Oct. 2, 1951 E. T. TAL 2,569,544

PORTABLE BENDING MACHINE

Filed June 1, 1948 3 Sheets-Sheet 1

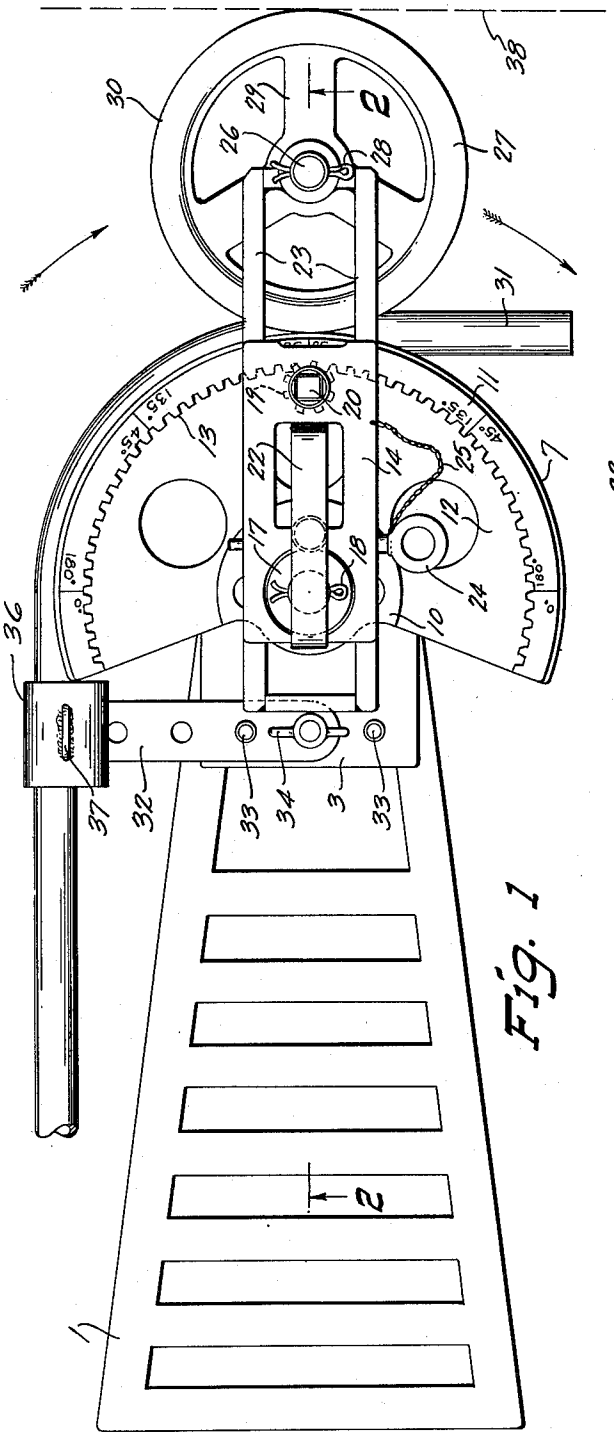

Fig. 1

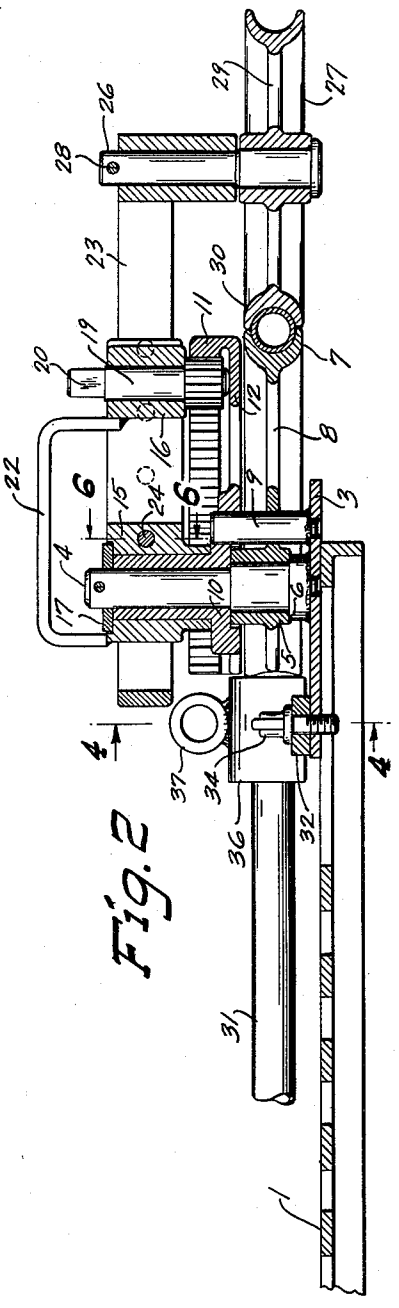

