T. AND S. KELLY.

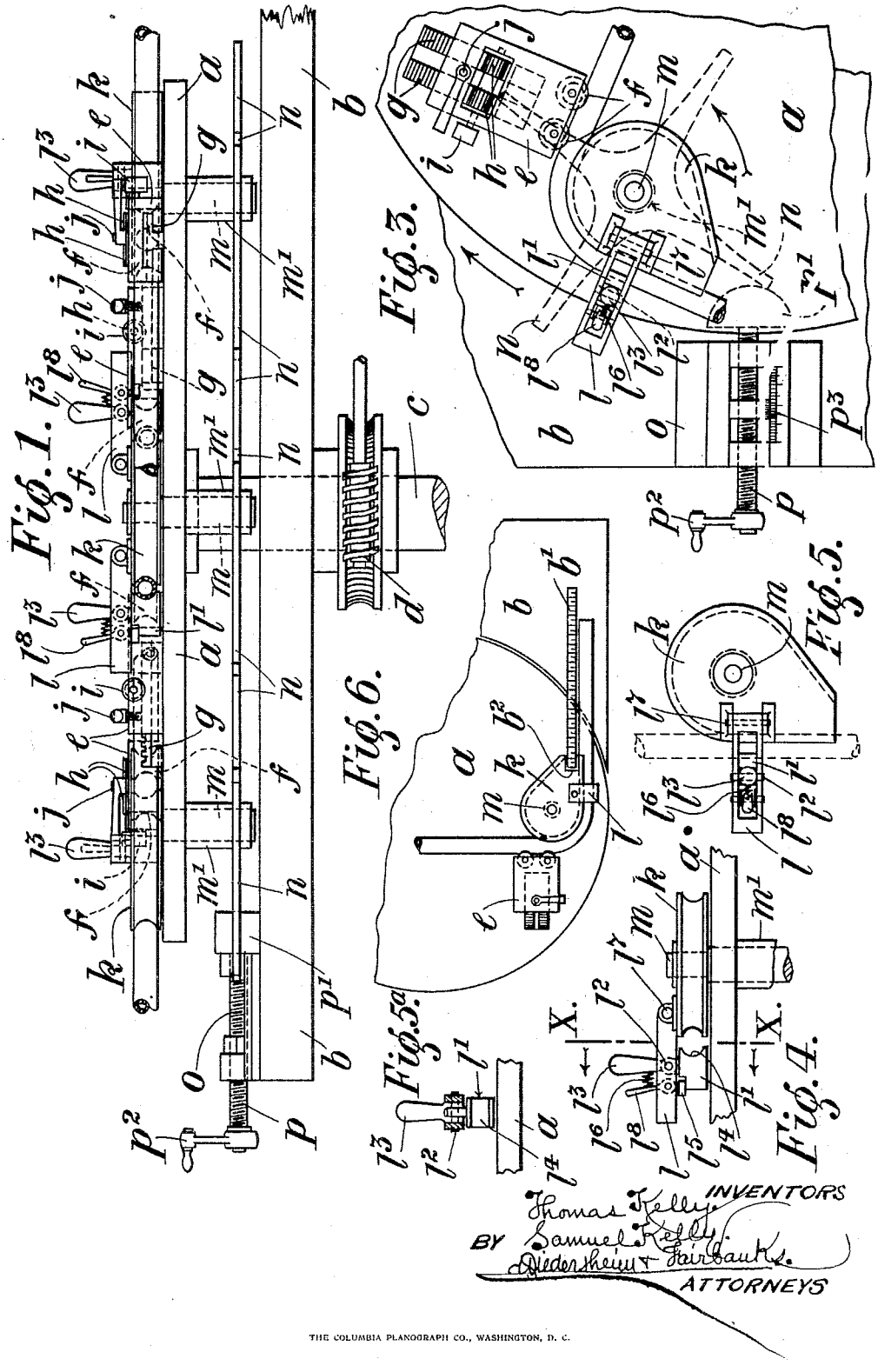
TUBE BENDING APPARATUS.

APPLICATION FILED DEC. 7, 1917.

