2 Sheets—Sheet 1.

E. FISHER & J. WATSON.

Die for Forging Metallic Horse-Collar Frames,

No. 226,737. **Patented April 20, 1880.**

Fig. 1.

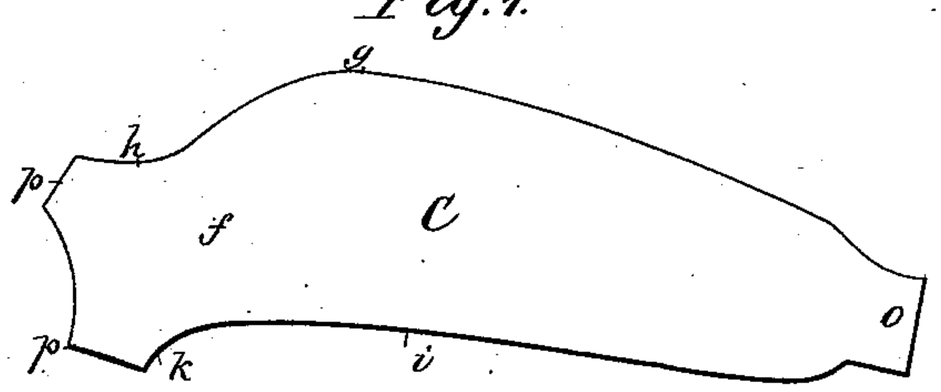


Fig. 2.

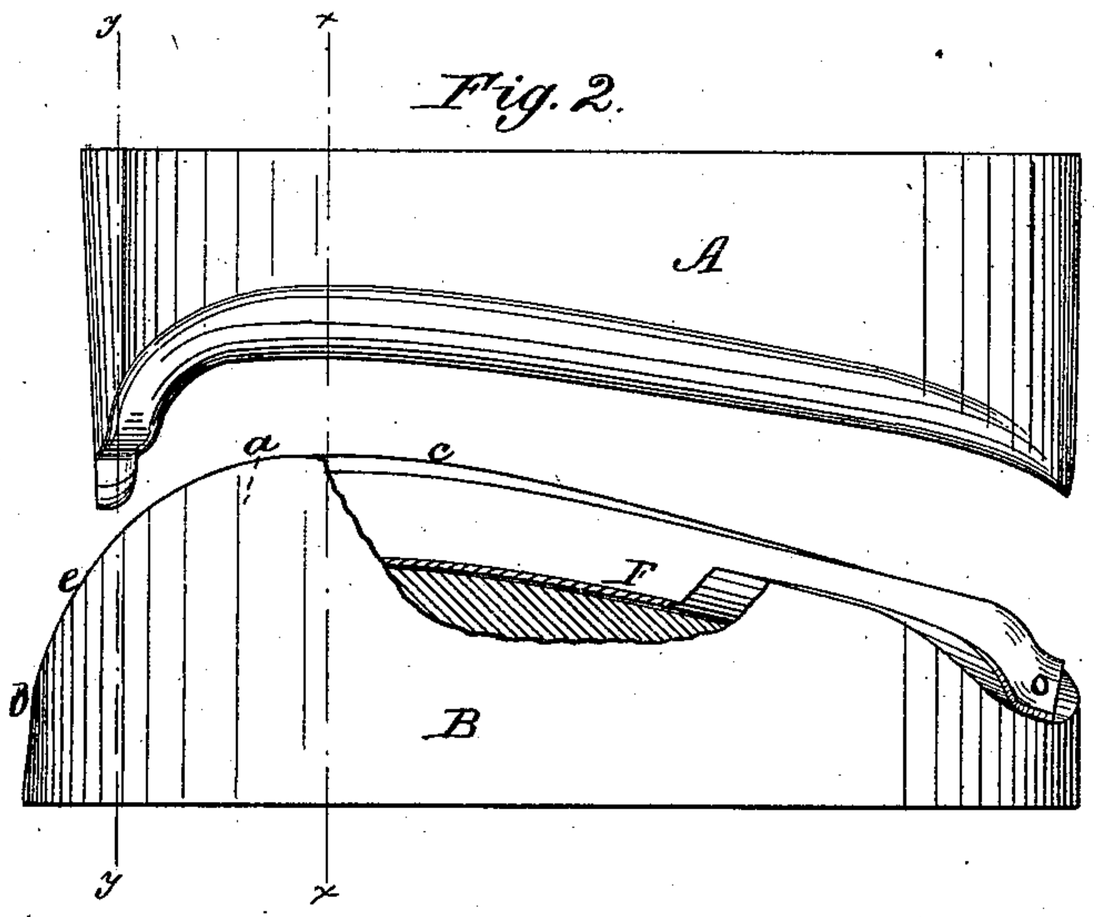


Fig. 3.

