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METHOD OF AND APPARATUS FOR MANUFACTURING AXLE BOXES.

No. 459,999 Patented Sept. 22, 1891.

FIG. 7.

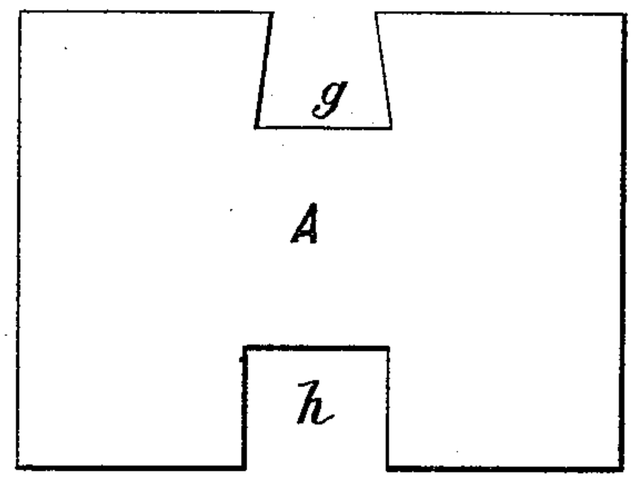


FIG. 1.

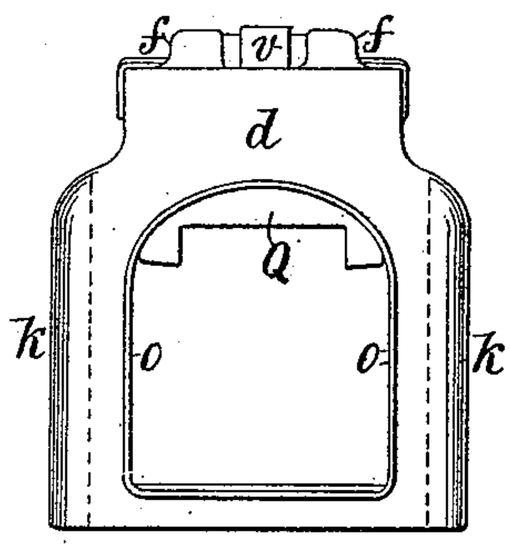


FIG. 2.

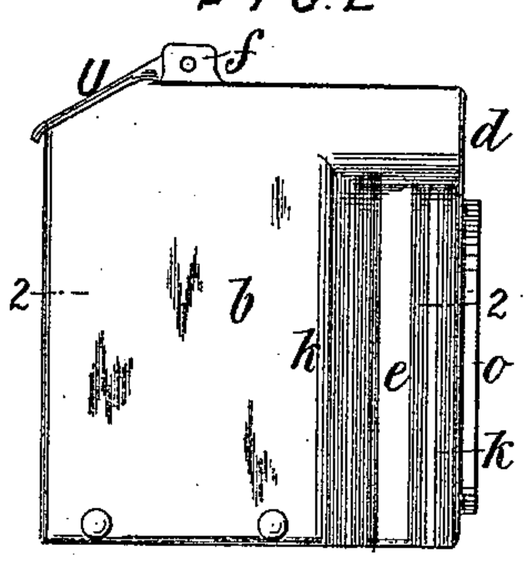


FIG. 3.

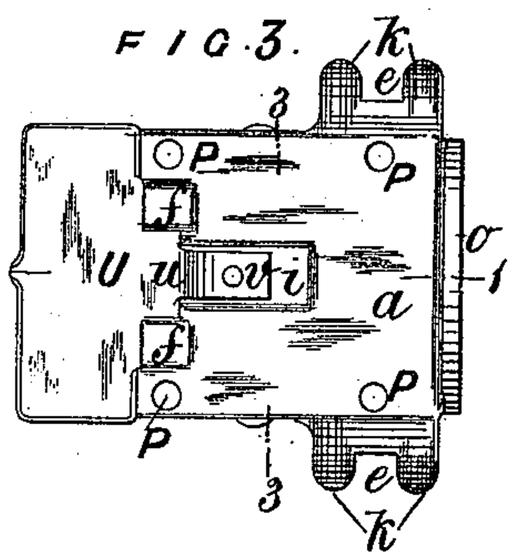


FIG. 4.

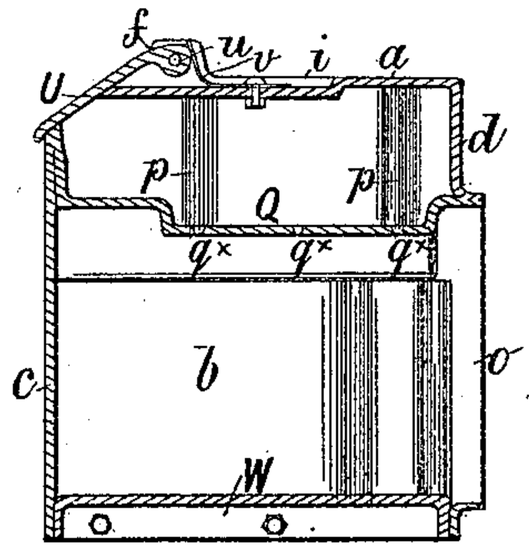


FIG. 5.