1,309,250.

Patented July 8, 1919.

2 SHEETS—SHEET 1.




THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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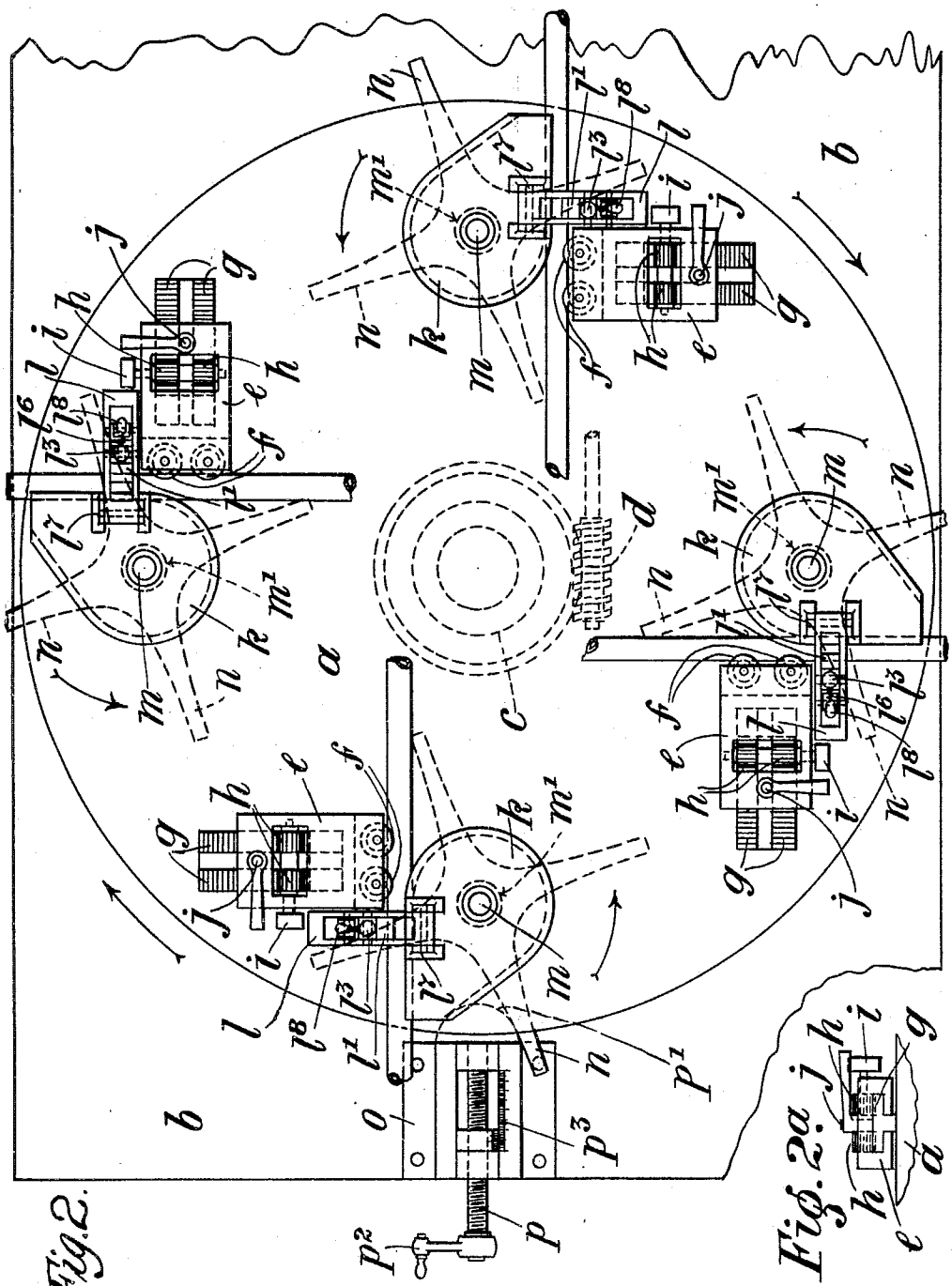


Fig. 2.



