stroke so as to give a shearing action of the edges 52 of the chisel and 55 of the shouldered anvil or cutting block 53. The chisel may be used in cutting sheet metal etc.

I have thus described specifically and in detail a fender tool or hammer embodying the features of my invention in the preferred form, in order that the nature and operation of the same and the manner of constructing and using the device of the invention may be fully understood, however, the specific terms are used in a descriptive rather than in a limiting sense, the scope of the invention being defined in the claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a manually portable power-driven tool adapted to the treatment of motor vehicle fenders when in place on the vehicle, and for other purposes, an anvil, a hammer, two arms supporting the anvil and the hammer, respectively, and connected at a point remote from the hammer and anvil to provide a frame for the tool whereby a fender may be admitted between the hammer and anvil, the frame being sufficiently rigid to support the hammer and anvil in their respective operative relations to the work, and being in the form of a yoke, the hammer arm being pivotally mounted at a point remote from the hammer, and means for vibrating the hammer arm relatively to said pivot, producing a succession of impacts of the hammer against the anvil or work thereon.

2. In a manually portable power-driven tool for treating motor vehicle fenders when in place on the vehicle, and for other purposes, an anvil, a hammer, two arms supporting the anvil and hammer, respectively, and connected at a point remote from the hammer and anvil to provide a frame for the tool whereby a fender is admitted between the hammer and anvil, the hammer arm being pivotally mounted at a point remote from the hammer, means for vibrating the hammer arm relatively to said pivot, producing a succession of impacts of the hammer against the anvil or work thereon, the hammer arm comprising a cantilever spring which is flexed in the operation of the hammer.

3. In a manually portable power-driven tool for treating motor vehicle fenders when in place on the vehicle and for other purposes, an anvil, a hammer, two arms supporting the anvil and hammer, respectively, and connected at a point remote from the hammer and anvil to provide a frame for the tool whereby a fender is admitted between the hammer and anvil, the hammer arm having pivotal means whereby it is connected to the arm supporting the anvil, means for vibrating the hammer arm relatively to said pivot, producing a succession of impacts of the hammer against the anvil or work thereon, the hammer arm comprising a cantilever spring which is flexed in the operation of the hammer, and a movable support for said pivot adapted to change the location of the center of the path of the hammer toward and from the anvil and hence adjust the force of the blow.

4. In a manually portable power-driven tool adapted to the treatment of motor vehicle fenders when in place on the vehicle, and for other purposes, an anvil, a hammer, two arms supporting the anvil and hammer, respectively, and connected at a point remote from the hammer and anvil to provide a frame for the tool whereby the fender is admitted between the hammer and anvil, the hammer arm having pivotal means whereby it is connected to the arm supporting the anvil, means for vibrating the hammer arm relatively to said pivot, producing a succession of impacts of the hammer against the anvil or work thereon, the hammer arm comprising a cantilever spring which is flexed in the operation of the hammer, and means for moving said pivot in a direction inclined to the direction of vibration to change the location of the hammer path and adjust the force and weight of the blow and to compensate for the tendency to change the point of impact of the blow on the anvil as the pivot is moved.

5. In a manually portable power-driven tool for treating motor vehicle fenders when in place on the vehicle, and for other purposes, an anvil, a hammer, two arms supporting the anvil and hammer, respectively, and connected at a point remote from the hammer and anvil to provide a frame for the tool whereby the fender is admitted between the hammer and anvil, the hammer

arm having pivotal means whereby it is connected to the arm supporting the anvil, means for vibrating the hammer arm relatively to said pivot producing a succession of impacts of the hammer against the anvil or work thereon, the hammer arm comprising a cantilever spring which is flexed in the operation of the hammer, a member having a bearing of large diameter as compared to the pivot rotatably mounted in the frame, the pivot pin being mounted in said member and spaced outward slightly from the center, manually engaged means for rotating said member to adjust the position of the pivot, a stop to locate said member in a predetermined position, and a spring tending to maintain said member in contact with the said stop.

6. In a manually portable power-driven tool of the percussive type particularly adapted for use in straightening and smoothing the fenders of motor vehicles when in place on the vehicle, and for other purposes, a hammer, an anvil, means supporting the hammer and anvil forming a yokelike frame providing for the admission of the fender between the hammer and anvil, the frame being sufficiently rigid to support the hammer and anvil in their respective operative relations to the work and means for reciprocating the hammer and imparting to it a series of strokes which terminate in contact with the work on the anvil.

