July 6, 1926. 1,591,069

M. WITTE

TUBE CUT-OFF MACHINE

Filed August 20, 1923 3 Sheets-Sheet 1

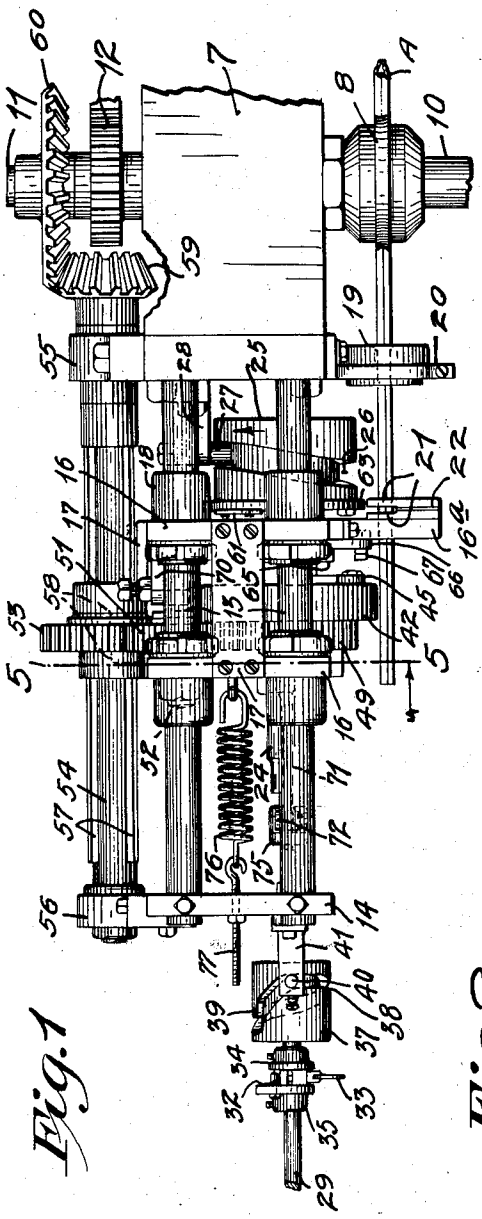

Fig. 1

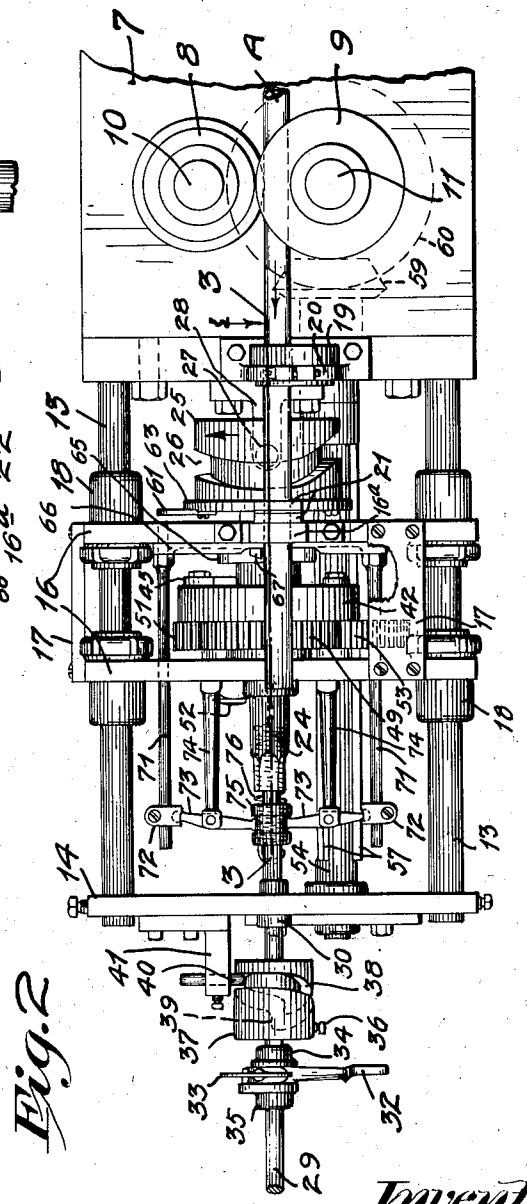

Fig. 2

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Fig. 3

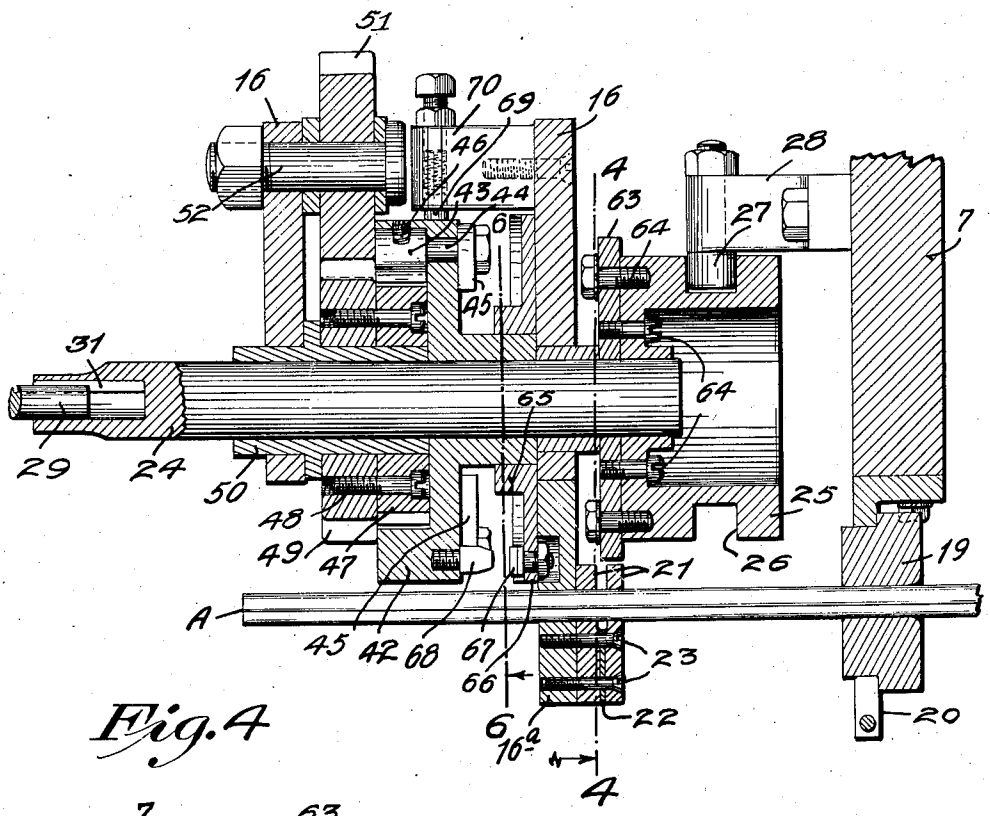

Fig. 4

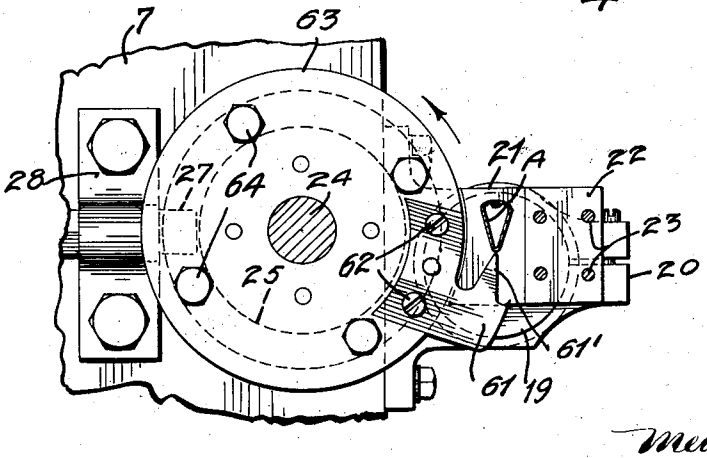

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Fig. 5

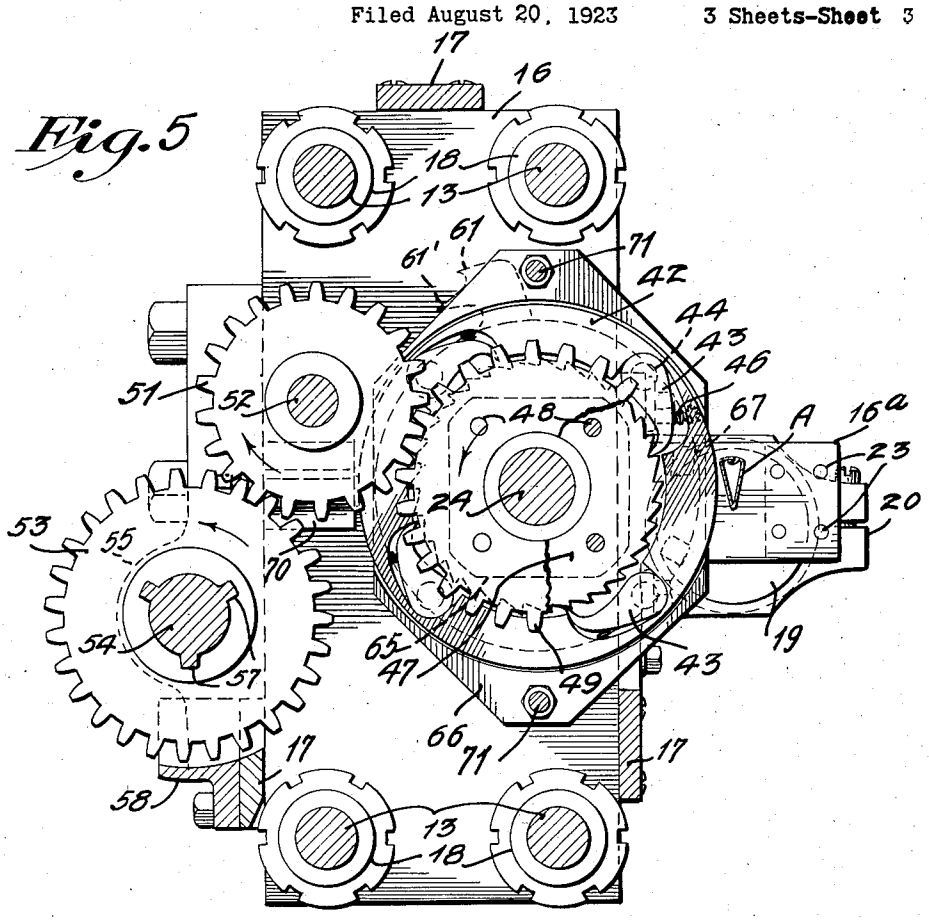
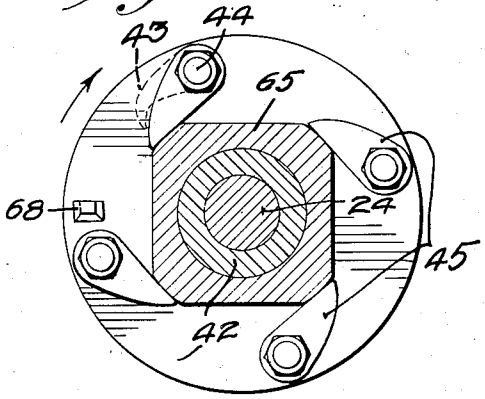


Fig. 6



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UNITED STATES PATENT OFFICE.

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TUBE-CUT-OFF MACHINE.

Application filed August 20, 1923. Serial No. 658,235.

My invention provides a highly efficient tube cut-off machine adapted for very general use but particularly designed and especially adapted for use to cut off thin brass or copper tubes of triangular cross section, such as employed in automobile radiators of the type disclosed and claimed in Letters Patent of the United States No. 1,365,759, granted to me of date January 18, 1921.

Generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

In practice, it has been found a difficult matter to cut off thin brass, copper, or other soft metal tubes without crushing or distorting the tubes on the cutting or shearing lines. It has been found especially difficult to properly cut off soft or thin sheet metal tubes of triangular cross section.

My invention provides a simple and highly efficient tube-cutting or shearing device, which will sever these thin tubes, whether of triangular or other form, by a clean shearing cut that will not in any way distort the cut end of the tube.