Fig. 2

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PORTABLE BENDING MACHINE

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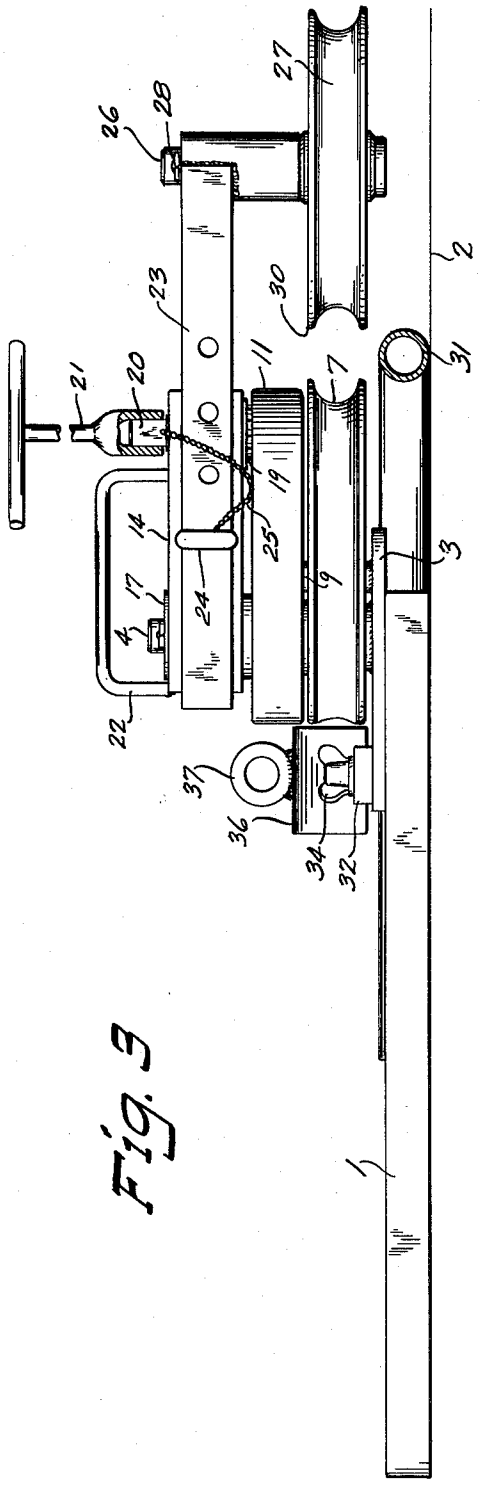