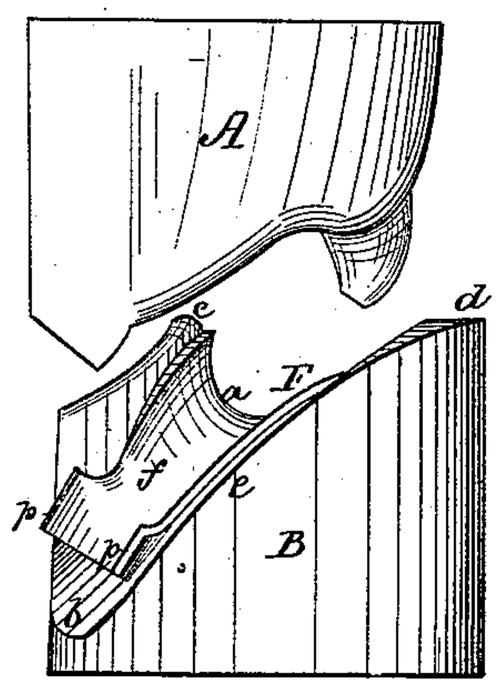


Fig. 4.

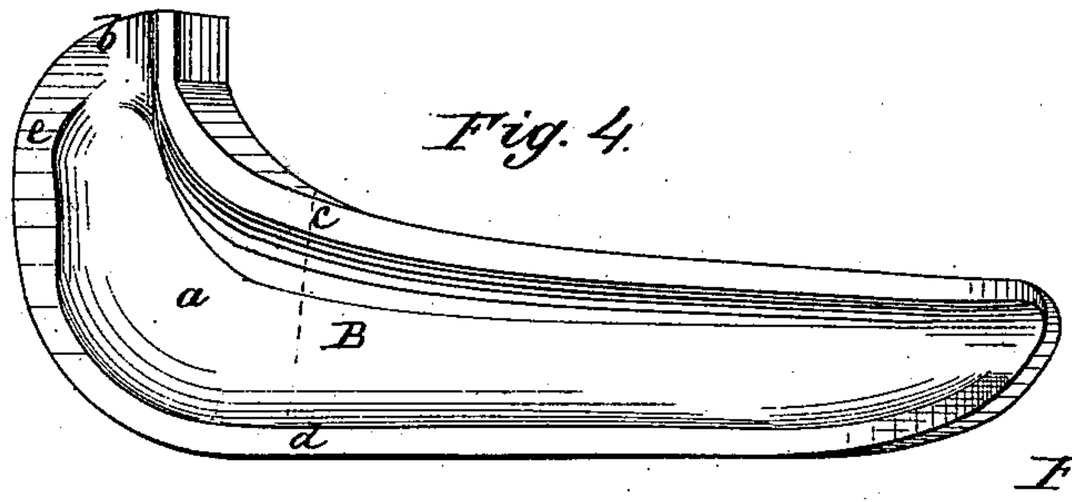


Fig. 5

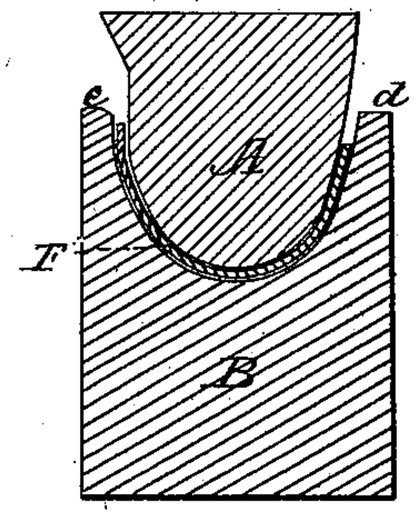
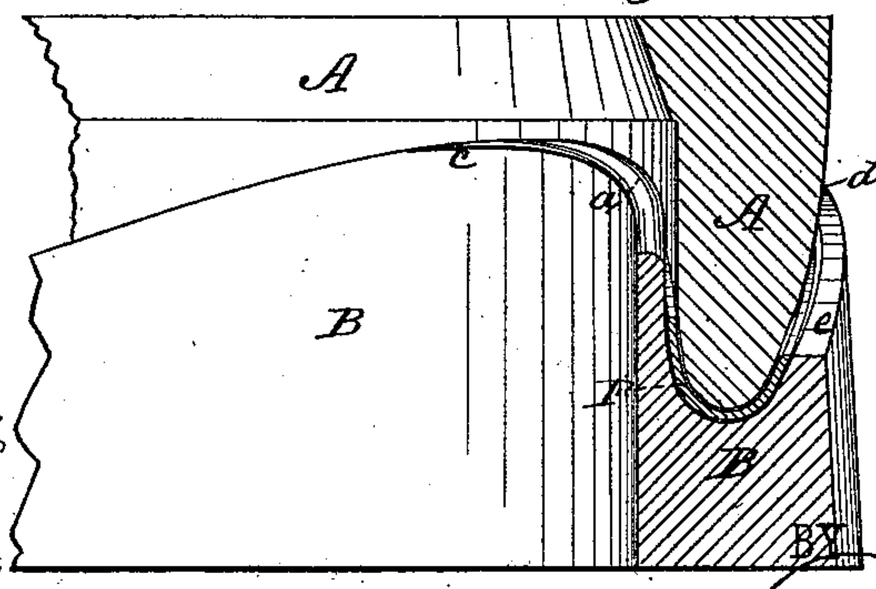


Fig. 6.



