Feb. 6, 1962 F. S. PEARNE 3,019,506

CUTTING APPARATUS

Filed March 9, 1960 4 Sheets-Sheet 1

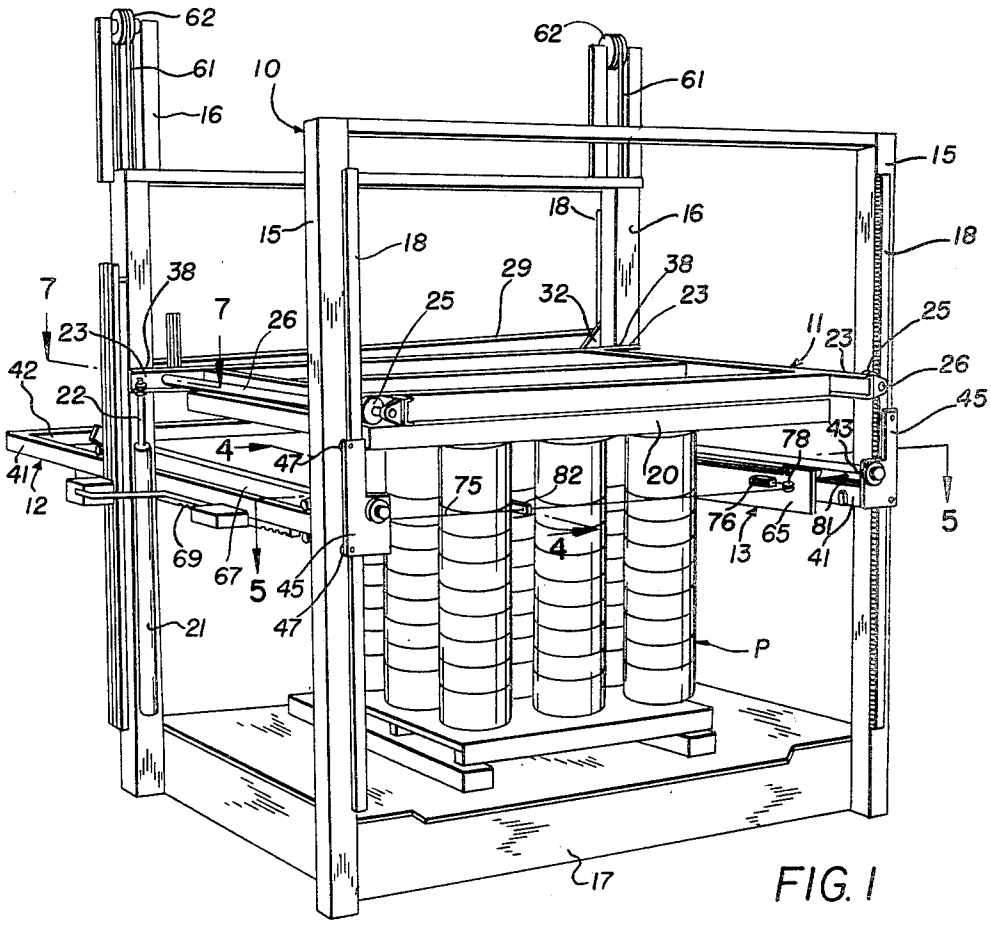


FIG. 1