Fig. 2a.

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# UNITED STATES PATENT OFFICE.

THOMAS KELLY AND SAMUEL KELLY, OF GLASGOW, SCOTLAND.

## TUBE-BENDING APPARATUS.

1,309,250. Specification of Letters Patent. Patented July 8, 1919.

Application filed December 7, 1917. Serial No. 206,061.

*To all whom it may concern:*

Be it known that we, THOMAS KELLY and SAMUEL KELLY, both subjects of the King of Great Britain, residing at Glasgow, Scotland, have invented certain new and useful Improvements in Tube-Bending Apparatus, of which the following is a specification.

This invention relates to apparatus for bending iron and steel and other tubes and it has for its object to provide improved means for this purpose.

With the present invention, very accurate bends can be obtained, and it has the advantage that it is possible in many cases to produce the bends without first filling the tubes with sand or other material or substance, thereby saving a great deal of time and fuel in the heating operation preparatory to bending, and also dispensing, in such cases, with the subsequent operation of removing the filling material or substance from the tube. A further advantage is that the use of water in the bending operation is dispensed with.

Under this invention the improved tube bending apparatus comprises a table which can be revolved in one direction and a bending device (or devices) fitted on the table which can be operated in a direction opposite to the direction of revolution of the table, whereby accurate bends can be obtained.

The invention also comprises means for operating the bending device, (or devices) preferably in the form of an adjustable stopper device or its equivalent and may have in connection with it measuring means for regulating the size of the bend.

In order that our said invention may be properly understood we have, by way of illustration or example, shown on the annexed drawings two forms of the apparatus.

On the drawings:—

Figure 1 is a side view of the apparatus.

Fig. 2 is a plan view of same.

Fig. 2[a] is an end view of the guide block *e* and its locking pin *j*.

Fig. 3 is a further plan view of part of the apparatus showing the bend completed.

Figs. 4 and 5 are end and plan views respectively, to an enlarged scale of one form of hinged clamp *l*, and Fig. 5[a] is a cross section of the clamp taken on the line X, X, Fig. 4, looking in the direction of the arrow.

Fig. 6 is a plan view of part of a modified form of the apparatus.

Referring to the drawings:—

In carrying out our invention, as illustrated at Figs. 1 to 5[a], the tube bending apparatus consists of a table *a* fitted in conjunction with a suitable framework *b* and supported on a vertical shaft *c* provided with worm gearing *d*, though any other suitable gearing may be used, said gearing being operated from a source of power so as to revolve the shaft *c* and table *a*. The source of power may be an electric motor or any other convenient means.

Fitted on the upper surface of the table *a* are adjustable guide blocks *e* having roller guides preferably consisting of two rollers *f* which operate in each guide block *e*, a rack or its equivalent *g*, *g*, being provided so that the guide block with its rollers can be moved toward or away from the tube being operated on, in accordance with the size of said tube. The framework of the grooved guide block *e* has fitted in it a pinion or its equivalent *h*, *h*, which gears with the rack *g*, *g*, and a hand wheel or the like *i* is also provided by means of which the guide block can be moved in the desired direction. A screwed locking pin *j* having a handle is provided in the guide block *e* so that when the guide block assumes the position required on the rack *g*, *g*, it can be locked in said position by operating the locking pin through its handle so that its lower end presses on the plain central part of the rack.

Provided on the upper surface of the table *a*, so as to work in connection with the grooved guide blocks *e*, are grooved wheels *k*, preferably of a somewhat heart-shape, and having a tube holding device in the form of a hinged clamp or its equivalent *l*, (see Figs. 4, 5 and 5[a]), fitted to the periphery thereof. The clamp *l* has a saddle piece $l^1$ which is pivoted to it at $l^2$, in such manner that by means of a handle $l^3$, it can be radially moved toward, or away from, the wheel *k*. The saddle piece $l^1$ is grooved or recessed at $l^4$ to correspond with the groove in the wheel *k* and the arrangement is such that when the tube is inserted, the saddle piece $l^1$ can be brought to bear on the exterior of the tube so as to hold it firmly in place. To enable the saddle piece $l^1$ to retain the tube firmly in position a locking

