March 24, 1964 C. T. STREIT 3,126,045

INDEXING MECHANISM FOR RECIPROCATING DEVICES

Filed May 31, 1960 2 Sheets-Sheet 1

Fig. 1.

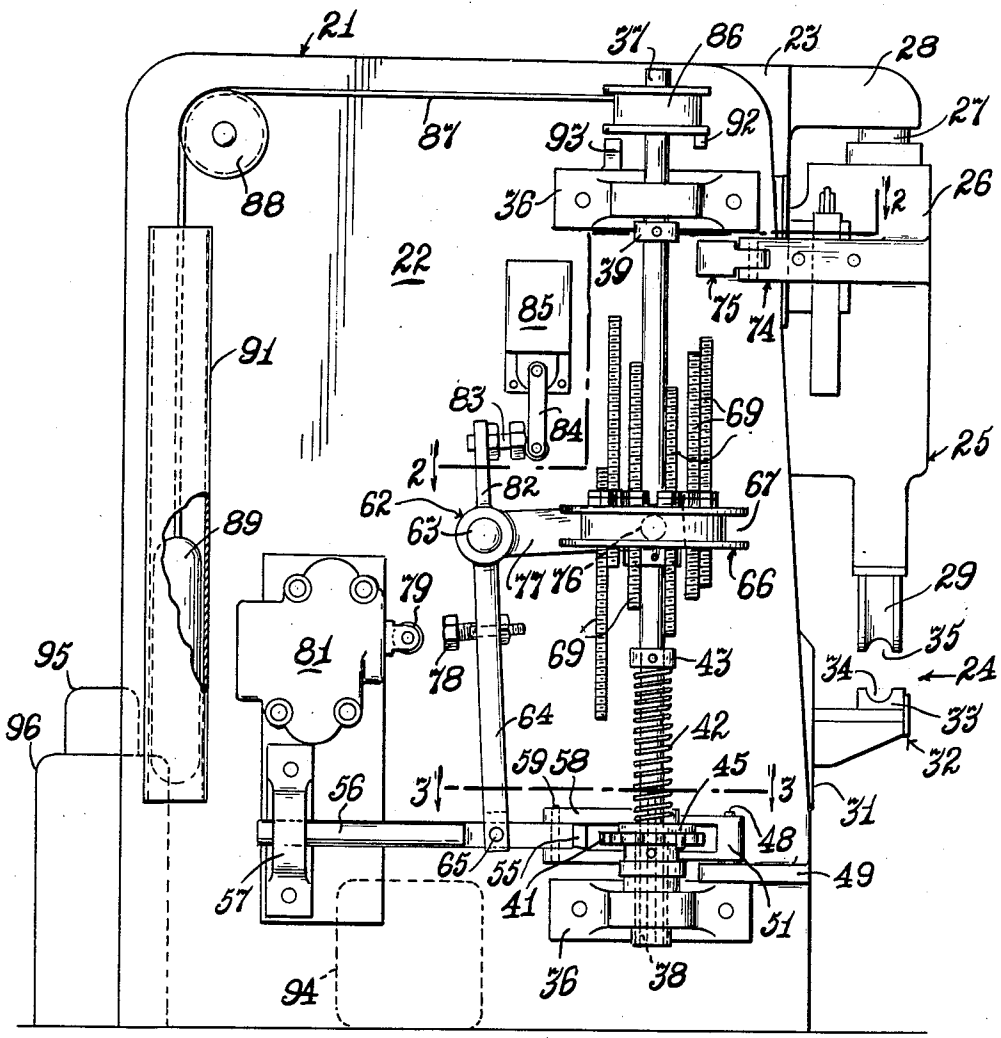


Fig. 5.

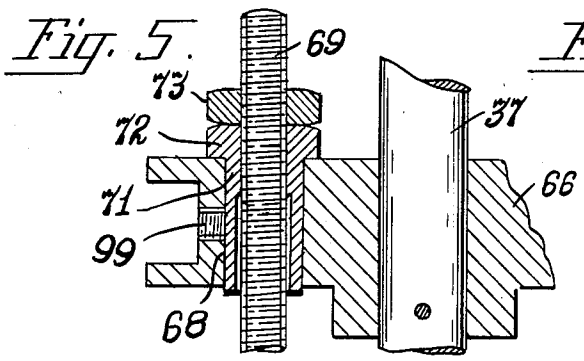
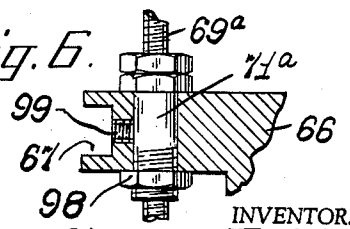


Fig. 6.