The improved tube cut-off machine involves various novel and important features, notably among which are simple and efficient means for causing the cutter or shearing device to travel with the moving tube while performing the cutting action and without interfering with the continuous operation of forming and feeding the tube; and a simple and highly efficient driving clutch and clutch-tripping or actuating device controlled by movements of the formed tube and operating to automatically time the cutting of the tube for predetermined lengths.

In the accompanying drawings, which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a plan view illustrating my invention applied to the delivery end of a tube-forming machine;

Fig. 2 is a side elevation of the parts shown in Fig. 1;

Fig. 3 is a horizontal section taken approximately on the line 3—3 of Fig. 2;

Fig. 4 is a transverse vertical section taken approximately on the line 4—4 of Fig. 3;

Fig. 5 is a transverse vertical section taken approximately on the line 5—5 of Fig. 1, some parts being broken away; and

Fig. 6 is a detail in transverse vertical section taken on the line 6—6 of Fig. 3.

The tube-forming machine, the delivery end portion only of which is illustrated, may be assumed to be of the type wherein the triangular tube A is formed by a continuous longitudinal movement under the action of co-operating rollers and dies. Of the parts of this tube-forming machine, it is desirable for the purposes of this case only to particularly note the framework or main support 7; co-operating upper and lower tube-feeding rollers 8 and 9 secured, respectively, to the power-driven upper and lower shafts 10 and 11 journaled in said frame 7; and intermeshing gears 12 that connect the two shafts 10 and 11 for simultaneous rotation and for rotation in synchronism with certain other tube-feeding and forming rollers, not shown.

Rigidly secured to the delivery end of the frame 7 and projecting horizontally therefrom is a carriage guide, preferably formed by two upper and two lower horizontal parallel guide rods 13, to the outer ends of which is rigidly secured a stationary tie-plate 14.

Mounted to slide on the guide rods 13 for movements parallel to the longitudinal axis and line of travel of the tube A is a cutter carriage shown as made up of parallel laterally spaced plates 16 and tie-plates 17 rigidly connecting the same. Preferably and as shown, the laterally spaced plates 16 have bearing sleeves 18 through which the guide rods 13 are directly passed.

The formed tube A, as it leaves the forming machine, passes through a guide block 19, shown as supported from the frame 7 by a suitable clamping bracket 20. From the guide 19, the tube A passes through a close-

ly fitting triangular guide passage formed in a projecting portion 16ª of the inner carriage plate 16, but first it passes through closely fittitng triangular guide passages formed in relatively fixed hardened shearing plates 21. These shearing plates 21, as shown, are slightly spaced by a metal shim 22 and are secured together and to the plate extension 16ª by screws 23. As will presently be noted, the space between the shearing plates 21 is only wide enough to permit the movable cutter blade to pass therebetween with very slight clearance.

Rotatively mounted in the plates 16 of the traveling cutter carrier and extending parallel to the guide rods 13 is a cutter shaft 24. This cutter shaft 24 is held against endwise movements in respect to the cutter carriage or, otherwise stated, is caused to travel with said cutter carriage and, hence, to move axially in respect to the main frame 7.

Keyed or otherwise rigidly secured to the inner end of the cutter shaft 24 is a cylindrical cam 25 having a peripheral cam groove 26 in which works a roller-equipped stub 27 that is supported in a stationary position by a bracket 28, which, in turn, is rigidly secured to and projects outward from the delivery end of the main frame 7. The nature of the cam groove 26 will be hereinafter stated.

As a supplemental or secondary portion of the cutter shaft 24, I provide a clutch-tripping shaft 29 that is connected to rotate with said shaft 24 but is capable of axial movements in respect thereto. This shaft 29 is preferably of considerably less diameter than the shaft 24, is mounted to rotate in and slide through a bearing 30 on the outer end tie-plate 14, and its inner end is telescoped into the outer end of the shaft 24 and is connected for rotation therewith by a long key and groove connection 31, (see particularly Figs. 2 and 3).

