

Aug. 16, 1938.

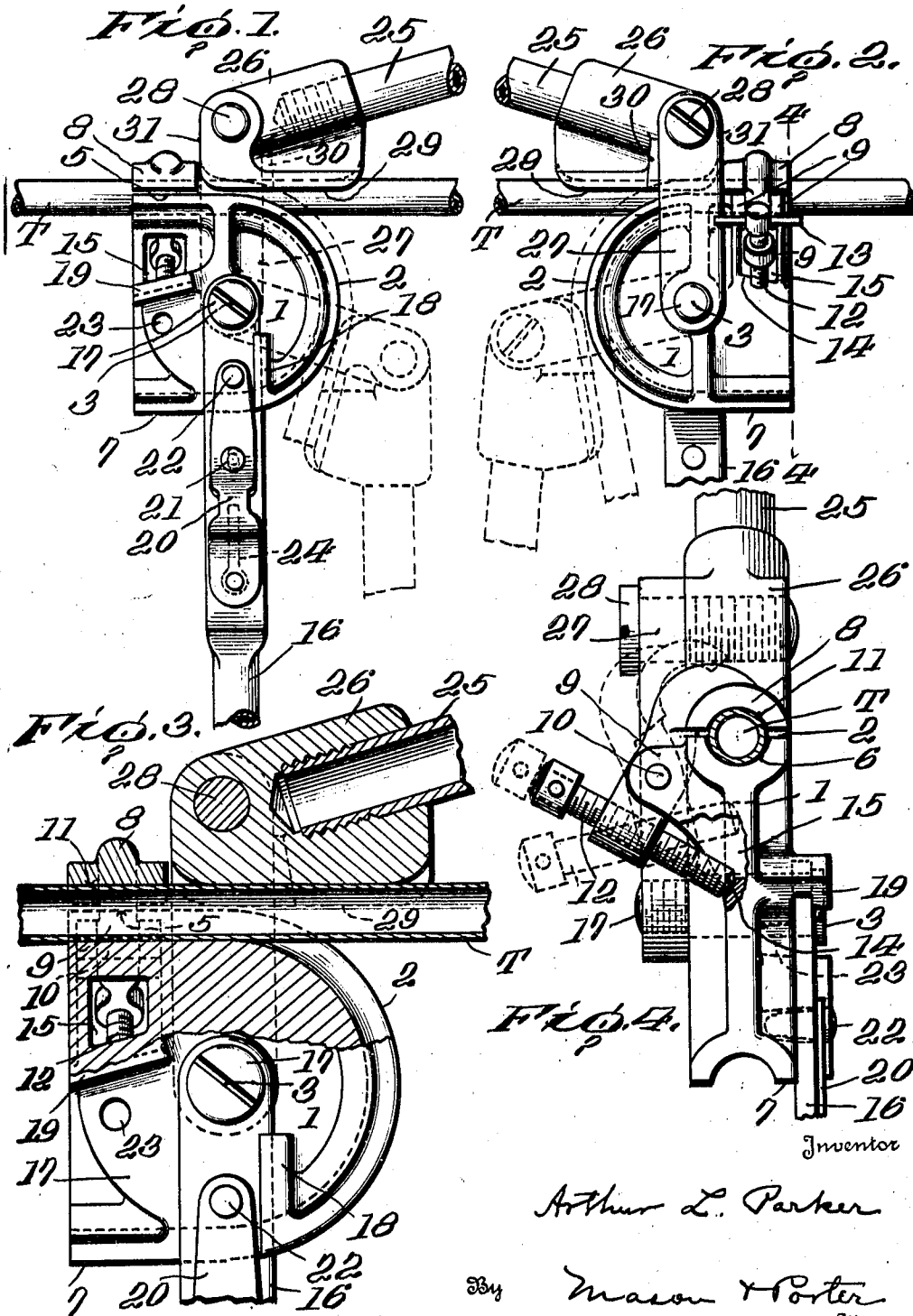
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TUBE BENDER