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INDEXING MECHANISM FOR RECIPROCATING DEVICES

Filed May 31, 1960

2 Sheets-Sheet 2

Fig. 2

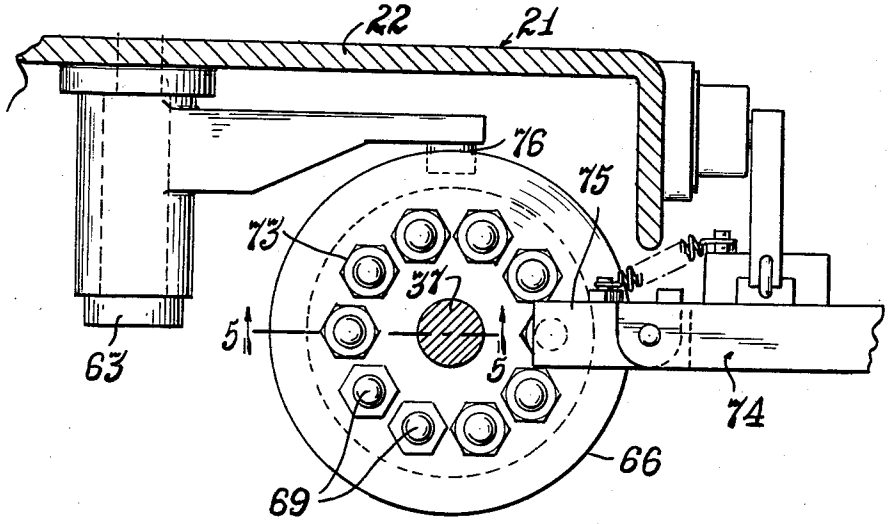


Fig. 3.

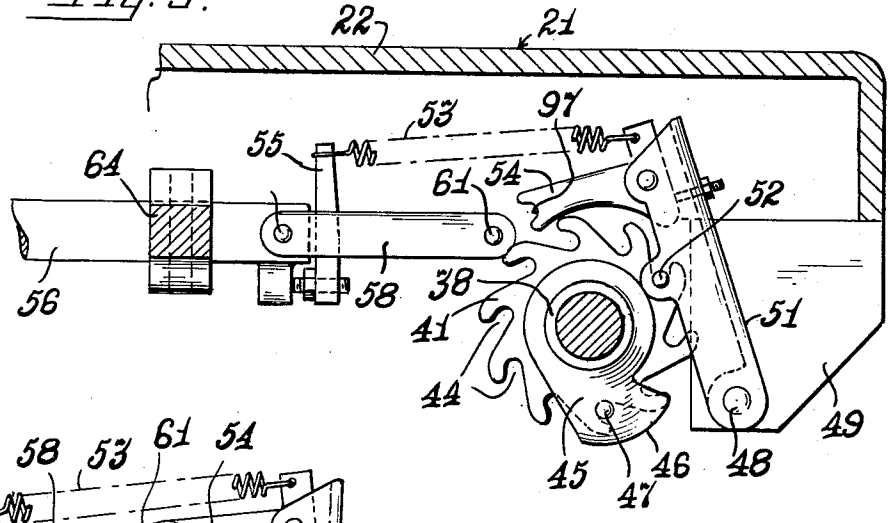
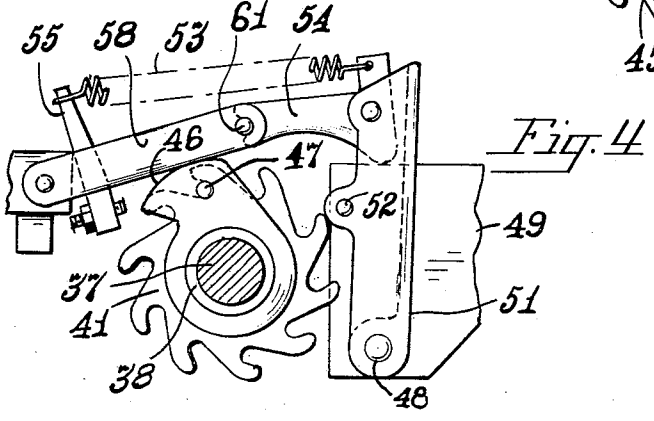


Fig. 4



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United States Patent Office 3,126,045 Patented Mar. 24, 1964

3,126,045

INDEXING MECHANISM FOR RECIPROCATING DEVICES

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Filed May 31, 1960, Ser. No. 32,774
18 Claims. (Cl. 153—21)

This invention relates to control mechanisms and more particularly to a novel indexing and stroke control device for use with a tube bending machine.

