July 17, 1956 N. V. KUEHLMAN ET AL 2,754,880

COMBINATION PIPE BENDING APPARATUS AND AUXILIARY PIVOTED TUBE BENDER

Filed Oct. 19, 1954 2 Sheets-Sheet 1

Fig. 1

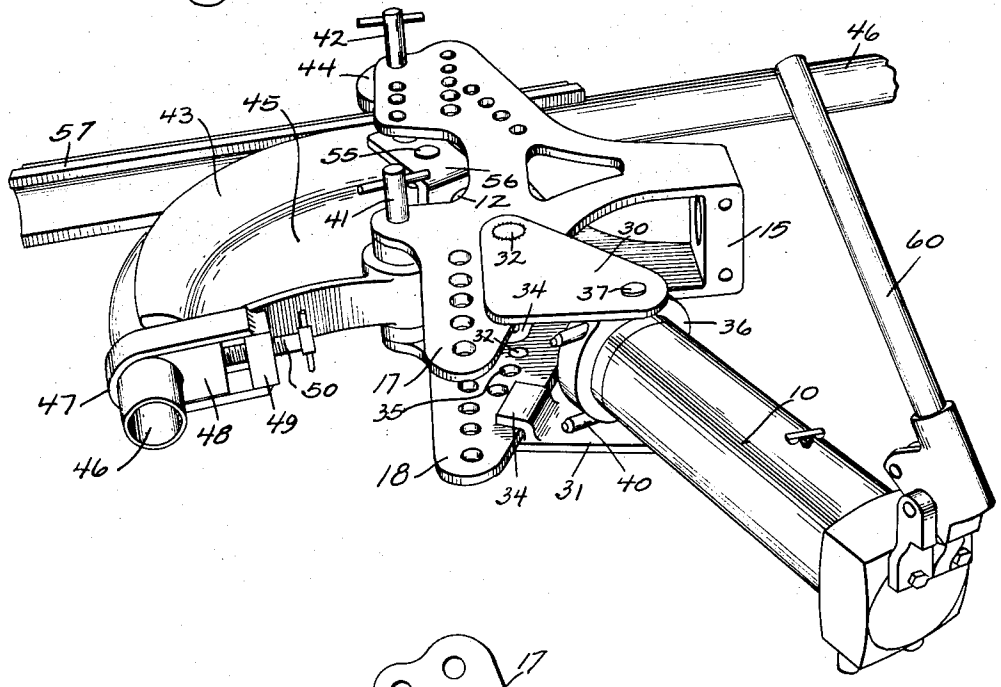
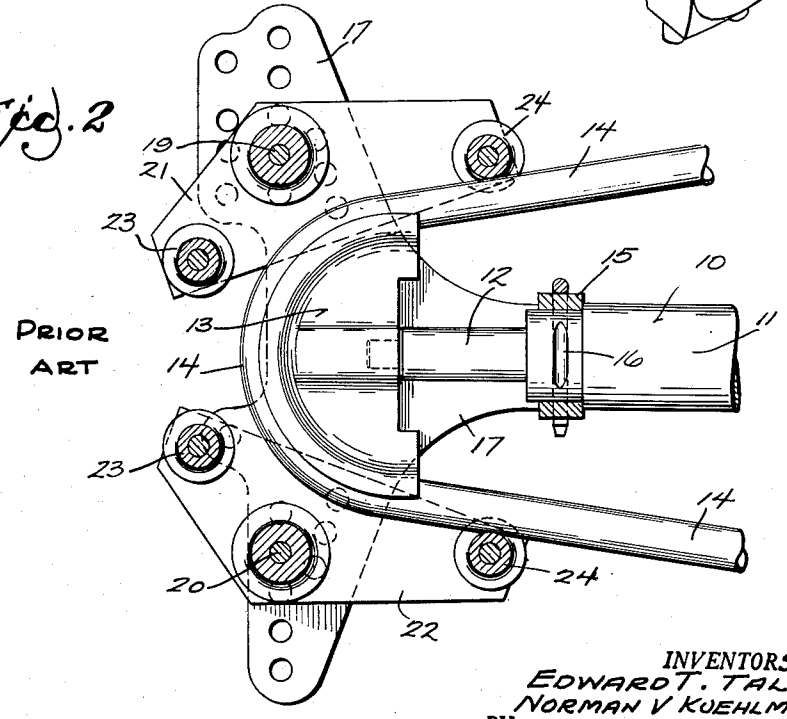


