April 23, 1946. D. A. FORSBERG 2,398,929

TUBE CUTTING MACHINE

Filed July 20, 1944 2 Sheets-Sheet 1

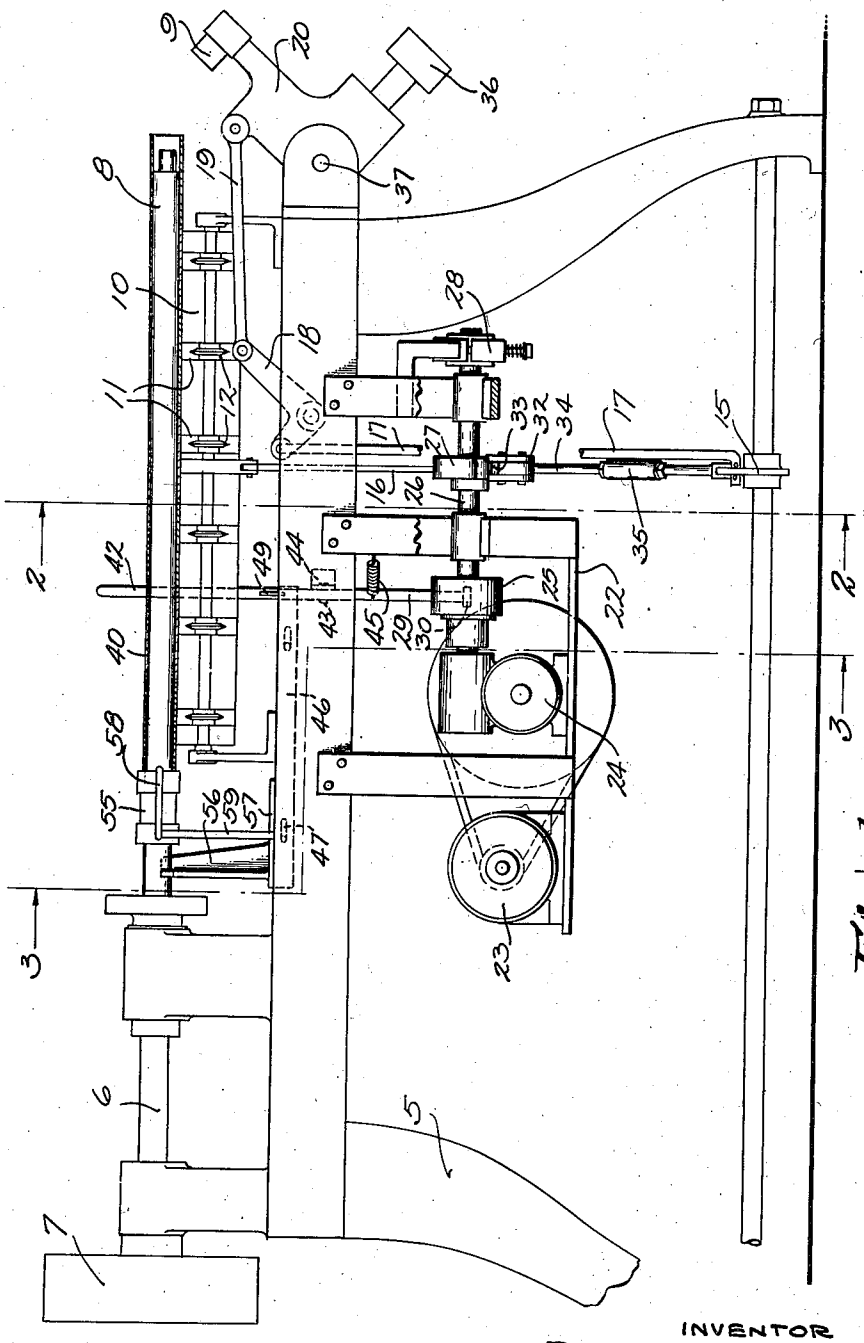


Fig. 1.

INVENTOR
DELBERT A. FORSBERG

BY
Wheeler, Wheeler & Wheeler
ATTORNEYS.