In the operation of the tube bending machines, quite frequently it is necessary to form a number of bends in a length of tubing with the bends having different depths or angles and lying in different planes. Such tubing workpieces are difficult to handle when separate presses are employed for each bend. Present practice is to use tube bending machines having a control mechanism by which multiple bends in different planes are accomplished in a single tubing work piece with but one tooling set-up.

In such presses a reciprocating ram carries a bending form which co-operates with a pressure die mechanism to form a bend. The depth of the bend is determined by the distance the bending form travels after initial engagement with the length of tubing positioned in the pressure die mechanism. Accordingly, by controlling the length of successive strokes of the ram it is possible to obtain a series of bends each having a different depth and lying in the same or a different plane than that of another bend. One such means for controlling the length of successive strokes of the ram is shown in Meredith Patent No. 2,837,928, issued June 10, 1958.

In the present invention, there is provided a novel adjustable indexing mechanism to control a series of successive strokes of the ram. Generally, this indexing mechanism includes a turret which is partially rotated with each return stroke of the ram. The turret has a number of longitudinally adjustable rod elements extending parallel to the stroke axis of the ram. The elements are intermittently and successively carried into an operating position with each stroke of the ram. As the ram contacts an element in operating position during an operating stroke of the ram, the turret is reciprocated with the ram for a predetermined distance at which time it acts to operate a limit control switch and a hydraulic deceleration-shut-off valve. Operation of said switch and shut-off valve serves to reverse the direction of stroke of the ram. In this manner the adjusted length of a rod element determines the working stroke travel of the ram during a bending operation.

Heretofore, the rod elements were screw threaded into the turret and secured in positions of longitudinal adjustment therein by jam nuts. After completion of a job the bending machine is set up for another job. In so doing the rod elements are readjusted for the job at hand and should a repeat operation of the initial job be required the rod elements must again be readjusted to their original positions. This situation entails the need to maintain accurate records of each job set up and requires time consuming labor for resetting.

In the present disclosure the rod elements each carry a sleeve thereon that is locked in a pre-set position and the rod-sleeve assembly is merely dropped into place in the turret. A set of rod elements with their sleeves properly positioned thereon can bet set up for each job and, when a change over is necessitated, it merely involves withdrawal of the rod-sleeve assemblies then on the turret and their replacement by a set having the required adjustments. The set removed can be laid aside until their use is again required. In vertical installations the sleeves remain in position in the turret by gravity whereas in horizontal installations they may be locked in place.

It is therefore an object of the invention to provide a novelly constructed indexing and control mechanism for a reciprocating device.

Another object is to provide a novel indexing rod and sleeve assembly for controlling the lengths of the successive strokes of a reciprocating device.

Another object is to provide a novel stroke control turret assembly for a reciprocating device.

Another object is to provide a reciprocating device with a novel stroke control turret assembly that is not expensive to manufacture, is easy and simple to set up and dismantle, and very positive and efficient in its use.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel features of construction, arrangement and combination of parts hereinafter fully described, illustrated in the accompanying drawings and particularly pointed out in the appended claims, it being understood that various changes in the form, proportion, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

For the purpose of facilitating an understanding of my invention, I have illustrated in the accompanying drawings preferred embodiments thereof, from an inspection of which, when considered in connection with the following description, my invention, its mode of construction, assembly and operation, and many of its advantages should be readily understood and appreciated.

Referring to the drawings in which the same characters of reference are employed to indicate corresponding or similar parts throughout the several figures of the drawings:

FIGURE 1 is a side elevational view of a representative tube bending machine, embodying features of the present invention.

FIGURE 2 is an enlarged detailed horizontal sectional view of the turret mechanism and related parts, taken substantially along line 2—2 of FIGURE 1.

FIGURE 3 is an enlarged detailed horizontal view of the indexing mechanism, taken along line 3—3 of FIGURE 1.

FIGURE 4 is a view similar to FIGURE 3 showing the indexing mechanism in a different position assumed during its operation.

FIGURE 5 is an enlarged vertical sectional view of the turret, taken on line 5—5 of FIGURE 2.

FIGURE 6 is a fragmentary sectional detailed view similar to FIGURE 5, showing a modified form of construction.

Referring now to the exemplary disclosure in the accompanying drawings, the invention is shown as embodied in a tube bending machine 21. It is to be understood, however, that the indexing and stroke control mechanism of this invention may be used in association with any reciprocating device, whether vertical or horizontal.