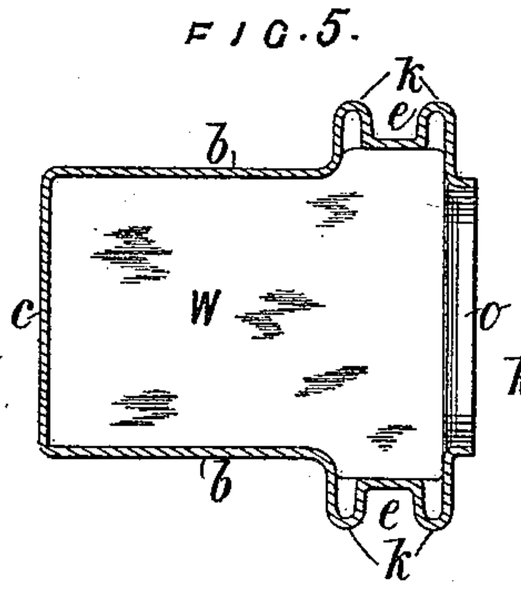
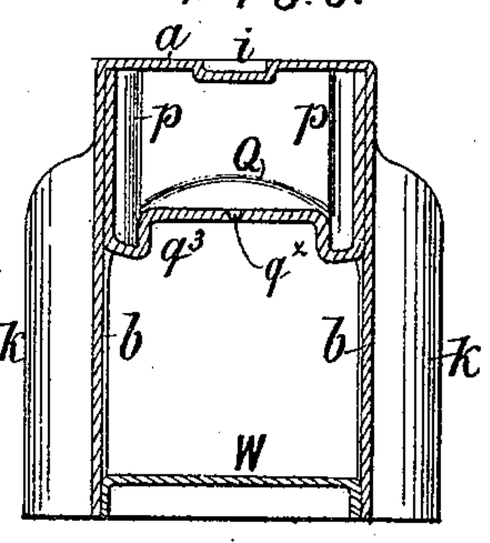


FIG. 6.



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(No Model.)

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METHOD OF AND APPARATUS FOR MANUFACTURING AXLE BOXES.

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FIG. 10.