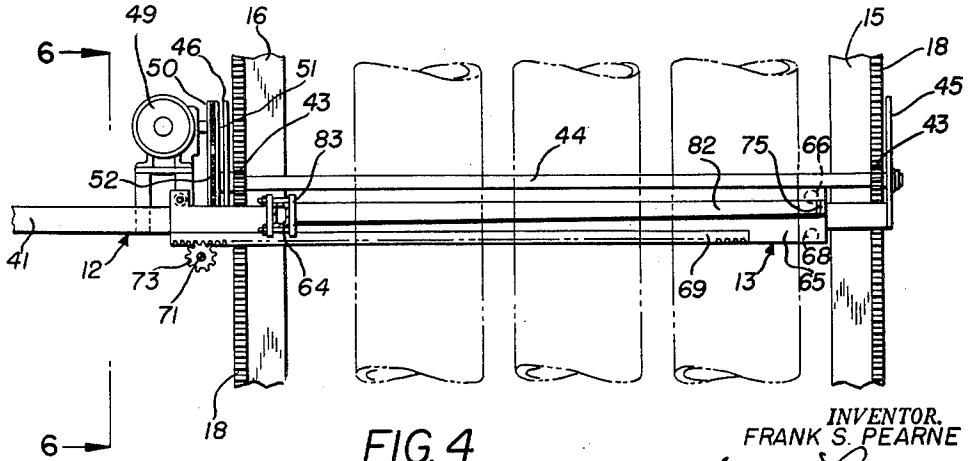


FIG. 4

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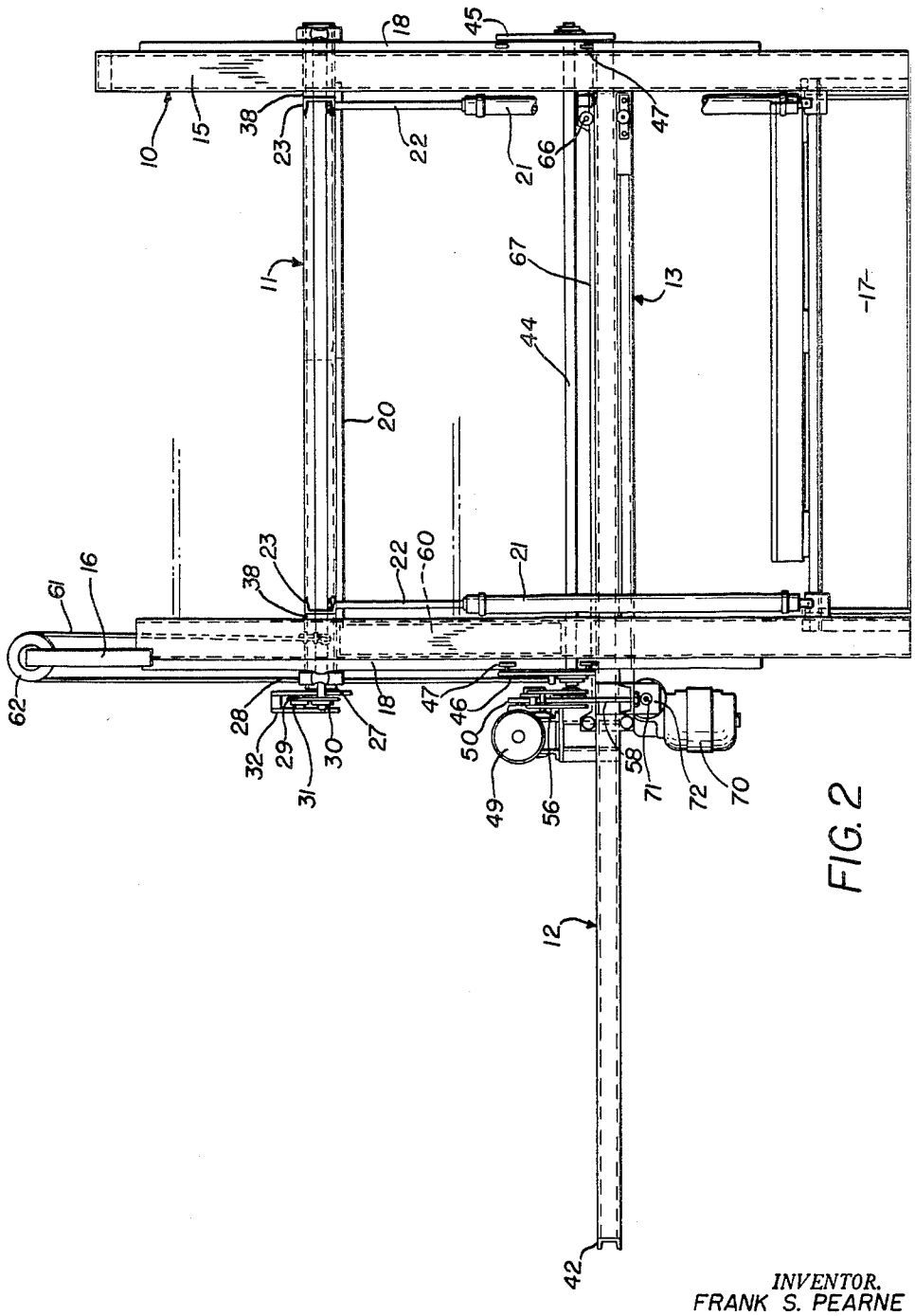