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2 Sheets—Sheet 2.

E. FISHER & J. WATSON.

Die for Forging Metallic Horse-Collar Frames,

No. 226,737. **Patented April 20, 1880.**

Fig. 7.

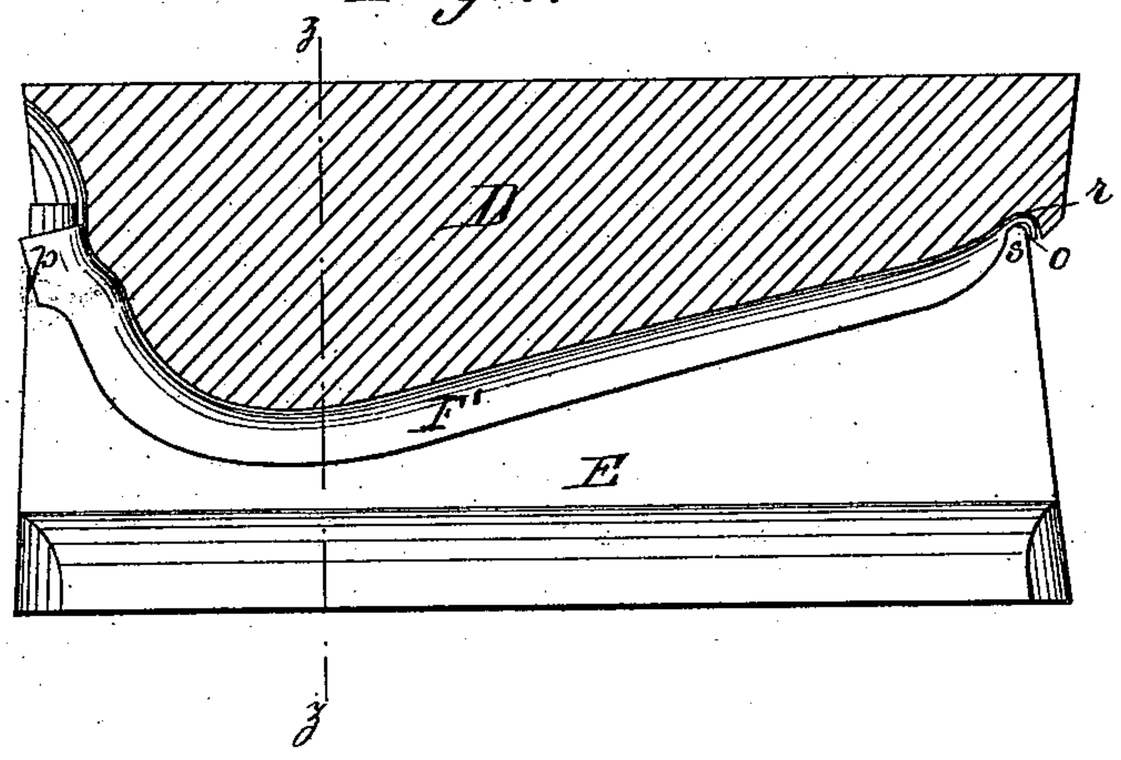


Fig. 8.