Fig. 3

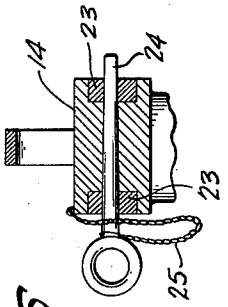

Fig. 6

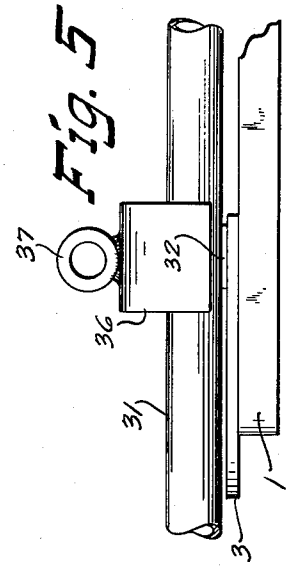

Fig. 5

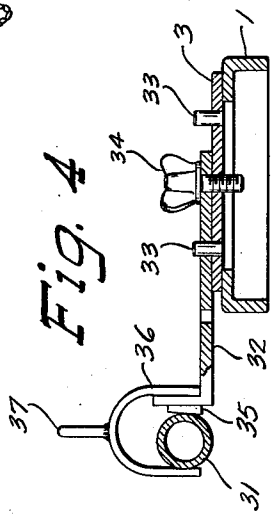

Fig. 4

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PORTABLE BENDING MACHINE

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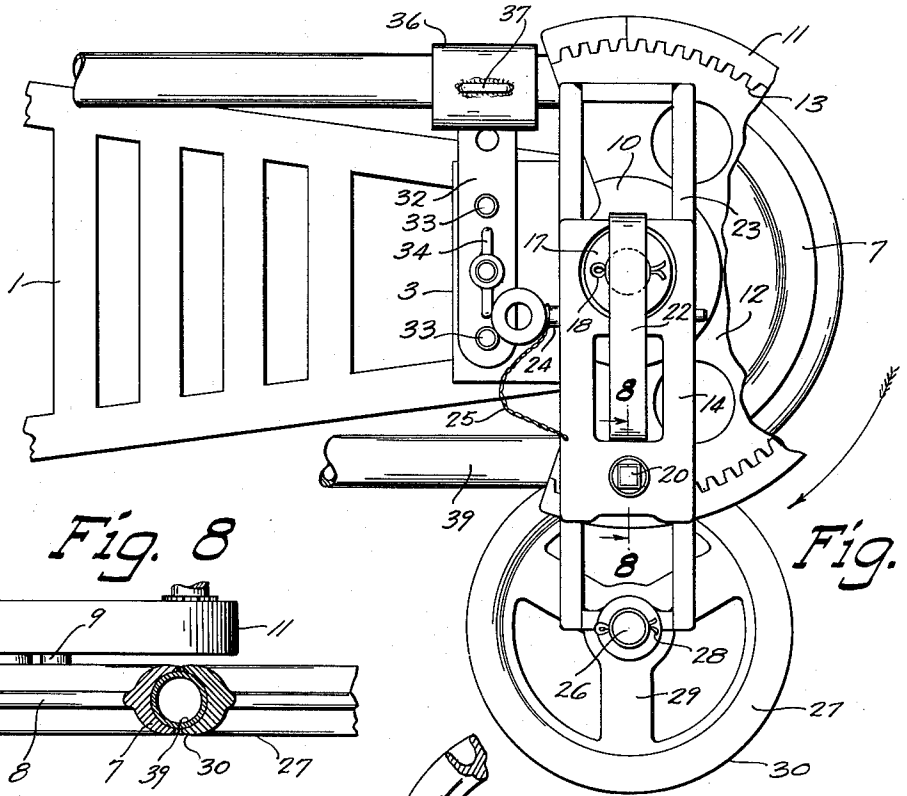

Fig. 8

Fig. 7

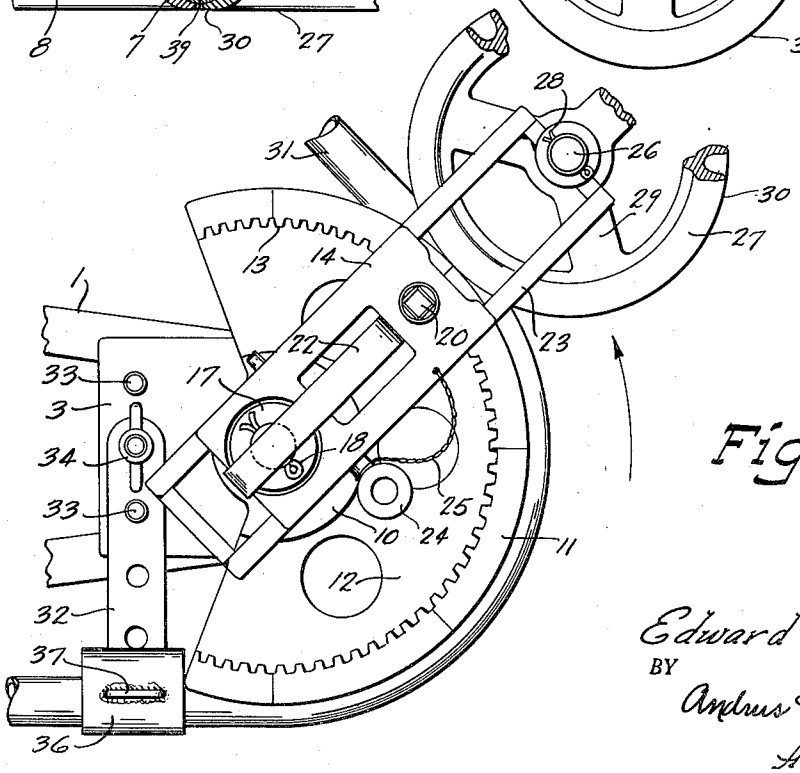

Fig. 9

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2,569,544

UNITED STATES PATENT OFFICE

2,569,544

PORTABLE BENDING MACHINE

Edward T. Tal, Milwaukee, Wis.

Application June 1, 1948, Serial No. 30,251

9 Claims. (Cl. 153—46)

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This invention relates to a portable bending machine and particularly has reference to a bending machine employed in the cold bending by hand to tubes and pipes of generally small diameter such as are employed in radiant heating installations.