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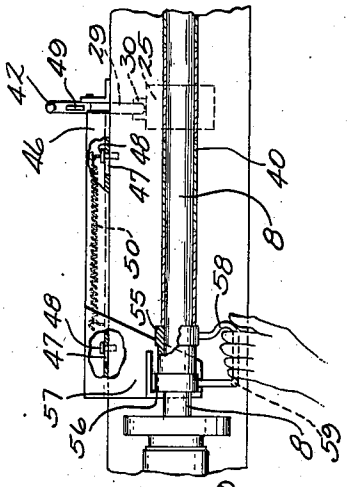


Fig. 4.

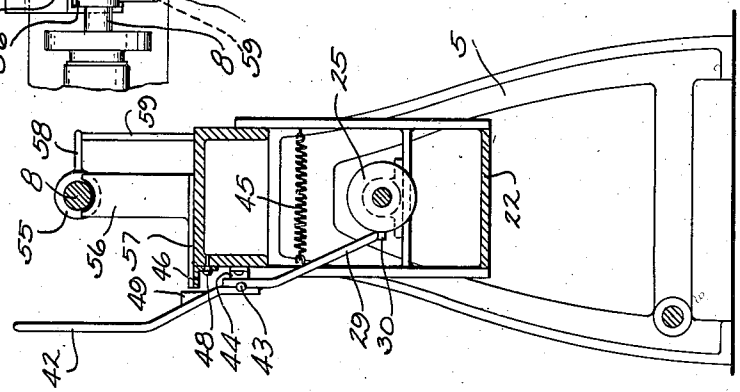


Fig. 3.

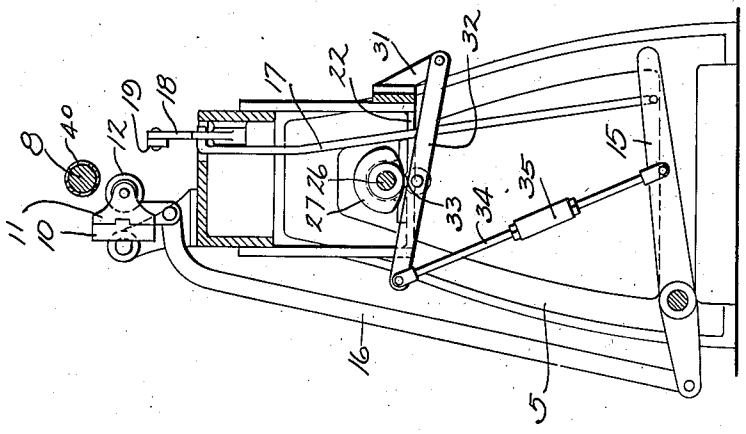


Fig. 2.

INVENTOR
DELBERT A. FORSBERG

BY

Wheeler, Wheeler & Wheeler
ATTORNEYS.

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TUBE CUTTING MACHINE

Delbert A. Forsberg, Madison, Wis.

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13 Claims. (Cl. 164—69)

This invention relates to improvements in tube cutting machines.

The objects of the invention are to improve and accelerate tube cutting operations, to provide for uniformity of operation of the cutting knives, both as to pressure, depth of cut and speed; to eliminate the need of experienced operators; to facilitate the discharge of cut cores from the mandrel; to promote safety in the use of the equipment; and to provide apparatus for achieving the foregoing objectives which can be attached to existing standard tube cutting machines to improve their functioning in the particulars specified.

Other objects will be apparent to those skilled in the art upon analysis of the following disclosure.

In the drawings:

Fig. 1 is a view principally in front elevation and partially broken away of a tube cutting machine embodying my invention.

Fig. 2 is a detail view taken in section on the line 2—2 of Fig. 1.

Fig. 3 is a detail view taken in section on the line 3—3 of Fig. 1.

Fig. 4 is a fragmentary plan view of a portion of the apparatus shown in Fig. 1, with parts broken away to expose underlying structure.

Like parts are identified by the same reference characters throughout the several views.

The tube cutting machine illustrated as a means of exemplifying the invention is fundamentally of conventional design. Such machines conventionally include parts corresponding to the frame 5, drive shaft and pulley 6, 7, mandrel 8, retractable mandrel bearing 9, the tiltable plate 10 upon which the carriers 11 are adjustable for the support of the disk knives 12, the lever 15, the linkage 16 to the tiltable plate 10, and the linkage 17, bell crank 18 and link 19 to the tiltable tail stock 20 for the retractable mandrel bearing 9.