A tube bending machine 21 includes a pair of upstanding frames 22, only one being shown. A secondary frame 23 is mounted on the main frames 22 and said frames support both the indexing and stroke control mechanisms of this invention and a bending ram construction 24. The secondary frame 23 includes vertical guides (not shown) for receiving a reciprocating ram 25 including a cylinder body 26. A piston (not shown), within the cylinder body 26, has a piston rod 27 depending from a support 28 attached by suitable means to frame 23. A bending die 29 of generally semi-circular shape is carried at the lower end of the cylinder 26. It is preferred that the die be removably attached. In the structure so far described, the cylinder 26 moves vertically relative to the stationary piston when fluid under pressure is introduced at either end of the cylinder.

A support table 31, mounted on main frames 22 of the machine carries a pressure die mechanism generally indicated at 32. The pressure die mechanism includes a pair of pressure dies 33 (only one shown) located on opposite sides of and equally spaced from the vertical axis of bending die 29. These pressure dies are adjustably mounted so as to align their tube receiving grooves 34 with a similar groove 35 in the bending die 29. Insofar as the apparatus has been described, the operation is as follows: A length of tubing is laid across pressure dies 33 and as the bending die 29 moves downwardly, the tubing bends around the bending die. The depth of the bend is determined by the distance the bending die moves relative to the pressure dies, consequently, novel means is provided to limit movement of the bending die.

The mechanism for controlling the length of the stroke of the ram cylinder and the bending die 29 carried thereby will now be described.

A pair of vertically spaced vertically aligned bearing blocks 36 are suitably attached and secured to one side of a frame 22 of the bending machine as shown in FIGURE 1. A vertical shaft 37 is journalled in and extends between the bearings. A sleeve or bushing 38 freely embraces the lower end portion of said shaft and extends through the lower bearing 36 and has a press fit in the inner race of an anti-friction bearing seated in lower bearing 36. A collar 39 is secured to said shaft below the upper bearing 36 to limit upward shifting of said shaft. Preferably the upper bearing 36 is also fitted with anti-friction bearing elements (not shown) to facilitate free rotation of the shaft therein. The sleeve 38 mounts a ratchet wheel 41 firmly and said sleeve and ratchet are jointly keyed to the shaft so as to rotate therewith and to permit relative endwise sliding of the shaft therethrough. The ratchet 41 comprises a part of an indexing mechanism assembly to be described presently. A coil spring 42 surrounds shaft 37 and has its lower end seated on the indexing mechanism assembly and its upper end bearing against a collar 43 secured to shaft 37 for urging said shaft into its upper position of endwise sliding.

As best shown in FIGURES 3 and 4, the ratchet wheel 41 has a plurality of teeth 44, 44. A cam plate 45 rotatably embraces sleeve 38 and is maintained against the upperside of the ratchet wheel by the coiled spring 42. One portion of cam plate 45 is extended to form a striking cam 46 so shaped as to provide a cam surface extending from the end of one ratchet tooth 44 to a point spaced radially outward of the next and clockwise adjacent tooth. A pin 47, carried by the striking cam is so positioned as to be rotated with the cam plate to seat between any pair of adjacent teeth 44, 44. When so positioned, the coiled spring 42 maintains the relation of parts. By elevating the cam plate and collapsing the coiled spring, the pin 47 may be rotated with the plate to any desired seat between adjacent ratchet teeth.

A post 48, extending upwardly from a fixed plate 49, carries one end of a swinging arm 51 carrying a pin 52 which acts as a pawl tooth to seat between adjacent ratchet teeth. The pawl tooth is spring urged into seated position by a coiled spring 53. One end of the spring is secured to one end of a rocker arm 54 carried by the swinging arm 51 and the other end is secured to a fixture 55 carried by a reciprocable rod 56.

Referring now particularly to FIGURE 1, the rod 56 is mounted for horizontal reciprocation in a bearing block 57 mounted on frame 22. It carries on its end a mounting fixture 55 and a pair of links 58 joined integrally by pivot mounting pin 59 at one end and a pin 61 at its other end. The rod 56 is adapted to be reciprocated in a manner to be described by oscillatable rotation of a bell-crank lever 62 journalled on frame 22 by stud 63 and having one of its arms 64 connected as at 65 to said rod. The pin 61 is arranged to engage between adjacent ratchet teeth by reason of spring 53.