Filed Sept. 13, 1935

2 Sheets-Sheet 1



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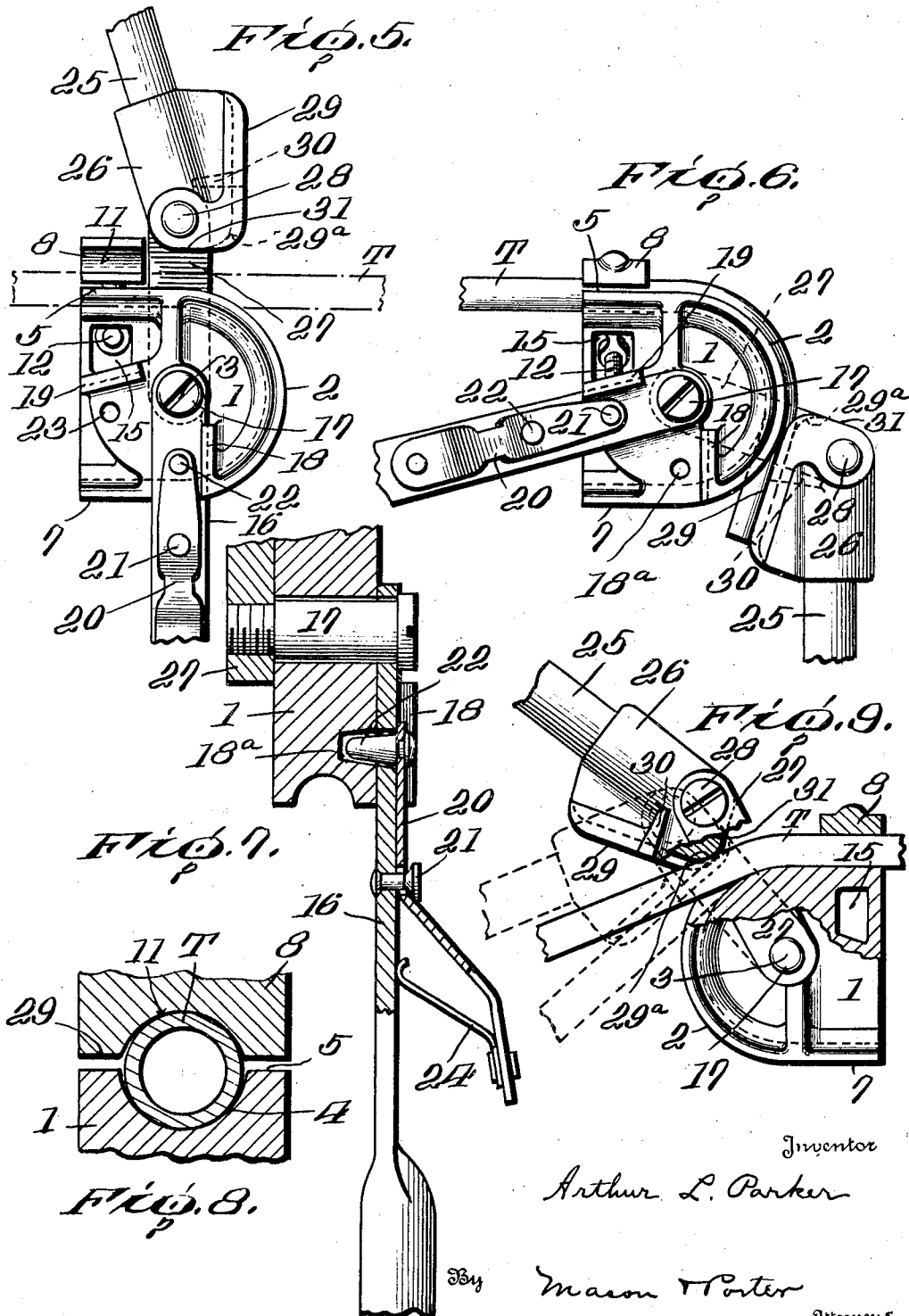
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2,127,185

TUBE BENDER

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Application September 13, 1935, Serial No. 40,508

11 Claims. (Cl. 153—46)

The invention relates to new and useful improvements in a tube bender, and more particularly to a hand-operated tube bender having a radius block curved to conform to the curvature to which the tube is to be bent.