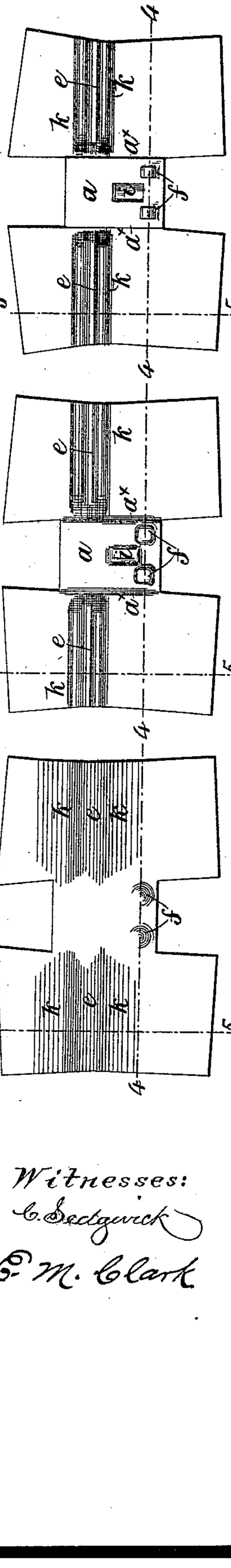

FIG. 10a

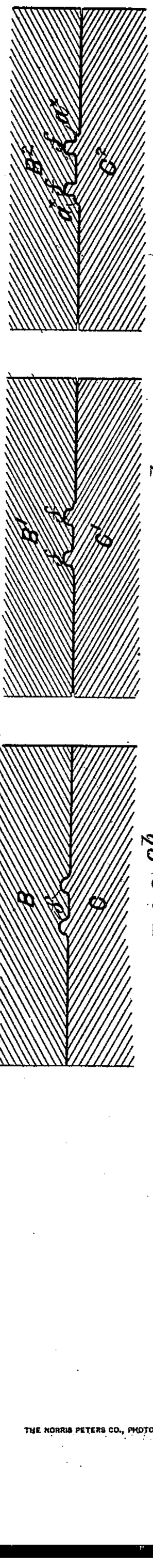

FIG. 10b

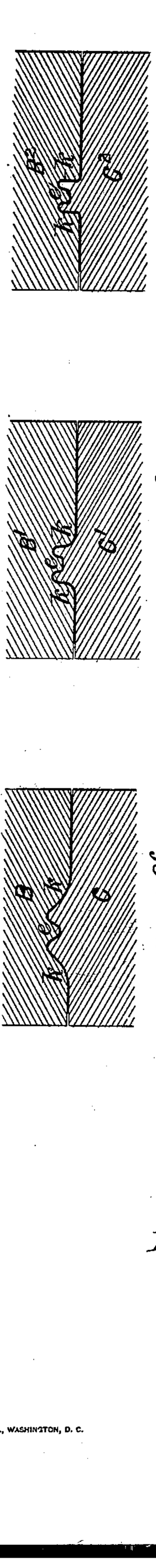

FIG. 10c

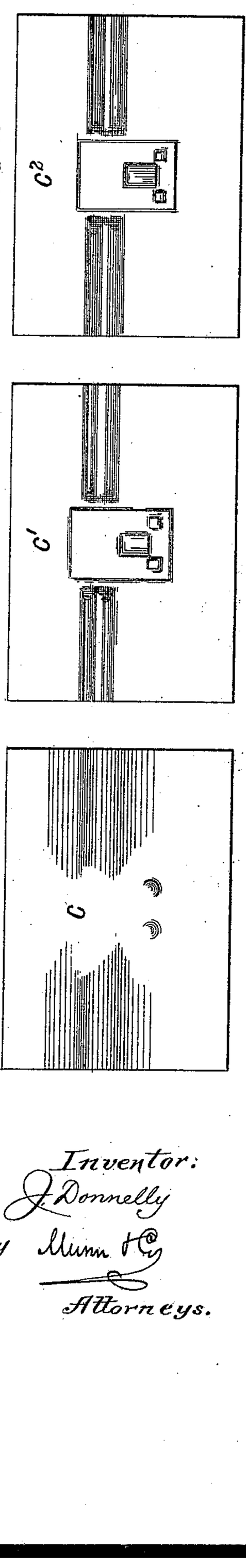

FIG. 9.

FIG. 9a

FIG. 9b

FIG. 9c

FIG. 8.

FIG. 8a

FIG. 8b

FIG. 8c

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METHOD OF AND APPARATUS FOR MANUFACTURING AXLE BOXES.

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FIG. 14.

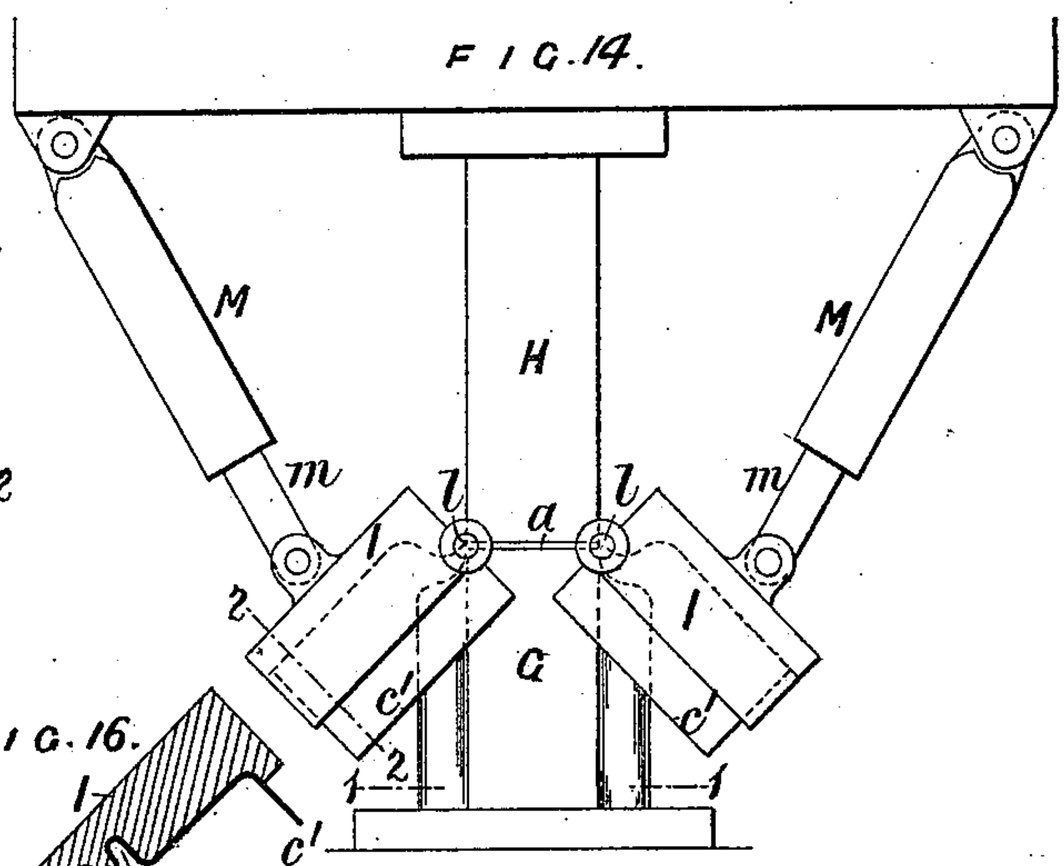


FIG. 11.