Fig. 2

PRIOR ART



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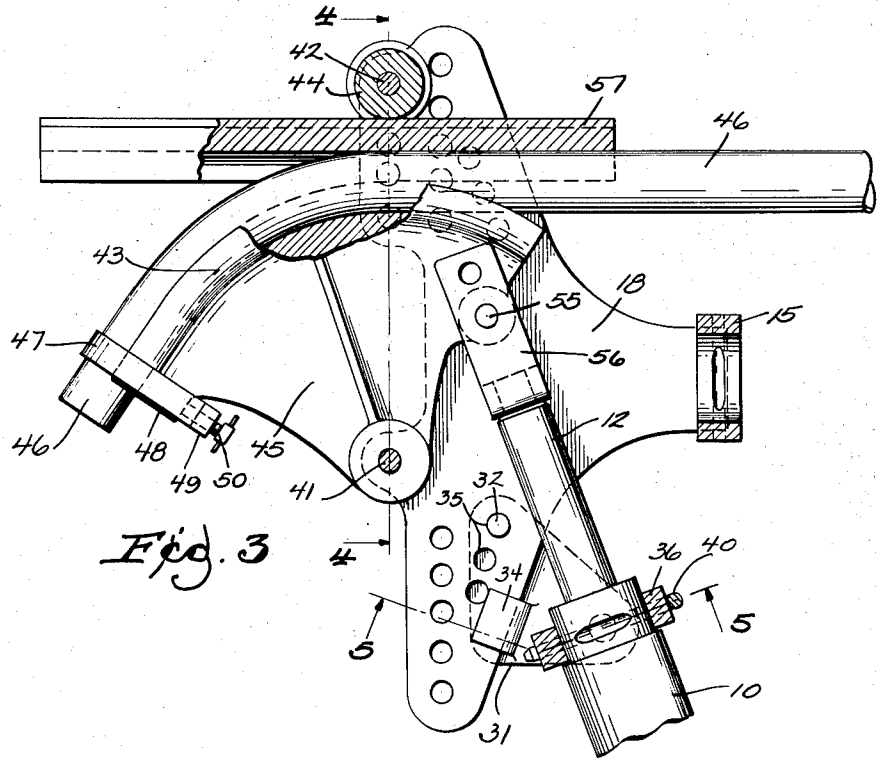


Fig. 3

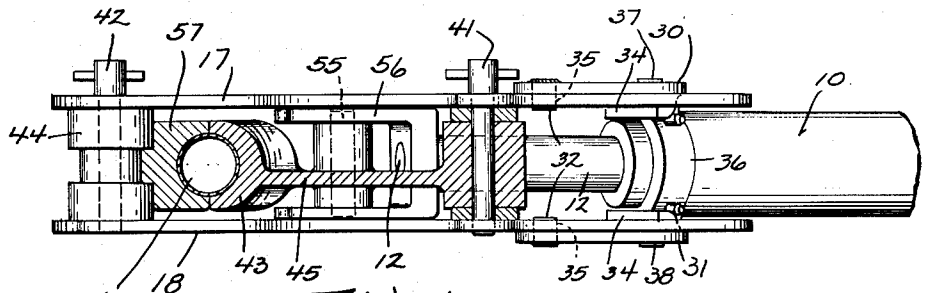


Fig. 4

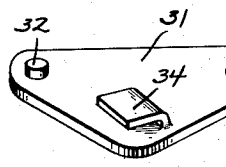


Fig. 6

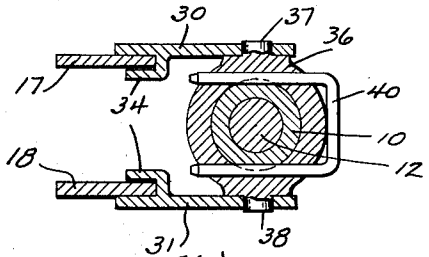


Fig. 5

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COMBINATION PIPE BENDING APPARATUS AND AUXILIARY PIVOTED TUBE BENDER

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6 Claims. (Cl. 153—40)

The invention relates to a combination pipe bending apparatus and tube bender.