One object of the invention is to provide a generally light-weight bending machine readily portable from place to place and which is held in place in service by the weight of the operator.

Another object is to provide a bending machine which can be used in a horizontal or vertical position on a floor or work bench.

Another object of the invention is to provide a bending machine from which the tube or pipe is readily released after bending.

Another object is to provide a bending machine in which the ring gear is protected from injury under rough handling.

Another object is to provide a bending machine which can be employed to bend tubes or pipes on the floor close to a wall of a room.

A further object is to provide a bending machine readily adjustable to bend tubes and pipes of different diameters.

Another object is to provide a bending machine for bending tubes and pipes to different radii of bend.

A further object is to provide a tube bender with a readily adjustable guide or clamp for different diameter of tube and pipe for initially guiding the same to be bent.

Another object is to provide a portable tube bender which can be laid on the floor in service and operated by the operator in a standing position.

Another object is to provide a bending machine which may be employed to bend a tubular member to the right or left.

These and other objects of the invention will appear hereinafter in connection with the following description of the drawing illustrating an embodiment of the invention.

In the drawing:

Figure 1 is a top plan view of the bending machine of the invention close to the wall of a room with a tubular member bent to a 90° angle;

Fig. 2 is a longitudinal sectional view taken on line 2—2 of Figure 1;

Fig. 3 is a side elevational view of the bending machine with the tubing released after bending;

Fig. 4 is a section taken transversely of the bender on line 4—4 of Fig. 2;

Fig. 5 is a detail side elevational view of the

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clamp or guide of the bending machine with a tube clamped in place for bending;

Fig. 6 is a detail sectional view taken on line 6—6 of Fig. 2;

Fig. 7 is a top plan view similar to Figure 1 with a larger diameter tubular member bent to a 180° angle and illustrating a former shoe of lesser diameter than the shoe in Figure 1;

Fig. 8 is a detail view taken on line 8—8 of Fig. 7; and

Fig. 9 is a view with a bending machine as in Figure 1 with the bender adjusted to make a left hand bend of 135°.

In general, the invention is directed to a bending machine which can be laid on a floor or bench and has a base member of a construction to be employed by the operator to hold the machine in place in service. The base supports a former shoe against which is bent a tube or pipe by a pivotal freely rotating roller wheel driven around the former shoe by a block and gear assembly. The entire unit is subject to various adjustments for handling tubes or pipes of different diameter and for bending them to different radii and angles of bend and is compact and portable so that it may be transported from place to place and be utilized on the floor to bend tubing close to the wall of a room.

Referring to the drawings the portable bending machine illustrated has a flat, elongated base 1 which rests on the floor 2 and is of sufficient width, length and strength to support a man standing or kneeling thereon to prevent it from sliding on the floor in service. The forwardly projecting plate 3 is secured across the forward end of base 1 and supports the upstanding stub shaft 4 which is welded to plate 3 and receives the forming assembly to be described.

The semi-circular former shoe is mounted on shaft 4 above base plate 3 and comprises a shank 5 which rests on a shoulder 6 of shaft 4 to space the shoe from the base, and an outer former rim 7 connected to the shank by a relatively thin web 8. The periphery of former rim 7 has a circumferentially extending semi-circular groove. A plurality of circumferentially spaced holes are provided in web 8 to register with the short pin 9 which is located directly forward of stub shaft 4 and is welded to base plate 3. Pin 9 secures the former shoe against rotation in the angular position of the shoe desired depending upon the hole in web 8 with which pin 9 is registered.

The shank 5 of the former shoe projects upwardly from the shoe to receive the hub 10 of the ring gear and axially space the body portions

of the ring gear and former shoe when the ring gear is assembled on stub shaft 4 directly above the former shoe. Hub 10 of the ring gear projects upwardly around shaft 4 from the gear proper to a circumferential line slightly spaced from the upper end of stub shaft 4 and overhangs shank 5 of the former shoe.

Ring gear hub 10 is connected to the peripheral upturned rim 11 of the gear by a generally thin web 12 which is provided with a plurality of holes registering with pin 9 to locate the ring gear in different angular positions corresponding to those of the former shoe. The ring gear also is of a generally semi-circular shape similar to the former shoe.

The inside of the rim 11 has a plurality of teeth 13 to provide the ring gear as a rack, the use of which will be described hereinafter.

A slide block of generally rectangular shape is mounted on stub shaft 4 above the ring gear and comprises a frame 14 within which is welded the rear bushing 15 and the forward bushing 16.