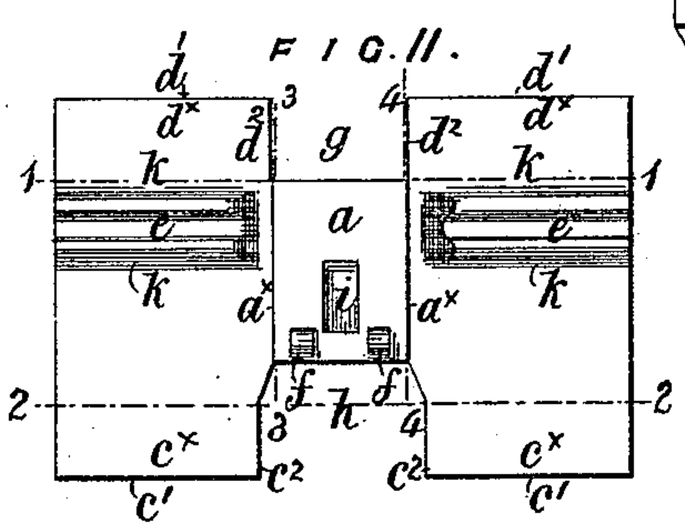


FIG. 12.

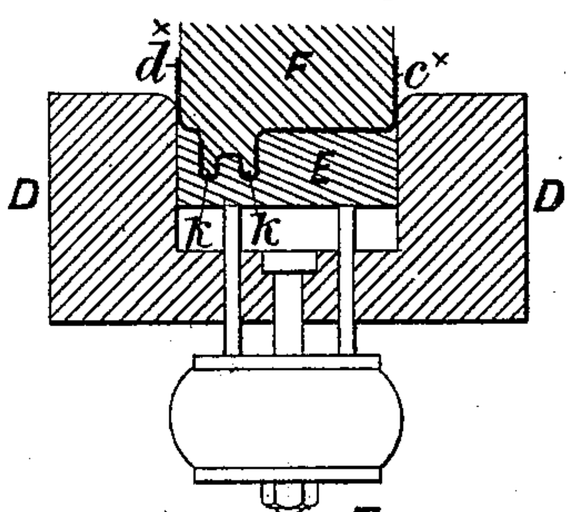


FIG. 13.

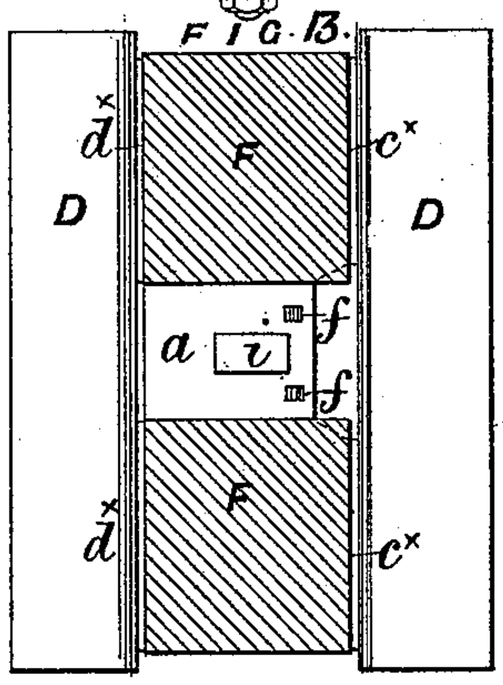


FIG. 16.

FIG. 15.

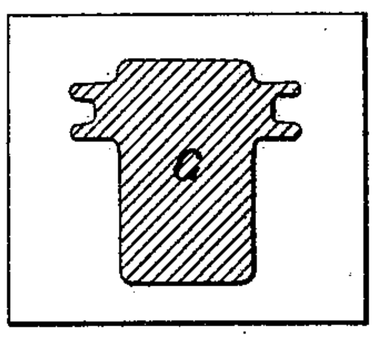


FIG. 17.

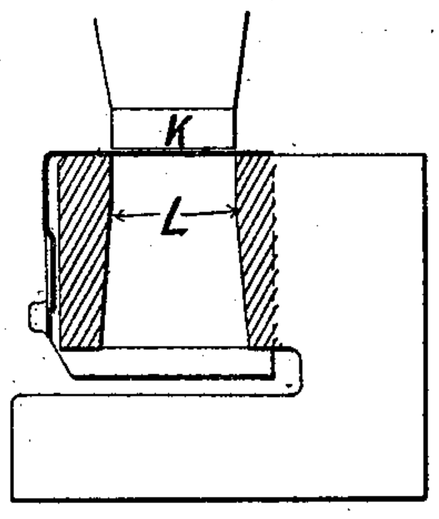
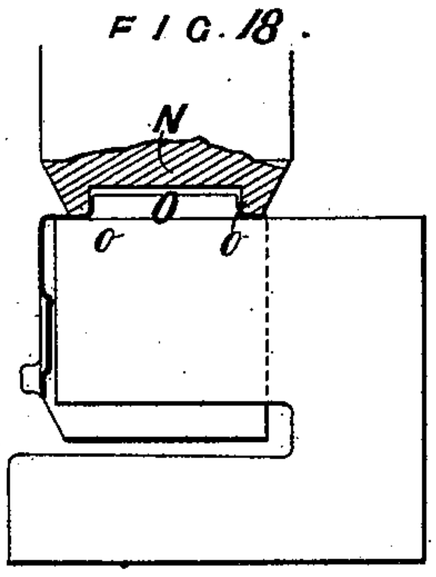


FIG. 18.