While the features of construction inherent in the carrying out of this invention may be applicable to many forms of pipe or tube benders, the general nature of the invention is the provision of readily interchangeable or accessory units for the frame of a bender so that a single power unit such as a hydraulic ram assembly may be usable in conjunction with a single relatively heavy frame to accomplish either a heavy pipe or bar bending operation or a tube bending operation, thus reducing the necessary equipment to be carried by the workman to meet the differing problems of bending which may be presented from time to time in his work.

More particularly stated the invention includes the provision of attachments or accessories for the frame of a bender such as that shown in U. S. Letters Patent to Mueller, No. 2,497,622, issued February 14, 1950, whereby the heavy tube bender with the same hydraulic power unit used for heavy pipe bending may be adapted to the special requirements in the bending of tubing.

In the drawings:

Fig. 1 is a perspective of a bender equipped with the accessories to carry out a tube bending operation, a tube being shown in a bent position in the apparatus.

Fig. 2 denominated "Prior Art" is a plan view of a Mueller type heavy pipe bender showing a bent pipe in position; a part of the hydraulic unit being broken away.

Fig. 3 is a plan view partially in horizontal section and showing the relationship of the tube bending parts, a tube being in bent position between the former and former bar.

Fig. 4 is a section on line 4—4 of Fig. 3.

Fig. 5 is a section on line 5—5 of Fig. 3.

Fig. 6 is a perspective of one of the hydraulic accessory mounting plates.

In the prior art as shown in Fig. 2 it has heretofore been known that a heavy pipe bender may include a hydraulic power unit **10** having a cylinder **11** and a hydraulic ram **12** which may be hydraulically thrust to the left as shown in this figure. Upon the extended end of the ram **12** may be mounted a former **13** which is peripherally grooved along its arcuate edge to bear against a heavy walled pipe **14**. The hydraulic power unit is mounted to a heavy collar **15** into which the reduced diameter of the end of the cylinder is peripherally grooved at **16** so that a U-shaped member made of round, wire-like stock and receivable through cross bores in the collar **15** may lock the cylinder to the collar as will be readily apparent from an examination of some of the other views in the drawings. The collar is a part of or is securely attached as by welding to spaced frame plates such as the plate **17** shown in Fig. 2, and the spaced plates have between them the former **13** mounted on the end of ram **12**.

Also mounted between the frame plates and mounted respectively upon mounting pins **19** and **20** are bell crank members **21** and **22** provided with spools **23** and **24** for each bell crank. As the pipe **14** is thrust between the spools by movement of the former **13**, the pipe is bent.

It is into this environment as shown generally in Fig. 2 that the apparatus of the instant invention is fitted and applied so that the apparatus of the prior art may be made adaptable for the bending of tubing as well as the heavy walled pipe which it has handled in the past.

The apparatus of the instant invention

Generally speaking, the spaced frame plates **17** and **18** and the heavy collar **15** comprising the larger elements of the prior art pipe bender provide the fundamental mounting frame upon which the apparatus of the instant invention is applied so that the hydraulic power unit **10** may be assembled to the frame in a new location where it can apply the force of its ram to effectively bend tubing. As shown in Fig. 1, the power unit **10** is displaced from the collar **15** and is mounted to the frame between accessory plates or separate ears **30** and **31**. These accessory plates as shown most clearly in Figs. 5 and 6 are generally triangular in shape and have a short stud **32** extending from one corner. A bore at **33** in another corner and a stout offset bracket **34** complete the most important specifications of these plates. Stud **32** is receivable through a hole **35** in one of the frame plates whereupon the accessory plate may be swung about the stud as a pivot sufficiently so that the marginal portion of frame plate **17** or **18** may be received between the accessory plate and the bracket. The throat between the offset bracket and the accessory plate is sufficiently deep and sufficiently closely fitted so that when plate **17** or **18** is received in the throat, the stud is locked in bore **35** and the accessory plate becomes a rigid ear outstanding from the frame plate with which it is assembled.

Whereas in the prior art assembly the hydraulic power unit **10** was received in heavy collar **15**, it is now receivable between the accessory plates **30** and **31** and an accessory collar **36** is used for this purpose. The shape of this accessory collar is best seen in Figs. 1 and 5. It provides trunnions at **37** and **38** receivable respectively in holes **33** of accessory plates **30** and **31** and when so received between these accessory plates before the margins of plates **17** and **18** have been received in the brackets **34** it is possible to swing the brackets into position embracing the edges of the plates **17** and **18** and thus complete an assembly which holds the accessory collar **36** snugly in position as shown in the drawings.