Bushing 15 is pivotally mounted on stub shaft 4 around the ring gear hub 10 and the lower end portion of the bushing projects downwardly from frame 14 to rest on a shoulder of the ring gear and axially space the body portion of the ring gear and slide block apart. The washer 17 is assembled over the upper end of shaft 4 against bushing 15 and cotter key 18 extends through shaft 4 across washer 17 to keep the assembly from axially moving off shaft 4.

Outer bushing 16 of the slide block overhangs the rim 11 of the ring gear and the pinion 19 is disposed therein for rotation. The lower end of pinion 19 rests on web 12 of the ring gear and the exterior of pinion 19 approaching the lower end is provided with pinion teeth which mesh with teeth 13 on the rim 11 of the ring gear to ride around the gear on the inside of rim 11 upon rotation of the pinion. The square head 20 is provided on the upper end of pinion 19 above bushing 16 for engagement by the handle 21 so the operator can rotate the pinion around the gear rack, as for example from a standing position, and effect rotary motion of the slide block. The handle 21 shown as broken in Fig. 3 is of a length so that the operator can rotate the pinion while standing on the elongated portion of base 1.

The handle 22 is welded to bushings 15 and 16 of the slide block to facilitate lifting the tube bender from place to place.

A slide member formed of a rectangular frame having side members 23 is assembled with the slide block and is free to slide transversely thereof inwardly and outwardly of the block to numerous positions, and is of a length to extend outwardly from the block a substantial distance. A horizontal hole is provided in bushing 15 and a plurality of spaced registering holes are provided in the side members 23 of the frame to receive the tapered pin 24 and lock the frame in a number of fixed positions relative to the slide block. Chain 25 secures the head of pin 24 to the slide block to prevent the pin from being lost.

A depending sleeve or bushing is secured within the outer overhanging end of the sliding frame to receive the shaft 26 of the roller wheel 27, and the unit is prevented from dropping from the sleeve by the cotter pin 28 which extends transversely through the upper end of shaft 26. The wheel freely rotates on shaft 26.

The shank of roller wheel 27 is connected by a plurality of spokes 29 to the rim 30 of the wheel which has a semi-circular groove in the periphery formed complementary to the groove in rim 7 of the former shoe so that the tube 31 which is bent by the bending machine can be received between the respective rims of the shoe and roller wheel.

Tube 31 after bending is released from the circular groove between rim 7 of the former shoe and rim 30 of the roller wheel by removal of tapered pin 24 from the registering holes in the slide block and sliding the frame outwardly from the block to separate the respective rims of the former shoe and roller wheel. When freed from the rims the tubing drops to the floor or bench and the bender can be lifted and moved to another spot for further bending operations.

A guide attachment is also provided with the bender to insure that the tube 31 will properly enter the circular groove between the former shoe and roller wheel and be prevented from slipping therebetween. The guide mechanism has a cross-plate 32 which extends transversely across base plate 3 to the rear of stub shaft 4. Plate 32 has a plurality of spaced holes which register with the spaced dowels 33 extending upwardly from base plate 3 and a hole in plate 3 between the dowels into which is threaded the thumb screw 34. The cross-plate 32 may be moved to several transverse positions for bending tubes or pipes to different radii. The dowels 33 keep the plate 32 from pivoting and the thumb screw holds it down against plate 3.

The outer end of cross-plate 32 has an abutment 35 which is engaged by the tube 31 to be bent. The U-clamp 36 which has a handle 37 is located across the abutment 35 and tube so that one leg of the clamp engages the tube and the other leg overlaps the abutment 35 to clamp the tube to the abutment to guide the tube 31 for entrance into the circular groove between the rims of the former shoe and roller wheel and prevent the tube from slipping during the bending operation. U-clamp 36 is quickly lifted from engagement with the abutment and tube to release the tube after the bending operation is completed. Cross-plate 32 may also be reversed in position by the operator for use in making right or left hand bends with the machine. The U-clamp 36 is changed in bending different diameter of tubes or pipe as will be described.

As an example of the operation of the bender, the device is first laid on the floor and the roller wheel 27 is rotated relative to the former shoe to the starting position for beginning the operation which is designated 0° in Figure 1. Tube 31 is then placed in the circular groove formed between rim 7 of the former shoe and the rim 30 of the roller wheel and the roller wheel is clamped securely against the former shoe by inserting tapered pin 24 in registering holes in the slide block and the slide frame.