FIG. 2

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CUTTING APPARATUS

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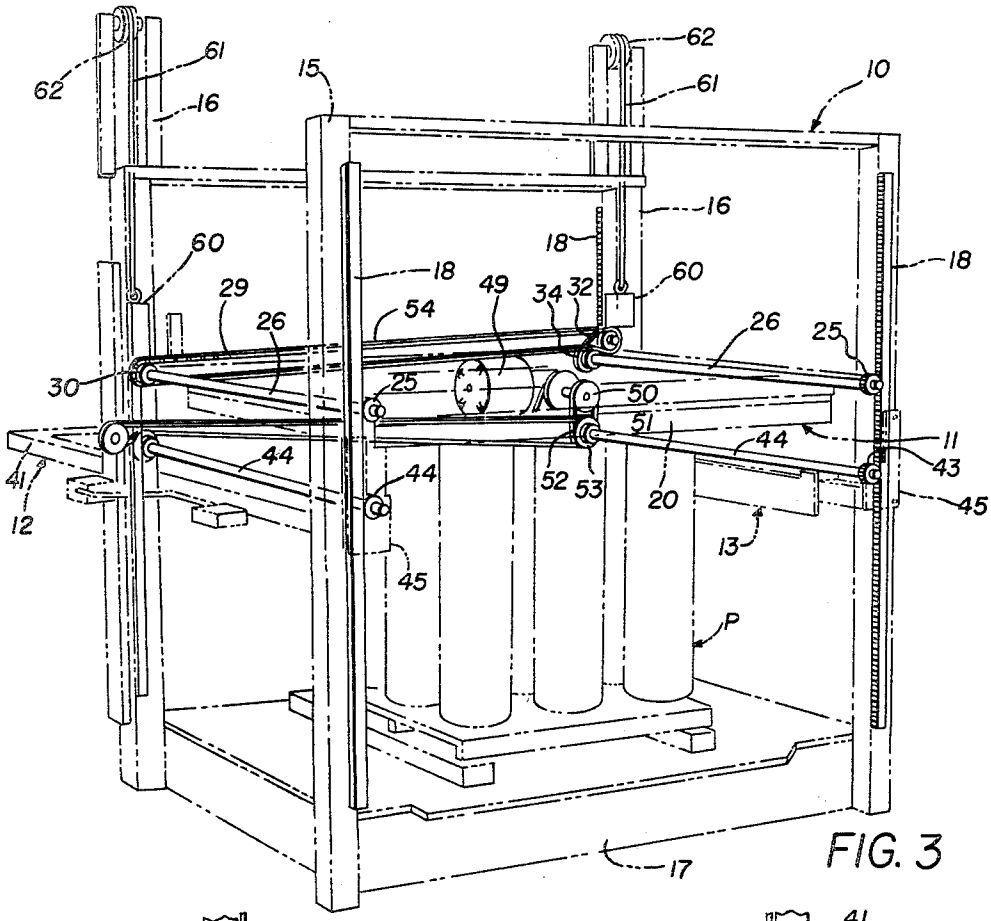