It will now be clear that the reduced diameter of the end of the cylinder **11** is receivable in the accessory collar **36** just as it was receivable in the heavy collar **15** in the prior art device and a U-shaped member **40** locks the cylinder into the accessory collar in a manner similar to that described above with respect to the prior art apparatus.

It is obvious from the drawings that whereas the power unit was received rigidly into the collar **15** and mounted rigidly with respect to plates **17** and **18** of the frame of the prior art apparatus, the new mounting of the hydraulic power unit with respect to the frame plates is a swinging mounting for reasons which will be described below.

In place of the bell crank members **21** and **22**, special bores are provided in the plates **17** and **18** to removably receive former pin **41** and former bar roller pin **42**. These pins provide mounting means upon which are receivable, between plates **17** and **18**, a tubing former **43** and a former bar roller **44**. The tubing former **43** is shaped as a sector having a web **45**, the periphery of which provides a pulley-like groove into which tubing **46** may be disposed for a tube bending operation. To hold the tube into the groove of the former **43**, a U-shaped screw clamp **47** is shaped to embrace the

tube. It also embraces block 48 forming part of the web 45 of former 43; and a bored and threaded clamp block 49 welded in position between the arms of the U-shaped clamp 47 receives a threaded screw 50 which may be used to bear against block 48 and pull the tube into the groove of the former as will be clearly seen in Figs. 1 and 3.

The ram 12 of the power unit has connections shaped to embrace and engage the web 45 of the former 43 as shown in Fig. 3. For this purpose a ram pin 55 extends through a ram adapter 56 on the end of the ram 12 and extends through the web 45 to provide the pivotable connection between the ram and the former 43 which is needed during the adjustment which must take place when the ram is thrust outwardly of the cylinder and the former 43 is oscillated about its pin 41.

To hold the tubing 46 into the groove of the former 43 a grooved bar former 57 is slidably receivable between the tubing and roller 44 so that in the progressive arcuate movement of the former 43 which draws the tubing 46 through the throat between the former 43 and the roller 44 the tubing may not escape from the former 43 and the shape of the groove in the bar former 57 permits of controlled bending in the manner well known in this art.

As is also well known in this art, the hydraulic unit 10 is operated by a pump of which the handle 60 is motivating part and there is a relief valve member (not shown) which may be used to relieve the hydraulic pressure when a tube bending operation is complete, thus removing the extreme pressures and enabling the operator to remove pin 42 or pin 41, or both so as to take the bent tube from the apparatus upon completion of the bending operation.

Operation

Assuming a workman is equipped with the prior art heavy walled pipe bender shown in Fig. 2 and assuming that he is equipped with the devices described above with reference to the instant invention, such a user of this equipment would pull the pins 19 and 20 so as to remove bell cranks 21 and 22 and their respective spools from their positions between the frame plates 17 and 18. Then upon removal of the U-shaped member 40, the hydraulic power unit theretofore positioned in the heavy block 15 is bodily dis-assemblable from the block 15 in readiness for re-assembly in accord with this invention.

Accessory plates or separate ears 30 and 31 are then placed in partially assembled relation upon the accessory collar 36 with the trunnions 37 and 38 inserted through holes 33 as shown in Fig. 5. While so loosely assembled upon the trunnions the two plates 30 and 31 are swingable into position so that the studs 32 are received through the bores 35 in plates 17—18. Accessory plates 30 and 31 are then swingably positionable into operative assembly with the frame plates 17 and 18 with the margins of plates 17 and 18 received between the accessory plates and their respective brackets 34. The U-shaped member 40 extended through the holes in the accessory collar therefor will extend through the groove 16 to lock the power unit into the collar 36. Former 43 is then positionable between plates 17 and 18 so that former pin 41 may be inserted as shown in the drawings to provide a pivot pin about which the former may oscillate. Former bar roller 44 is then insertable between 17 and 18 so that former bar roller pin 42 may be extended into and between the plates to provide a mounting for the roller.

With these parts in position, tube 46 may be inserted in the groove of the former 43 and the U-shaped clamp 47 may be used to secure one end of the sector to the tube as shown most clearly in Figure 1, it being understood, of course, that Fig. 1 shows a fairly advanced stage in the bending operation, whereas with the commencement of the operation, the former 43 is so positioned as to present the clamp 47 close to the roller 44.