Thereafter the tube 31 is held against abutment 35 and U-clamp 36 is clamped by the operator over the abutment and tube to grip the tube therebetween and index it relative to the circular groove between the former shoe and roller wheel. The clamp also binds the tube to the former shoe and prevents the tube from slipping during the bending operation.

The operator then engages head 20 of pinion 19 with a wrench or crank or the long handle 21, and pinion 19 is rotated on gear teeth 13 to rotate roller wheel 27 around the grooved rim 7 of the former shoe through the slide block and the frame from which the roller wheel 27 is suspended.

The tubing may be bent to any angle on the

former shoe shown up to 200°. In the drawings angles of 45°, 90°, 135° and 180° are designated on the machine in both directions in Figure 1 for purposes of illustration. The rotation of the roller wheel is stopped at the desired angle of bend. When the tubing is bent to the desired angle tapered pin **24** is withdrawn and the frame is moved outwardly of the slide block to separate the rim **30** of the roller wheel from the rim **7** of the former shoe and drop tubing **31** to the floor or bench as in Fig. 3.

The ready removal of the tubing from the bender is an important feature of the invention and particularly finds use in radiant heating installations where the tubing is laid flat on the foundation or base of the floor and bent in a series of continuous shapes of S form. The tubing is quickly released and drops a mere matter of inches to the base from the bender so there is no danger of injury.

The bender of the invention is readily adaptable in bending pipe and tubing of different diameter and to different radii of bends.

The roller wheel **27** need only be changed for different diameters or size of pipe and tubing and the former shoe is changed to bend pipes and tubes of different size and also to bend pipes and tubes to different radii of bends. Thus, for example, by replacing roller wheel **27** and the former shoe with other roller wheels and shoes with grooves of different extent, pipes or tubes of one-quarter, three-eighths, one-half, five-eighths, three-quarters, seven-eighths and one inch in diameter may each be bent to a radii of say two, three, four and one-half, six, and seven and one-half inches or even a larger radii.

By replacing only the former shoe with shoes of different diameter and using the same roller wheel, pipes, or tubes say of one-half inch diameter can be bent to two, three, four and a half, six or seven and one-half inches in radii. This is made possible by sliding the frame outwardly of the slide block to position roller wheel **27** farther from stub shaft **4** and accommodate a former shoe of greater diameter therebetween. The U-clamp **36** is also changed to properly clamp pipes or tubes of different diameters.

A different former shoe is readily replaced simply by removing cotter key **18** and washer **17** from the stub shaft **4** lifting off the slide block and the frame carrying the roller wheel **27** and slipping the ring gear, and shoe to be replaced off the shaft. The new former shoe is then mounted on the shaft **4**, the ring gear is slipped in place followed by the slide block and the frame and the washer **17** is placed over the shaft and cotter key **18** is then inserted through the upper end of the shaft **4** to secure the assembly in place.

When the former **7** is of smaller diameter than the gear **11**, the wheel **27**, because of its large diameter, will lie partly under the ring gear in certain positions of the frame with respect to the slide block and will carry the ring gear with it when the frame and slide block are lifted from shaft **4**.

The roller wheel **27** is simply replaced by removal of cotter pin **28** and mounting the shaft **26** of a new wheel in the sleeve on the end of frame **23** and inserting pin **28** in place. When the former shoe is changed to one of greater or lesser diameter the guide attachment must be adjusted to properly guide or index the tubing to be bent into the circular groove between the former shoe and roller wheel **27**. In making this adjustment cap screw **34** is unthreaded to release

cross-plate **32** from base plate **3** and the plate **32** is lifted from dowell **33** upon which it is assembled as in Figure 1 and shifted inwardly for example and mounted over dowels **33** as in Fig. 6. The thumb screw **34** is threaded home to hold plate **32** in place against plate **3**, the dowell or dowels keeping the plate **32** from pivoting.

Figure 1 illustrates a right hand bend of a tube to 90° and the bend has been made close to the wall indicated by the broken line **38**.

In Fig. 7 the tube **39** is shown as of greater diameter than the tube **31** in Figure 1 and a bend of lesser radii has been accomplished with the tube bent to 180°. The former shoe is of lesser diameter and Fig. 8 illustrates the larger grooves in the shoe and roller wheel to receive the greater diameter tube **39**.

In Fig. 9 the bender of Figure 1 has been adjusted to make a left hand bend of the tube **31** to a 135° angle.

The bender has a number of advantages over previouls pipe or tube benders. It is of generally light weight and readily portable from place to place and can be used either on a floor or bench. In use on the floor a long handle is supplied to rotate the roller wheel. Very little effort or power is required to rotate the pinion around the ring gear so that hard or soft metal tubes or pipe of copper or steel may readily be bent. The teeth of the ring gear are fully protected against injury for hard use in service by locating them inside the rim of the gear ring.

