J. Grey,

Spinning Sheet-Metal.

No. 28,075. Patented May 1, 1860.

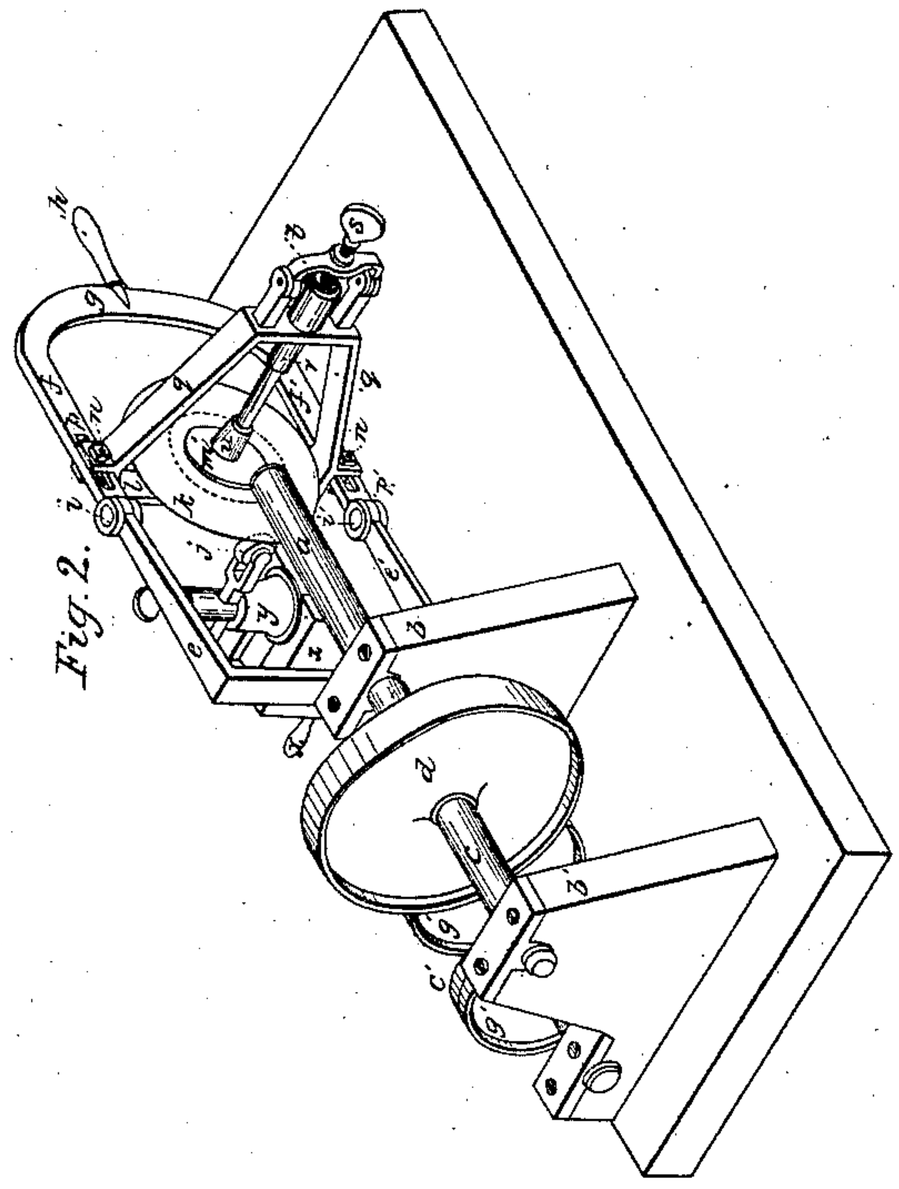

Fig. 2.