The reciprocable rod and link assembly is so arranged

that a stroke forwardly (to the right in FIGURE 3) causes the pin 61 to rotate the ratchet wheel 41 a distance slightly greater than the width of one tooth 44. The pawl pin 52 cams over the sloping edge of a ratchet tooth from a position on one side thereof to the other side. When the pawl pin 52 engages between a pair of ratchet teeth, the ratchet wheel 41 is held against rotation in a counter-clockwise direction. This permits the rod and link assembly to travel in the opposite direction to withdraw pin 61 from engagement with the ratchet wheel. This relation of parts is shown in FIGURE 3.

Also mounted on shaft 37 between bearing blocks 36 is a turret plate 66 having an annular groove 67 in its circumferential surface and a plurality of mutually spaced apart apertures 68 (FIGURE 5). These apertures are arranged in a circle concentric with the axis of shaft 37 and their circumferential spacing is the same as the spacing between adjacent teeth 44, 44 of ratchet wheel 41.

Each aperture 68, or at least some of the apertures 68, is adapted to receive therein and mount an adjustable rod element 69. As best shown in FIGURE 5, each rod element 69 is threaded throughout its length and has threaded thereon a sleeve 71 having an external diameter of a size to permit it to be extended through a turret aperture 68. A flange 72 on the upper end of the sleeve seats on the top face of the turret plate to retain it in place. Obviously, when a plurality of rod elements 69 are to be mounted in the turret plate they may be adjusted individually relative to their sleeves and locked by jam nut 73 so that when mounted in the turret plate they will extend upwardly from the turret plate predetermined distances for a purpose to be described presently.

The arrangement is such that when ratchet wheel 41 is rotated a distance equal to the spacing between adjacent teeth thereof, the turret plate 66 is rotated a like distance to move one rod element 69 into a position formerly occupied by an adjacent rod element. This position is directly under a selector trip arm assembly 74.

The selector trip arm assembly 74 is carried by the vertically reciprocable ram cylinder for movement therewith and it includes a trip arm 75 disposed in vertical alignment with and above the rod element moved into operating position by the indexing of ratchet wheel 41. With the ram cylinder in its uppermost position, as shown in FIGURE 1, trip arm 75 is located so as to be in vertical spaced relation to the said positioned rod element, and when said ram cylinder moves downwardly, the trip arm engages the positioned rod element and moves it and the turret plate 66 and shaft 37 in a downward direction axially.

The annular groove 67 in turret plate 66 has a roller pin 76 engaged therein. This pin is carried on the end of arm 77 of the bell crank 62. An abutment screw or stud 78 carried by the other bell crank arm 64 between its ends is in alignment with a reciprocable valve stem 79 of a hydraulic deceleration-shutoff valve 81 so as to actuate said valve each time the bell crank 62 is rocked about its pivot 63. The bell crank also includes an upstanding finger 82 carrying an adjustable screw 83 disposed to co-operate with an actuating member 84 of a limit switch 85.

As earlier indicated, the shaft 37 is adapted to be rotated in a clockwise direction during each successive operating stroke of reciprocable rod 56 and when a predetermined number of operating strokes have been completed the ratchet mechanism is released. When this occurs, the shaft 37 and the ratchet wheel 41 and turret assembly are freed to return to an initial or starting position. Such return operation is effected by mounting a drum 86 on the upper end of shaft 37. One end of a cable 87 is anchored to the drum 86 and extends over a sheave 88 rotatably mounted on the frame. The other end of the cable carries a weight 89 which moves within a tube or container 91. The weight, through the cable and drum, exerts a torque on shaft 37 tending to rotate

it counterclockwise which normally is prevented by the engagement of the pawl and ratchet as previously described. An ear 92 on said drum acts as an arm for engaging a stop plate 93 to limit rotation of the drum in a counter-clockwise direction. This provides for initial or starting position of the device with the pawl and ratchet out of engagement.

The operation of the tube bending machine, with the indexing and stroke control mechanisms, will now be described.

With the drum 86 rotated by weight 89 to a position in which the extending ear 92 engages stop plate 93, the turret rod elements 69 are arranged in the turret in positions to limit the length of successive strokes of the ram cylinder. As many rod elements, starting with the rod element positioned beneath the trip arm 75 and working in a counter-clockwise direction on the turret plate, are provided as there are bends to be formed. Generally, the length of the stroke of the ram cylinder is the distance between the trip arm 75 at the start of the power stroke and an adjusted rod element, plus the distance the turret plate 66 moves to actuate the make and break switch 85 and the deceleration shutoff valve 81. Consequently, a power stroke of the ram cylinder is determined by the adjusted length of a rod element above the turret plate.