In the use of conventional machines comprising the foregoing elements, it took considerable skill to exert exactly the right amount of pressure on the knives to sever the tube on the mandrel without blunting the edges of the knives against the mandrel or cutting into the mandrel. A dextrous operator could perform many more operations in a given period than a less dextrous operator, even though the latter had the skill enabling him to know the right amount of pressure to use.

In order to eliminate the need for skill and dexterity and in order, moreover, to promote safety and to enable even the most unskilled operator safely and expeditiously to operate the machine, I have proivded means for mechanically performing the requisite operations, and controls which require the use of both hands of the operator at positions keeping them from the danger zone.

From the central portion of the frame, I suspend a sub-frame 22 upon which is mounted a motor 23 operatively connected through reduction gearing 24 and clutch 25 to drive a cam shaft 26 which carries a cam 27 and is constantly subject to the drag of a friction brake shoe at 28. The clutch 25 is of the type, well known commercially, which is disengaged when a stop member such as that shown at 29 encounters a lug 30 on the exterior of the clutch. When the stop lever 29 is pivoted out of engagement with the lug 30, the clutch automatically engages to complete a driving connection to the cam shaft.

Pivoted on arm 31 is a cam follower lever 32 supporting the cam follower roller 33 in peripheral engagement with the cam 27. A link 34 having a turn buckle 35 for adjusting its length, connects the cam follower lever 32 with the conventional operating lever 15 of the machine. In lieu of a spring to hold the cam follower roller 33 in peripheral engagement with cam 27, reliance is placed on the biasing weight 36 with which the tail stock 20 is conventionally provided, such weight acting constantly to tend to tilt the tail stock 20 pivotally about its fulcrum at 37. The bias is transmitted through the bell crank 18, lever 17 to lever 15. When the high part of cam 27 engages the roller 33, it actuates the lever 15 in opposition to the bias of weight 36 to lift the tail stock 20, to engage the bearing 9 with the mandrel 8 and to bring the knives 12 into operative cutting engagement with the core tube 40 on the mandrel 8. The adjustment afforded by the turn buckle at 35 provides a very precise control of the operation of these parts in the course of rotation of the cam 27. The rate of rotation of the cam shaft 26 and cam 27 determines the period of time required for the cutting operation and the adjustment determines the depth of cut.

The lever 29 which effects engagement and disengagement of the clutch 25 has an operating handle projecting upwardly at 42. The lever is fulcrumed at 43 on a bracket 44 attached to the back of the frame. The handle must be pulled forwardly slightly to disengage the stop lever 29 from block 30. As soon as clearance for the lug

is afforded, the operator may release lever **42** and it will be drawn back to lug engaging position by the bias of a tension spring **45** connected appropriately between the lever and the sub-frame.

However, the lever **29, 42** cannot even be moved to release the lug **30** and engage lugs **25** until a slide **46** slotted at **47** for guidance on bolts **48** at the rear of the frame is first retracted out of the path of a stop web **49** carried by the handle portion **42** of lever **29**. Fig. 4 shows the slide retracted to the left against the bias of spring **50** which tends to draw the slide into stop position in the path of web **49**. The slide is moved to the left to retract it from the path of web **49** by means of a manually operable stripping sleeve **55** on the mandrel and an arm **56** notched to receive the mandrel and disposed in the path of the stripping sleeve **55**, such arm being mounted on a plate **57** carried by the slide **46**, as best shown in Figs. 3 and 4. The stripping sleeve has a handle at **58** from which depends a rod **59** which, engaging the bed of the frame, keeps the sleeve **55** from rotating with the mandrel at such times as the operator does not happen to be using the handle **58**.

When the uncut core tube is slid on to the end of mandrel **8** exposed by the retraction of bearing **9**, the stripping sleeve **55** must be moved ahead of the core tube toward the left, as viewed in Fig. 2, where it ultimately contacts the notched arm **56**. At this point, the entire length of the core tube **40** is on the mandrel, leaving clearance at the end of the mandrel for engagement of the mandrel by the tail stock bearing **9**. The stripping sleeve is not, however, at the extreme limit of its leftward movement, being yieldably precluded from advance to its extreme left position by the bias of spring **50** which, acting on the slide, yieldably positions the notched arm **56** with which the stripping sleeve **55** is engaged.