An object of the invention is to provide a tube bender wherein the bending arm is provided with a rigid head contacting with the tube and the mounting for said bending arm is so constructed that the head thereof is free from contact with the radius block during the bending operation.

A further object of the invention is to provide a tube bender of the above type wherein the supporting arm for the radius block is so attached to said block that it may be shifted to different set positions relative thereto.

A still further object of the invention is to provide a tube bender of the above type with a clamping vise for holding the tube in a set position during bending, which clamping vise may be quickly released from the tube and the clamping member thereof positioned so as to permit the tube to be moved laterally into the vise.

A still further object of the invention is to provide a tube bender of the above type wherein the bending arm and the rigid head carried thereby may be turned to a position so as to permit the tube to be inserted between the radius block and the bending head by the lateral movement of the tube.

These and other objects will in part be obvious and will in part be hereinafter more fully disclosed.

In the drawings—

Figure 1 is a front view of a bending device embodying the improvements, showing in full lines a tube in place for bending and in broken lines the bending arm moved for curving the tube;

Fig. 2 is a rear view of the bending device showing the tube in position in full lines for bending and in dotted lines the bending arm and head moved for curving the tube to conform to the radius block;

Fig. 3 is a view partly in side elevation and partly in section on an enlarged scale, and showing the tube positioned and clamped ready for bending;

Fig. 4 is a view on the line 4—4 of Fig. 2, showing in full lines the vise in position for clamping the tube and in broken lines in position for releasing the tube;

Fig. 5 is a view partly in plan and partly in section showing the clamping vise in open position and the bending head turned so that the

tube to be bent may be inserted in the tube bender by the lateral movement thereof;

Fig. 6 is a view showing the tube as bent through an arc of 90 degrees and the lever handle supporting the vise shifted to a different set position so that the bending operation may be continued;

Fig. 7 is a detail in section showing the locking device for holding the lever arm in different set positions on the radius block;

Fig. 8 is a transverse sectional view through a portion of the radius block and bending head, and

Fig. 9 is a view partly in section showing the bending head positioned for compounding the pressure exerted upon the tube for bending the same.

The invention has to do with a tube bender which is particularly adapted for hand operation and which may be used for bending tubes. The tube bender includes a radius block 1 which is provided with a face 2 curved about the center 3 of the radius block. This is the bending face around which the tube is curved, and it is shaped to conform to the desired curvature which is to be given the tube. As illustrated in the drawings, this curved face extends through an arc of approximately 180 degrees. The curved face is provided with a recess 4 which extends peripherally thereof and is located midway between the side face of the radius block. This recess is preferably curved to conform to the cross-sectional curvature of the tube and serves as a seat for the tube and prevents lateral movement of the tube in the radius block.

The radius block is extended to the left of the center as viewed in Fig. 1, and the upper face 5 of this extension is tangential to the curved face 2 of the radius block. This upper face 5 is also provided with a recess 6 (see Fig. 4) which is shaped to conform to the recess 4. This portion of the radius block constitutes one member of a clamping vise which holds the tube that is to be bent in a set position on the radius block. The lower face 7 of the extension of the radius block is likewise recessed so as to form a seat for the tube and permit the tube to be bent so that the curved portion thereof extends through an arc of 180 degrees, and the tube ends connected thereto are parallel.