FIG. 3

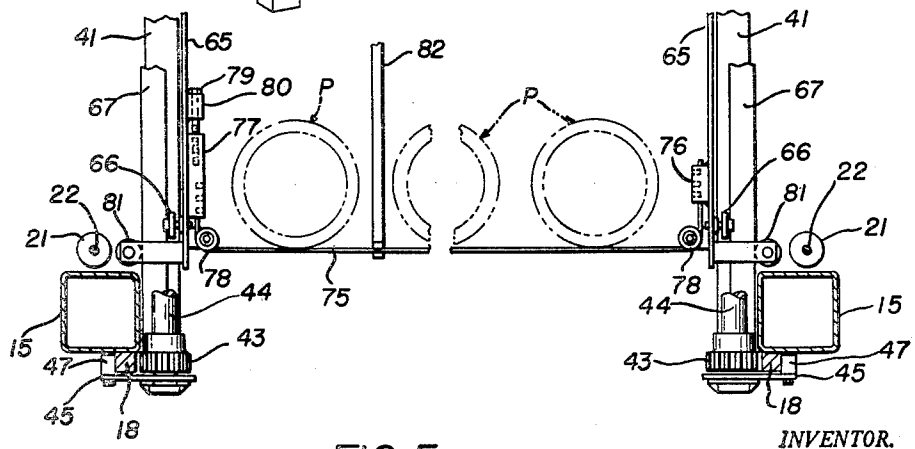


FIG. 5

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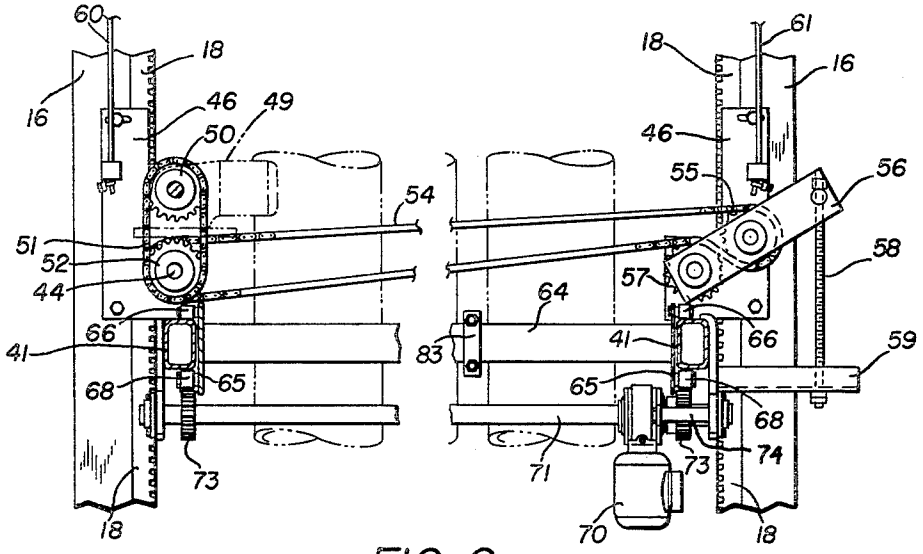


FIG. 6

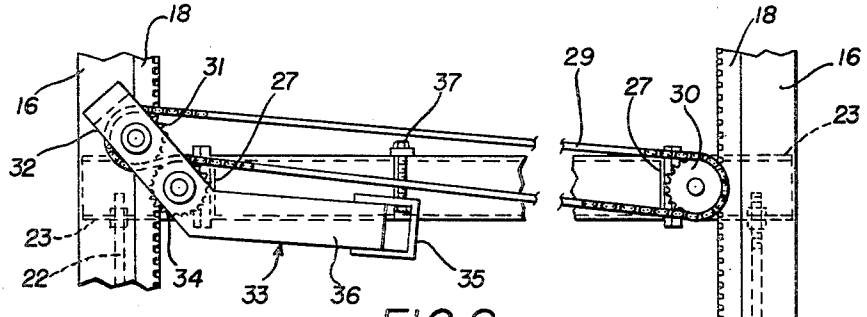


FIG. 8

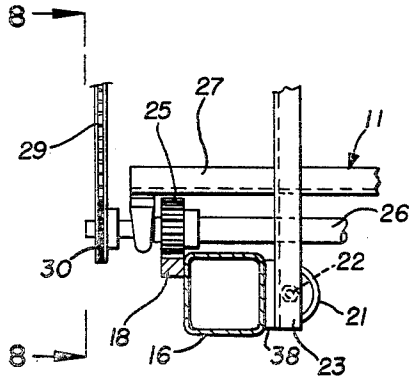


FIG. 7

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United States Patent Office 3,019,506 Patented Feb. 6, 1962

3,019,506

CUTTING APPARATUS

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Filed Mar. 9, 1960, Ser. No. 13,854
7 Claims. (Cl. 25—108)

The present invention relates generally to cutting apparatus, and, more specifically, to apparatus for cutting elongated hollow objects into a plurality of sections.