To the shaft 29 is secured a radially projecting trip arm 32, the extended end of which will normally stand in the path of movement of the tube A and, hence, in position to be engaged thereby. As shown, the inner end of the arm 32 is split and adapted to be rigidly secured to the shaft 29 in different longitudinal and rotary or circumferential adjustments, by a thumb screw 33. Also, as shown, the inner end of the hub or arm 32 is placed between retaining collars 34 and 35 that are rigidly but adjustably secured to the shaft 29 by a set screw or the like.

Rigidly but adjustably secured on the shaft 29, inward of the trip arm 32, by means of a set screw 36 or the like, is a cam-acting collar 37 that is formed with a peripheral cam groove 38, which groove, at one point, is formed with a longitudinal portion 39, the purpose of which will presently appear.

Working in the cam groove 38 is a stud 40 that is supported in a fixed position by a bracket 41 rigidly secured to the tie-plate 14. The peculiar form and action of the cam groove 38 will be hereinafter described.

Located between the carriage plates 16 and keyed or otherwise rigidly secured to the cutter shaft 24 is a clutch element in the form of a heavy disc 42. This disc carries one or more, as shown four, circumferentially spaced clutch dogs 43, which, as shown, work within a large recess of said disc and are secured to short shafts 44 journaled in said disc and provided at their projecting ends with rigidly attached dog-releasing arms 45. The dogs 43 are yieldingly pressed radially inward by light coiled springs 46.

The clutch dogs 43 are spaced circumferentially around and are engageable with a clutch element in the form of a ratchet wheel 47, which, as shown, is rigidly secured by machine screws 48 to a spur gear 49. Said ratchet wheel 47 and gear 49 are free to rotate on a bearing sleeve 50 (see Fig. 3) shown as projected through and secured to the outer carriage plate 16.

The gear 49 meshes with an intermediate gear 51 shown as journaled on a stub 52 rigidly secured to the outer carriage plate 16, (see particularly Figs. 3 and 5). The intermediate gear 51 meshes with a traveling driving gear 53 that is arranged to slide on a driving shaft 54 that is journaled in bearings 55 and 56, respectively, on the main frame 7 and on the tie-plate 14. The shaft 54 is held against axial movements but is provided with long keys 57, which cause the gear 53 to rotate therewith but permit the same to slide thereon. The gear 53 is caused to travel with the cutter carriage 16—17 by a bifurcated shipper bracket 58, (see Figs. 1 and 5), that embraces the sides of said gear and is, itself, rigidly secured to the outer carriage plate 16. At its front end, the shaft 54 carries a bevel pinion 59 that meshes with a bevel gear 60 on the lower roller shaft 11.

The movable shearing blade or knife is preferably in the form of a flat tempered blade 61, which is not, however, sharpened like an ordinary knife, that is, brought to a sharp edge in the plane of its main surface, but the cutting edge of which is preferably at a right angle to the plane of its main surface. As an important feature, however, this shearing blade is provided with a V-shaped cutting point 61′, that is, it is formed with a chisel-like point that is adapted to force its initial entrance through the tube. This shearing blade, by screws 62 or other suitable means, is rigidly but detachably secured to a holder shown as in the form of a disc 63, which, in turn, is rigidly secured to the cylindrical cam 25 by screws

64. Said shearing blade 61 is thus mounted so that it will pass through the gap left between the relatively fixed shearing blades 21; and, as is obvious, the said movable or rotary shearing blade will be caused to travel with the blades 21 and with the carriage 16—17.

Mounted to slide on the hub of the dog-carrying disc 42 is a hub-like approximately rectangular dog-releasing cam 65, the corners of which are preferably rounded off, as best shown in Fig. 6. This cam 65 has a disc-like flange 66 that carries a stop lug 67 shown as in the form of a nut-equipped bolt and which is arranged to engage a stop in the form of a stud 68 carried by the dog-carrying disc 42. The stops 67 and 68, when engaged, prevent the knife-carrying disc 63 from being rotated by momentum in anti-clockwise direction beyond the position shown in Fig. 4, in which position it will be noted that the chisel point 61′ of the cutter blade 61 is but slightly below the converging lower edge of the tube A. To act as a friction brake to stop the rotation of the disc 42 when it is released from a driving connection, I have shown a spring-pressed plunger-like brake shoe 69 mounted in a lug 70 secured on the inner carriage plate 16.

