

May 8, 1934.

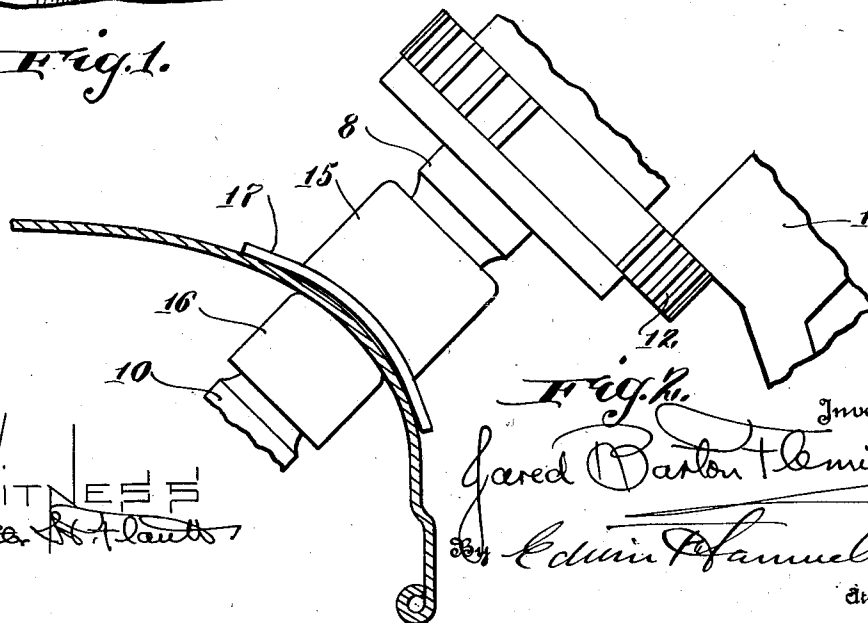
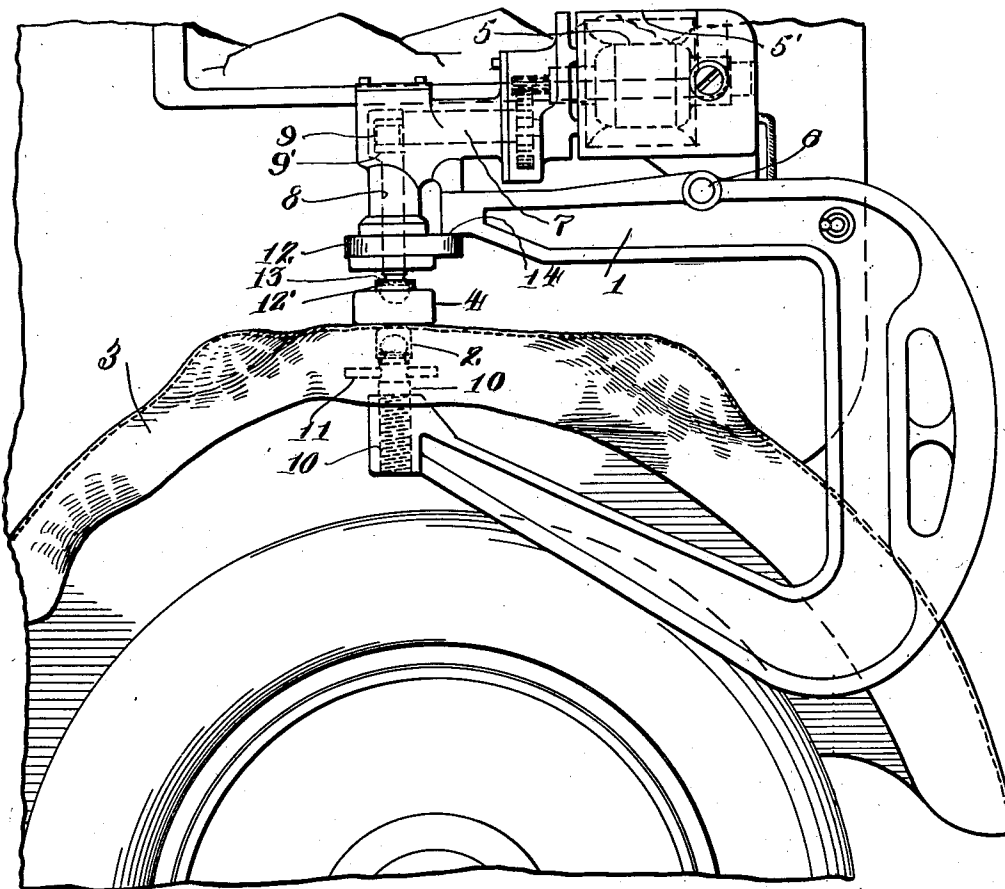
J. B. FLEMING

1,957,495

METHOD OF STRAIGHTENING FENDERS AND OTHER SHEET METAL

Filed March 16, 1931

3 Sheets-Sheet 1



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May 8, 1934.