The invention is particularly concerned with the provision of an apparatus for cutting objects formed of green clay into relatively short axial lengths which may be used for a variety of purposes. For example, it is a conventional procedure to burn or fire clay pipe by setting them on end on a kiln car and moving the car through the kiln. A similar operation is followed when drying relatively large diameter, green clay pipe. If, in either case, the pipe are positioned directly on the deck of the kiln car, they frequently crack or fracture at their bottom ends. This is because the normal pipe shrinkage of approximately 1¼ inch per foot of diameter is substantially restrained by the direct contact between the pipe and kiln car, and this restraint causes the pipe to distort and crack. It has been found that if the pipe are positioned on ring segments of the same diameter instead of directly on the deck of the kiln car, this cracking problem is alleviated since the distortion and cracking is incurred in the rings while the normal shrinkage of the pipe is unrestrained.

Another use of the invention is to make drain tile from longer lengths of sewer pipe. As will hereinafter become apparent, the apparatus comprising the invention is adapted to simultaneously cut a plurality of pipe into ring-shaped segments of any desired length. In addition to cutting pipe into drain tile, the invention can be used also to form fittings and other similar shapes.

While the invention is shown and described in connection with the specific operation of cutting green clay pipe into ring-shaped segments, it is to be understood that the apparatus is equally well adapted for cutting objects other than those having a cylindrical cross-section. For example, the invention may be employed to cut rectangular objects in sections for use as flue lining and the like.

The principal object of the invention is to provide an apparatus for quickly and efficiently cutting a plurality of elongated hollow objects into relatively short axial sections.

Other objects include the provision of an apparatus, such as described in the previous paragraph, which is effective to cut green clay objects into shorter segments, and which may be operated with a minimum amount of work handling.

Other advantages and uses of the invention will become apparent when the same is considered in connection with the following detailed description and the accompanying drawings wherein:

FIGURE 1 is a perspective view of the apparatus comprising the invention, showing a plurality of partially cut pipe positioned therein.

FIGURE 2 is a side elevation of the invention.

FIGURE 3 is a schematic perspective view, partially in dot-dash outline, and showing the several drive mechanisms of the apparatus.

FIGURE 4 is a sectional view taken along the line 4—4 of FIG. 1.

FIGURE 5 is a horizontal sectional view taken along the line 5—5 of FIG. 1.

FIGURE 6 is a rear elevational view, partially in section, taken along the line 6—6 of FIG. 4.

FIGURE 7 is a fragmentary sectional view taken along the line 7—7 of FIG. 1.

FIGURE 8 is a fragmentary view taken along the line 8—8 of FIG. 7.

Referring to the drawings, there is shown in FIGS. 1 and 2 an apparatus for cutting cylindrical objects, such as green clay pipe, into ring-shaped segments. This apparatus generally comprises a frame **10**, a clamping board **11** and an elevator **12** vertically reciprocal along the frame, and a wire carriage **13** movable on the elevator in a direction transverse to the paths of movement of the clamping board and elevator.

The frame **10** is formed by front posts **15** and back posts **16**, the posts being secured to the corners of a rectangular base **17**. This base **17** functions as a platform for supporting a pallet upon which are disposed a plurality of pipe P, the pipe being arranged in aligned rows on the pallet and resting on their spigot ends. Each of the four posts of the frame **10** carries a rack **18** extending along substantially the full length of the post. These racks are fastened to the outer face of each post along the inner side thereof.

The clamping board **11** is shown as a rectangular framework constructed from suitable structural members, and having on its lower surface a pad **20** formed from a soft, spongy material, such as a rubber or plastic sponge, felt, or similar pad. This pad is adapted to be placed in contact with the upper or bell ends of the pipe P when the framework is vertically lowered to hold the pipe in their aligned, upright position. Although the provision of the pad **20** is not essential to the operation of the disclosed apparatus, such a pad is desirable since it prevents the bell ends of the pipe from being damaged during the clamping operation so that these ends subsequently can be used as fittings.

In the illlustrated embodiment, the clamping board **11** is raised and lowered by four piston-cylinder mechanisms located at each corner of the frame **10**. The cylinders **21** of these piston-cylinder mechanisms are fixedly mounted adjacent the inner wall surfaces of the posts **15** and **16**, while the piston rods **22** are connected to the ends of the extended channel members **23** of the clamping board framework. Suitable fluid connections (not shown) to the cylinders **21** may be made so that four cylinders can be actuated simultaneously.