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METHOD OF AND APPARATUS FOR MANUFACTURING AXLE BOXES.

No. 459,999. Patented Sept. 22, 1891.

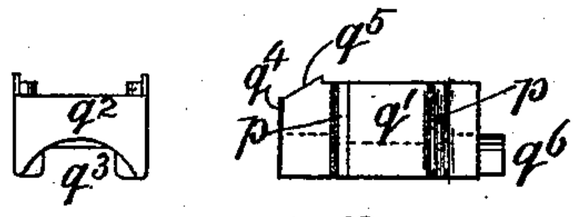


FIG. 19.

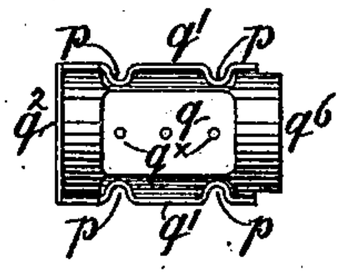


FIG. 20.

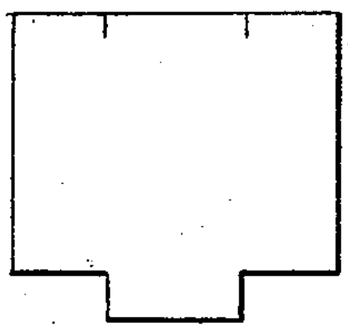


FIG. 24.

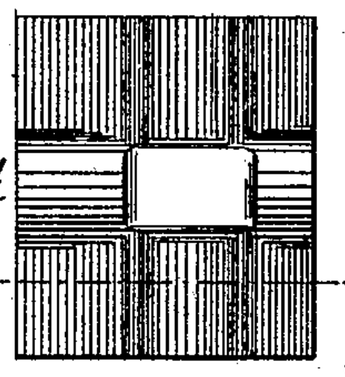


FIG. 21.

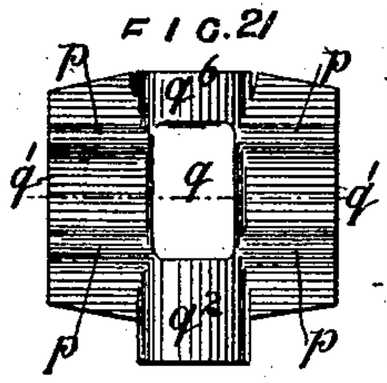


FIG. 27.

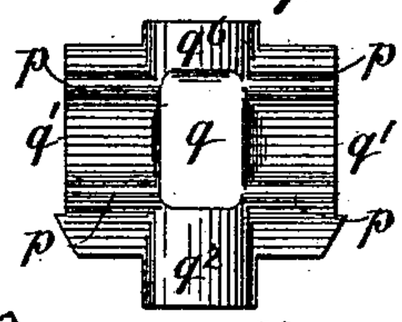


FIG. 22.

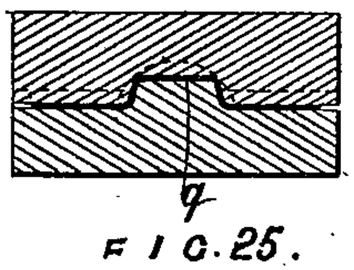


FIG. 23.

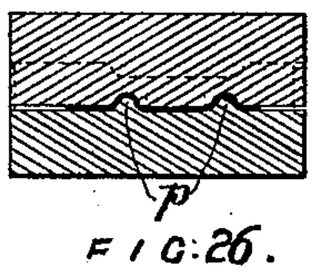


FIG. 28.

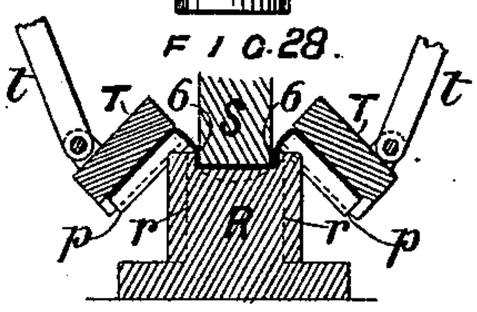


FIG. 25.

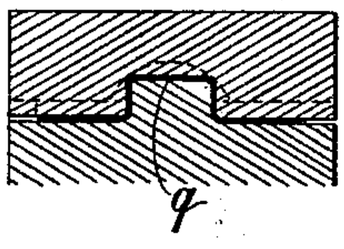


FIG. 26.

