Nov. 3, 1964 R. H. WEISGERBER 3,154,891

APPARATUS FOR GRINDING FLEXIBLE CORD

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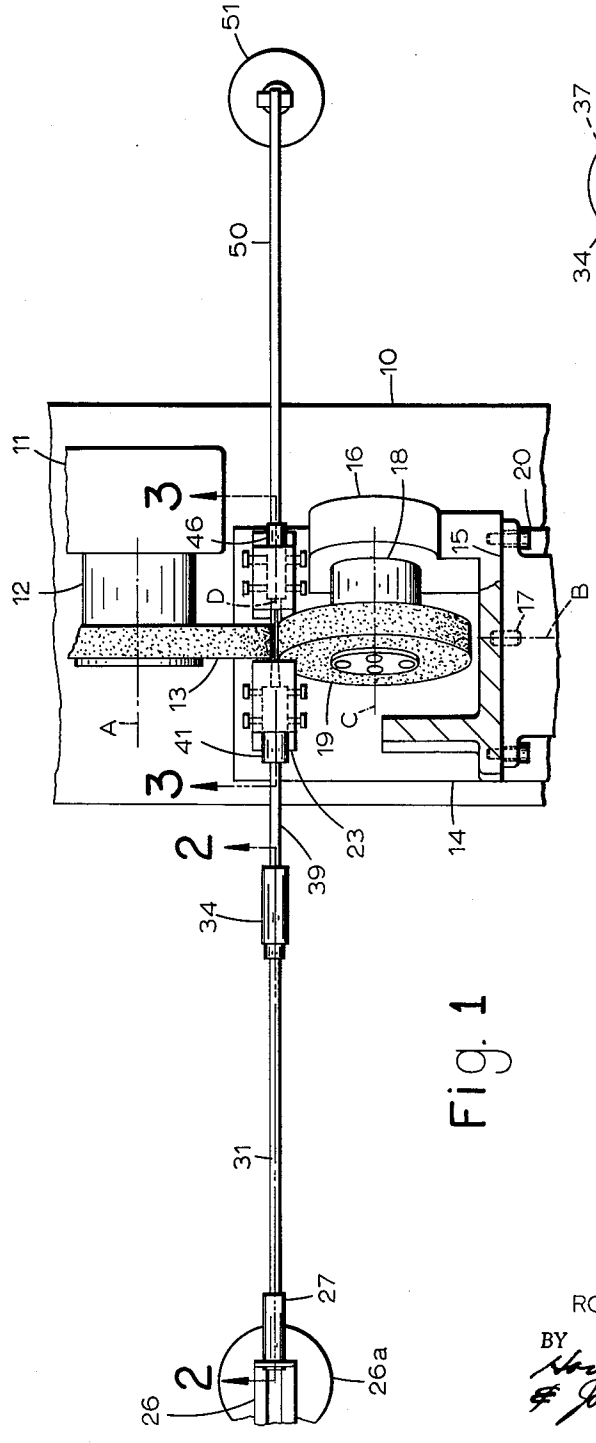