The ratchet wheel indexing assembly is then adjusted for the number of tubing bends desired. With the extending ear 92 of the drum in contact with stop plate 93 and the pawl pin 52 seated in a tooth recess of the ratchet wheel, the cam plate 45 is manually lifted against the force of coiled spring 42 to release its pin 47. The cam plate is then rotated to position pin 47 in a proper tooth recess and the manual pressure released. This recess will be spaced the same number of recesses from the first one in which the pawl pin 52 engages as the number of bends to be accomplished. The coiled spring 42 maintains the cam plate and pin in adjusted position. As shown in FIGURES 3 and 4, the foregoing adjustment positions the striking cam 46 at the same tooth recess as that in which pin 47 is seated.

The foregoing are the only adjustments necessary in providing a series of bends in a length of tubing. Once the adjustments are completed as many lengths of tubing as desired may be bent, the turret automatically repeating the cycle.

More particularly an operator positions the length of tubing in the aligned tube receiving grooves 34 of pressure dies 33. Closing a circuit to operate a motor 94 and pump 95 to admit fluid from a fluid reservoir 96 into the lower end of the ram cylinder 26 starts it on its downward power stroke. Cooperation of bending die 29 with pressure dies 33 effects a bending of the tubing. The depth of the bend is limited by the breaking of the turret switch 85 through the engagement of trip arm 75 with a rod element 69 to move the turret plate 66 downwardly and rock the bell-crank lever into engagement with and actuation of the switch arm 84. This movement of the bell-crank lever also actuates valve 81.

As the ram cylinder starts on an upward or reverse stroke, the reciprocable indexing rod 56 moves forwardly toward ratchet wheel 41. The ratchet actuator pin 61, moved forwardly by said rod and links 58, rotates the ratchet wheel in a clockwise direction one notch. Simultaneously, the pawl pin 52 cams on the rearwardly curved surface of the adjacent tooth 41 to seat in the next tooth recess. The coiled spring 53 pulls and holds the pawl in its seated position thereby locking the ratchet wheel against rotation in a counter-clockwise direction. Simultaneously with the rotation of the ratchet wheel, the turret plate 66 rotates with shaft 37 thereby moving the next rod element 69 into position in alignment with trip arm 75. When the ram cylinder 26 reverses movement, the pin 61 is withdrawn from the

ratchet wheel whereby the pawl 51 holds the ratchet wheel against counter-clockwise rotation by the weight 89.

This step-by-step operation for effecting a series of bends continues until the last bend is reached. It is to be understood, of course, that as each bend is completed, the operator removes the finished bend from the dies and inserts therein a portion of the tubing to receive the next bend. Also, the operator rotates the tubing on its own longitudinal axis to obtain a desired circumferential spacing between bends or to effect bends in different planes.

When the last bend is reached, the striking cam 46 is moved into the position substantially as shown in FIGURE 4. As the pin 61 is withdrawn from the tooth recess, it rides upwardly on the cam 46. When the links 58 again travel to the right the parts assume the positions as shown in FIGURE 4 wherein the links 58 ride on the face of the cam and locate pin 61 in position to engage in the recessed end 97 of rocker arm 54 whereupon further movement of the pin 61 results in moving the pawl pin 52 out of engagement with the ratchet wheel. The ratchet wheel 41 is then rotated, by the weight 89 acting through the cable 87, in a counter-clockwise direction until the drum ear 92 engages stop plate 93. The parts are then in starting position with the turret having also been rotated to place the rod elements in position for controlling successive strokes of the ram cylinder in making a like series of bends in another length of tubing.

It will be noted that the ratchet wheel 41 is shown as having 10 teeth. This is for purposes of illustration only as any desired number of teeth may be provided. Inasmuch as the striking cam 46 seats within one of the tooth recesses, it follows that as many bends may be accomplished as there are recesses in the ratchet wheel from the starting tooth to, but not including, the recess in which the cam seats. Consequently, any number of the tooth recesses of the ratchet wheel may be used to provide a series of bends in a length of the tubing.

Although the tube bending machine 21 is shown in vertical position, it is intended that the indexing and stroke control mechanism of this invention may be applied to a stroking device in horizontal position. One change required thereby would be the locating of the cover tube 91 in a vertical position to permit up and down movement of the weight 89. Obviously, a spring might be substituted. It also would be necessary to secure the rod element sleeves in the turret plate. One such alternate structure is shown in FIGURE 6 wherein the sleeve 71*a* mounting the rod element 69*a* extends through the turret plate and is externally threaded to receive a nut 98. Alternately, a set screw can be threaded into a tapped opening 99 in the turret plate to lock the sleeves 71 or 71*a* in place therein.

It is believed that my invention, its mode of construction and assembly, and many of its advantages should be readily understood from the foregoing without further description, and it should also be manifest that while preferred embodiments of the invention have been shown and described for illustrative purposes, the structural details are nevertheless capable of wide variation within the purview of my invention as defined in the appended claims.

