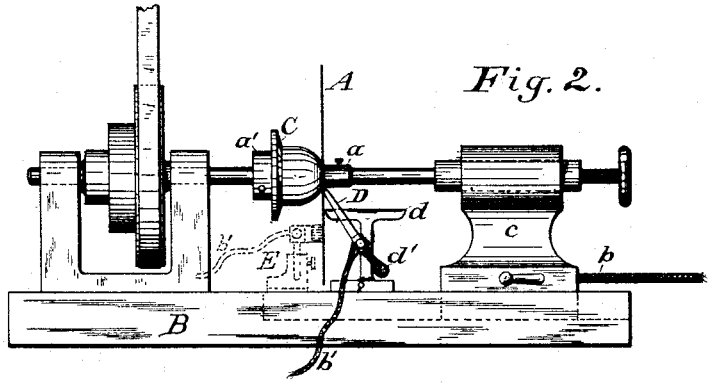
(No Model.) 2 Sheets—Sheet 1.

M. W. DEWEY.

METHOD OF UTILIZING ELECTRICITY IN THE FORMATION OF SHEET METAL ARTICLES.

No. 438,406. Patented Oct. 14, 1890.

Fig. 2.



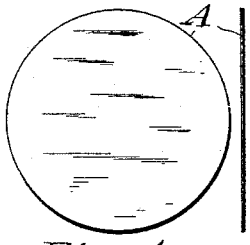


Fig. 1.

Fig. 3.

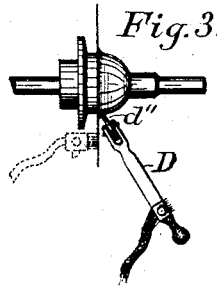


Fig. 4.

Fig. 5.

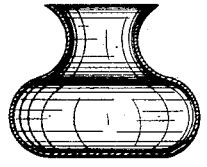


Fig. 6.

Fig. 7.

Fig. 8.

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(No Model.) 2 Sheets—Sheet 2.

M. W. DEWEY.

METHOD OF UTILIZING ELECTRICITY IN THE FORMATION OF SHEET METAL ARTICLES.

No. 438,406. Patented Oct. 14, 1890.

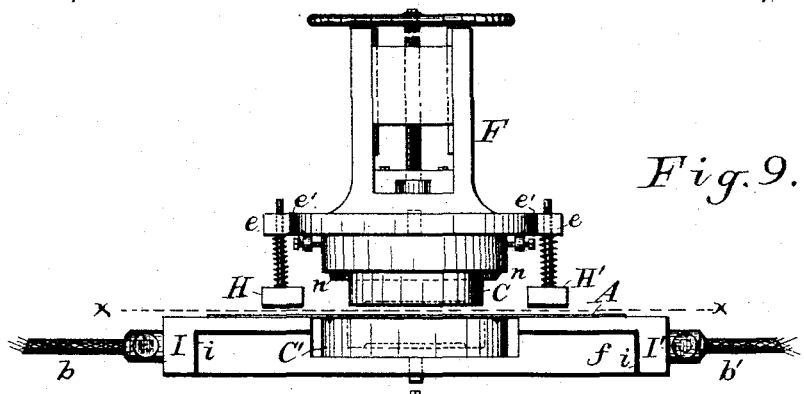

Fig. 9.

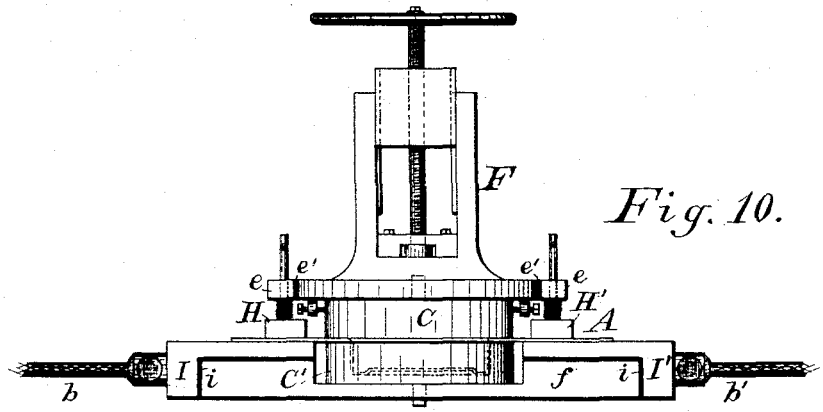

Fig. 10.

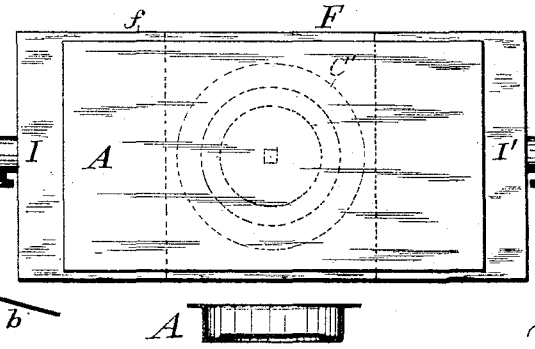

Fig. 11.