Fig. 1

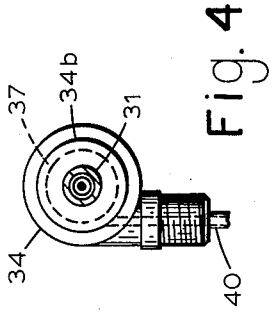


Fig. 4

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Fig. 2

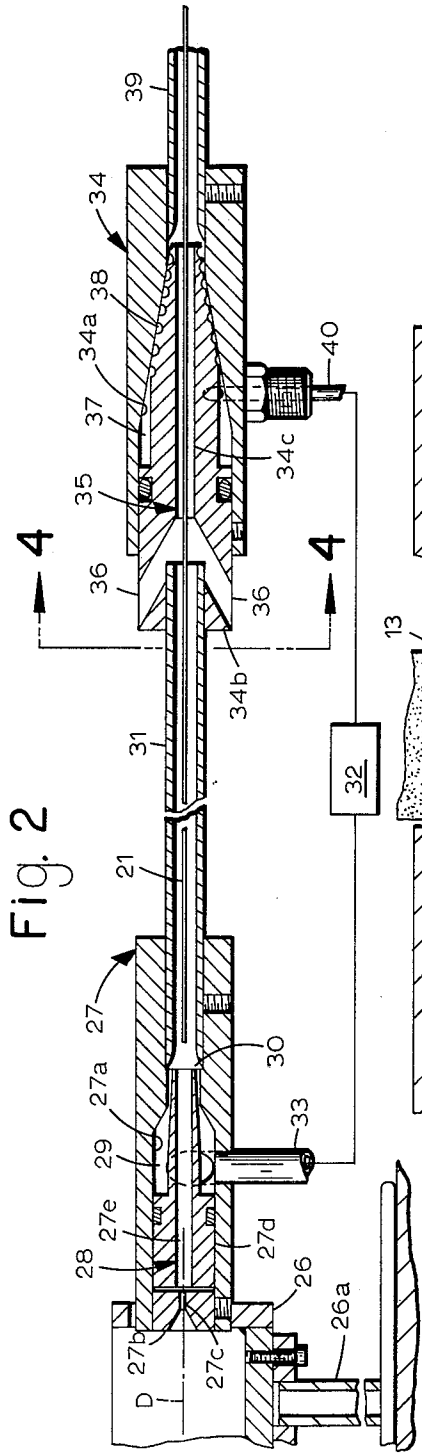
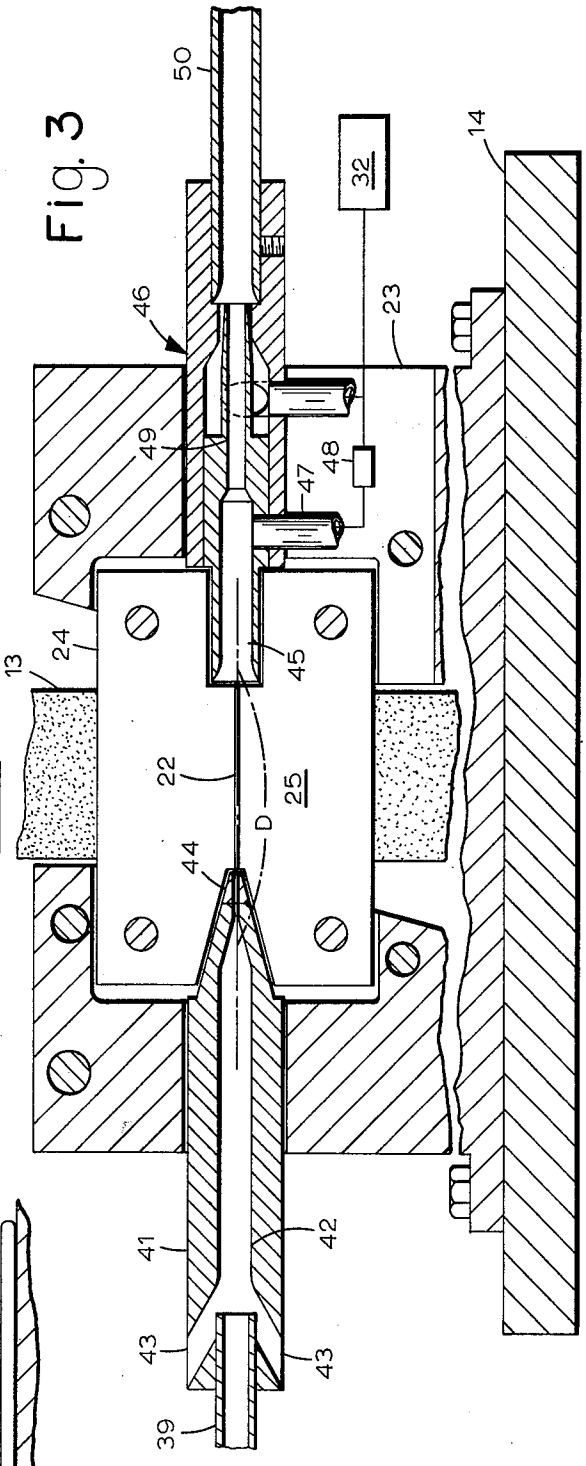


Fig. 3



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APPARATUS FOR GRINDING FLEXIBLE CORD

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The present invention relates to the grinding of long, flexible cord, such as catgut, and, more particularly, to the feeding and rotation of the cord for grinding.

It is conventional to grind long flexible cord (such as catgut for musical instrument strings or surgical sutures and ligatures) in a through feed centerless grinding machine. A grinding wheel and a regulating wheel, the peripheries of which are spaced a small distance apart, define a grinding throat therebetween. A blade in the grinding throat supports the catgut, which is rotated on the blade by the regulating wheel. Usually, the regulating wheel is tilted slightly to urge the catgut along the blade as it is ground by the grinding wheel.

The grinding wheel and regulating wheel, since both are engaged with the catgut, exert a positive, mechanical, grip on the material and it is desirable to avoid other positive, mechanical, grips thereon which, in conjunction with the grip exerted in the grinding throat, could readily snap the thin catgut. For this reason, it is known to use pneumatic feeders to bring the catgut up to and away from the grinding throat. The air, although it is capable of moving the light catgut, does not exert a sufficient force to break the catgut if the catgut is slowed down or stopped momentarily by some other force.