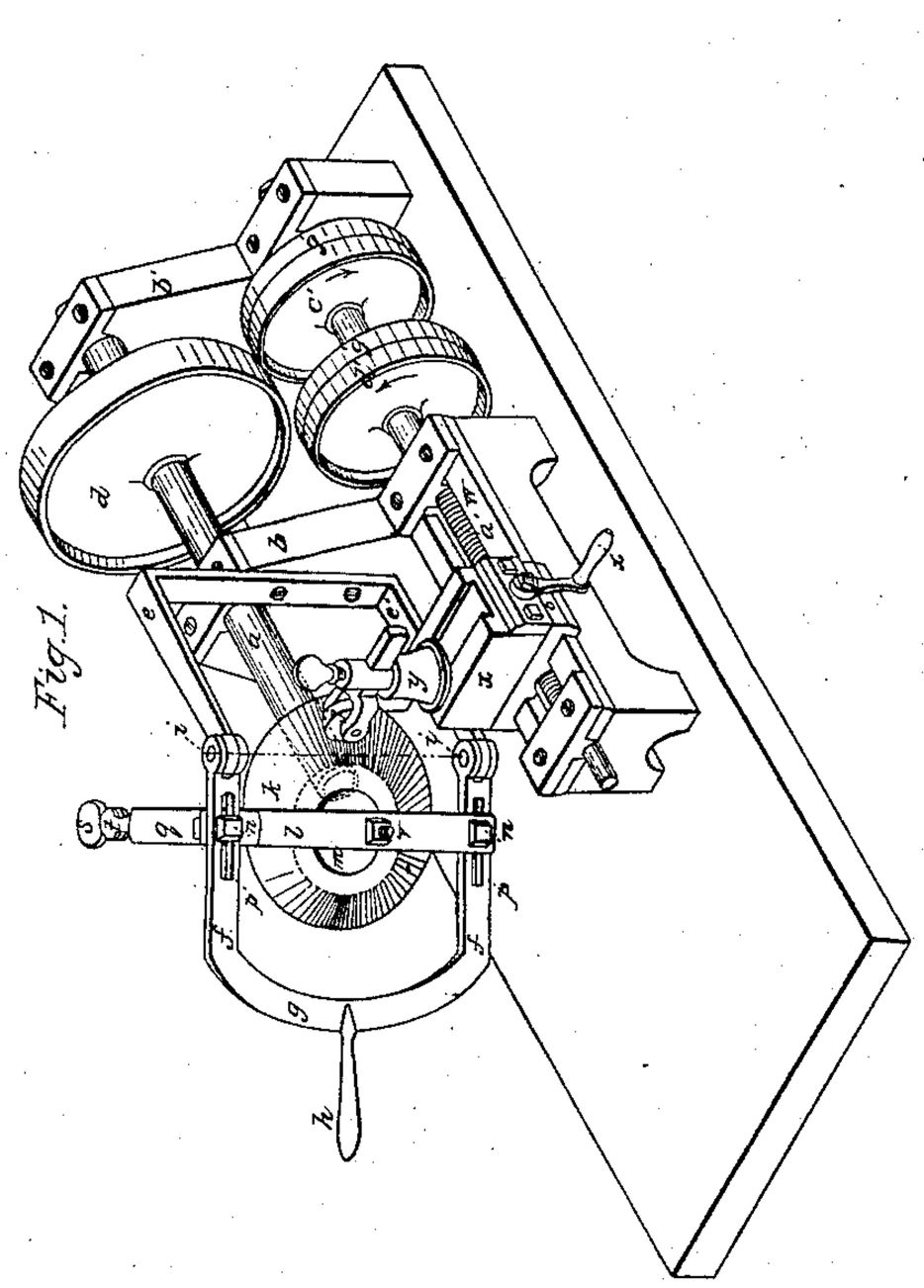

Fig. 1.

UNITED STATES PATENT OFFICE.

JOHN GREY, OF PITTSBURG, PENNSYLVANIA.

IMPROVED MACHINE FOR SPINNING METALLIC HOLLOW WARE.

Specification forming part of Letters Patent No. **28,075**, dated May 1, 1860.

To all whom it may concern:

Be it known that I, JOHN GREY, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful improvements in machines for making kettles and other hollow ware from disks or sheets of copper, brass, iron, and other ductile metals; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the annexed drawings, forming part of this specification, in which—

Figure I is a perspective representation of my machine viewed from the front end. Fig. II is a perspective view of my machine viewed from the rear end, and exhibiting the reverse side to that shown in Fig. I.

In both figures like letters of reference denote similar parts of my machine.

The mode of manufacturing metallic hollow ware by the process which is called "spinning" has long been known and used, and has been applied to the formation of various articles. This process consists in placing a plane disk of some ductile metal in a lathe, and, as the metallic disk rapidly revolves, pressing up against it a tool, which is caused to travel from the center (or near the center) of the disk toward its circumference, the pressure of the tool being supported by a form or mandrel on the inside of the disk, and the tool thus traveling spirally over the disk, or, rather, the disk passing spirally under the tool, the metallic disk is gradually contracted circumferentially, and this process is repeated until the necessary "dish" is given to the sides of the kettle or other article to be manufactured.