The dog-releasing or tripping cam 65 is movable laterally into and out of operative positions and is held against rotation by means of a plurality of horizontally projecting parallel plungers 71 rigidly secured to the flange 66 and working slidably through the outer carriage plate 16. At their outer ends, the plungers 71 are provided with rigidly secured longitudinally adjustable heads 72. Short levers 73 are pivoted to the outer ends of horizontal posts 74 rigidly secured to the outer carriage plate 16. The outer ends of the levers 73 are pivotally seated in the heads 72 and their inner ends work in an annular groove formed in a shipper collar 75 that is rigidly secured to the clutch-tripping shaft 29, which latter, it will be remembered, rotates with the cutter shaft 24. The numeral 76 indicates a coiled spring anchored at its inner end to the outer plate 16 of the cutter carriage and at its outer end adjustably anchored to the fixed outer end tie-plate 14 by a nut-equipped hook bolt 77.

Operation.

Normally, the cutter blade 61 will be in an idle position approximately shown in Fig. 4, and the cutter carriage will be at its extreme position toward the right in respect to Figs. 1, 2 and 3. The cutter shaft 24 rotates in the direction of the arrows marked on Figs. 1, 2 and 4, and it will take about a three-quarter turn of said shaft 24 and of the cutter cam 25 to move the cutter carriage to its extreme or normal position toward the right.

Normally, the trip arm 32 will stand in the line or path of movement of the tube A and rotation of the cutter shaft will be positively stopped by engagement of the longitudinal portion 39 of the cam groove 38, (see Figs. 1 and 2), with the fixed stud or pin 40, and, moreover, the dog-tripping cam 65 will then be active on the arms 45 and the clutch dogs 43 will be held out of engagement with the ratchet wheel 47. When the tube A is forced against the trip arm 32, it will move the same and the clutch-tripping shaft 29 axially outward, thereby moving the longitudinal portion 39 of the cam groove 38 outward of the stud 40 and into alignment with the main channel of said cam groove. This movement of the shaft 29 not only releases the cutter shafts and other parts that are rotatable therewith, so that they are free for rotation, but the axial movement of said shaft 29, acting through the shipper collar 75, levers 73 and plungers 71, will move said cam 65 axially out of engagement with the arms 45, thereby permitting the dogs 43 to engage the ratchet wheel 47. Obviously, when the dogs are engaged with the continuously driven ratchet wheel, the cutter shaft through the gear drive described will be rotated.

The very act of rotating the cutter shaft 24 also rotates the cutter cam 25, and its cam groove 26, acting on the stud 27, immediately starts the travel of the cutter carriage toward the left. The said cam groove 26 is so formed that, during approximately the first quarter of rotation from normal position, it will cause the cutter carriage to travel at the same speed as the tube A and it is during this quarter rotation, more or less, that the shearing blade passes through the tube and severs the same. It is, of course, of the utmost importance that the fixed shearing blades 21, as well as the movable shearing blade 61, move with the cutter carriage at the same speed as the tube during the cutting or shearing action, and this is effectually accomplished by the means described.

The manner in which the chisel-pointed shearing blade cuts the tube should now be noted. The initial cut into the tube is produced by the chisel edge or point of the shearing blade, which exerts a pressure directly against the flat sides of the tube and without producing any inward lateral pressure against the said sides. The tube is thus adapted to withstand the initial entrance of the chisel point. When the chisel point has once punctured the tube, the rest of the shearing action is produced entirely by outward pressure on the walls of the tube and there is no tendency whatever to crush the tube. Of course, the outward pressure

on the walls of the tube is resisted by the closely fitting fixed shearing blades 21 and these blades work in such close proximity to the sides of the blades 61 that a perfect shearing action is produced. This shearing device, as already indicated, does not cut like a knife but severs the tube by cutting therefrom a thin strip that is the width of the shearing blade 61.

As above indicated, approximately the first quarter rotation of the shearing blade from its normal position will carry the same completely through the tube and clear thereof. Positions of the parts reached by the first quarter rotation of the cutter beyond normal position are illustrated in Figs. 1 and 2. Here, attention is further called to the fact that the spring 76 simply acts to assist in overcoming inertia of the cutter frame, so that it will quickly move when acted upon by the cam 25.