If a piece of catgut is moved into the grinding throat without rotation, the forward end of the piece begins to rotate the instant it is gripped between the wheels. If the piece is long, the trailing end of the piece will not begin to rotate, and, consequently, the piece will be twisted as it is fed into the grinding throat. The twisting of the piece as it feeds into the grinding throat makes the piece harder to control during grinding and, more importantly, distorts the piece to deleteriously affect the grind thereon.

In the present invention, there is provided a workpiece driver to rotate a long flexible cord, such as catgut, without exerting a positive mechanical grip thereon. This is accomplished by passing the catgut through a straight guide passage, and passing fluid under pressure through a helical passage terminating at the guide passage to create a vortex in the guide passage which rotates the catgut.

In the preferred form of the invention the driver, which is located on the entry side of the grinding throat, is between two pneumatic feeders and initiates rotation of the piece leaving the upstream feeder before the piece enters the throat. The helical passage in the driver has convolutions which diminish in diameter as they extend downstream so that the angular velocity of the air increases as it passes through the helical passage for discharge from the downstream end thereof into the guide passage.

It is therefore one object of the present invention to provide mechanism for rotation of a long flexible cord without exerting a mechanical grip on the cord.

It is another object of the present invention to provide mechanism in a grinding machine for rotation of a piece of catgut before entry thereof into the grinding throat by creating a vortex in the guide passage through which the catgut passes.

In the drawings:

FIG. 1 is a plan view of a centerless grinding machine incorporating the present invention;

FIGS. 2 and 3 are enlarged views taken on the lines 2—2 and 3—3, respectively, of FIG. 1; and

FIG. 4 is a view taken on the line 4—4 of FIG. 2.

There is shown in FIG. 1 a plan view of a centerless grinding machine having a base 10. A wheelhead 11 is mounted on the base and supports, on horizontal axis A, a rotatable spindle 12 on which grinding wheel 13 is mounted. A slide 14 is also mounted on base 10 and has a vertical face 15 on which a regulating wheel housing 16 is mounted. The regulating wheel housing is pivotal on slide 14 about pin 17, lying on horizontal axis B which is perpendicular to axis A. A spindle 18 is mounted in housing 16 on axis C and carries a regulating wheel 19 at one end. As in conventional through feed grinding, the regulating wheel housing 16 is clamped to slide 14 by bolts 20 in an angular position to hold the regulating wheel 19 tilted with respect to grinding wheel 13. A long flexible cord 21, received in the grinding throat 22 between the grinding wheel 13 and regulating wheel 19, is held in grinding engagement with the grinding wheel by the regulating wheel. The cord is rotated by the regulating wheel and fed through the throat (to the right as viewed in FIG. 1) thereby by virtue of the tilt thereof. The slide 14, although adjustable on base 10 so that the grinding throat can accommodate cord, such as catgut, of different diameter, is held fixed on the base during through feed grinding of the catgut.

A support 23, mounted on slide 14, carries two closely spaced blades 24 and 25, one above the other, which extend between the wheels 13 and 19 to guide the catgut therebetween through the grinding throat 22.

The long, thin, flexible catgut workpieces are fed along an axis D extending through the grinding throat 22. The cord, or catgut, is stored in a trough 26 which is mounted on pedestal 26*a*. Each piece of gut is fed manually to a pneumatic feeder 27 which has an internal bore 27*a* extending therethrough on axis D. A guide member 27*b*, having an orifice 27*c* therein, is received in the upstream end of bore 27*a*, and a guide tube 31 is received in the downstream end thereof. Between guide member 27*b* and guide tube 31, a core member 27*d* is received in bore 27*a* to define an annular chamber 29 with the bore 27*a*. A horizontal passage 27*e* through core member 27*d* connects orifice 27*c* to the inside of tube 31 to define a horizontal passage 28 extending through the feeder 27 for the passage of the catgut 21. Annular chamber 29 is closed at the upstream end and has a narrow annular opening 30 at the downstream end which is in communication with the interior of guide tube 31. Air under pressure, supplied from a source 32 through inlet pipe 33 to annular chamber 29, is propelled into guide tube 31 to urge the catgut 21 toward the grinding throat (to the right as viewed in FIG. 2).