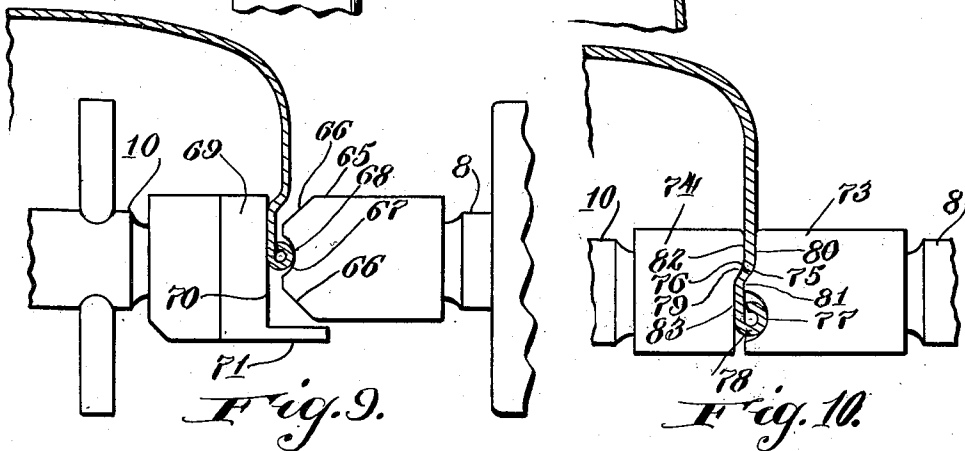
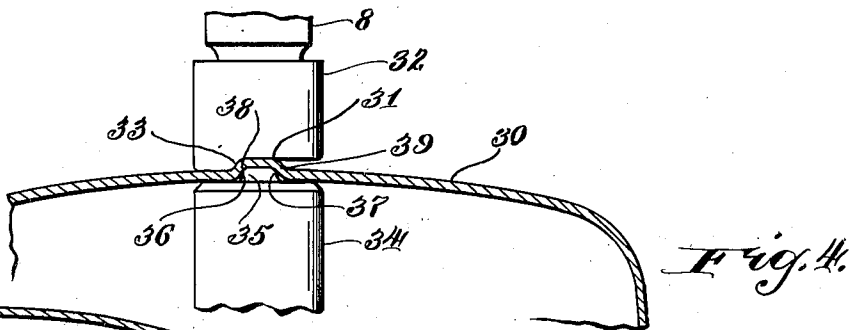
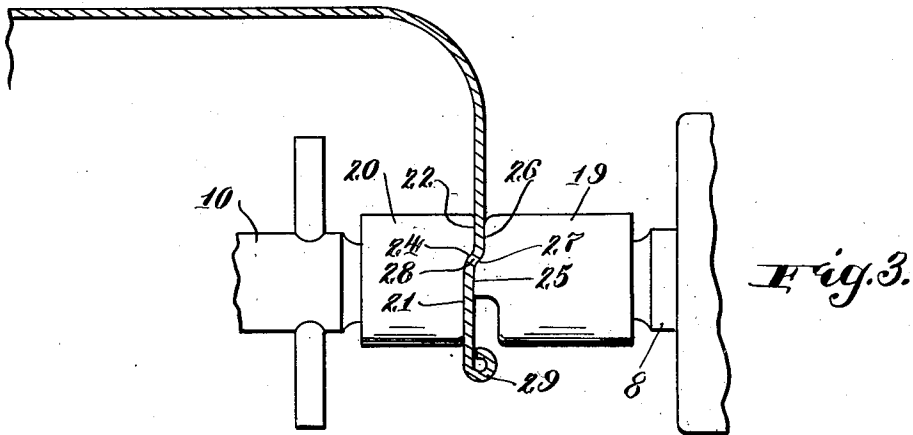
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METHOD OF STRAIGHTENING FENDERS AND OTHER SHEET METAL