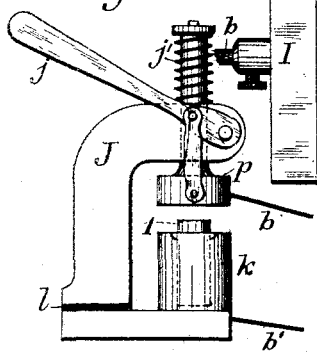

Fig. 15.

Fig. 12.

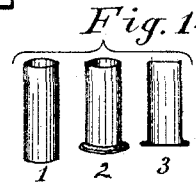

Fig. 14.

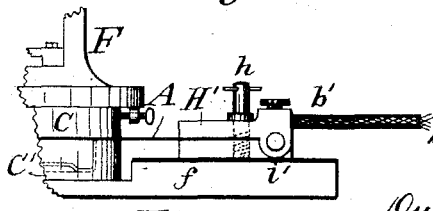

Fig. 13.

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UNITED STATES PATENT OFFICE.

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METHOD OF UTILIZING ELECTRICITY IN THE FORMATION OF SHEET-METAL ARTICLES.

SPECIFICATION forming part of Letters Patent No. 438,406, dated October 14, 1890.

Application filed May 17, 1890. Serial No. 352,159. (No model.)

To all whom it may concern:

Be it known that I, MARK W. DEWEY, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Method of Utilizing Electricity in the Formation of Sheet-Metal Articles, (Case 59,) of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to those processes of forming sheet-metal articles which required the employment of heat to soften or anneal the metal, and the application of pressure to gradually conform the sheet to the surface of a suitable die or mold.

Articles have been manufactured from sheet metal heretofore by successive and graduated pressings depending on the depth of the article, and in some cases the metal was annealed after each pressing, as such pressing operation rapidly hardened it, which in turn caused the metal to tear and crack. Some metals, as German silver, are too brittle to be pressed to a great extent by this method. The process depends for its success upon the malleability of the metal; and it is the purpose of my invention to keep the metal annealed or in a softened condition during a greater part of if not the entire or complete formation of the article and to decrease the number of molds as well as the number of pressings usually required in forming or shaping the article, and also to save time and handling.

The object of my invention also is to provide a process or method that will produce more durable and superior sheet-metal ware and to allow the formation of articles from thicker sheet metal, and various metals heretofore incapable of being pressed.

My invention consists, essentially, in electrically heating the metal sheet, preferably by passing an electric current through the same before and while said sheet is formed over or within a die or mold by pressure gradually and suitably applied, as hereinafter described.

My invention consists, also, in certain improved processes involving the application of a heating-current of electricity to the formation of sheet-metal hollow ware, cartridge-cases, &c., and also in certain apparatus and devices useful in practicing the method or process described and claimed herein.

In the accompanying drawings, Figure 1 is a side and edge view of a disk of sheet metal to be operated upon. Fig. 2 shows a side elevation of a lathe for holding the disk of sheet metal upon a mold and rotating the same while pressure is applied with an instrument to form said disk to the shape of the mold. Fig. 3 shows a sheet-metal article partly formed over the same mold. Fig. 4 represents the article completed. Figs. 5, 6, 7, and 8 are sectional views of a number of different-shaped articles that may be formed by my process. Fig. 9 is an elevation of an apparatus for effecting my method of forming sheet-metal articles by stamping or drawing, and is a view taken before the operation upon the sheet. Fig. 10 shows the same apparatus after the operation upon the sheet. Fig. 11 is a plan view of a portion of the apparatus, taken below the dotted line $x x$ in Fig. 1. Fig. 12 is a sectional view of the article after it is pressed. Fig. 13 represents a modified form of making electric contact with the sheet while in position. Fig. 14 shows several views of a metallic cartridge-case formed by my method. One view shows the case in perspective after it is formed, but prior to the heading operation. Another view shows the same after the heading operation, and another is a sectional view. Fig. 15 represents a simple cartridge-case-heading machine that may be employed in carrying out my method.

Referring specifically to the drawings, A in Fig. 2 is a sheet of thin metal, preferably in the form of a disk, as shown in Fig. 1, mounted upon a lathe B, and held by pressure from a head-stock a against a mold C of the required form, fixed on the face-plate a' of the revolving spindle. The metal sheet may be cut into the form of a disk in any suitable manner, either before or after said sheet is placed in position upon the mold in the lathe. The disk is preferably heated by passing a heating current of electricity through the same from a point at or near its center, or where the head-stock a bears against it, to the point

where the pressure-instrument or burnisher D is in contact with it.