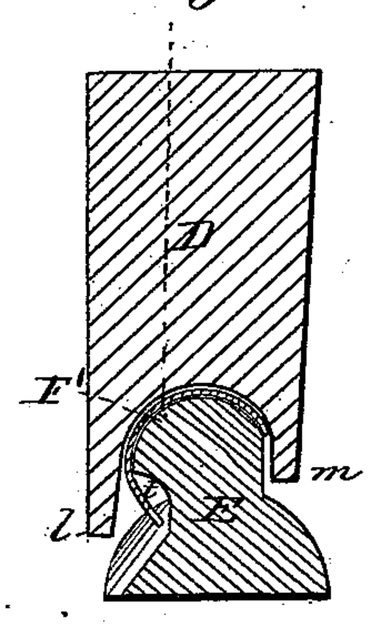
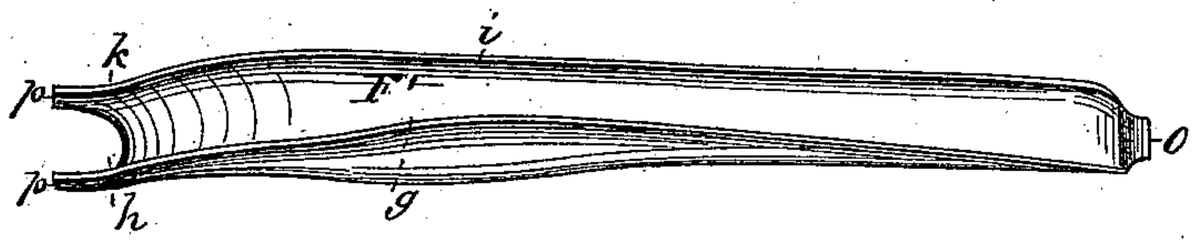


Fig. 9.



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UNITED STATES PATENT OFFICE.

EBENEZER FISHER AND JOHN WATSON, OF KINCARDINE, ONTARIO, CANADA.

DIE FOR FORGING METALLIC HORSE-COLLAR FRAMES.

SPECIFICATION forming part of Letters Patent No. 226,737, dated April 20, 1880.

Application filed December 30, 1879.

To all whom it may concern:

Be it known that we, EBENEZER FISHER and JOHN WATSON, of Kincardine, Ontario, Canada, have invented a new and useful Improvement in Dies for Forging Metallic Horse-Collar Frames; and we do hereby declare that the following is a full, clear, and exact description of the same.

Hameless metallic horse-collars have qualities which greatly commend them to practical use; but if constructed of cast metal they are not so light, nor for other reasons so useful and desirable, as when struck up or swaged out of wrought-metal plates. For this purpose steel plates are by far most suitable, since they possess maximum toughness and strength with minimum thickness and weight. The best form in respect to these qualities for the respective sides of halves of a steel or other wrought-metal collar-frame is that in which both edges of the respective lengthwise halves or sections thereof project laterally, as shown in the patent granted to Ebenezer Fisher, dated October 14, 1879, for an improvement in dies for forming horse-collar frames; but the operation of swaging or striking up the flanged sections of this class of hameless collars has been heretofore attended with such extreme difficulty that, so far as we have been able to ascertain, no satisfactory result had been attained prior to our invention. The difficulty referred to arose from the unequal distribution of the metal on the lines of greatest curvature of the collar-sections, it being drawn out or thinned in places and upset or thickened in others to such an extent by the swaging action of the die that it tended to crack and buckle, thereby becoming worthless. After a long series of experiments we have developed a form of die with which the desired perfection of operation and result may be obtained with certainty and precision, and a collar-frame produced having the desired form, proportions, and lines of curvature required for greatest strength and lightness combined.