In order to prevent the clamping board from tilting during its movement, and in order that the board will apply equal clamping pressure to the ends of the pipe, rack gears **25** are provided which mesh with the racks **18**. As shown in FIGS. 1, 3, 7, and 8, these rack gears are mounted near the ends of the two shafts **26** which extend through the channel members **23** along each side of the clamping board **11**. At the front and rear of the clamping board, the channel members **27** of the clamping board framework are extended and are provided with pillow blocks **28**, or other bearing support means, in which the shafts **26** are journalled. These pillow blocks serve to hold the gears **25** in meshing engagement with the racks **18**.

The two shafts **26** are connected together by a chain **29**, located at the rear of the clamping board **11**, so that the shafts must turn together. This chain is entrained around a pinion **30** carried at the end of one of the shafts **26**, and around a pinion **31** carried by an arm **32** of a bell crank **33**. The bell crank **33** is pivotally mounted on the other shaft **26** and is positioned adjacent the pinion **34** mounted on the same shaft. The lower bight of the chain **29** is passed over the top of the pinion **34** so that this pinion, and thus the attached shaft, will be turned in an opposite direction to the pinion and its corresponding shaft. The chain **29** is kept taut and in driving engagement with the pinions by an

adjustable bracket 35 which engages the end of the arm 36 of the bell crank 33. This bracket is connected to the clamping board framework by a bolt 37 so that the bell crank can be pivoted to tighten or loosen the chain 29 by raising or lowering the bolt and bracket correspondingly.

In addition to the above described structure for preventing tilting of the clamping board, guide shoes 38 can be attached to the channel members 23 in sliding engagement with the inner wall of each of the four posts of the frame 10, as indicated in FIG. 6. These shoes 38 are effective to prevent endwise movement of the clamping board 11 relative to the frame 10. Obviously, many equivalent mechanical devices may be used to guide and move the clamping board for the purposes described herein.

The elevator 12 is mounted for vertical movement on the frame 10 between the base 17 and the clamping board 11. As most clearly shown in FIGS. 1 and 3, the elevator 12 is an open-ended rectangular frame formed by side bars 41 which are connected together at one end by a bar 42. The length of the side bars is approximately twice the distance between the posts 15 and 16.

As in the case of the clamping board, the elevator 12 is provided with four rack gears which mesh with the racks 18. These rack gears 43 are mounted on the ends of two shafts 44 which are positioned above the side bars 41 and which extend between the posts 15 and 16. The front ends of the shafts 44 are journalled in plates 45 secured to the ends of the bars 41, and these plates are in sliding engagement with the outer faces of the racks 18 which are fastened to the posts 15 (FIGS. 1, 4 and 5). The other ends of the shafts 44 are journalled in plates 46 which are rigidly connected to the side bars 41, as indicated in FIG. 6. These plates 46 also are in slidable engagement with the outer faces of the racks fastened to posts 16. The rack gears 43 are maintained in meshing engagement with the racks 18 by rollers 47 which are attached to the tops and bottoms of the plates 45 and 46 at their outer side edges. These rollers engage and roll along the side edges of the racks 18 opposite from the rack teeth when the elevator is moved.

Referring to FIGS. 3 and 6, it will be seen that the elevator 12 is driven up and down relative to the frame 10 by a motor 49 which is fixedly mounted on the elevator. This motor is geared to a pinion 50 which is connected by a short chain 51 to a pinion 52 mounted on the end of one of the shafts 44. Mounted inwardly of the pinion 52, and on the same shaft, is a second pinion 53. A chain 54 is entrained around the pinion 53, and another pinion 55, which is carried by a lever 56 which is pivotally mounted on the other shaft 44. The lower bight of the chain 54 engages a pinion 57 carried by same shaft as the lever 56 so that the shafts 44 will be turned in opposite directions when the motor is actuated to raise or lower the elevator.

A tie-rod 58 is fastened to the end of the lever 56 opposite from its pivot point, and to a brace 59 fixed to the elevator. Thus, it will be apparent that the chain 54 can be tightened or loosened by adjusting the tie-rod so as to move the lever and associated pinion 55. As is true of the mechanism for guiding and moving the clamping board 11, many equivalent mechanical devices may be used to guide and actuate the elevator 12.