What I claim and desire to secure by Letters Patent of the United States is:

1. In a machine for performing a multiple of bends in a length of tubing, a pair of spaced tube bending devices, a reciprocal ram mounting one of said devices, means operable to move the ram for carrying the devices toward and away from one another during a tube bending operation, an axially displaceable rotatable turret, a plurality of stop elements seated loosely in said turret, means on the ram engageable with a selected one of said stop elements when the ram is moved in one direction to move the turret axially in said direction, means operable when the turret reaches a predetermined position

axially to reverse the operating stroke of the ram, means to return the turret to its initial position, indexing means for said turret, and lever means connecting the turret with said indexing means operable during the return movement of the turret to positively actuate the indexing means and to rotate the turret to position another one of said stop elements for engagement by the means on the ram during a succeeding operating stroke.

2. In a machine for performing a multiple of bends in a length of tubing, a pair of spaced tube bending devices, a reciprocal ram mounting one of said devices, means operable to move the ram for carrying the devices toward and away from one another during a tube bending operation, an axially displaceable rotatable turret, a plurality of sleeves seated in said turret, a stop element carried by each sleeve, means on the ram engageable with a selected one of said stop elements when the ram is moved in one direction to move the turret axially in said direction, lever means operable when the turret reaches a predetermined position axially to reverse the operating stroke of the ram, means to return the turret to its initial position, indexing means for said turret, and said lever means connecting the turret with said indexing means operable during the return movement of the turret to actuate the indexing means and to rotate the turret to position another one of said stop elements for engagement by the means on the ram during a succeeding operating stroke.

3. In a machine for performing a multiple of bends in a length of tubing, a pair of spaced tube bending devices movable toward and away from each other, means operable to impart relative movement to said devices during a tube bending operation, an axially displaceable rotatable turret, a plurality of internally threaded sleeves mounted on the turret, a rod element threaded into each sleeve, lock means for securing said sleeve and rod element in positions of adjustment relative to each other, means on the operable means engageable with a selected one of said rod elements when said means is moved in one direction to move the turret axially in said direction, lever means operable when the turret reaches a predetermined position axially to move said operable means in a reverse direction, means to return the turret to its initial position, indexing said lever means for said turret, and means connecting the turret with said indexing means operable during the return movement of the turret to actuate the indexing means and to rotate the turret to position another one of said rod elements for engagement by the rod element engaging means during a succeeding operating stroke.

4. In a machine for performing a multiple of bends in a length of tubing, a pair of spaced tube bending devices, a reciprocal ram mounting one of said devices, means operable to move the ram for carrying the devices toward and away from one another during a tube bending operation, a rotatable turret, said turret having a plurality of circumferentially spaced sockets surrounding its axis, an internally threaded sleeve loosely seated in each socket, threaded rod elements threaded through each sleeve, means on the ram engageable with a selected one of said rod elements when the ram is moved in one direction, lever means operable upon engagement with said one rod element to actuate means operable to reverse the operating stroke of the ram, indexing means for said turret, and said lever means connecting the turret with said indexing means operable to actuate the indexing means and to rotate the turret to position another one of said rod elements for engagement by the means on the ram during a succeeding operating stroke.

5. In an indexing and control mechanism, an axially reciprocable turret plate, a plurality of threaded rod elements carried by said turret plate, a flanged sleeve threaded on each rod element and supporting said elements in place on said turret plate, reciprocal means engageable with a positioned one of said rod elements and operable to move the turret plate axially in one direction, means to limit movement of said turret plate in said one direction, spring means to return said turret plate to its initial position, indexing means for said turret plate operable to rotate said turret plate and position another of said rod elements for engagement by said engageable means, and lever means operably connecting said turret plate with the indexing means for operating the latter when the turret plate returns to its initial position.

6. The indexing and control mechanism recited in claim 5, in which the rod elements are axially adjustable in said flanged sleeves.

7. The indexing and control mechanism recited in claim 5, in which the turret plate has circumferentially spaced apertures and the flanged sleeves are seated one in each aperture.

8. In an indexing and control mechanism, an axially reciprocable turret plate having mutually spaced openings therein, a plurality of threaded rod elements carried by said turret plate, a flanged element on each rod element and mounted loosely one in each opening for suspending said elements in place on said turret plate, reciprocal means engageable with a positioned one of said rod elements and operable to move the turret plate axially in one direction, means to limit movement of said turret plate in said one direction, spring means to return said turret plate to its initial position, indexing means for said turret plate operable to rotate said plate and position another of said rod elements for engagement by said engageable means, and lever means operably connecting said turret plate with the indexing means for operating the latter when the turret plate returns to its initial position.