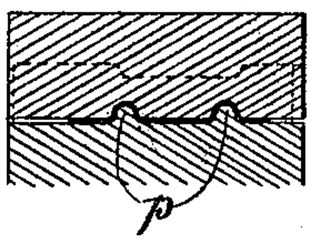
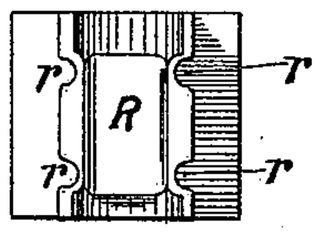


FIG. 29.



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UNITED STATES PATENT OFFICE.

JOHN DONNELLY, OF LONDON, ENGLAND.

METHOD OF AND APPARATUS FOR MANUFACTURING AXLE-BOXES.

SPECIFICATION forming part of Letters Patent No. 459,999, dated September 22, 1891.

Application filed July 3, 1890. Serial No. 357,608. (No model.)

To all whom it may concern:

Be it known that I, JOHN DONNELLY, engineer, of the Metropolitan Works, Dockley Road, Bermondsey, in the county of Surrey, England, have invented new and useful Improvements in the Method of and Apparatus for Manufacturing Axle-Boxes, of which the following is a full, clear, and exact description.

This invention relates to an improved method of and apparatus for manufacturing axle-boxes for railway-carriages from sheet-metal plates by successive stamping, pressing, and bending operations, one object of the invention being to avoid the necessity of planing or otherwise machining the horn-plate grooves out of the solid metal, as was commonly practiced heretofore.

The invention will be described with reference to the accompanying drawings, forming part of this specification, wherein Figures 1 to 6, inclusive, illustrate, by way of example, a common form of axle-box that can advantageously be made by the process of this invention, it being understood that the invention is not limited to the production of this particular form, which may be varied in detail by varying the form of the tools hereinafter described.

Fig. 1 is a rear elevation, Fig. 2 a side elevation, and Fig. 3 a plan, of the box. Fig. 4 is a central longitudinal section on line 1 1, Fig. 3. Fig. 5 is a horizontal section on line 2 2, Fig. 2; and Fig. 6 is a cross-section on line 3 3, Fig. 3. The foregoing figures are drawn to a larger scale than the following figures, which illustrate the process of making an axle-box substantially similar to that represented in the foregoing figures, although slightly differing therefrom in certain details. Figs. 7 to 10 show successive stages of embossing and corrugating the blank of metal to form the said box. Figs. 8^a, 8^b, 8^c, 9^a, 9^b, 9^c, 10^a, 10^b, and 10^c represent cross-sectional and face views of the pairs of dies by which the forms shown in the correspondingly-numbered figures are produced, the sections being taken on lines 4 4 and 5 5, respectively.

The top *a*, the sides *b b*, the front *c*, and the back *d* of the shell of the box are made of a single plate A of mild steel of uniform thickness—say one-fourth of an inch—and of oblong form, which is, by successive reheatings and pressings between successive pairs of dies, dished at the center to form the seat *i* for the box-lid spring *v* and corrugated and embossed at the proper places to form, when the box is completed, the horn-plate grooves *e* (and dust-guard grooves, if any) and the bosses *f* for the lid-hinge. To describe this sequence of operations more in detail, the plate A is first cut to the shape shown in Fig. 7—that is to say, gaps *g h* of the shape and proportions shown are cut in its two long edges, so as to remove superfluous metal, leaving the middle part of the plate of a width corresponding to the intended length of the box from front to back, allowing for the grease-box opening, hereinafter referred to. The plate is then heated to a bright red and pressed between a pair of male and female dies B C, (shown in Figs. 8^a, 8^b, and 8^c,) whereby it is brought to the form shown in cross-section in those figures and in plan in Fig. 8. The plate is then reheated and pressed between a second pair of dies B′ C′, (shown in Figs. 9^a, 9^b, and 9^c,) whereby it is brought to the form shown in cross-section in those figures and in plan in Fig. 9. The plate is again reheated and pressed between a third pair of dies B^2 C^2, (shown in Figs. 10^a, 10^b, and 10^c,) whereby it is brought to the final form. (Shown in cross-section in those figures and in plan in Fig. 10.) It will be seen that these successive pairs of dies progressively approximate to the final form to which the plate is to be brought before being bent up to form a box, so that the embossing action of the said dies is gradual and progressive. By these three (more or less) successive operations the middle part of the plate, which will form the top of the box, has been embossed with a rectangular figure $a^\times$, as shown in cross-section in Fig. 10^a and in plan in Fig. 10, defining the outline of the top *a* of the box, with bosses *f* for the lid-hinge and with a cavity *i* to receive the spring of the lid-hinge. The lateral portions of the plate, which will ultimately form the sides of the box, have also been embossed with pairs of parallel corrugations *k*, which, standing out from the surface of the plate, define the grooves *e* for the horn-plates. By the gathering of the metal to form these corrugations the plate is somewhat distorted, and the next operation

is to trim its edges square and enlarge the gap *h*, so as to bring the plate to the form shown in Fig. 11, so that when the plate is bent to the form of a box by the subsequent operations, hereinafter described, the edges to be welded to make a complete box will come properly together and an inclined opening or mouth will be left at the front part of the box.