Former bar 57 is then inserted between the roller 44 and the former 43 with the groove of the former bar partially embracing the tube.

As soon as the pin 55 has been inserted to connect the ram 12 and ram adapter 56 to the former 43, the apparatus is ready for a tube bending operation. The relief valve is, of course, closed and the handle 60 of the power unit 10 is operated to hydraulically thrust the ram 12 outwardly of the cylinder 11. The force of the ram exerted upon the former 43 eccentrically of the pin 41 causes the former 43 to swing to the left as seen in Figs. 1 and 3. As the oscillation progresses, the former bar confined between the tube and the roller 44 progresses to the left and maintains the confined relation of the tube between the sector of the former 43 and the groove of the former bar. The clamp 47 forces the tube to conform to the groove of the former 43 and the operation progresses until a bend of sufficient extent has been accomplished.

When the bending operation has been completed, the relief valve is opened to reduce the outward pressure upon the ram 12 and the clamp 47 may then be released by retraction of the manually operable screw 50.

The removal of pin 42 and the roller 44 permits the former bar 57 to drop away from the bent tube and the apparatus is wide open for release of the bent tube.

During all the period of hydraulic stress the trunnions have no tendency to move out of their position of engagement with the accessory plates 30—31 and the brackets 34 snugly engaged with the plates 17 and 18 hold the studs 32 in engagement in their operating locations.

It will be clear from the above description that the dis-assembly of the accessory parts from the frame plates 17—18 is easily accomplished. The pulling of the pins 41 and 42 and the swingable retraction of the brackets 34 from their engagement with the plates 17—18 permits of ready dis-assembly and the power unit 10 may be removed from accessory collar 36 upon withdrawal of the U-shaped member 40.

One of the features of importance in this invention which will now be obvious to those who are accustomed to the use of pipe and tube benders is the fact that the accessory plates for the mounting of the power unit are removable from the heavy frame plates so as not to interfere in the compound bending of pipe when the power unit is assembled in its position in the heavy collar 15.

I claim:

1. In a device of the character described having spaced frame plates having a primary mounting and a power unit attachable thereto, a pair of accessory plates each attachable to a frame plate in position to provide an outwardly extending secondary mounting for the power unit to be received between said accessory plates, a tube former and mounting pin therefor demountably pivotally positioned between the frame plates for oscillation in a tube bending operation, and a connection for the power unit and former for former motivation.

2. The device of claim 1 wherein each accessory plate is provided with a stud receivable in adjustable relation to the frame plate and a bracket shaped to receive a margin of the frame plate in the adjustment of the plate about the stud whereby to rigidly position the accessory plate in outstanding relation to the frame plate.

3. The device of claim 1 wherein the accessory plate is provided with a stud receivable in adjustable relation to the frame plate and a bracket shaped to swingably receive a margin of the frame plate in the adjustment of the plate about the stud with reference to the frame, and said accessory plate is provided with means for releasable pivotal attachment of the power unit thereto.

4. In a device of the character described having spaced

frame plates and a heavy collar with a power unit releasably secured therein, a pair of accessory plates having means for respectively releasably pivotally attaching the accessory plates to the frame plates at points spaced from the heavy collar, brackets forming part of said accessory plates and shaped to hold the accessory plates in outstanding relation with respect to the frame plates, an accessory collar for releasable pivotal mounting of the power unit releasably engageable with the accessory plates, and a light tubing former sector attachable between the frame plates to the power unit.

5. In a pipe bender having apertured plates secured together in spaced relation to provide a frame, a former and pipe bending apparatus mounted for oscillation between said plates, a power unit having means for connection to said former and means for pivotal mounting of the power unit positioned outwardly of said frame, separate ears for attachment to each plate and provided with mounting means for connection to a pivotal mounting of said power unit, each of said ears having a stud

outstanding therefrom for projection through an aperture in one of said frames and an outstanding bracket for each of said ears positioned to engage a margin of a frame plate upon oscillation of the ear about said stud.

6. The pipe bender of claim 5 wherein the pivotal mounting of the power unit and the point of connection of the power unit with the former is eccentric to the studs whereby upon operation of the power unit to rotate the ears in a direction to firmly clamp the edges of the plates in said brackets.

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