The cam groove 38, in the cam 37, is so formed that, during the time that the cutter carriage is given its travel with the tube, as above described, it will cause the trip arm 32 to move with or slightly ahead of the outer end of the tube. During the three-quarter rotation from the positions shown in Figs. 1 and 2, the following actions will take place:—The cam 25 will return the carriage to its normal position to the right and the cam 37 will cause the shaft 29 to move therewith at approximately the same speed as the cutter shaft 24 and cutter carriage, during approximately the second and third quarters of rotation, but, during the last quarter of rotation, the cam groove 38 of the cam 37 will slow up the axial movement of the shaft 29 and shipper collar 75 and thereby cause the levers 73, acting through the plungers 71, to move the dog-releasing cam 65 into the path of movement of the arms 45 with the result that slightly before the full rotation is completed, the dogs 33 will be cammed out of engagement with the ratchet wheel 47. This, as is evident, releases the shafts 24 and 29 from the driving connections. At the completion of the full rotation, the longitudinal portion of the cam groove 38 again engages the fixed cam stud 40 and positively stops rotation of the shafts 24 and 29 and the parts carried thereby. Also, engagement of the stop 68 of the disk 42 with the stop 67 of the non-rotary cam 65 further and positively insures proper stopping of the rotary parts, including the cutter or shearing blade 61.

It is evident that, when the end of the tube A strikes the trip arm 32 and moves the same and the shaft 29 toward the left, thereby throwing the clutch mechanism into action and cause rotation of the cutter, the shaft 24 will rotate the shaft 29 and immediately carry the arm 32 out of the path of movement of the tube, and upon completion of the full rotation of the cutter and shafts, said trip arm will be again positioned within the path of movement of the tube. The tube sections cut off from the continuously moving tube will, of course, drop out of the way, thereby giving clear space for the advance movement of the uncut tube.

This describes the complete cycle of operation of the machine, but, of course, these cycles will be automatically repeated as long as the tube A is continuously fed.

This improved machine is especially designed and particularly adapted for the severing of tubes, but many of the novel features herein disclosed and claimed are capable of use for cutting or severing solid rods, bars and the like.

What I claim is:

1. The combination with tube-feeding means, of a cutter carriage mounted to move in the direction of the travel of the tube, a cutter shaft rotatably mounted on and movable with said carriage, a tube cutter carried by said shaft, a cam carried by said cutter shaft, a relatively fixed cam-engaging device co-operating with same cam to cause said carriage to travel with the tube during the tube-cutting action, means including clutch mechanism for rotating said cutter shaft while traveling with said carriage, and a clutch trip arranged to be engaged and operated by the moving tube.

2. The structure defined in claim 1 in further combination with fixed shearing blades on said carriage arranged to co-operate with said movable cutter.

3. The structure defined in claim 1 in further combination with fixed shearing blades carried by said cutter carriage and having guide passages that clearly fit the exterior of the tube.

4. The combination with tube-feeding means, of a cutter carriage mounted to move in the direction of the travel of the tube, a cutter shaft rotatably mounted on and movable with said carriage, a tube cutter carried by said shaft, a cam carried by said cutter shaft, a relatively fixed cam-engaging device co-operating with said cam to cause the carriage to travel with the tube during the tube-cutting action, means including clutch mechanism for rotating said cutter shaft while traveling with the carriage, a clutch-tripping shaft rotatable with said cutter shaft but movable axially in respect thereto, a clutch-tripping arm carried by said clutch-tripping shaft but normally standing in the path of movement of the tube, a cam carried by said clutch-tripping shaft, a fixed cam-engaging device co-operating with said latter noted cam to impart axial movement thereto differing from that of said cutter shaft, and a clutch-tripping device operated by said clutch-tripping shaft.

5. The structure defined in claim 4 in which the cam on said clutch-tripping shaft has a longitudinal portion normally acting as a stop to hold the two shafts and the cutter against rotation.

6. The structure defined in claim 4 in which said trip arm is adjustable on said clutch-tripping shaft to set the machine for cutting the tube in different lengths.

7. The combination with tube-feeding means, of a tube cutter arranged to travel with the tube during the tube-cutting action, and means including a positive feed device and a trip for throwing the latter into action, said tube-feeding means when thrown into action causing said tube cutter to positively travel with the tube during the tube-cutting action.