The pressure-instrument D may be of metal or some suitable non-conducting material. When said instrument is metallic, the current may be circulated through the apparatus, as shown, from the conductor *b*, through the back head *c*, spindle and head-stock *a*, to the sheet A, through said sheet to the point where the instrument D is pressed against it, and through the instrument to and through the flexible conductor *b'*, connected therewith, back to a suitable source of electricity, to which both conductors *b* and *b'* are connected.

When the instrument D is of non-conducting material, as bone or wood, or even when metallic, the current may be passed through an adjustable contact or brush E bearing upon the disk, as shown in dotted lines in the figure. Said contact may be adjusted and moved to any desired position to make and maintain contact with the disk while it is rotated and formed into an article. The conductor *b'* is then connected to the contact E, instead of the instrument D. Instead of passing the current through the lathe-spindle, another contact, attached to the conductor *b*, may be provided to bear upon the disk.

The pressure-instrument D is held upon the lathe-rest *d* as a fulcrum, and while the disk A and mold C is revolved said instrument is applied to the disk near the center and rapidly bent or swaged, so as to fit close against the curved face of the mold. The instrument D may be held by any suitable means, but preferably in the hand and by the handle *d'*. A gentle pressure is caused to bear on one point, thus producing a slight depression; but as the sheet is spinning at high velocity the depression at once forms a circle, and so by continuing the pressure of the instrument and gradually moving the same the sheet is molded into any form accordingly.

The mold C is preferably made of non-conducting material or of conducting material coated with a non-electric conducting material, as a mineral paint or enamel. Various forms of pressure instruments or burnishers may be used, the one shown in Fig. 3 being provided with a roll *d''* to decrease the friction between the bearing-points. Sectional molds are employed when the form of the article, as shown in Fig. 6, will not permit the removal of a solid mold after the article is formed or spun over the mold.

Referring now to Figs. 9, 10, and 11 of the drawings, F represents an ordinary screw stamping-press in different positions and having a number of improvements for carrying out my process or method by stamping or drawing. Two molds or dies are employed in this apparatus at a time. The hollow mold C' is placed on the bed or base *f*, and upon it is laid a blank of sheet metal A, or a pile of blanks when several are to be stamped at once. The under side of the blank or sheet A rests upon the flat upper surface of the hollow die. When the upper die or mold C descends, (which die fits quite closely into the lower hollow die or mold when at its lowest position,) yielding clamps H, and H' carried upon the follower or plunger to which the upper die is secured, descend with it and firmly press the sheet A at points on each side of the dies against electric terminals I and I', connected to the conductors *b* and *b'* to make good electric contact between the same and the sheet. The electric current is thus permitted to flow through the sheet A between the terminals, the sheet becomes heated and softened or annealed and is expanded into the hollow die stretching out into a smooth seamless pan or other article without buckling or corrugating. These yielding clamps H and H' serve as holders for the sheet A and may be located on all sides of the dies, if desired. Said clamps may be faced with non-electric conducting material where they come in contact with the sheet, or the ears *e*, supporting said clamps, may be insulated from the plunger by insulation *e'* to prevent short-circuiting of the current through the plunger. The base *f* of the press is insulated from the terminals by insulation *i i*, to prevent the current short-circuiting through the base.

I do not limit myself to the form of holders or clamps, as any suitably formed and insulated holders may be used, another form of which is shown in Fig. 13 of the drawings. This clamp H' is fixed to, but insulated from, the base *f* by insulation *i'*, and is directly connected with the conductor *b'*. The pivoted jaws of the clamp firmly grip the edge of the sheet A by means of the screw *h*, and the said sheet is not only held to make good electric contact but to keep the same smooth while it is pressed or formed.

The molds or dies for my stamping apparatus are also preferably formed entirely of or faced with a suitable non-electric conducting material to prevent the current short-circuiting through them. The dies C and C' (shown in Figs. 9 and 10) cut the article just before it is completely formed from the sheet by means of the annular knife *n;* but this is not essential, as it may not be cut until after it is entirely completed or removed from the dies.

In Fig. 12 the article is shown in section as it appears after it is removed from the dies.

I do not limit myself to forming completely an article by a single impression, as it may be necessary or desirable to make several impressions upon the article before it is completed.

In forming a cartridge-case by my method, for instance, I preferably first form the case without a head, as shown at 1 in Fig. 14, making it somewhat longer than the finished case to allow for the formation of a head. Then the case is placed in a suitable countersunk die *k*, so that the closed end is held projected

sufficiently, and the die containing the case is passed in the heading-press J, (shown in Fig. 15) beneath the heading-punch *p* thereof, which descends by means of the handle *j* to flatten the closed end of the tube or case into the countersink. The surplus length or metal in the case is thus taken up in the formation of the head, as shown at 2 and 3 in Fig. 14. In the heading-press the dies *k* and *p* are connected with the conductors *b* and *b'*, and the current flows from one die to the other through the cartridge-case. The dies are insulated from each other by insulation *l* to prevent the current short-circuiting through the frame. The die *p* of the heading-press is returned to its original position by means of the spring J'.