7. In a portable power-driven tool of the percussive type particularly adapted for use in straightening and smoothing the fenders of motor vehicles when in place on the vehicles, and for other purposes, a hammer, an anvil, means supporting the hammer and anvil forming a yokelike frame providing for the admission of the fender between the hammer and anvil, means for reciprocating the hammer and imparting to it a series of strokes which terminate in contact with the work on the anvil, the hammer support comprising a cantilever spring which is vibrated by said reciprocating means with a frequency corresponding to the natural frequency of the spring and hammer.

8. In a portable power-driven tool of the percussive type particularly adapted for use in straightening and smoothing the fenders of motor vehicles when in place on the vehicles, and for other purposes, a hammer, an anvil, means supporting the hammer and anvil forming a yoke like frame providing for the admission of the fender between the hammer and anvil, means for reciprocating the hammer and imparting to it a series of strokes which terminate in contact with the work on the anvil, the hammer support comprising a cantilever spring arm pivotally mounted, said reciprocating means engaging said arm adjacent the pivot.

9. In a portable power-driven tool of the percussive type particularly adapted for use in straightening and smoothing the fenders of motor vehicles in place on the vehicles, a hammer, an anvil, means supporting the hammer and anvil forming a yokelike frame providing for the admission of the fender between the hammer and anvil, means for reciprocating the hammer and imparting to it a series of strokes which terminate in contact with the work on the anvil, the hammer support comprising a cantilever spring arm pivotally mounted, said reciprocating means engaging said arm adjacent the pivot, means for adjusting the position of the pivot to vary the path of the hammer relatively to the anvil and substantially in the direction of the stroke, changing the force of the blow.

10. In a portable power-driven tool of the percussive type particularly adapted for use in straightening and smoothing the fenders of motor vehicles in place on the vehicles, and for other purposes, a hammer, an anvil, means supporting the hammer and anvil forming a yoke-like frame providing for the admission of the fender between the hammer and anvil, means for reciprocating the hammer and imparting to it a series of strokes which terminate in contact with the work on the anvil, the hammer support comprising a cantilever spring arm pivotally mounted, said reciprocating means engaging said arm adjacent the pivot, means for adjusting the position of the pivot to vary the path of the hammer relatively to the anvil and substantially in the direction of the stroke, changing the force of the blow, said adjustment of the pivot being inclined to the direction of vibration to compensate for any tendency to change the point of impact of the hammer on the anvil.

11. A portable power-driven tool consisting of an anvil, a hammer head, arms supporting said anvil and hammer head respectively, means connecting said arms to form a yoke-like frame adapted to admit a fender between the anvil and hammer, the hammer head arm being in the form of a cantilever including a spring, a motor for vibrating the cantilever arm to produce a series of impacts of the hammer upon the anvil or the work thereon, the tool being elongated in the direction of the length of the arms and of relatively short dimension in the direction of the stroke whereby the tool is adapted to reach the various parts of an automobile fender and to operate thereon.

12. A portable power-driven tool consisting of an anvil, a hammer head, arms supporting said anvil and hammer head respectively, means connecting said arms to form a yoke-like frame adapted to admit a fender between the anvil and hammer, the hammer head arm being in the form of a cantilever including a spring, a motor for vibrating the cantilever arm to produce a series of impacts of the hammer upon the anvil or the work thereon, the tool being elongated in the direction of the length of the arms and of relatively short dimension in the direction of the stroke whereby the tool is adapted to reach the various parts of an automobile fender, means for changing the point in the stroke at which the hammer contacts the work or anvil whereby the power of the blow is varied and determined.

13. A portable power-driven tool, consisting of an anvil, a hammer head, arms supporting said anvil and hammer head respectively, means connecting said arms to form a yoke like frame adapted to admit a fender between the anvil and hammer, the hammer head arm being in the form of a cantilever including a spring, a motor for vibrating the cantilever arm to produce a series of impacts of the hammer upon the anvil or the work thereon, the tool being elongated in the direction of the length of the arms and of relatively short dimension in the direction of the stroke whereby the tool is adapted to reach the various parts of an automobile fender, the cantilever arm having a pivotal support about which it is vibrated, a support for said pivot having a circular bearing in the frame considerably larger than the pivot and carrying the same in an eccentric position as to said bearing, means for moving said support about the center of said

bearing to move the pivot of the hammer spring and determine the force of the blow.