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3 Sheets-Sheet 2



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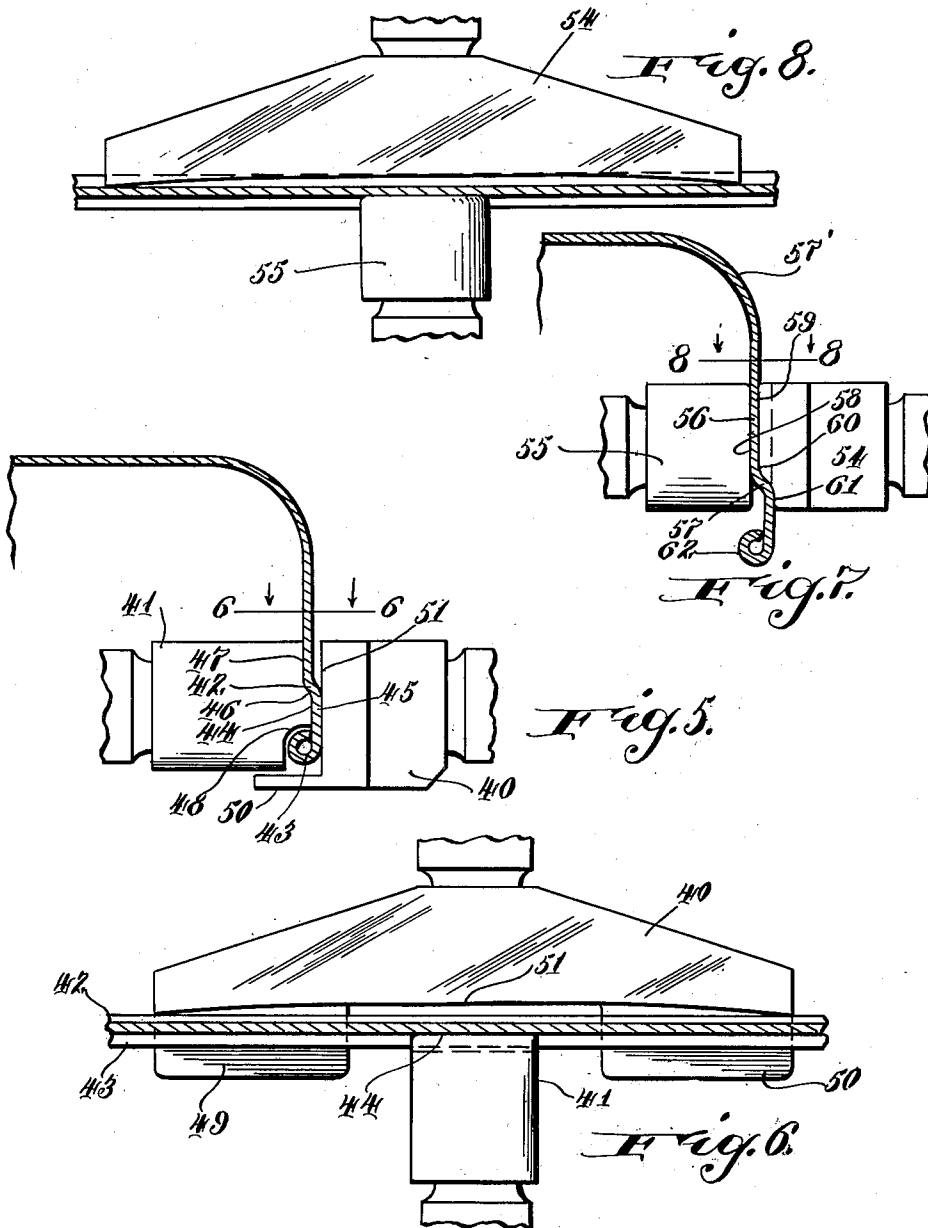
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1,957,495

METHOD OF STRAIGHTENING FENDERS AND OTHER SHEET METAL

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3 Sheets-Sheet 3



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1,957,495

METHOD OF STRAIGHTENING FENDERS
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Application March 16, 1931, Serial No. 522,825

6 Claims. (Cl. 153—32)

The straightening of automobile fenders damaged by collision or otherwise, the straightening operation being performed by means of a hand hammer and a dolly or anvil, the dolly being used to support the fender from one side while it is beaten from the other with the hammer, has been practiced ever since sheet metal fenders or mud guards, as they were first termed, came into use and this same method was practiced generally in the shaping and straightening of other sheet metal shapes and constructions. It is a fact which is almost universally understood and appreciated, that this hand work is lacking in uniformity and imperfect and that the final result, i. e. the form which the work will assume after repairing, approaches more or less remotely to the original form of the fender or other work, depending on the different degrees of skill applied.