In accompanying drawings, forming part of this specification, Figure 1 is a plan view of the steel plate from which the collar-frame blank is swaged. Fig. 2 is a side view, with part broken away, of the partible break-down die, representing its parts separated by a narrow space. Fig. 3 is an end view of the same. Fig. 4 is a plan view of the lower part or matrix of the break-down die. Figs. 5 and 6 are cross-sections on lines *x x* and *y y*, respectively, of Fig. 2. Fig. 7 is a vertical longitudinal section of the finishing-die. Fig. 8 is a vertical cross-section on line *z z* of Fig. 7. Fig. 9 is a side view of the finished blank of a collar-frame section.

In said drawings, A and B indicate the parts of the break-down die, or the respective upper and lower parts of a die which is employed to break down or first act on the steel plate C; and D and E are corresponding parts of the finishing-die, to which the blanks D are transferred from the break-down die A B, and by which they are ultimately conformed to the desired shape.

The lower part or matrix, B, has a curved lengthwise cavity of a form suitable to give nearly the required shape to the middle portion and outer flange of the finished collar-section F′, Fig. 9; but the ends and inner flange of the section receive the final curvature in the finishing-die, Figs. 7 and 8, as will be presently explained.

The chief peculiarities of the die A are the form and angle or inclination of its curved end portion—to wit, that part lying between the point *a* and the end *b*—and the inclination or position of its inner wall, *c*, with reference to such angle. Heretofore such curved portion *a b* of the die-cavity has usually been in a vertical plane, and the outer wall, *d*, also vertical, or nearly so, the result in such case being that the thin metal was unable to endure the stretching and strain incident to the subsequent attempt to impart the required curve to it as well as to the inner flange, so that the operation was practically a failure as to collars having the desired delicacy of curve or outline and the required combination of lightness and strength. It could only answer for other purposes—as, for instance, for producing metal wearing or shoulder plates for use as attachments of leather collars.

If, in order to avoid the difficulty just mentioned, the part of the die-cavity between

points *a b* be placed horizontal, so that the outer wall, *d*, of the cavity would also be horizontal, or nearly so, then a greater difficulty arises, since the inner wall of the die-cavity must in such case be vertical and the outer one approximately horizontal, so that the blank swaged in such form of cavity has its flanges at too great an angle to allow the inner one to be bent inward by the finishing-die without stretching the metal unduly and cracking the metal at the point of greatest curvature. At least this will be the ordinary result. In brief, if the part of the die-cavity between *a b* be placed at any lateral angle which is near either the vertical or horizontal, then so good results cannot be obtained, since either one flange or the other of the collar-frame section cannot be properly—that is, sufficiently—curved in the first operation of the die, and hence cannot be subsequently reduced to the desired conformation with ease and safety; but when the relation of parts is as shown in the drawings we find the difficulty greatly overcome, since the outer flange of the collar-frame section not only receives its finished form, but the inner flange is bent or curved so far inward that it is far less liable to crack in the final bending operation to which it is subjected in the finishing-die.

While such advantage attends the placing of the shorter portion, *a b*, of the die-cavity at the lateral angle stated, we find that a correlative but more important one is obtained by the form of the larger end of the plunger A—namely, by the slope or bevel *e* of the outer wall of the cavity between points *a b*. We have found that when the wall is not thus sloped or cut away it is difficult, and in nearly all cases impossible, to produce a collar-frame section having the desired perfection of form, and without a crack, buckle, or other like defect.

Without giving a detailed explanation of the reason of such result following the operation of a die thus constructed, it is sufficient to state that the proper redistribution of metal along the edges of the metal plate and between points cannot, in general, be effected so long as the height of the outer wall, *d*, of the die-cavity is maintained at the end *e*, or so long as it is high enough to hinder the shorter arm, *f*, of the plate C curving downward and inward under the action of the cameo die or plunger A. We prefer, for the best results, to cut away the wall nearly down to a level with the bed of the cavity, as shown in Fig. 3; but something less than this may answer a very good purpose.