The method of forming cartridge-cases shown and described in this application forms the subject-matter of a separate application, which is a division hereof, filed August 8, 1890, Serial No. 361,413.

Although the stamping presses shown in the drawings are designed to be operated by hand, it will be obvious that they may be operated by any suitable and well-known means. It will be also apparent that the sheet of metal may be by this method maintained in a heated, softened, or annealed condition during the entire formation of the article, if desired, and that with suitable current-regulating devices in circuit the sheet may be kept at any temperature desired without danger of burning or heating the sheet metal too much.

The metal sheets may be fed to the forming apparatuses and the formed articles withdrawn therefrom in any suitable manner and by any suitable and well-known means heretofore used in connection with similar sheet-metal-forming apparatus.

The apparatus herein set out, but not claimed, forms the subject-matter of my two applications, filed July 28, 1890, Serial Nos. 360,122 and 360,123.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of utilizing electricity in the formation of sheet-metal articles, consisting in electrically heating a sheet of metal, applying a suitable force to form the sheet as desired, and maintaining said sheet of metal in the heated condition while it is thus formed.

2. The method of utilizing electricity in the formation of sheet-metal articles, consisting in passing a current of electricity through a sheet of metal to soften the same and then gradually forming said sheet by pressure over a die or mold.

3. The method of utilizing electricity in the formation of sheet-metal articles, consisting in electrically heating a sheet of metal while in position upon a die or mold and applying pressure to gradually form the sheet to correspond to the form of the surface of the die or mold.

4. The method of utilizing electricity in the formation of sheet-metal articles, consisting in passing a current of electricity through a sheet of metal between two points to soften the same and then gradually applying pressure to form the sheet over a suitable circular die or mold.

5. The method of utilizing electricity in the formation of sheet-metal articles, consisting in passing a current of electricity through a sheet of metal between two points, one at or near the center and the other nearer the edge or periphery of the sheet to soften the same, and then applying pressure to the sheet to form the same over a suitable die or mold surface.

6. The method of utilizing electricity in the formation of sheet-metal articles, consisting in electrically heating a sheet of metal while it is rotated and gradually formed or spun over or upon a suitable die or mold.

7. The method of utilizing electricity in the formation of sheet-metal articles, consisting in electrically heating a sheet of metal by passing a current of electricity through the same while it is rotated, and formed or spun upon a suitable die or mold surface.

8. The method of utilizing electricity in the formation of sheet-metal articles, consisting in electrically heating a sheet of metal by passing a current of electricity through the same while it is rotated and formed or spun upon a suitable die or mold surface, and passing said current between two points, one at or near where the sheet is held by the rotating device and the other where the pressure-instrument is applied.

9. The method of utilizing electricity in the forming of sheet-metal articles, consisting in communicating a rapid circular motion to a sheet of metal held against a mold, passing a heating-current of electricity through the sheet to soften the same, and then by means of a suitable instrument applying pressure to successive points upon the sheet to form said sheet to correspond to the form of the surface of the mold.

10. The method of utilizing electricity in the forming of sheet-metal articles, consisting in communicating a rapid circular motion to a sheet of metal and a mold held against it, passing a heating-current of electricity through the sheet to soften the same, and then applying pressure with a movable instrument upon successive parts of the sheet and toward the mold to conform said sheet to the form of the surface of the mold.

11. The method of utilizing electricity in the forming of sheet-metal articles, consisting in communicating a rapid circular motion to a flat disk-shaped sheet of metal and a mold held against it, passing a heating-current of electricity through the sheet to soften the same, and then applying pressure with a movable instrument upon successive parts of the sheet and toward the mold to conform said sheet to the form of the surface of the mold.

12. The method of utilizing electricity in the forming of sheet-metal articles, consisting in communicating a rapid circular motion to a sheet of metal and a mold held against it, electrically heating the sheet while in motion to soften the same, and then applying pressure with an instrument upon successive parts of the sheet beginning at or near the center and gradually approaching the edge and toward the mold, to conform said sheet to the form of the surface of the mold.

13. The method of utilizing electricity in the formation of sheet-metal articles, consisting in electrically heating a sheet of metal to soften the same, and then gradually applying pressure to form the sheet over a suitable circular die or mold.

In testimony whereof I have hereunto signed my name this 14th day of May, 1890.

MARK W. DEWEY. [L. S.]

Witnesses:
C. H. DUELL,
J. J. LAASS.