By substituting a roller wheel of large diameter for the small roller usually employed a smoother bend is naturally obtained in pipes or tubes which are bent in the machine due to the lesser pressure per square inch. The large diameter wheel makes it possible to obtain adjustments for bending tubes or pipes to different radii without disturbing the power applied through the pinion and ring gear. The large wheel also aids in disassembling the bending machine to replace the former shoe when desired.

The bender can be used close to the wall for a right or left hand bend and a tube is readily dropped from the member by separating the roller wheel from the former shoe as described.

The readly adjustment of the roller wheel outwardly and easy removal of the wheel and former shoe for substitution of other shoes and wheels of different size makes the bender available for bending numerous sizes of pipes and tubes and to be used in different places requiring different radii and angle of bend.

The U-shape guide clamp is also a simple inexpensive device for guiding the tube and pipe between the shoe and roller to be bent and it is readily removed, replaced by hand and adjusted in service. The clamp prevents the tube from slipping.

Various embodiments of the invention may be employed within the scope of the accompanying claims.

I claim:

1. A portable bending machine for bending a pipe or tube member in a substantially horizontal plane which comprises an elongated plate-like base adapted to rest upon the floor and to be maintained in place during bending operations by an operator standing thereon, an upstanding shaft secured to said base adjacent one end thereof, a former shoe mounted on said shaft above the base and having a circumferentially extending rim with a groove therein of semi-circular cross-section, a generally large size free-

ly rotating roller wheel having a circumferentially extending rim radially aligned with the rim of said shoe and a groove in said rim of semi-circular cross-section complementary to the groove in said shoe to provide a circular groove between the roller wheel and shoe to receive the member to be bent, means to support said wheel from said shaft for rotation around the former shoe, and means mounted on said first mentioned means, geared to said shoe, and extending substantially vertically upwardly therefrom for access to the operator for rotating the wheel around the shoe on said shaft to bend the member to the angle desired.

2. A portable bending machine for bending a pipe or tube member which comprises a base, an upstanding shaft secured to said base, a former shoe mounted on said shaft above the base and having a circumferentially extending rim with a groove in the outer periphery thereof of semi-circular cross-section, a generally large size freely rotating roller wheel having a circumferentially extending rim radially aligned with the rim of said shoe and a groove in said rim of semi-circular cross-section complementary to the groove in said shoe to provide a circular groove between the roller wheel and shoe to receive the member to be bent, means to support said wheel from said shaft for rotation around the former shoe, a stationary ring gear mounted on the shaft above said former shoe with gear teeth provided circumferentially around the inside of the rim thereof, and a pinion projecting from said means in engagement with said gear teeth with a head on the upper end for engagement by a vertically extending tool for rotating the pinion and the supporting means for said wheel to rotate the wheel around said shoe and bend the member to the angle desired.

3. A portable bending machine for bending a pipe or tube member which comprises a base, an upstanding shaft secured to said base, a former shoe mounted on said shaft above the base and having a circumferentially extending rim with a groove in the outer periphery thereof of semi-circular cross-section, said former shoe being interchangeable with a former shoe of different diameter to obtain different radii of bends in members, a ring gear mounted on the shaft above said former shoe with gear teeth provided circumferentially around the inside of the rim thereof, a generally large diameter rotating roller wheel having a circumferentially extending rim radially aligned with the rim of said shoe and a groove in said rim of semi-circular cross-section complementary to the groove in said shoe to provide a circular groove between the roller wheel and shoe to receive the member to be bent, a frame member pivoted on said shaft and supporting said wheel for rotation around the former shoe, and a pinion projecting from said frame member in engagement with said gear teeth with a head on the upper end for engagement by a tool for rotating the pinion and frame member to rotate the wheel around said shoe and bend the member to the angle desired, said frame member being adapted to shift inwardly and outwardly of the shaft to dispose said wheel for the various size shoes employed under the ring gear or outwardly thereof to obtain different radii of bends in members to be bent and the large diameter of the wheel effecting use with said different diameters of shoes without disturbing the gear ratio of said machine.