In order that the machine may function to slit or cut the core tube **40**, the operator is required to grasp the handle **58** with his left hand and the handle **42** with his right hand. When the operator pushes handle **58** to the left, the sleeve **55** will thrust arm **56** and slide **46** to the left against spring **50**, thus removing the stop end of slide **46** from the path of the web **49** on lever **42**. The operator can now pull the handle **42** forwardly to release stop lever **29** from the clutch lug **30**, thereby engaging the clutch. The operator may then release both of the handles **42** and **58**. The handle **42** will be drawn by spring **45** to a position where it will disengage the clutch upon the completion of one cam shaft rotation. Thereupon the slide **46** will be pulled to the right, as viewed in Figs. 2 and 4, into the path of web **49** to prevent any further movement of handle **42** until the above sequence of operations is repeated.

Meantime the engagement of the clutch is causing one full rotation of the cam shaft **26** which, almost instantly, will swing the tail stock bearing **9** into engagement with the free end of the mandrel and simultaneously raise the knives to cut the core tube to precisely the correct depth and will, thereupon, withdraw the knives and retract the tail stock bearing.

Using the stripping sleeve **55** by means of handle **58** (a feature valuable independently of the cutting control), the operator will now eject the cut cores from mandrel **8** by sliding the sleeve the length of the mandrel and forcing the cores from the end thereof. A new core tube is immediately placed on the mandrel, the stripping sleeve **55** being simultaneously returned and the sequence of operations is then repeated. The mandrel will be understood to remain in continuous rotation. The motor **23** and the drive through the reduction gearing at **24** as far as the clutch is also in continuous operation while the machine is in use. The drag brake at **28** prevents overrun of the cam shaft and arrests cam shaft movement promptly upon the completion of one rotation.

Since the operator is required to use both hands to withdraw the stop slide **46** and to actuate the clutch engaging lever, and since the cutting knives move into engagement with the work and out again before the operator can release these parts and move his hands into danger, the machine is safe as well as speedy by reason of the attachments described.

I claim:

1. In a core tube cutting machine including a mandrel and knife means movable to and from engagement with work on the mandrel, the combination with actuating connections for such knife means, of a constantly operating driving motor, a driven operator for said connections, a clutch subject to manual control for coupling said motor with said operator and provided with means for clutch disengagement after a predetermined operation of said operator, and manual control means for engaging the clutch, said operator and connections being adapted to move the knife means to and from the mandrel in a single complete cycle upon each manually initiated clutch operation.

2. In a device of the character described having a mandrel and knife means movable to and from the mandrel, and actuating conections for said knife means including a lever and a link connecting the lever with the knife means, the combination with said lever of mechanical operating means therefor comprising a cam follower, means including an adjustable link mechanically connecting the cam follower with the lever, a cam rotatably mounted and in operative association with the cam follower and manually controllable means for rotating said cam for one revolution, said cam being contoured to actuate said lever in the course of such cam revolution for the advance of the knife means and the retraction thereof.

3. In a device of the character described having a mandrel and knife means movable to and from the mandrel, the combination with actuating connections for said knife means including a rotatable part and mechanism for advancing and retracting the knife means in a single complete cycle in the course of a single part rotation, a clutch controlling part rotation and including means for mechanically disengaging the clutch upon the completion of a single rotation of said part, means for manually initiating the clutch controlled part rotation, and a continuously operable source of power in driving relation through the clutch to said part.

4. The device of claim 3 in which said clutch has a clutch disengaging lug and the manual control means for the clutch includes a stop normally disposed in the path of said lug and manually displaceable therefrom, whereby displacement of the stop will release the lug and release of the stop will occasion the reengagement of the lug to disengage the clutch upon the completion of one rotation of said part.

5. In a device of the character described including a mandrel, a knife support movable to and from the mandrel, and knife means on said support, the combination with actuating connections for said support, of rotatable means for operating said connections to move said support

from a normally retracted position to operative cutting relation to work on the mandrel and thence back to said position, and means for actuating said rotatable means and comprising a motor, a clutch, and means for engaging said clutch for a single rotation, said motor having a driving connection through said clutch to said rotatable means.