14. A portable power-driven tool, consisting of an anvil, a hammer head, arms supporting said anvil and hammer head respectively, means connecting said arms to form a yokelike frame adapted to admit a fender between the anvil and hammer, the hammer head arm being in the form of a cantilever including a spring, a motor for vibrating the cantilever arm to produce a series of impacts of the hammer upon the anvil or the work thereon, the entire tool being elongated in the direction of the length of the arms and the relatively short dimension in the direction of the stroke whereby the tool is adapted to reach the various parts of an automobile fender, the cantilever arm having a pivotal support about which it is vibrated, a support for said pivot having a circular bearing in the frame considerably larger than the pivot and carrying the same in an eccentric position within said bearing, means for moving said support about the center of said bearing to move the pivot of the hammer spring and determine the force of the blow, and a spring tending to hold said rotary support in a predetermined position of adjustment.

15. A portable power-driven tool consisting of an anvil, a hammer head, arms supporting said anvil and hammer head respectively, means connecting said arms to form a yokelike frame adapted to admit a fender between the anvil and hammer, the hammer head arm being in the form of a cantilever including a spring, a motor for vibrating the cantilever arm to produce a series of impacts of the hammer upon the anvil of the work thereon, the tool being elongated in the direction of the length of the arms and the relatively short dimension in the short direction of the stroke whereby the tool is adapted to reach the various parts of an automobile fender, the cantilever arm having a pivotal support about which it is vibrated, a support for said pivot having a circular bearing in the frame considerably larger than the pivot and carrying the same in an eccentric position within said bearing, means for moving said support about the center of said bearing to move the pivot of the hammer spring and determine the force of the blow, and a spring tending to hold said rotary support in a position of maximum adjustment.

16. In a portable power-driven tool for straightening and smoothing fenders of motor vehicles in position on the vehicle, a hammer head and an anvil, two arms supporting said hammer and anvil respectively, means connecting and supporting said arms remote from the hammer and anvil forming a frame adapted to admit the fender between the hammer and the anvil, the hammer arm comprising a cantilever spring, power means for vibrating the spring at a period of vibration corresponding to the natural period of vibration of the hammer head and spring producing a series of impacts of the hammer against the anvil, the anvil arm having a considerably higher frequency of vibration than that of the hammer.

17. A manually portable power-driven tool for treating motor vehicle fenders in position on the vehicle for smoothing and straightening the same, comprising an anvil, a hammer, supporting arms for the hammer and anvil respectively, connected at a point remote from said hammer and anvil, forming a yoke-shaped frame adapted to admit the fenders between the hammer and anvil, the hammer arm comprising a pivotally mounted block and a cantilever spring secured to the block, an electric motor having reducing gears and a connecting rod connected to said block to reciprocate the same about said pivot to vibrate the spring and produce a series of impacts on the hammer or work thereon.

18. A manually portable power-driven tool for treating motor vehicle fenders in position on the vehicle for smoothing and straightening the same, comprising an anvil, a hammer, supporting arms for the hammer and anvil respectively, connected at a point remote from said hammer and anvil, forming a yoke-shaped frame adapted to admit the fenders between the hammer and anvil, the hammer arm comprising a pivotally mounted block and a cantilever spring secured to the block, an electric motor having reducing gears and a connecting rod connected to said block to reciprocate the same about said pivot to vibrate the spring and produce a series of impacts on the hammer or work thereon, a disk-like member surrounding said pivot and of considerably larger diameter than the pivot having a bearing at its periphery in the frame, means for rotating said disk to change the position of the pivot and the force of the blow.

19. In a power driven tool, a hammer head, a cantilever arm on the end of which the hammer head is mounted, a support for the arm, said arm being flexible and resilient and being on account of its flexibility subject to distortion transversely to its length during the operation of the hammer, and means for vibrating the arm at a point near the support and thereby vibrating the head producing a series of hammer strokes, the length of the strokes being varied by the distortion of the arm as it is flexed on the opposite sides of its normal alignment.

20. In a motor driven manually portable tool, a hammer head, a cantilever arm on the end of which the hammer head is mounted, a support for the arm, said arm being flexible and resilient and being on account of its flexibility subject to distortion transversely to its length during the operation of the hammer and means for vibrating the arm at a point near the support and thereby vibrating the head producing a series of hammer strokes, the length of the strokes being varied by the distortion of the arm as it is flexed on the opposite sides of its normal alignment, the vibrations being effected at a frequency which conforms in definite relation to the natural frequence of the flexible arm.

EDWIN L. CONNELL.