Pivotaly mounted on the extension of the radius block is a clamping member 8. The radius block has spaced lugs 9, 9 formed integral therewith, and the clamping member 8 is mounted on a pivot pin 10 extending through said lugs. The

face of the clamping member 8 is provided with a recess 11. This clamping member serves, together with the extension of the radius block, as a vise for clamping the tube. In the drawings, the tube which is to be bent is indicated at T, and it will be noted that in Fig. 4 of the drawings, this tube is firmly clamped in the vise. The clamping member 8 extends beyond the pivot pin 10 and is threaded to receive a clamping bolt 12. The clamping bolt 12 is provided with a cross arm 13 which may be utilized for turning the clamping bolt. When the clamping member is moved to a closed position, as shown in full lines in Fig. 4, the clamping bolt is then turned until it is brought into contact with the shoulder 14. This serves as an abutment so that the turning of the bolt will cause the tube to be firmly clamped in the vise. The radius block is cut away at 15 just above the shoulder, and when it is desired to release the vise, the clamping bolt is turned so as to withdraw the bolt from contact with the shoulder. It is only necessary to retract the bolt a slight distance from the shoulder in order to permit the end of the bolt to move into the cutaway 15 and the clamping member to swing to open position. This makes a clamping member which is quickly releasable for releasing the tube so that it can be removed from the bender. When the clamping member 8 of the vise is moved to the open position, as shown in Fig. 4, the tube can be moved laterally on to the seat in the radius block and does not have to be threaded endwise into the bender.

Attached to the radius block is a lever arm 16. Centrally of the radius block is a pivot stud 17 and this lever arm is mounted on this pivot stud for free swinging movement about the axis thereof. Said radius block is provided with a stop shoulder 18 which limits the movement of the lever arm 16 in a counter-clockwise direction about the pivot stud. It is also provided with a stop shoulder 19 which limits the movement of the lever arm in a clockwise direction about said pivot stud. Mounted on the lever arm 16 is a latch or holding device 20 for holding said lever arm in a set position, either in contact with the stop shoulder 18 or stop shoulder 19. This latch or holding device is in the form of a lever mounted on a pin 21. Said lever at the inner end thereof is provided with a locking pin 22 which passes through an opening in the lever arm 16 and is adapted to enter a hole 18a associated with the stop shoulder 18 or a hole associated with the stop shoulder 19. This last-named hole is indicated at 23 in the drawings. A spring 24 serves to urge the holding pin toward the radius block and will cause it to enter the hole when it is moved to a position in register therewith. This latch or holding device may be readily pressed upon at its outer end for withdrawing the pin. When the pin is seated in one of the holes with the lever arm against its stop shoulder, then said lever arm is in a fixed position relative to the radius block and serves as a supporting means for the radius block.

Associated with the radius block is a bending arm 25. Said arm is fixed to a bending head 26. Attached to the pivot stud 17 is a link 27. This link is free to swing with the pivot stud and extends beyond the periphery of the radius block. The bending head 26 is mounted on a pivot stud 28 attached to the outer end of the link 27. This bending head 26 is provided with a straight line face 29 which is provided with a recess extending lengthwise thereof. Said recess is curved