Several machines have been constructed, especially intended for the manufacture of brass and copper kettles, which make use of the spinning process, but which are liable to serious objections. To remedy or avoid these is the design of my improvements. In some of these machines the metallic disk is secured to a rotary form of slightly convex shape, so as to revolve with it, while the pressing-tool is caused to travel in a path corresponding with the convexity of the form from its center (or near it) to its circumference, and thus by circumferential contraction of the disk give to it the degree of convexity which the "form" possessed. Another form is then used in like manner, having a still greater degree of convexity, and the tool caused to travel over it as it rotates, giving the disk a still greater convexity or dish; and, again, a third form is used, a succession of forms being necessary, each having a greater convexity than the last, until the required shape is given to the kettle. This process is liable to the serious objections that a separate series of forms must be had to suit each different size of the kettle to be made; that the disk must be removed and a new form placed in the machine at each stage of the operation; that it is difficult to adjust the gradation in convexity of these forms to the degree to which the metal will contract circumferentially at each passage of the tool over its surface, so that a form may happen to be used having a greater increase of convexity than can be given to it by a single operation, and the varying shape of the forms requires the employment of very complicated machinery to cause the tool to travel in the exact path or track corresponding thereto, which is necessary to give the requisite uniform pressure of the point of the tool against the surface of the disk.

Other machines have been made in which the use of a form or succession of forms is entirely dispensed with, and in lieu thereof a couple of revolving tools or rollers are used, placed with their edges opposite to each other, between which the disk is made to revolve. These rollers have both a positive motion on their axis, and are either of equal diameter and speed, or differ in diameter and speed. The disk is held between clamps in a rest and is inserted between the rollers. The rest or carriage which supports the clamps may be set at any required angle to suit the dish given by each operation to the sides of the kettle, and as there is no form used nor support to the disk other than the bearing of the face of the rollers against the disk opposite to each other, either the rollers are made to recede from the disk or the disk from the rollers, so as to operate on the disk from near its center to its circumference. The objections to this description of machine are twofold: first, that the disk not being supported except at the point of the grip of the rollers, it will crimp and not contract circumferen-

tially with sufficient uniformity to make the sides of the kettle straight; and, second, that unless the pivot or turning-point of the adjustable clamp carriage or rest is exactly in the same vertical line as the edge of the bottom of the kettle, (that is, the point where the circumferential contraction of the disk commences to form the sides,) the disk cannot be so placed between the rollers after the dish of the sides has commenced as to be drawn through the rollers without warping the kettle, and as the diameter of the bottoms of kettles varies with the different sizes of the kettles, a machine thus constructed can only make in perfection that particular size of kettle which has a bottom whose semi-diameter is equal to the distance from the pivot of the clamp rest or carriage to a point in a vertical line passing through the center of the disk. My improvements are designed to obviate these difficulties, and while I dispense with the use of a form or succession of forms having the shape designed to be given to the kettle or other article to be manufactured at each successive stage of the operation, I also avoid the necessity of causing the clamps and the disk held by them to recede from the tool and mandrel, or, vice versa, the motion of the mandrel and tool from the disk. I also prevent the crimping of the kettle by supporting the inside of the disk against a straight mandrel throughout the entire length from the edge of the bottom of the kettle to the circumference of the disk, and am enabled so to adjust the distance of the center of the disk from the turning-point of the clamp-frame as to cause the side of the kettle to lie parallel with and against the face of the mandrel after the tool has passed over it, no matter what degree of dish has been given to it by the operation of circumferential contraction.

To enable others skilled in the art to construct and use my improved machine, I will proceed to describe its construction and operation.