6. In a device of the character described including a mandrel, a knife support movable to and from the mandrel, and knife means on said support, the combination with actuating connections for said support, of rotatable means for operating said connections to move said support from a normally retracted position to operative cutting relation to work on the mandrel and thence back to said position, and means for actuating said rotatable means and comprising a motor, a clutch, and means for engaging said clutch for a single rotation, said motor having a driving connection through said clutch to said rotatable means, together with a hand lever for the actuation of said clutch, releasing means, and a stop having a separate handle and disposed in the path of said hand lever whereby said stop must be moved by the operator coincidentally with the actuation of said hand lever as a prerequisite to clutch engagement.

7. In a machine of the character described having a mandrel, a knife support movable to and from the mandrel, and knife means on the support for engagement with work on the mandrel, and a lever provided with a link connection to said support for the actuation thereof, the combination with a driving motor and driving connections therefrom including a normally disengaged clutch, of means connected to be driven through said clutch for the oscillation of said lever through a given cycle of forth and back movement, and means for manually engaging said clutch for a single rotation.

8. The device of claim 7 in which said clutch has a stop lug and said clutch engaging means comprises a lever having a stop portion biased for movement into the path of said lug and removable therefrom to permit the release of said lug for the engagement of the clutch, a detent normally in the path of oscillation of said lever and movable from said path whereby the movement of the detent is a prerequisite to the operation of the lever for the engagement of said clutch, and a sleeve on the mandrel, said detent having means engaged by the sleeve for moving said detent from the path of lever movement, said sleeve being provided with a handle.

9. In a device of the character described having a mandrel, a knife support and knife means on the support, the combination with the mandrel, of a stripping sleeve mounted thereon for axial movement and provided with a handle fixed thereto, and means for preventing sleeve rotation with said mandrel, whereby said handle is accessible during manual rotation.

10. In a device of the character described having a mandrel, a knife support and knife means on the support, the combination with the mandrel, of a stripping sleeve mounted thereon for axial movement and provided with a handle, together with mechanical actuating connections provided with a manual control for advancing the knives toward the mandrel and retracting the knives therefrom, said manual control having a detent normally precluding its operation, and retracting means for the detent disposed in the path of the stripping sleeve to be actuated thereby, whereby a movement of the stripping sleeve is a prerequisite to the actuation through said manual control of the connections for advancing and retracting the knife means.

11. In a device of the character described including a mandrel, a knife support and knife means movable on said support to and from the mandrel, the combination with the mandrel, of a stripping sleeve mounted thereon and movable axially of the mandrel, a handle for the operation of the stripping sleeve, a retractable detent, means for transmitting motion from the stripping sleeve to the detent for the retraction of the detent, a manually operable control mounted for movement across the path of the detent whereby to be inoperable pending detent retraction, and mechanical operating connections for the knife support including a clutch engageable subject to said manual control.

12. A device of the character described comprising a motor, a clutch having a peripheral clutch disengaging lug, a manually retractable stop in the path of said lug for clutch disengagement, a cam connected to receive motion from said motor through said clutch when the clutch is engaged, a cam follower, an adjustable link connected with said cam follower, a knife movable to and from work engagement, and connections from said link for the actuation of said knife into and from work engagement in the course of cam rotation, the range of knife movement being predetermined by the adjustment of said link.

13. In a device of the character described having a mandrel, a knife support, knife means on the support movable to and from the mandrel, and an actuating lever in operative connection with said knife support, the combination of a hand lever provided with a fulcrum and a handle portion projecting above said mandrel, a detent in the path of said hand lever comprising a slide reciprocable in substantial parallelism with the mandrel, an arm connected with said slide and notched to receive the mandrel, a stripping sleeve upon the mandrel provided with a handle and engageable with said arm for the retraction of said detent, means for biasing said detent against retraction by said sleeve, a motor adapted for continuous operation, driving connections from the motor including a clutch having a peripheral clutch disengaging lug with which said hand lever is normally in contact, said lever being movable to release said lock upon the retraction of said detent, a cam operatively connected to receive motion from said driving connections through said clutch when said clutch is engaged, a cam follower biased to peripheral engagement with the cam, and means including an adjustable link connecting said cam follower with the lever which operates the knife support.

DELBERT A. FORSBERG.