As shown most clearly in FIGS. 1, 2, and 3, the elevator has been effectively counterbalanced so that the power required to move the elevator is kept at a minimum. Counterbalance weights 60 are located within the two rear posts 16, and are connected to the elevator by cables 61 which pass over the pulley wheels 62 at the top of the posts. The location of the counterbalance weights within the rear posts of the frame 10 has been found particularly advantageous since this is very nearly the center of gravity of the elevator and associated wire carriage 13.

The wire carriage 13 is mounted for movement on the elevator 12 in a direction transverse to the paths of travel of the elevator and the clamping board 11. This carriage is formed by a pair of flat side plates 65 which extend parallel to the sides of the elevator, and which have a length substantially equal to the distance between the posts 15 and 16. The side plates are connected at one end by a cross-member 64 (FIGS. 5 and 6).

Rollers 66 are provided at each end of each side plate 65, and these rollers co-operate with the tracks 67 to guide the carriage for reciprocatory movement. As shown in FIG. 5, the tracks 67 consist of a straight metal bar fixed to the top of each side member 41 of the elevator. A second roller 68 is carried by the side plates 65 of the wire carriage below each roller 66 for rollingly engaging the undersides of the sides of the elevator, as indicated in FIGS. 2 and 6. In addition to the rollers, plates 65 also carry racks 69 which are mounted on the outside faces of the plates at the bottom edges thereof.

Movement is imparted to the wire carriage by a reversible motor 70 which is shown most clearly in in FIG. 6. This motor is carried by and rotates a shaft 71 which has its ends journalled in plates 72 depending from either side 41 of the elevator. Pinions 73, mounted on the shaft 71 at either end, are in driving engagement with the racks 69, and thus serve to drive the carriage along the elevator when the motor 70 is actuated. A bracket 74 connects the housing of the motor 70 to the adjacent side plate 72 for holding the motor against rotation with the shaft 71.

Referring next to FIGS. 1 and 5, a cutting wire 75 is shown as extending across the front or open end of the wire carriage 13. This wire serves to cut through the pipe P in a plane perpendicular to their axes when the wire carriage is moved.

The ends of the wire are held by a suitable gripping mechanism at either side of the wire carriage. This mechanism consists of a wire gripping block 76 fixedly secured to the inner face of one side 65 of the wire carriage, a movable gripping block 77 mounted on the inner face of the other side of the wire carriage, and a small pulley wheel 78 immediately forward of each gripping block. The block 77 is slidably mounted in grooves so that it can be slid forward or backward to draw the wire around the pulley wheels to loosen or tighten the wire, respectively. To this end, a bolt 79, carried by a collar 80, is threaded into the block.

In addition to the above-described gripping mechanism for tightening the wire 75, the front of the wire carriage is provided with a pair of vertically disposed rollers 81 which are fixed to the outer surfaces of the carriage sides 65. As shown in FIGS. 2 and 4, these rollers roll along the outer side surfaces of the elevator 12, and, in this manner, are effective to keep the wire 75 taut at all times. The wire carriage 13 also may be provided with one or more wire-loading fingers 82 (only one being shown) to prevent the wire 75 from flexing when the pipe are being cut. As indicated in FIGS. 1 and 4, the wire-loading finger 82 is adjustably connected to the rear cross-member 64 of the wire carriage, and extends parallel to the sides of the carriage. The adjustable mounting 83 for the finger permits it to be positioned so that it extends between an adjacent pair of aligned rows of pipe on the pallet.

Having thus described the detailed structure of the apparatus, the following general description of its operation will be readily understood.

When the carriage 13 has been moved to the rear of the elevator 12, a pallet having rows of aligned pipe P can be conveniently positioned on the base 17, as shown in FIG. 1, by a lift-truck or the like. The fluid cylinders 21 are then actuated to lower the clamping

board 11 against the bell ends of the pipe to prevent movement of the pipe during the subsequent cutting operation.

The elevator 12 is then lowered to a position near the bottom or spigot ends of the pipe, and the carriage motor 70 is actuated to drive the carriage toward the front of the elevator. The forward movement of the carriage 13 causes the wire 75 to pass through the pipe so as to cut the pipe in a plane transverse to their axial length. When the wire has cut through all of the pipe, the elevator is raised toward the clamping board 11 to a new position, and the carriage is driven rearwardly to its first position, thereby cutting the pipe in a second plane parallel to and spaced from the first plane. This series of operations is repeated until the pipe have been completely cut into ring-shaped segments.