In the drawings, Figs. I and II, *a* is the mandrel, being a shaft of iron or steel of uniform diameter and sufficient length for the required capacity of the machine—that is, equal in length to the depth of any kettle required to be made on it. The outer end of the mandrel is free, the inner end being supported on a bearing in the pillow-block *b*. The mandrel *a* is either attached to or forms a continuation of the shaft *c*, which is supported by and turns horizontally on its axis in bearings in the blocks *b b'*. To the shaft *c* is attached a pulley, *d*, by which it is caused to revolve by means of a belt or gearing from a steam-engine or other prime motor. To the pillow-block *b* is attached the clamp-frame, consisting of two horizontal arms, *e' e'*, which are parallel with and equidistant from the horizontal mandrel *a*, and of two swinging arms, *f f'*, which are connected at their outer ends by a cross-piece, *g*. The swinging arms *f f'* and cross-piece *g* may be conveniently made of one piece. The swinging arms *f f'* are pivoted at *i i'* to the stationary arms *e e'*. It is important that the pivots *i i'* should be in the same vertical line, as shown by the red dotted line in Fig. I, and that the line *i i'* should be in the same vertical plane as the end of the mandrel *a*—that is, the horizontal distance from the block *b* to the line *i i'* must be exactly the same as the length of the mandrel *a* from the block *b*, because the extremity of the mandrel *a* must extend along the face of the metallic disk *k* (from which the kettle is being made) to the edge of the bottom of the kettle, as seen in Fig. I, and no farther, and as the edge of the kettle's bottom is the point where the dish of the disk commences, which dish is regulated by turning the clamp-frame on its pivots *i i'* at each successive operation of the tool *j*, it is requisite, as before stated, that the line *i i'* should be in the same plane as the end of the mandrel *a*. A sliding bar, *l*, is attached to the swinging arms *f f'* in a vertical position by screw bolts and nuts *n n*, the bolts passing through horizontal slots *p p* in the arms *f f'*, so that the sliding bar *l* may be set at any required distance from the pivots *i i'*, which distance must be the semi-diameter of the bottom of the kettle, because to the sliding bar *l* is attached, by the screw-bolt *v*, one of the clamps, *m*, by which the disk *k* is held in place. The other clamp, *m'*, (seen in Fig. II,) is held in place opposite to the clamp *m* by means of the arch *q*, through the vertex of which the rod *r* is placed in the line of the center of the inner clamp, *m'*, and the clamp is tightened by means of the thumb-screw *s*, working in a head-piece, *t*, which turns on pivots, so that the screw *s* being loosened the head-piece *t* may be turned out of the way to one side, leaving a clear passage for withdrawing the rod *r*, when the clamp *m'* is loosened to remove or replace the disk *k*. The clamps *m m'* have each a sleeve, *n*, (see Fig. II,) which serves as an axis into which the end of the rod *r* is inserted, and on which it turns with the disk *k*. The face of the inner clamp, *m'*, is in a line with the outer edge of the mandrel *a*, against which the disk rests when the swinging part of the clamp-frame is set straight with the machine, as in Fig. II, so that when the disk is placed between the clamps *m* and *m'* and the swinging part of the clamp-frame is set straight the disk is in a vertical plane exactly parallel to the axis of the shaft *c* and mandrel *a*, and coincident with the vertical plane touching the outer edge of the mandrel *a*—that is, the edge turned toward the eye in Fig. I. This position of the clamp-frame and disk in relation to the mandrel is seen in Fig. II.

On a suitable bed-plate, *w*, is set a slide-rest, *x*, which carries the tool *j*, the tool being a small steel roller projecting horizontally from an upright pillar, *y*, which has a sliding motion on the slide-rest *x* at right angles to the axis of the mandrel *a* by means of the wrench

z, by which the tool is pressed up against or withdrawn from the mandrel *a* at pleasure. The axis of the roller or tool *j* is in the same horizontal plane as the axis of the mandrel *a*, so that the tool presses fair against the mandrel, or against the disk, when interposed between it and the mandrel *a*, as seen in Fig. I. The slide-rest *x* has a longitudinal motion parallel to the axis of the mandrel *a* on the bed-plate *w* by means of a screw, *a'*, working horizontally under the bed-plate *w*, and through a female screw in the lower part of the slide-rest *x*. The length of this longitudinal motion is equal to the length of the mandrel *a*, parallel therewith and opposite thereto, so that the revolving of the screw *a'* (which is turned by means of the pulley *d'*) causes the tool *j* to pass horizontally along the mandrel *a* from its extremity to the block *b* and backward by means of the pulley *c'*. The pulleys *d'* and *c'* revolve in opposite directions. (Indicated by the arrows in Fig. I.) Beside each of the fixed pulleys *d'* and *c'*, by which the screw *a'* is turned, is placed a loose pulley, *g'*, on which the belts are placed when the screw is not desired to revolve. Thus, when the screw *a'* is being turned by means of one of the fixed pulleys, the belt which is designed to work the reversing fixed pulley is slipped onto its loose pulley, so as not to interfere at all with the operation of the tool.