lever $l^8$ is provided, said lever having a locking block $l^5$ at its lower end which bears on the saddle piece $l^1$. The locking lever $l^8$ is also pivoted to the clamp $l$ and is normally retained in the "locked" position by means of a spring or its equivalent $l^6$. When it is desired to move the saddle piece $l^1$ into or out of contact with the tube being bent, the handle $l^3$ and lever $l^8$ are grasped by hand so that they are pulled toward each other the locking block $l^5$ being thereby moved clear of the saddle piece $l^3$. When this movement has taken place the saddle piece $l^3$ can be pivotally moved away from the tube; and the clamp $l$, which is hinged to the wheel $k$ at $l^7$, can be turned upward thereby enabling the bent tube to be readily moved away from the bending device.

Each wheel $k$ is connected to a shaft $m$ which extends downward through bearings $m^1$ in the table $a$ and is provided at its lower end with means whereby, when the table $a$ is revolved in one direction, the wheels $k$ are operated in the opposite direction. The means for operating each wheel $k$ preferably consists of a star-shaped wheel or its equivalent $n$ fitted on the shafts $m$ and near to the lower ends thereof, the teeth or points of the wheels $n$ being arranged in conjunction with a stopper device $o$ fitted on the framework $b$ at a suitable distance from the edge of the table $a$. This stopper device $o$ preferably has an adjusting screw $p$ fitted therein, provided with a curved contact piece $p^1$ at one end, and an operating handle $p^2$ at the other end. The stopper device $o$ is preferably marked off in inches and parts thereof, or in any other convenient manner, as indicated at $p^3$, for the purpose of enabling the movement of the adjusting screw $p$ and contact piece $p^1$ to be regulated as required.

When it is desired to make a bend, with this apparatus, the tube is heated to the required temperature and inserted between the guide rollers $f$ and the heart-shaped wheel $k$, one end of the tube being inserted in the clamp $l$ of the tube holding device. The table $a$ is then caused to revolve through the medium of the gearing $d$ and in its revolution the teeth or points of each star-shaped wheel $n$ contact, in turn, with the curved contact piece $p^1$ of the stopper device $o$ in such manner as to cause each wheel $k$, in turn, to partially revolve in a direction opposite to that of the table $a$. In such partial revolution each wheel $k$ carries the tube with it and causes the bend to be produced by the tube contacting with the periphery of the wheel. The size of the bend produced in the tube is regulated by the extent to which the wheel $k$ is operated and in order to produce a greater or smaller movement of said wheel the curved contact piece $p^1$ of the stopper device $o$ can be moved, by means of its screw $p^1$ and operating handle $p^2$, so as to remain a longer or shorter period in contact with the teeth or points of the wheel $n$ which, being fitted on the shaft $m$ carrying the wheel $k$, thereby regulates the amount of movement of the latter.

The apparatus, as illustrated at Figs. 1 to $5^a$, has four bending devices fitted thereto, and may be used for making standard bends, thereby largely increasing the output, as four bends can be made in succession.

The grooved guide blocks $e$, the guide rollers $f$, and the wheels $k$ can be varied in size or changed to allow of tubes of larger or smaller diameter being operated on and they are preferably so fitted in connection with the revolving table $a$ that they can be readily removed when desired.

If desired, the stopper device $o$ for operating the wheel $k$ may be dispensed with and said wheel may be made with a peripheral opening or orifice for the insertion of a rod or its equivalent so that when the table $a$ is being revolved, during the making of a bend, the necessary movement can be given by hand to the wheel $k$ through the medium of the rod or its equivalent.

In Fig. 6 a slightly modified form of apparatus, specially suitable for forming bends in long lengths of tube, is illustrated, in which only one bending device is fitted on the table $a$. In this arrangement the table $a$ may be made flush with the framework $b$ and a measuring device $b^1$ may be provided to facilitate measuring operations. One end of the measuring device $b^1$ is bent for insertion in a hole or opening $b^2$ formed in the wheel $k$ so that the measuring device is placed conveniently for measuring purposes and can be readily removed if desired.