When the cutting operation is complete, the carriage is again moved rearwardly, the clamping board is raised, and the pallet of cut pipe is removed from the apparatus.

While the operation has been described as one in which the pipe are cut from the spigot to the bell ends, it will be apparent that the operation could be reversed and the carriage lowered for each succeeding cutting step instead of being raised. It will likewise be apparent that the stepwise movement of the elevator and the reciprocatory movement of the wire carriage can be automatically controlled as by suitably positioned limit switches. For example, a series of such switches could be spaced along one of the posts of the frame 10 and connected in a known manner into the power circuits of the motors 50 and 70 (not shown) to the carriage motor 70, while other switches could be placed at the front and rear ends of the elevator in the path of movement of the carriage and connected to the elevator motor 50. Thus, when the carriage trips one of the switches on the elevator, the elevator will be either raised or lowered to a new position. As the elevator reaches this new position, it will trip a switch on the frame post to reverse the movement of the carriage.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that it is intended to cover all modifications and variations which do not constitute a departure from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. Apparatus for cutting a plurality of pipes into sections comprising a frame, clamping means vertically reciprocable along said frame for abutting the end of axially vertically disposed pipes to hold said pipes against movement, reversible actuating means connected to said frame and to said clamping means for reciprocating said clamping means, an elevator vertically movable on said frame toward and away from said clamping means along the axis of said pipes, first reversible motor drive means drivingly connected between said frame and said elevator for raising and lowering said elevator, a carriage mounted on said elevator for movement transverse to the paths of movement of said clamping means and elevator, second reversible motor drive means drivingly connected between said elevator and said carriage for moving said carriage so that one end thereof is caused to pass beneath said clamping means, and cutting means mounted on said one end of said carriage whereby forward movement of said carriage in one direction when said elevator is in a first position will cause said cutting means to cut said pipes in a first plane transverse to their axial length, and movement of said elevator to a second position and reverse movement of said carriage will cut said pipes in a plane parallel to and spaced from said first plane.

2. Apparatus for cutting an object into a plurality of sections comprising a frame having a base and upwardly extending posts secured to said base, a clamping board slidably mounted on said posts, means for moving said clamping board toward said base to abut the end of an axially vertically disposed object, an elevator framework slidably mounted on said posts between said base and said clamping board, first intermittent motor drive means for moving said elevator from a first position to a second position along said posts, a carriage mounted on said elevator framework, second intermittent motor drive means for reciprocably moving one end of said carriage beneath said clamping board in a path transverse to said posts, and cutting means carried by said end of said carriage whereby movement of said carriage in said first and second positions of said elevator will cause said cutting means to cut said vertically disposed object into a plurality of sections.

3. The apparatus as claimed in claim 2 wherein said cutting means comprises a wire and wherein means are provided for tightening said wire and for keeping it taut during reciprocation of said carriage.

4. Apparatus for cutting elongated objects into sections comprising a frame, said frame including spaced, upright posts secured to a base; a clamping board guided on said posts for reciprocation toward and away from said base; reversible fluid actuators fixed to said posts and connected to said clamping board; an elevator, said elevator including spaced side bars extending between said posts, said side bars being reciprocally guided by said posts for movement between said frame base and said clamping board; first reversible motor drive means drivingly connected between said posts and said elevator; a wire carriage mounted on said elevator for reciprocation transverse to its path of movement, said carriage including side plates adjacent to and parallel with said side bars of said elevator, and a cutting wire extending between said side plates; and second reversible motor drive means drivingly connected between said elevator and carirage.

5. Apparatus as claimed in claim 4 wherein said first reversible motor drive means for said elevator comprises a rack connected to at least one of said posts and being substantially co-extensive therewith, a rack gear rotatably mounted on said elevator in meshing engagement with said rack, and a reversible motor mounted on said elevator in driving connection with said rack gear.

6. Apparatus as claimed in claim 5 wherein said second reversible motor drive means for said wire carriage comprises a carriage rack fastened to one of said side plates of said carriage, a second rotatable rack gear carried by said elevator in meshing engagement with said carriage rack, and a second reversible motor carried by said elevator in driving engagement with said second rack gear.

7. Apparatus as claimed in claim 6 wherein said clamping board is provided with a rotatable rack gear in meshing engagement with said rack secured to said frame post.

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