The embossed and corrugated plate shown in Fig. 11 is brought to the box form by bending up the wings or projecting portions of the long edges of the plate on parallel lines 1 1 2 2, Fig. 11, and to planes at right angles to the general plane of the plate, the two bent-up portions $c^{\times}$ $c^{\times}$ being intended to form together the front wall of the box and the two portions $d^{\times}$ $d^{\times}$ the rear wall of the box when their long edges are brought together and united, as hereinafter described. The bending of the four side wings $c^{\times}$ $d^{\times}$, which ultimately form the component parts of the front and back walls of the box, may be effected at one stroke by means of apparatus shown in Figs. 12 and 13, wherein D D are a pair of bolsters, each containing a false bottom or pressure-plate E, whose face is grooved to receive the corrugations *k*, and which is supported by a spring always tending to raise it. F F are plungers or male dies corresponding to the bolsters D, and each having projections on its face to correspond to the hollows of the corrugations *k*. The plate A being red-hot is laid face downward on the pair of bolsters and the plungers are brought down, so as to grip the plate firmly between them and the yielding followers, the continued downward motion of the plungers past the upstanding opposite sides of the bolster causing the side wings $c^{\times}$ $d^{\times}$ to be bent up at right angles to the plane of the plate, as shown in cross-section in Fig. 12 and plan in Fig. 13. The plate is then reheated and bent transversely on lines 3 3 4 4, Fig. 11, at each side of the central portion until the portions so bent down stand at about right angles to the original plane of the plate and the edges *c'* *c'* and *d'* *d'* of the parts $c^{\times}$ $d^{\times}$ are brought together and made to overlap at about the center line of the front and rear walls of the box, respectively. The short edges d^2 d^2 of the wings $d^{\times}$, which constitute the rear wall of the box, abut against the rear edge of the middle portion of the plate which constitutes the top of the box. The edges c^2 of the other pair of wings do not meet the top, but are so shaped as to leave an opening for introducing grease.

The apparatus by which the transverse bending of the plate is performed is illustrated in Figs. 14, 15, and 16, whereof Fig. 14 is a front elevation and Figs. 15 and 16 are respectively a sectional plan and a cross-section on lines 1 1 and 2 2 of Fig. 14.

The operation is performed on a block or "former" G, carried by the rising table of a press and corresponding to the internal configuration of the box-shell, and upon which the central part of the plate, which is to form the top *a* of the box, is clamped by a die H, corresponding in form to the embossed central portion of the plate and carried by the press-head. To each side of this top die H are hinged (on centers *l*, coinciding with the lines 3 3 and 4 4, Fig. 11, on which the plate is to be bent) lateral dies I I, whose faces are grooved to correspond to the corrugations *k* *k* of the portions of the plate A on which they are to act. These lateral dies I are jointed at back to thrust-rods *m*, which are the rams of hydraulic cylinders M, jointed to the press-head, so as to be free to accommodate themselves to the angular motion of the dies I.

The operation is performed as follows: The plate having been embossed, corrugated, and bent, as before described, is brought to a red heat and placed with its central portion *a* on the former G, which is then raised until the plate is gripped between it and the central top die H, whereupon the lateral dies I are brought down, so as to close the corrugated end portions of the plate against the sides of the block G. By this operation the plate is brought approximately to a box form, the edges *c'* *c'* and *d'* *d'* of the parts $c^{\times}$ $c^{\times}$ and $d^{\times}$ $d^{\times}$ being brought together and caused to overlap at about the center line of the front and back of the block G. The rough shell is then removed from the block and the overlapping edges *c'* *c'* and *d'* *d'* welded together, the edges d^2 d^2 being also welded to the rear edge of the top *a*, which may be conveniently done under a pneumatic hammer after heating the parts to be welded by means of an ordinary gas welding apparatus. In the rear side of box-shell a circular opening is then punched for the passage of the axle-journal, and said opening is flanged outward. The first of these operations is performed by means of a punch and die, (shown in part sectional elevation in Fig. 17, wherein K is the punch and L the die,) the die-block being so overhung or supported that the box-shell can be slipped onto it in a direction at right angles to that of the stroke of the punch, the box being shown in position on the block. The edges of the aperture after being reheated are then bent outward to form a flange *o* by a similar tool, (shown in Fig. 18,) except that a female die N occupies the place of the punch, and a male die O is formed on the block on which the box is placed, as in the former case. Holes P, Fig. 3, are now drilled or punched in the top of the box to receive the bolts by which the carriage-spring is to be secured to the box. The shell of the box is now ready to receive a liner Q, forming both an abutment for the axle-bearing and a box for grease. This liner or grease-box is shown in position in the axle-box in Figs. 1, 4, and 6, and is represented separately in end view, side view, and plan in Fig. 19. It has a bottom *q*, two sides *q'* *q'*, and an end q^2, and it

is inserted in and welded to the axle-box shell made as above described. This grease-box has corrugations p formed in its sides to give passage to the holding-down bolts above referred to, and it is also formed with a central recess q^3 in its bottom to form a seat for the axle brass or bearing. The grease-box having been placed within the shell so that the edges of its upwardly-directed side q' abut against the top a of the shell, the grease-box is welded to the outer shell along the front edge q^4 and inclined side edges q^5 of the mouth of the grease-box, and the curved rear edge q^6 of the grease-box projects through the journal-opening in the rear of the axle-box and is welded to the upper part of the flange o, as shown in Fig. 4.