8. The combination with tube-feeding means, of a tube cutter including a rotary and non-rotary shearing blades arranged to travel with the tube during the tube-cutting action, said non-rotary shearing blades having passages that closely fit the tube and afford a guide therefor.

9. The combination with tube-feeding means, of a cutter carriage movable in the direction of the travel of the tube, a tube cutter on said carriage and comprising laterally spaced non-rotary shearing blades and a rotary shearing blade, said non-rotary shearing blades having passages that closely fit the tube and afford a guide therefor, and means for rotating said cutter while traveling with said cutter during the tube-cutting action, said means including a trip operated by the movable tube.

10. The combination with tube-feeding means, of a cutter carriage movable in the direction of the travel of the tube, a cutter rotatably mounted on said carriage, means for driving said cutter including a clutch, means for causing said carriage to travel with the tube during the tube-cutting action, a clutch-tripping shaft rotatable with the cutter but having an axial movement in respect thereto and having connections for operating said clutch, and a trip arm carried by said trip shaft and normally standing in the path of movement of the tube.

11. The structure defined in claim 10 in further combination with an element on said trip shaft and a co-operating relatively fixed element operative normally to hold said trip arm and cutter against rotation.

12. The combination with tube-feeding means, of a cutter shaft and a clutch-tripping shaft connected for common rotation but capable of relative axial movements, a tube cutter carried by said cutter shaft, means for intermittently rotating said cutter shaft and for moving the same axially during the tube-cutting action, said means including a one-revolution clutch, and means for imparting to said clutch-tripping shaft axial movements differing from that of the said cutter shaft to thereby actuate said clutch.

13. The structure defined in claim 12 in which said latter noted means includes a cam on said clutch-tripping shaft and a co-operating relatively fixed cam-actuating abutment.

14. The structure defined in claim 12 in which said latter noted means includes a cam on said clutch-tripping shaft and a co-operating relatively fixed cam-actuating abutment, said cam having an axially extended portion that affords a stop when engaged with said abutment and from which abutment the cam is released by axial movements.

15. The combination with tube-feeding means, of a cutter shaft and a clutch-tripping shaft connected for common rotation but capable of relative axial movements, a tube cutter carried by said cutter shaft, a radially projecting trip arm carried by said clutch-tripping shaft, means including a one-revolution clutch for rotating said shafts and cutter, means for moving said cutter shaft and cutter axially during the tube-cutting action, means for stopping said shafts with said trip arm in the path of movement of said tube, and means for moving said clutch-tripping shaft axially to trip said clutch into action.

16. The structure defined in claim 15 in which said latter noted means includes a cam on said clutch-tripping shaft, and a co-operating relatively fixed cam-actuating abutment.

17. The structure defined in claim 15 in which said latter noted means includes a cam on said clutch-tripping shaft, and a co-operating relatively fixed cam-actuating abutment, said cam having a longitudinal portion affording means for normally stopping said trip arm in the path of movement of said tube.

18. The structure defined in claim 15 in which the means for imparting axial movement to said cutter shaft and cutter includes a cam on said cutter shaft and a co-operating relatively fixed cam-actuating abutment.

19. The structure defined in claim 15 in which the means for imparting axial movement to said cutter shaft and cutter is a cam on said cutter shaft and a co-operating relatively fixed cam-actuating abutment, and in which the means for imparting differential axial movement to said clutch-tripping shaft is a cam on said clutch-tripping shaft and a co-operating relatively fixed cam-actuating abutment.

20. The structure defined in claim 15 in which the means whereby axial movement of said clutch-tripping shaft operates said clutch includes a continuously driven ratchet wheel, a cooperating driving dog, a non-ro-

tary laterally movable dog-releasing element, and a lever connection between the latter and said clutch-tripping shaft.

21. The combination with an angular guide constructed and arranged to hold an angular tube with its salient angles against rotation and in definite positions in respect to rotation, of a cutter provided with a chisel-like point arranged to primarily engage a salient angle of the tube and to sever the same by outward cutting action in opposite directions transversely of the axis of the tube.

In testimony whereof I affix my signature.

MEINHARD WITTE.