When this plate is placed on the matrix B and the plunger A brought down upon it the inner edge of the plate is finished, so far as this die permits, and held firmly against the inner wall, *c*, of the die-cavity, and as the plunger A continues to descend the shorter curved arm *f* of the plate C is bent laterally and downward—that is to say, in an oblique direction corresponding to the inclination of that part of the die-cavity which lies beneath it. The shorter arm *f* of the plate C is, in fact, twisted inward and downward, and to allow such curvature the plate must stretch or draw out somewhat thinner on the outer edge between points *g h*, Fig. 1, and to still greater thinness on the inner edge between points *i k*, else the plate would crack at those places and buckle at others, and the operation be a complete failure. To facilitate such twist and curvature of the plate, so as to bring it into the position shown in the blank, Figs. 3, 9, the outer corner or side of the shorter arm *f* must be allowed freedom of movement. In other words, it should be left free to sweep inward on a curve until it rests on the bed of the sloping portion of the cavity shown in Figs. 3, 6. This result is secured by cutting away or sloping the wall of the matrix B at the point *e*, as before stated. This feature—to wit, the slope *e* of the matrix-wall *d*—co-operates with the oblique inclination of the die-cavity, or has a certain relation to it; but yet it is possible to obtain certain good results with it alone, or without the said inclination of the die-cavity.

When the blank F leaves the break-down die it has the form shown in Figs. 2, 3, and is completely formed, except on the inner side and at the ends. It is then placed on the bed portion E of the finishing-die and the matrix D brought down upon it. The wider lip or flange *l* of such part D impinges on and thus holds or steadies the blank, while the inner flange, *m*, which is shorter, acts on the inner flange of the blank and gives it the curve it is required to have in the finished collar-frame section F′, which is represented in Fig. 9, and this is accomplished without danger of cracking or distorting the blank.

We construct our flanged steel collar with an eye at the upper end of the sections, for the purpose of hinging them together, and with lips or claws at the lower end to receive and hold a sliding adjustable coupling, thus dispensing with fastenings, which require to be riveted on. It is desirable and important that such eye and claws shall be constructed in one piece with the body of the sections. We therefore cut the steel plates C with a lengthwise projection or extension, *o*, Fig. 1, at its upper end, and lateral projections or extensions *p p* at its opposite end. These receive a certain degree of curvature in the break-down die, as will be seen by reference to Figs. 2, 3; but in the finishing-die D E the lateral flanges *p p* are bent still farther inward, so as to be parallel in the finished blank F′, Fig. 9, while the projection or flange *o* is bent inward at a right angle, or thereabout.

The matrix D has a recess, *r*, to receive the horn or angular projection *s* of the lower part, E, of the die, by which means the flange *o* is bent to the angle shown. The respective flanges *o p* are thus brought into the form

which adapts them to be most easily shaped by subsequent forging into the eye and lips or claws, which they become in the completed collar-section.

The side of the bed part E of the finishing-die is cut away on the under side, as shown at *t* in Fig. 8, to allow space for the curved outer flange of the blank F, so that the latter may be placed on said part E and the complete collar-section F′ removed from it without being obstructed by the lateral bulge of the die.

We have referred to the blank F′ shown in Fig. 9 as being finished, or in the form required for the complete collar-frame section; but the edges of the blanks may be rolled in still farther, in order to give the complete collar greater strength.

What we claim is—

1. A partible break-down die for use in forging a section of a metallic horse-collar frame, consisting of the plunger A and the matrix B, which has the shorter portion of its cavity—to wit, the part included between the points *a b*—placed at an oblique inclination, preferably at an angle of about forty-five degrees, substantially as set forth, for the purpose stated.

2. A partible break-down die for use in forging a section of a metallic horse-collar frame, consisting of the plunger A and the matrix B, whose outer end wall, *e*, is cut away or sloped, substantially as set forth, for the purpose specified.

3. The partible break-down die consisting of the parts A B, having corresponding obliquely-inclined portions, and the maxtrix having its outer end wall sloped, as shown and described.

4. As an improvement in blanks from which to manufacture collar-sections of sheet-steel, the projections *p p*, as shown in Fig. 1, for the purpose set forth.

5. The partible finishing-die having the form shown, to adapt it to act on the blank as it comes from the break-down die, the parts D E of the same being respectively provided with the cavity and horn, as shown and described, for the purpose specified.

6. The combination of finishing-die, consisting of parts D E, with the break-down die, consisting of the parts A B, the latter having the oblique inclination of their contact surfaces, as specified.

7. The lower part, E, of the finishing-die, having its side undercut beneath the bulging portion, as shown and described.

The above specification of our invention signed by us this 23d day of December, A. D. 1879.

E. FISHER.
JOHN WATSON.

Witnesses:
SOLON C. KEMON,
AMOS W. HART.