to conform to the recess 4 and serves as a seat for engagement with the tube T which is to be bent. The bending head is provided with a stop shoulder 30 (see Figures 8 and 9). This stop shoulder limits the turning movement of the bending head on the pivot stud 28. Said stop shoulder is so positioned that when the head is swung to a point where said stop shoulder engages the side face of the link 27, then the straight face 29 of the bending head is parallel to a line tangential of the curved face 2 at a point in the axial line of the link 27, that is, a line passing centrally through the stud 17 and the stud 28. If there is no tube in the bender and the arm 25 is turned in a counter-clockwise direction on the pivot stud 28, as viewed in Fig. 2, this stop shoulder will limit the movement to the position shown in said figure, and as the link 27 turns about the stud 17, the bending head will always maintain the same tangential position relative to the curved face 2 of the radius block. There is sufficient clearance between the face 29 of the bending head and the radius block 2 so that said bending head does not contact with the radius block during the bending operation. The bending head 26 is shaped so that the face 31 thereof is substantially at right angles to the face 29, and this face 31 is so disposed relative to the center of the stud 28 that when the arm 25 is swung to the position shown in Fig. 5, there is sufficient clearance between this face 31 and the radius block so that the tube may be inserted directly over the radius block and underneath the bending head. Between the face 31 and the face 29 is a curved heel 29a providing sufficient clearance so that when the link 27 is at right angles to the tube, the head may be swung into the position shown in Figures 1 and 2. When the bender is used on soft metal tubes, such as copper, sufficient pressure can be easily obtained when the parts are in the position shown in Fig. 1, by a pull upon the bending arm so as to bend the tube to conform to the radius block. The bending head will slide increment by increment along the tube as it takes its curved form, and of course, will slide freely along the tube when it is curved to conform to the radius block. In bending steel tubes, it is desirable to compound the pressure force obtained by a manipulation of the bending arm and this is accomplished in the following manner. The bending arm is positioned as shown in Fig. 9 relative to the link 27 and the link is turned so that it lies at an acute angle to the straight axis of the tube which is to be curved. The center of the curved portion 29a will contact with the tube, and this line of contact between the tube and the bending head is at one side of a line passing centrally through the pivot stud 28 and the pivot stud 17. When the arm 25 is pulled upon so that the head swings about the pivot stud 28 to the position shown in broken lines in Fig. 9, there is a cam action and a compounding of the forces bearing on the tube. In other words, the center of the pivot stud 28 when moved to the dotted line position in Fig. 9, will cause the curved portion of the bending head to bear against the tube so as to force it into the dotted line position. The arm 25 can be again turned to the same angular position relative to the straight part of the tube and moved so that the curved part 29a of the bending head will contact with the tube at a new point further along the straight part of the tube and this portion forced into contact with the radius block by a movement of the arm to the dotted line position. Thus it is that the

bending head can be moved and stepped along the tube so as to compound the force applied against the tube for the bending of the same. This enables very hard tubes to be readily bent to conform to the radius block.

The bending head slides along the tube increment by increment and curves the same to conform to the radius of the block. When the bending arm has moved along the radius block through an arc of 90 degrees or thereabouts, then the arm 25 is substantially parallel to and close to the lever arm 16. The lever arm 16 is then shifted to a new set position on the radius block. The operator pressing on the holding device 20, releases the pin 22 from the radius block and shifts the lever arm 16 to the position shown in Fig. 6. The holding device is then released and this will lock the arm 16 in this set position. The operator then continues to move the bending arm 25 in a clockwise direction and this will complete the bending of the tube throughout an arc of 180 degrees. To release the tube, the bending arm is turned so as to bring the face 31 of the bending head into a position parallel to a tangent to the curved face of the radius block. The vise is opened and the tube may be lifted by the lateral movement from the bender. This shifting of the lever arm 16 enables the two arms which are to be moved toward each other for the bending of the tube to have a working movement substantially within an arc of 90 degrees. Inasmuch as this bender can be placed on the tube by a lateral movement relative thereto, the bender may be used for the shaping of protruding ends of tubes without disturbing the tube already installed. It will be noted that the tube bender while strong and rugged is of few parts and the metal content is reduced to a minimum so that the bender can be handled in tight corners and under difficult installation conditions.

It is obvious that many changes may be made in the details of construction and the arrangement of the parts without departing from the spirit of the invention as set forth in the appended claims.

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

1. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a lever handle fixed to said block, a vise associated with the radius block for clamping the tube in a set position tangentially to said radius block, a link pivotally attached to the radius block at its center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same and a stop shoulder carried by the head and disposed so as to contact with the side face of said link for limiting the turning movement of the arm on said link when the face of the head reaches a position substantially at right angles to the axial line of said link.

2. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a lever handle fixed to said block, a vise associated with the radius block for clamping the tube in a set position tangentially to said radius block, a link pivotally attached to the radius block at its center of curvature and projecting

radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, and a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same and means whereby said lever handle may be shifted from one fixed position on said radius block to another fixed position.

3. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a lever handle fixed to said block, a vise associated with the radius block for clamping the tube in a set position tangentially to said radius block, a link pivotally attached to the radius block at its center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same, said radius block having an abutment shoulder, said vise including a clamping member, and a clamping screw carried thereby and adapted to engage the abutment shoulder on the radius block, said radius block being cut away adjacent said shoulder so as to permit the clamping member to be quickly swung to wide open position when the clamping screw is released from contact with the shoulder.

4. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a lever handle fixed to said block, a vise associated with the radius block for clamping the tube in a set position tangentially to said radius block, a link pivotally attached to the radius block at its center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same, and a stop for limiting the movement of said arm relative to said link so that said head is maintained free from contact with the radius block.

5. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a lever handle fixed to said block, a vise associated with the radius block for clamping the tube in a set position tangentially to said radius block, a link pivotally attached to the radius block at its center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same, a stop for limiting the movement of said arm relative to said link so that said head is maintained free from contact with the radius block, and means whereby said lever handle may be shifted from one fixed position on said radius block to another fixed position thereon.

6. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a lever handle fixed to said block, a vise associated with the radius block for clamping the tube in a set position tangentially to said radius block, a link pivotally attached to the radius block at its center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm

and having a straight line face adapted to engage the tube for bending the same, said straight line face on said head at the inner end thereof merging into the curved face disposed so as to contact with a straight portion of the tube at one side of the center line of the link for compounding the bending force applied to the tube when pressure is applied to the bending arm.

7. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a lever handle fixed to said block, a vise associated with the radius block for clamping the tube in a set position tangentially to said radius block, a link pivotally attached to the radius block at its center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same, said straight line face on said head at the inner end thereof merging into the curved face disposed so as to contact with a straight portion of the tube at one side of the center line of the link for compounding the bending force applied to the tube when pressure is applied to the bending arm, and a stop for limiting the movement of said bending arm relative to said link so that said head is maintained free from contact with the radius block at all times.

8. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a hand lever fixed to said block and shiftable to different set positions thereon, a vise associated with the radius block for clamping a tube in set position thereon, said vise having a clamping member, and means operating to hold said clamping member in contact with the tube, a link pivotally attached to the radius block at the center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same, said peripheral face of the radius block and said straight line face of the bending head being recessed to conform to the tube operated upon.

9. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a hand lever fixed to said block and shiftable to different set positions thereon, a vise associated with the radius block for clamping a tube in set position thereon, said vise having a clamping member and means operating to hold said clamping member in contact with the tube, a link pivotally attached to the radius block at the center of curvature and projecting radially beyond the periphery of said block, a bending

arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same, said peripheral face of the radius block and said straight line face of the bending head being recessed to conform to the tube operated upon, and a stop for limiting the movement of the bending arm relative to said link so that the bending head is maintained free from contact with the radius block at all times.

10. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a hand lever fixed to said block and shiftable to different set positions thereon, a vise associated with the radius block for clamping a tube in set position thereon, said vise having a clamping member and means operating to hold said clamping member in contact with the tube, a link pivotally attached to the radius block at the center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same, said peripheral face of the radius block and said straight line face of the bending head being recessed to conform to the tube operated upon, said bending head at the inner end thereof having a curved face disposed so as to contact with the straight portion of the tube at one side of the link whereby the force exerted upon the tube may be compounded.

11. A tube bender comprising a radius block having the peripheral face thereof curved to conform to the curvature to which the tube is to be bent, a hand lever fixed to said block and shiftable to different set positions thereon, a vise associated with the radius block for clamping a tube in set position thereon, said vise having a clamping member and means operating to hold said clamping member in contact with the tube, a link pivotally attached to the radius block at the center of curvature and projecting radially beyond the periphery of said block, a bending arm pivotally connected to said link at the outer end thereof, a head rigid with said arm and having a straight line face adapted to engage the tube for bending the same, said peripheral face of the radius block and said straight line face of the bending head being recessed to conform to the tube operated upon, said bending head at the inner end thereof having a curved face disposed so as to contact with the straight portion of the tube at one side of the link whereby the force exerted upon the tube may be compounded, and a stop for limiting the movement of the bending arm relative to the link whereby said bending head is maintained at all times free from contact with the radius block.

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