4. A portable bending machine for bending a pipe or tube member to different angles and radii of bend which comprises a base, an upstanding shaft secured to said base, a former shoe mounted on said shaft above the base and having a circumferentially extending rim with a groove therein of semi-circular cross-section, a generally large size freely rotating roller wheel having a circumferentially extending rim radially aligned with the rim on said shoe and a groove in said rim of semi-circular cross-section complementary to the groove in said shoe to provide a circular groove between the roller wheel and shoe to receive the member to be bent, a slide block pivotally mounted on said shaft above the former shoe, a frame member comprising spaced side members mounted in the sides of said block and projecting outwardly thereof to receive the shaft of said wheel at the outer end of said side members, said members being adapted to shift inwardly and outwardly of the block to space the wheel from the shoe and release the member bent between the same and accommodate operation of the wheel with former shoes of different diameter for obtaining different radii of bends, and means to rotate the block, frame and wheel around the shoe on said shaft to bend the member to the angle desired.

5. In a bending machine for bending a pipe or tube member, a base, an upstanding shaft secured to said member, a former shoe mounted on said shaft above the base and comprising a shank assembled on the shaft and a circumferentially extending rim having a semi-circular groove therein and connected to the shank by a thin web having a plurality of circumferentially spaced holes, a gear ring mounted on said shaft with a shank and outer rim connected by a thin web having a plurality of circumferentially spaced holes therein corresponding to the holes in the web of the former shoe, and a short pin secured to the base of the machine and registering with the holes in said shoe and ring gear to hold the same against rotation in a number of different angular positions.

6. A bending machine for bending a generally small diameter tubular member comprising a base, an upstanding shaft mounted thereon, a peripherally grooved former shoe mounted on said shaft, a complementary formed roller wheel supported for pivotal movement around said former shoe, a stationary ring gear mounted on the shaft above said former shoe and having a rim with gear teeth provided circumferentially on the inside thereof, a frame member mounted above the former shoe on the shaft and supporting the roller wheel therefrom, and a pinion mounted in said frame member and engaging the teeth of the ring gear to be rotated therearound when engaged by a vertically extending tool to pivot the frame and roller wheel around said shoe.

7. In a bending machine for bending a generally small diameter tubular member and having a rotatable peripheral grooved roller wheel pivoted around a complementary formed former shoe mounted upon a shaft, a base for supporting said shaft, a ring gear mounted on the shaft above the former shoe and having a gear rack around the inside of the circumferentially extending upstanding rim thereof, a slide block having an inner bushing mounted on the shaft above the ring gear and side members connecting said inner bushing to an outer bushing supporting a depending pinion therefrom in engagement with the gear rack to drive the block around on said shaft, and a sliding frame supported by the slide

block to slide inwardly and outwardly of said block and pivoting therewith and having the shaft of the freely rotating roller wheel mounted therefrom at the outer end, and a pin registering in holes in the frame and slide block to hold the frame and the roller wheel suspended therefrom in different radial positions as respects the former shoe mounted on the shaft.

8. In a bending machine for bending a generally small diameter tubular member and having a rotatable peripheral grooved roller wheel pivoted around a complementary formed former shoe mounted upon a shaft, a base for supporting said shaft, a ring gear mounted on the shaft above the former shoe and having a gear rack around the inside of the circumferentially extending upstanding rim thereof, a slide block having an inner bushing mounted on the shaft above the ring gear and connected by side members to an outer bushing supporting a depending pinion therefrom in engagement with the gear rack to drive the block around on said shaft, and a handle welded to the inner and outer bushings of the slide block to facilitate lifting the machine from place to place.

9. A portable bending machine for bending a pipe or tube member in a substantially horizontal plane to different angles and radii of bend which comprises an elongated plate-like base adapted to rest upon the floor and to be maintained in place during bending operations by an operator standing thereon, an upstanding shaft secured to said base adjacent one end thereof, a former shoe mounted on said shaft above the base and having a circumferentially extending rim with a groove therein of semi-circular cross-section, a ring gear fixed to said shoe, a generally large size freely rotating roller wheel having a circumferentially extending rim radially aligned with the rim on said shoe and a groove in said rim of semi-circular cross-section complementary to the groove in said shoe to provide a circular groove between the roller wheel and shoe to receive the member to be bent, an extensible frame member pivotally mounted on said shaft to support said roller wheel and to shift the latter inwardly and outwardly of said shaft to space the wheel from the shoe to release the member bent between the same and to accommodate operation of the wheel with former shoes of different diameter for obtaining different radii of bends, a stub shaft extending vertically through said frame member between the axis of said wheel and said shaft, and a pinion fixed on said shaft and geared to said ring gear to rotate the frame and wheel around the shoe by rotation of said shaft in order to bend the member to the angle desired, the upper end of said shaft being adapted for connection to operating means extending substantially vertically upwardly therefrom for access to the operator.

EDWARD T. TAL.

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