Having thus described the construction of my machine, I will proceed to explain more fully its mode of operation. The swinging arms *f f'* of the clamp-frame being set straight, or parallel to the axis of the mandrel *a*, the circular disk *k*, of brass or other metal, is inserted between the clamps *m m'* by loosening the thumb-screw *s*, turning the head-piece *t* to one side and withdrawing the rod *r*, and then replacing the parts when the disk is set between the clamps. The tool *j* is set so as to press against the outer face of the disk against the extremity of the mandrel *a*. The sliding bar *l* is then set (by means of the nuts *n n*) so that the distance from the center of the disk *k* to the end of the mandrel *a* is just equal to the semi-diameter of the bottom of the kettle to be made. Thus the tool presses against the disk *k* just at the point where the formation of the sides of the kettle, by "dishing" the disk, is to be commenced. The shaft *c* is then set in motion in the direction indicated by the arrow on the pulley *d*, and by means of the pulley *c'* the screw *a'* is also started, causing the tool to travel along the mandrel *a*. The winch-handle *z* is turned so as to press the tool *j* close up against the disk *k*, with the requisite degree of force to produce the spinning effect on the disk. As the mandrel *a* has a positive motion on its axis, and the disk is pressed against the mandrel by the tool *j*, the disk revolves with the clamps *m m'*. The tool *j* also revolves on its axis, not with a positive motion, but by rolling contact induced by the revolution of the disk. As the passage of the disk between the mandrel and tool, while the tool is slowly moving toward the circumference of the disk, causes the tool to describe a spiral path over the whole surface of the disk outside of the circular bottom of the kettle, (which is untouched by the tool,) the disk is elongated in a radial direction and contracted circumferentially, as before described. This gives a slight dish to the disk on the first operation, and permits the swinging part of the clamp-frame to be pushed out of the straight line, so that the arms *f f'* will form an angle with the arms *e e'* of the clamp-frame, equal to the dish of the disk, or the angle which the side of the kettle now forms with the bottom. As the acuteness of this angle, or the dish, is thus increased on each repetition of the operation of the passage of the tool over the disk, so the inclination of the swinging part of the clamp-frame to the fixed part is increased by pressing it to one side by means of the handle *h*, and as the extremity of the mandrel *a* is always at the point on the disk where the dish or angle commences, and as the line *i i* (the center of motion of the swinging clamp-frame) is in the same plane as the extremity of the mandrel, and very nearly coincident with the point at the extremity of the mandrel which touches the disk, (as seen by the red line in Fig. I,) the disk will always lie close up against the mandrel, no matter what the dish of the sides of the kettle may be, by simply pressing the handle *h* away from the side of the machine on which the tool is situate, as seen in Fig. I. When the tool has passed once over the disk, the winch *z* is turned so as to withdraw the tool from contact with the disk, and the motion of the screw *a'* being reversed by means of the pulley *d'*, the slide-rest *x* and its tool *j* are slid back to their former position with the tool at the extremity of the mandrel. The motion of the screw is now again reversed, and the swinging clamp-frame being set at the required angle, the tool is again caused to pass along the mandrel *a* over the disk toward its circumference. By repeating this operation until the required dish is given to the disk the kettle is gradually formed into the proper shape, the sides of the kettle being kept straight, and the unequal contraction of the metal being prevented by the use of the straight cylindrical mandrel.

If preferred, the mandrel may be made slightly tapering toward the extremity, but this is not advisable, as it makes it necessary to set the mandrel-shaft *c* with its axis at the same angle to the axis of the screw *a'* of the slide-rest *x*, which carries the tool *j*, as the face of the mandrel has to its axis, because the face of the mandrel turned toward the disk must be exactly parallel to the path of the tool by which the metal is spun out against the mandrel.

Having thus described my improvement in machinery for spinning out metallic hollow ware, I do not claim the process of forming hol-

low ware from disks of metal by the spinning process; but

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. The use in machines for spinning out hollow ware from disks of metal, of a straight cylindrical mandrel revolving on its axis, of sufficient length to sustain the disk from the circumference to the point where the operation of the tool commences, in combination with a tool having a longitudinal motion parallel to the axis or face of the cylinder, and so arranged as to compress the disk between itself and the mandrel, substantially as described.

2. In the combination of the swinging clamp-frame, having its center of motion in the same vertical plane as the extremity of the mandrel, with the adjustable bar or its equivalent, for setting the clamps which hold the disk at any required distance from the extremity of the mandrel, for the purpose of regulating at pleasure the diameter of the bottom of the kettle or other article to be made, and at the same time permitting the side of the kettle or other article to lie close to the mandrel while the tool is passing over it, no matter what degree of dish is given to the disk.

In testimony whereof the said JOHN GREY has hereunto set his hand in presence of us.

JOHN GREY.

Witnesses:

MARTIN G. CUSHING,

THOMAS GREY.