The old method is necessarily more or less unsatisfactory on account of the practical impossibility of achieving any considerable degree of uniformity or accuracy. The variation in skill and strength on the part of the operators and the varying degrees of experience, and the variation in the position of the work, as well as the difficulty incident to so holding the dolly that it will support the work at exactly the right moment and in the right way, all contribute to the well known lack of uniformity in execution between the different jobs and between different portions of the same job. As there is no way in which these elements can be controlled, there can be no uniformity as to the quality of the work and very little first class work is produced. Also, the quality of skilled labor required can not be maintained by the average repair shop, the physical labor on many of the jobs is excessive and the expense incident to removing fenders to repair them on a stationary power machine is considerable and usually prohibitive.

The old method is also inferior on account of the relatively wide separation of the blows in point of time and the consequent tendency to apply heavier blows and blows of varying impact which make a satisfactory and presentable result almost impossible.

The invention relates to a hand controlled power operation whereby fenders and sheet metal bodies may be smoothed and straightened without removing from the vehicle, other sheet metal shapes being similarly treated.

An important factor in the application of power to this work, particularly the straightening of fenders and body parts without their re-

moval from the vehicles, is that in the power operation of the invention the impact of the individual blows can if desired be reduced and the blows can be kept uniform or uniformly regulated as desired and the work can be completed in a much more satisfactory manner than previously and in a relatively short time, as the rapidity with which the blows are repeated is many times greater than could possibly be attained by hand and the power applied in this way being distributed in the form of a large number of blows or impulses of relatively uniform impact produces the desired result to much better advantage and with very much less chance of disfiguring the fender than with the application of more or less irregular and much heavier blows applied at longer intervals in the practice of the old method in which both tools are operated by hand, which has previously been the only method available in treating fenders when in position on the vehicle and vehicle bodies under similar conditions.

In the practice of the method of the invention, which in the preferred form is a combined hand and power method, a pair of form tools referred to for convenience as a hammer and dolly, are supported on opposite sides of the fender or other work in any suitable manner, as by means of a single manually portable support which is adapted to straddle the fender or other sheet metal work and these members are reciprocated each relatively to the other, applying simultaneously to the opposite sides of the fender or other work a series of rapidly repeated pressure impulses or blows whereby power from any suitable source may be utilized in the straightening and smoothing of sheet metal fenders and bodies in position on the vehicle and other sheet metal work.

In the preferred practice as illustrated, it being understood that the practice may be varied if desired, the power resulting in the rapidly repeated impulses or strokes referred to is applied directly to one of the tools, i. e., the hammer or dolly, there being in this regard no real distinction between the form of tools employed, corresponding opposite impulses or thrusts being applied simultaneously to the other tool by the reaction of the force exerted in the actuation of the first mentioned tool to which the power is directly applied. In addition to the reciprocating motion, both tools are at the same time moved simultaneously in the direction of the plane of the work to apply the straightening or forming operation to the entire area requiring treatment. This is a new operation in the repair of fenders and bodies

when in place on the vehicle whereby a greatly improved result is obtained.

In the practice of the method of repairing and straightening fenders, bodies and other sheet metal work which is the subject of the invention, the apparatus may include a set of tools for the shaping, smoothing and straightening of sheet metal parts, the greatest demand for this kind of work, as already pointed out, being in the repair of fenders, wherefore the apparatus which is used in the practice of the method is shown in the form or forms best adapted to the treatment of fenders. The tools are ordinarily made, used and sold in a set or sets comprising a plurality of pairs of tools, the tools of each pair corresponding to a hammer and dolly. Such a set may include pairs of cooperating form tools of any shape as a pair of tools for general ironing out of the metal sheets, a pair of radiusing tools for reshaping the convexly curved crown portion of the fenders. Such a set of tools should also include two or more types of form tools for producing and repairing the beaded portion of the fender or other work and tools for straightening the sheet metal after the beading has been formed or reformed and tools for reshaping the beading when it is close to the rolled edge of the sheet and for straightening the rolled edges of the fender.

In the accompanying drawings I have illustrated an apparatus adapted to the practice of the method of the invention including a set of tools consisting of a number of pairs of tools, each pair comprising a hammer and dolly or anvil specially formed and adapted to a particular operation in the forming and repairing of fenders and/or in the forming and straightening of other sheet metal parts.