By manipulating the tube in the bending device, bends can be formed with this apparatus at varying angles and at any desired interval.

If desired, the parts of the apparatus, including the revolving table, may be so arranged that they can be operated in a plane other than a horizontal plane.

Having now fully described our invention, what we claim and desire to secure by Letters Patent is:—

1. Tube bending apparatus comprising a table, a framework fitted in conjunction with the table, means for revolubly supporting the table, means for revolving the table, adjustable grooved guide blocks fitted on the table, grooved wheels having tube holding devices fitted in the table, and means for revolving the grooved wheels in a direction opposite to the direction of revolution of the table.

2. Tube bending apparatus comprising a table, a framework fitted in conjunction with the table, means for revolubly supporting the table in the framework, adjustable

grooved guide blocks fitted on the table, irregularly shaped grooved wheels fitted on the table having tube holding devices in connection therewith and means for operating the table and the wheels in opposite directions.

3. Tube bending apparatus comprising a table, a framework fitted in conjunction with the table, means for revolubly supporting the table, means for revolving the table, adjustable grooved guide blocks fitted on the table, roller guides fitted in the guide blocks, rack and pinion mechanism fitted in connection with the guide blocks for adjusting same, grooved wheels having tube holding devices fitted in the table, and means for revolving the grooved wheels in a direction opposite to the direction of revolution of the table.

4. Tube bending apparatus comprising a table, a framework fitted in conjunction with the table, means for revolubly supporting the table, means for revolving the table, adjustable grooved guide blocks fitted on the table, roller guides fitted in the guide blocks, rack and pinion mechanism fitted in connection with the guide blocks for adjusting same, locking means for adjustably securing the guide blocks in position, grooved wheels having tube holding devices fitted in the table, and means for revolving the grooved wheels in a direction opposite to the direction of revolution of the table.

5. Tube bending apparatus comprising a table, a framework fitted in conjunction with the table, means for revolubly supporting the table, means for revolving the table, adjustable grooved guide blocks fitted on the table, grooved wheels fitted on the table, clamp devices fitted to the peripheries of said wheels, vertical shafts supporting the wheels, star shaped operating wheels fitted axially below the grooved wheels, a stopper device on the framework contacting with and operating the star shaped wheels and the grooved wheels in a direction opposite to the direction of revolution of the table.

6. Tube bending apparatus comprising a table, a framework fitted in conjunction with the table, means for revolubly supporting the table, means for revolving the table, adjustable grooved guide blocks fitted on the table, grooved wheels fitted on the table, clamp devices fitted to the peripheries of said wheels, vertical shafts supporting the wheels, star shaped operating wheels fitted axially below the grooved wheels, an adjustable stopper device for varying the size of the bend and operating the star shaped wheels in a direction opposite to the direction of revolution of the table.

7. Tube bending apparatus comprising a table, a framework fitted in conjunction with the table, means for revolubly supporting the table, means for revolving the table, adjustable grooved guide blocks fitted on the table, grooved wheels fitted on the table, clamp devices fitted to the peripheries of said wheels, vertical shafts supporting the wheels, star shaped operating wheels fitted axially below the grooved wheels, and an adjustable stopper device comprising an adjusting screw, a handle and a contact piece for operating the bending means in a direction opposite to the direction of revolution of the table.

8. Tube bending apparatus comprising a table, a framework fitted in conjunction with the table, means for revolubly supporting the table, means for revolving the table, adjustable grooved guide blocks fitted on the table, grooved wheels fitted on the table, clamp devices fitted to the peripheries of said wheels, vertical shafts supporting the wheels, star shaped operating wheels fitted axially below the grooved wheels, an adjustable stopper device comprising an adjusting screw, a handle and a contact piece for operating the bending means in a direction opposite to the direction of revolution of the table, and a measuring device on the stopper device for measuring the movement thereof.

In testimony whereof we affix our signatures in presence of two witnesses.

THOMAS KELLY.
SAMUEL KELLY.

Witnesses:
WILLIAM FLEMING.
KATE WALKER.

**Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."**