The downstream end of guide tube 31 is received in a workpiece driver 34 located between feeder 27 and the grinding throat 22. Driver 34 has a horizontal bore 34*a* extending therethrough on axis D into the upstream end of which a core member 34*b* is received. Tube 31 is received in the upstream end of core member 34*b*, and a horizontal passage 34*c* through core member 34*b* connects tube 31 to a guide tube 39 received in the downstream end of driver 34 to define a horizontal passage 35 through the driver 34 for the passage of catgut 21 from guide tube 31 to guide tube 39. Air from tube 31 in excess of that which can pass through passage 34*c* is expelled through side vents 36. The core member 34*b* defines, with bore 34*a*, an annular chamber 37, the upstream end of which is closed. The downstream end of chamber 37 is in communication with one end of a helical passage 38 defined by core member 34*b* and bore 34*a*. The downstream end of passage 38 is in communication

with the guide tube 39. The diameter of the convolutions of the helical passage 38 diminish as the passage 38 extends in the downstream direction. Air under pressure from source 32 passes into chamber 37 through inlet tube 40 and is discharged therefrom into guide tube 39, the air accelerating as it flows through the progressively smaller diameter convolutions of the passage 38. The air swirling through the helical passage 38 has an angular velocity as well as an axial downstream velocity which creates a vortex in guide tube 39 moving downstream toward the grinding throat 22. This vortex imparts rotation to catgut entering tube 39 from the driver and carries the catgut toward the grinding throat. Thus, the driver 34 defines a workpiece rotator as well as a workpiece feeder.

The downstream end of tube 39 is received in a guide block 41 which is mounted in support 23. The guide block 41 has a horizontal passage 42, with side vents 43, which terminates in orifice 44 through which the rotating catgut enters the grinding throat 22. The rotating workpiece is received between the wheels 13 and 19 for grinding, being rotated and fed toward the exit end of the throat thereby. Since the catgut 21 is already rotating when it is initially gripped between the wheels 13 and 19, twisting thereof by the action of the wheels is minimized.

Workpieces fed through the grinding throat 22 are received in chamber 45 of a workpiece feeder 46. The source 32 of air under pressure is connected to chamber 45 through inlet pipe 47 and pressure reducing valve 48 to maintain a barrier pressure in chamber 45, slightly above atmospheric pressure, for repelling coolant and grit which may be present in the grinding throat. In other respects, the workpiece feeder 46 is similar to the workpiece feeder 27 and has a horizontal passage 49 on axis D, extending between chamber 45 and guide tube 50. The guide tube 50 is preferably almost as long as the pieces of catgut being ground so that the tendency of the workpieces rotated by the wheels to whip will be minimized. Finished workpieces are expelled from the downstream end of guide tube 50, which is supported by a pedestal 51.

It will be noted that the driver 34 acts not only as a workpiece rotator but also as a workpiece feeder. Thus, drivers similar to driver 34 may be used in place of feeder 27 and/or feeder 46. Generally, however, the driver 34, at the entry side of the grinding throat 22, provides sufficient rotation to the catgut to prevent undesirable twisting of the catgut resulting from the positive grip exerted thereon in the grinding throat for rotation and grinding thereof by the wheels 13 and 19.

What is claimed is:

1. In a centerless grinding machine having a grinding throat for grinding a long flexible cord, the combination therewith of a workpiece driver comprising a body having a straight passage extending therethrough, said passage aligned with the grinding throat for passage of the cord therethrough, said body having a helical passage connectable to a source of fluid under pressure and terminating in the straight passage to create a vortex therein for rotation of the cord.

2. In a centerless grinding machine having a grinding throat for grinding catgut, the combination therewith of a workpiece driver on the entry side of the grinding throat comprising a body having a straight passage extending therethrough, said passage aligned with the grinding throat for passage of the catgut downstream toward the grinding throat, said body having a helical passage, one end of said helical passage adapted for connection to a source of fluid under pressure and the other end thereof terminating in the straight passage downstream from said one end to create a vortex in the straight passage moving downstream for rotation of the catgut and feeding movement thereof toward the grinding throat.

3. In a centerless grinding machine having a grinding throat for grinding catgut, the combination therewith of a workpiece driver on the entry side of the grinding throat comprising a body having a straight passage extending therethrough, said passage aligned with the grinding throat for passage of the catgut downstream toward the grinding throat, said body having a helical passage with the convolutions thereof diminishing in diameter as they extend in the downstream direction, one end of said helical passage adapted for connection to a source of fluid under pressure and the other end thereof terminating in the straight passage downstream from said one end to create a vortex therein moving downstream for rotation of the catgut and feeding movement thereof toward the grinding throat.

4. In a centerless grinding machine having a grinding throat for grinding catgut, the combination therewith of a pair of workpiece feeders straddling the grinding throat, each of said workpiece feeders having a straight passage therethrough aligned with the grinding throat and each having a passage connected to a source of pressure for discharge of fluid downstream into said straight passage, a workpiece driver on the entry side of the grinding throat and between said feeders, said driver having a straight passage extending therethrough aligned with said straight passages in the feeders for passage of the catgut from the upstream feeder to the downstream feeder, said driver having a helical passage, one end of said helical passage connected to a source of fluid under pressure and the other end thereof terminating in the straight driver passage downstream from said one end to create a vortex for rotation of the catgut.

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