In the drawings:

Figure 1 shows a portable power driven tool having a frame adapted to straddle a fender or other sheet metal shape to support a hammer and dolly or other pair of forming tools, one on each side of the work, and power means adapted to operate the forming tools and reciprocate them relatively to the work. The forming tools in this instance are adapted for use in the general ironing out of the sheet metal. A fender in the course of repair is also shown.

Figure 2 is a section transversely to the fender showing the operation in accordance with the invention of a pair of forming tools of the radiusing type for shaping the crown portion of the fender or other sheet metal work.

Figure 3 shows the operation of a pair of forming tools adapted for use in beading fenders or other sheet metal work.

Figure 4 shows the operation in accordance with the present invention of another pair of forming or beading tools.

Figure 5 shows in the same connection a pair of special forming tools for straightening the edge portion of a sheet between the beading and the rolled edge, and performing this operation after the beading has been reformed, this figure being a section taken transversely of the fender.

Figure 6 is a longitudinal section through the fender taken on the line 6—6 in Figure 5, and looking at the work and the tools from this line.

Figure 7 shows the operation of a pair or set of tools in straightening the metal on the side of the beading away from the edge of the fender, the view being a section at right angles to the length of the fender.

Figure 8 is a view looking at the tools and work at right angles to Figure 7, Figure 8 being a sec-

tion on the line 8—8, Figure 7, looking in the direction of the arrows.

Figure 9 is a section at right angles to the length of the fender showing the operation of straightening the rolled edge of the sheet or fender.

Figure 10 illustrates the operation of reshaping the beading when it is close to the rolled edge of the sheet.

Referring to the drawings by numerals, each of which is used to indicate the same or similar parts in the different figures, the construction shown in Figure 1 includes a portable power driven tool having a C shaped frame 1, adapted to straddle the frame and support a lower form tool referred to for convenience as a dolly 2 on one side of the work as a sheet metal fender 3 and a hammer 4 or any suitable cooperating form tool on the other side of the work. Power is obtained from any convenient source as the electric motor 5 mounted in a suitable casing 5' which may be pivotally supported at 6 on the frame so that the motor with the gear casing 7 and the hammer 4, which is removably mounted on an eccentric rod 8 operated by the short stroke eccentric 9, is adapted to swing upwardly separating the hammer from the dolly 2 to admit the work between the hammer and dolly and inside of the C shaped frame. By this arrangement the dolly may be applied to one side of the fender and the hammer to the other, the tools 2, 4, of course, being in line in the direction of the eccentric rod or thrust rod 8. In this connection it must be borne in mind that the terms hammer and dolly are used for convenience, the tools being cooperating form tools, either or both of which may be reciprocated. In the form of apparatus shown the dolly or lower form tool is adjustable into contact with the work by rotation of the screw 10 by manual engagement with the transverse pin 11. The thrust rod or eccentric rod 8 with the hammer or upper form tool 4, the gear casing 7 and the motor 5 are locked in position on the frame and relatively to the work by an eccentric ring 12 which is of varied radial extent and is engaged beneath the end of the frame at 14, as shown in Figure 1, by rotation of the eccentric ring 12 about the rod 8 when the motor and gear casing, etc. have been brought to operative position.

The dolly 2 being at the time in engagement with the work, the operation of the motor imparts relatively short vibrations to the hammer due to the eccentricity of the eccentric 9, the vibrations being repeated at very short intervals, giving the hammer approximately 1500 strokes per minute in the present preferred form of the method. In this way the power and work applied to the fender is distributed in a large number of relatively small impulses or impacts whereby it is made possible to change the shape of the fender bringing it to the desired contour in a comparatively short time with greater uniformity and certainty as to the result and with a better result than previously attained. In the practice of the invention the reciprocation of the upper form tool relatively to the upper arm of the frame on which it and the motor and/or the motor shaft are supported, produces a reaction by which the lower arm of the frame and the lower form tool are likewise and oppositely reciprocated so that in effect the work, instead of being merely supported beneath the point of impact, is operated upon by opposite impulses or blows, the opposite impacts applied to the opposite sides of the work being nearly equal and of simultaneous recurrence.

In Figure 2 I have illustrated a portion of the C shaped frame 1, the locking eccentric 12 and a portion of the eccentric rod or thrust rod 8 and the dolly supporting screw 10. In this instance

5 I have shown a pair of radiusing tools 15 and 16. The tool 15, which is for convenience designated as the hammer, though there is no real distinction, being concave and, if desired, provided with a surface plate 17 of resilient material to distribute the pressure and prevent marring or injury to the crown portion of the fender. The dolly or lower member 16 of this pair of tools is shown as correspondingly convex to fit in the hollow of the fender beneath the crown.