The grease-box is formed of a plate of mild steel about a quarter of an inch thick, of the form shown in Fig. 20, and it is pressed hot between successive pairs of dies of suitable configuration, whereby it is brought gradually to the desired form. Figs. 22 and 23 are cross-sections, and Fig. 24 a face view, of the first pair of dies by which the plate is brought to the form shown in Figs. 21, 22, and 23. Figs. 25 and 26 show a second pair of dies by which the plate after being reheated is brought to the form shown in cross-section in those figures.

The plate is buckled or dished at q^3, Fig. 19, and corrugations p extending to the ends of the plate are made. The plate is then cut to the form shown in Fig. 27, and having been reheated is then bent up to form three sides of a box—that is to say, the two end portions which have been longitudinally corrugated, as above described, are first bent up on parallel lines 6 6, Fig. 28, at each side of the central dished portion until they are at right angles to the original plane of the sheet. This operation is performed by means of apparatus (similar to that before described for bending the axle-box itself) represented in elevation in Fig. 28, wherein R is a block or former and S a top die, both corresponding in configuration to the central part of the plate, the block R having grooves r at the sides, as shown in plan in Fig. 29, to receive the corrugations p of the plate. Lateral dies T T, having ribs to fit the corrugations p, are hinged to the top die S, so as to have angular motion about centers coinciding with the bends 6 6. These dies are operated by thrust-rods t, which form the rams of hydraulic cylinders that are hinged to the press-head, the operation being the same as previously described in reference to Figs. 14, 15, and 16. The corrugated end portions of the plate having been thus closed against the sides of the block R, the offset or projecting portion q^2 of the plate is then hammered down flat against the end of block R. The partly-formed box is then removed from the block, and the meeting edges of the three sides q' q' q^2 thus brought together are united by welding to form the front corners of the box. Holes $q^\times$ for the passage of the grease are made in the bottom of the box.

The grease-box lid U, Figs. 3 and 4, is hinged to the hollow bosses f (struck up in the top of the axle-box shell) by a hinge-pin received in holes in said bosses and in a knuckle-piece u on the lid, which is held in either the open or closed position by a spring v, fixed in the recess i in the top of the box and pressing on flats on the knuckle-piece. The axle-box is closed at bottom by a flanged plate W, bolted within the walls of the box.

The whole of the herein-described tools for embossing or stamping and bending the plates to form the box-shell and liner to their final form are preferably operated by hydraulic pressure applied in the ordinary way; but other mechanical power may be used.

When the carriage-spring and axle-box are not to be bolted together, the bolt-holes in the top of the axle-box and the grooves or corrugations in the sides of the grease-box are not required.

Although it has been directed that the plate should be reheated for each of the above-mentioned stamping operations, it should be understood that if a sufficient number of presses be provided two or more consecutive operations may be done at one heating of the plate.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The method herein described of manufacturing the shells of axle-boxes, consisting in subjecting a blank to the action of dies to form the usual axle-box depressions and projections, then bending the blank into box-like form, and finally welding the meeting edges together, as specified.

2. The method herein described of making axle-box shells, consisting in subjecting a blank to the successive action of dies to form the horn-plate grooves and the projections and depression for the reception of the box-lid appurtenances, then bending the blank into box-like form, and finally welding the meeting edges together, as set forth.

3. The method herein described of making grease-boxes for axle-box shells, consisting in subjecting a blank to the action of dies to corrugate the same, and then bending the blank into box-like form, substantially as described.

4. The herein-described method of manufacturing an axle-box with a liner forming an abutment for the axle-bearing and a box for grease, which consists on the one hand in forming the box-shell by embossing or stamping a plate, bending it to box form, welding the juxtaposed edges, and punching and flanging the axle-journal aperture, as described, and on the other hand in embossing and corrugating another plate and then bend-

ing it on longitudinal and transverse lines, as described, and finally placing the lines so formed within the shell formed as above specified and welding the two together at front and back, as specified.

5. In an apparatus for forging axle-boxes, the combination, with a former block and die, of lateral dies hinged to the first-named die and movable toward the block for bending the blank, substantially as set forth.

The foregoing specification of my improvements in the manufacture of axle-boxes signed by me this 16th day of June, 1890.

JOHN DONNELLY.

Witnesses:
T. T. BARNES,
W. J. NORWOOD,
Both of 17 *Gracechurch Street, London, E. C., Notary's Clerks.*