9. In an indexing and control mechanism, a rotatable axially reciprocable turret plate, said turret plate having mutually spaced apertures therein arranged concentric to its axis, a sleeve seated loosely in each aperture, a threaded rod element carried by each sleeve for longitudinal adjustment in said sleeve, reciprocal means engageable with a positioned one of said rod elements and operable to move the turret plate axially in one direction, means to limit movement of said turret plate in said one direction, spring means to return said turret plate to its initial position, indexing means for said turret plate operable to rotate said plate and position another of said rod elements for engagement by said engageable means, and a lever operably connecting said turret plate with the indexing means for operating the latter when the turret plate returns to its initial position.

10. In an indexing and control mechanism, a turret plate having mutually spaced openings therein, a plurality of threaded rod elements, a flanged sleeve threaded on each rod element and telescoped loosely in selected openings with its flange abutting said plate for supporting said elements in place on said turret plate, reciprocal means engageable with a positioned one of said rod elements, indexing means for said turret plate operable to rotate said plate and position another of said rod elements for engagement by said engageable means, and a lever operably connecting said turret plate with the indexing means for operating the latter.

11. In an indexing and control mechanism, an axially reciprocable shaft, indexing mechanism operably connected with said shaft operable to impart step by step rotation to said shaft, a turret plate carried firmly on said shaft, a plurality of rod elements seated loosely in said turret plate, said rod elements being circumferentially spaced in a concentric circle on said turret plate, means operable to engage a selected one of said rod elements end-wise to move the shaft axially in one direction, spring means to return the shaft to its initial position, a control switch, a lever operable when the shaft reaches a predetermined position when moved in said one direction to actuate the switch to stop movement in said direction, and said lever being operable during return movement of said shaft to actuate said indexing mechanism.

12. In an indexing and control mechanism, an axially reciprocable shaft, indexing mechanism operably connected with said shaft operable to impart step-by-step rotation to said shaft, a turret plate carried firmly on said shaft, a plurality of rod elements on said turret, said rod elements being circumferentially spaced in a concentric circle on said turret plate, means operable to engage a selected one of said rod elements endwise to move the shaft axially in one direction, a lever mechanism operably connected to said turret plate and operable when the shaft reaches a predetermined position when moved in said one direction to stop movement in said direction, spring means to return the shaft to its initial position, and reciprocable means operable by said lever mechanism during return movement of said shaft to actuate said indexing mechanism.

13. In an indexing and control mechanism, a turret plate rotatable on a vertical axis, a plurality of circumferentially spaced apertures in said turret plate arranged in a circle concentric with said axis and parallel thereto, internally threaded sleeves one mounted loosely in each of selected apertures, said sleeves having a shoulder on one end to abut said turret plate to retain them suspended therein, a threaded rod element threaded through each sleeve, and means to lock said rod elements in longitudinally adjusted positions in said sleeves.

14. In an indexing and control mechanism, a turret plate rotatable on a vertical axis, a plurality of circumferentially spaced apertures in said turret plate arranged in a circle concentric with said axis and parallel thereto, sleeves one telescoped loosely in each of selected apertures, said sleeves having a shoulder on one end to abut said turret plate to retain them suspended therein, a rod element carried firmly by each sleeve, and means to adjust said rod elements longitudinally in said sleeves.

15. In an indexing and control mechanism, a turret plate having a plurality of circumferentially spaced apertures therein, internally threaded sleeves one seated in each aperture, rod elements one threaded in each sleeve, said rod elements each being longitudinally adjustable relative to its sleeve, and means to lock said rod elements in adjusted positions.

16. In an indexing and control mechanism, a turret plate having a plurality of circumferentially spaced apertures therein, internally threaded sleeves one seated in each aperture, and rod elements one threaded into each sleeve, said rod elements each being longitudinally adjustable relative to its sleeve.

17. In an indexing and control mechanism, a turret plate having a plurality of circumferentially spaced apertures therein, sleeves one seated loosely in each aperture, and rod elements one carried by each sleeve, said rod elements each being longitudinally adjustable relative to its sleeve.

18. In an indexing and control mechanism, a turret plate having a plurality of circumferentially spaced sockets therein, internally threaded sleeves one extending through each socket, means to lock said sleeves in fixed position on the turret plate, rod elements one threaded through each sleeve, said rod elements each being longitudinally adjustable relative to its sleeve, and means to lock said rod elements in adjusted positions.

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