15 Figure 3 shows a pair of beading tools, the hammer member being designated as 19 and the dolly member as 20. These tools are shown in operative relation to the work. The dolly has a main engaging surface 21 and an advanced engaging portion or surface 22, the two engaging surfaces being connected by an inclined or shoulder portion 24. The hammer 19 is shaped to cooperate with the dolly or vice versa having an advanced main engaging surface 25 to cooperate with the surface 21 on the dolly and a rear or depressed portion 26 adapted to cooperate with the advanced surface 22 of the dolly. The hammer 19 also has a shoulder 27 connecting the surfaces 25 and 26. The shoulders 24 and 27 on the members 19 and 20 are adapted to cooperate to form a bead 28 which would ordinarily extend longitudinally of the fender or other work and in this instance it is shown as adjacent the rolled edge 29 of the fender or other sheet metal work.

35 The pair of tools 19 and 20 are best adapted to the formation of a single bead as shown in Figure 3 at 28.

40 Figure 4 shows a fender 30 on which has been formed a central upwardly projecting longitudinal double bead 31. This figure shows a pair of bead forming tools adapted to cooperate in the formation of such a double bead. These form tools or forming tools may be treated for convenience as comprising a hammer member 32 having a shoulder 33 like that of the dolly 20. On the other hand, the dolly 34 of this pair of tools has an upwardly projecting bead forming tongue or rib 35, which is adapted to form a bead of double width by running the tools in the cooperative relation shown along the bead in the direction of the bead to be produced, the position of the tools or hammer 32 relatively to the frame being preferably reversed to form the other side of the bead when one side of the bead is completed so that the shoulder 33 on the hammer cooperates first with one side or shoulder 36 of the dolly and then with the other shoulder 37, forming a double bead with two corresponding shoulders or sides 38 and 39 as shown.

70 Figures 5 and 6 show a pair or set of special tools 40 and 41, for use in straightening metal particularly in fender work, but capable of more general application, the portion of the fender which these tools are best adapted to straighten being that which lies between the bead 42 and the rolled edge 43. The tool 41 which is shown in the position of the dolly is provided with an advance surface 44 for engaging the metal 45 between the roll 43 and the bead 42. This advanced portion 44 has a shoulder 46 adjacent one edge where it is stepped down to a supporting surface 47 which engages the fender adjacent the bead and on the other side of this ad-

vanced portion 44 the dolly is cut away and chambered at 48 to accommodate the edge roll 43. The member 40 which is referred to for convenience as the hammer member has guiding flanges 49, 50 for the convenience of the operator in bringing the tool into engagement with the proper part of the fender or other work. It will also be noticed that this member 40 as shown, particularly in Figure 6, has its work engaging surface 51 curved upwardly or concave as to its longitudinal elements. The tool may be formed in this way to straighten the edges of the plates treated, bending them beyond the predetermined flat plane so that they spring back to the desired contour otherwise the edge cannot be made straight.

Figures 7 and 8 show a pair or set of tools, 54, 55, to be used in the practice of the method particularly in straightening the metal at 56 adjacent to the bead 57. The fender is shown at 57'. In this instance the member which takes the position of the dolly at 55 is shown as having a flat work engaging surface at 58. The forming tool which takes the position in this instance of the hammer at 54 is shown as having an advanced work engaging surface at 59 with a shoulder 60 at one edge adapted to engage the bead 57 by which shoulder the working surface of the tool is stepped back to a second rearwardly spaced surface 61 which does not deflect the metal unless it happens to be deformed at this point. This tool is of particular advantage in straightening the metal adjacent the bead particularly after the bead has been first formed, but it may be used for straightening the metal in repair work, the tool is best adapted to engage the metal on the side of the bead away from the edge roll 62 and toward the central portion of the fender.

Figure 9 shows a pair of tools particularly adapted for use in straightening the rolled edges of fenders and other sheet metal work. In this instance the hammer 65 is chamfered or tapered at its edges at 66, and it is centrally grooved at 67 to straddle the roll 68 formed on the edge of the work. The other tool or member of the pair or set of tools at 69 in the preferred form has a flat work engaging surface shown at 70 and it is shown as provided with an edge flange 71.

It will be easily understood that by means of these tools operated in accordance with the method described having imparted to them a large number of rapidly repeated working impulses, which impulses tend to apply the tools 65 and 69 simultaneously to the opposite sides of the work, the desired effect of straightening the rolled edge of the fender or other work in the manner described can be attained and accomplished almost instantaneously, and without any tendency to damage or disfigure it.

Figure 10 shows a tool or set of tools for reshaping the beading when it is close to the rolled edge of the sheet metal. In this instance the upper or outer tool which is ordinarily connected to the reciprocating mechanism and may therefore be termed the hammer, is indicated by reference character 73 and the inside or lower tool, which is rigidly connected to the frame though this is not essential, is indicated by reference character 74, it being understood that no distinction as to the actual operation, i. e., whether one or the other is a hammer or anvil or dolly being intended to be drawn in this description. The member 73 is shown as shouldered at 75 to engage the bead

76 in the work and recessed at 77, to accommodate the roll 78 and the other tool 74 previously referred to as the dolly for convenience in description, is shouldered at 79 to cooperate with the 5 shoulder 75 and to engage the bead 76 from the lower side. The shoulder 75 connects the work engaging surfaces 80 and 81 on the tool 73 and the shoulder 79 connects the work engaging surfaces 82 and 83 on the dolly which surfaces 82 and 83 on the tool 74 cooperate with the surfaces 80 and 81, respectively, on the tool 73.

In the practice of the method the tools 2 and 4, or 15 and 16, or 19 and 20, or 32 and 34, etc. in accordance with the particular step or operation 15 to be performed are attached to the eccentric rod or thrust rod 8 and the support 10, respectively, on the opposite legs of the frame, the arrangement of the tools in this regard depending particularly upon the distinction as to which surface is to be engaged by which tool and which tool can in view of the fact thus determined be most conveniently engaged with the eccentric or thrust rod 8 or the support 10, it being understood that the vibratory action set up by means of the 25 eccentric 9 or other vibrating means is, in effect, a relative vibration of the hammer and dolly.

When the particular forming tools adapted to the operation in hand are thus mounted, they are applied to the appropriate portion of the work in 30 the manner described and illustrated in the respective figures of the drawings. When any pair of suitable forming tools is mounted in the manner described, a series of successive simultaneous and opposite impulses or vibrations repeated at short intervals is imparted to the respective tools 35 of the pair or set of tools thus placed in operative relation to the work. This may be accomplished in various ways, the operation shown and described being the preferred one. The form tools 40 are changed from time to time to suit the work, the tools best adapted to the work in hand being applied repeatedly and simultaneously with working thrust to the opposite sides of the work. An unlimited amount of power can be applied in this 45 way to the straightening or forming operation without exertion on the part of the operator and with a great saving of time as well as labor, also the impact of the successive impulses may be so small individually when desired that the possibility of injuring the work by defacing it by individual impacts or blows is practically eliminated without loss of power, the relatively slight impact being compensated by the frequency of the blows.

The simultaneous vibratory action of two co- 55 operating forming tools placed on the opposite sides of the work in this way, the tools being kept in line in the direction of the stroke, and moved in the plane of the work and relatively to the work over the area to be treated, is the substance and intent of the method of the invention whereby 60 straightening, repairing and forming of sheet metal work is accomplished by a combined hand and power operation or a hand controlled power operation particularly adapted to the repairing 65 and straightening, smoothing and forming of fenders and bodies of automobiles while in place on the vehicle.

The connecting rod 8 constitutes a rigid connection for transmitting vibrations to the tool or hammer member 4. To this end the head or upper end of the connecting rod 8 is provided with a bearing ring 9' seated therein and rigidly secured and this bearing ring is engaged by an 70 eccentric pin 9 which fits as closely in the ring 9'

as is permissible with a suitable running fit, the eccentricity of the pin 9 being somewhat exaggerated for purposes of illustration. The rod 8 passes through and is guided in plate 12 and at its lower end it is provided with any suitable connection to the hammer or tool 4. In the present instance a ball and socket joint 12' is shown, the ball being held in the socket by a spring locking ring 13 or in any suitable manner, such connections being well known in the art. In this way 80 the motion of the eccentric pin 9 is communicated directly and through a rigid connection to the hammer 4, accomplishing a definite and limited vibration thereof, which permits the hammer to remain in contact with the work, the anvil being in contact with the opposite side of the work or substantially in contact therewith throughout the fender straightening operation, which is thus accomplished by a vibratory pressing action as distinguished from the ordinary hammering or 95 beating method as already pointed out.

I have thus described specifically and in detail a method of smoothing, straightening and forming sheet metal which is particularly adapted to the repairing and reforming of sheet metal fenders and sheet metal bodies when in position on the vehicle, but which is adapted to other uses and I have also described an apparatus by means of which the method may be practiced. This method may, however, in theory, at least, be performed by hand and the apparatus may be widely changed and varied particularly as to the relative weights of the form tools and the extent of their relative motion and the means for actuating these form tools, and as to other details and features which are specifically described herein in order that the invention may be fully understood. 100

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

1. The method of straightening and smoothing 115 motor vehicle fenders and bodies particularly adapted to the treatment of these members while in place on the vehicle and to the straightening of other sheet metal shapes, which consists in supporting a dolly or anvil on one side of the 120 work and a cooperating hammer member on the opposite side of the work and in alignment and applying a series of rapidly repeated impulses to said hammer, the dolly being reciprocated by the reaction of the hammer impulses whereby both 125 the hammer and dolly are reciprocated one toward the other and in operative contact with the opposite sides of the work the impulses applied to and by the hammer and dolly being of substantially equal force and moving said hammer and dolly in the direction of the plane of the sheet metal and maintaining their alignment in the direction of the said impulses.

2. The method of straightening, smoothing and shaping sheet metal fenders and bodies of motor 135 vehicles, particularly adapted to treatment of these members while in place on the vehicle, and to the treatment of other sheet metal shapes, which consists in supporting a pair of forming tools, one on each side of the work and applying 140 to one of said tools a series of impulses tending to move said tool toward the other the reaction of said impulse being utilized to impart a substantially equal and opposite impulse to the other tool whereby both tools are reciprocated simultaneously and oppositely with a substantially equal force applying to the work a series of blows which are rapidly repeated and applied to the opposite sides of the work by means of the tools, and moving said tools simultaneously in the direction of 150

the plane of the sheet metal work to smooth and shape the sheet metal.

3. The method of straightening, smoothing and shaping sheet metal fenders and bodies of motor vehicles particularly adapted to treatment of these members while in place on the vehicle and to the treatment of other sheet metal shapes which consists in supporting a pair of forming tools, one on each side of the work and applying to said tools a series of impulses rapidly repeated, whereby said impulses which are substantially equal in momentum as to the respective tools are in turn imparted simultaneously to the opposite sides of the work by means of the tools and moving said tools simultaneously in the direction of the plane of the sheet metal work to smooth and shape the sheet metal, the impulses being applied directly to one of the tools of said pair, the application of power to the other of said tools being accomplished by the reaction incident to reciprocating the tool to which the power is directly applied.

4. The method of smoothing and straightening and forming sheet metal fenders, bodies and the like, particularly adapted to treatment of these members when in place on the vehicle and to the treatment of other sheet metal shapes which consists in supporting a pair of cooperating shaping tools on opposite sides of the work by means of a manually portable support and imparting a series of reciprocating strokes to one of said tools, moving it toward and from the other said tool, the latter tool being rigidly connected to the first mentioned reciprocating tool and likewise reciprocated by the reaction due to reciprocating the first mentioned tool whereby both said tools are caused to apply simultaneously at each stroke a corresponding thrust to the opposite sides of the work at the same point, and

moving said members simultaneously in the direction of the plane of the work.

5. The method of smoothing, straightening and forming sheet metal, the same being particularly adapted to the repairing and forming of fenders and automobile bodies when in place on the vehicle and to other sheet metal work, which consists in supporting suitable cooperating forming tools on each side of the work by means of a single manually supported structure, and vibrating said tools simultaneously and oppositely so that they apply rapidly repeated simultaneous opposite thrusts to opposite sides of the work and moving said members in the direction of the plane of the work to apply them to the entire area requiring treatment the tools being rigidly connected whereby the vibrations of one said tool results from the reaction of the vibrations of the other said tool.

6. The method of smoothing, straightening and forming sheet metal, the same being particularly adapted to the repairing and forming of fenders and automobile bodies when in place on the vehicle and to other sheet metal work which consists in supporting suitable cooperating forming tools on each side of the work by means of a single manually supported structure which straddles the work and vibrating one of said tools whereby the other tool is vibrated simultaneously and oppositely due to reaction of the vibrations of the other tool so that they apply rapidly repeated simultaneous thrusts to opposite sides of the work and moving said frame and said members to cover the area requiring treatment, said forming tools being made to conform to the various portions of the work and being correspondingly interchanged as each new portion of the work is undertaken.

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