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MECHANISM FOR GROOVING MINE HOIST DRUMS AND THE LIKE

Original Filed Jan. 22, 1962

7 Sheets-Sheet 1

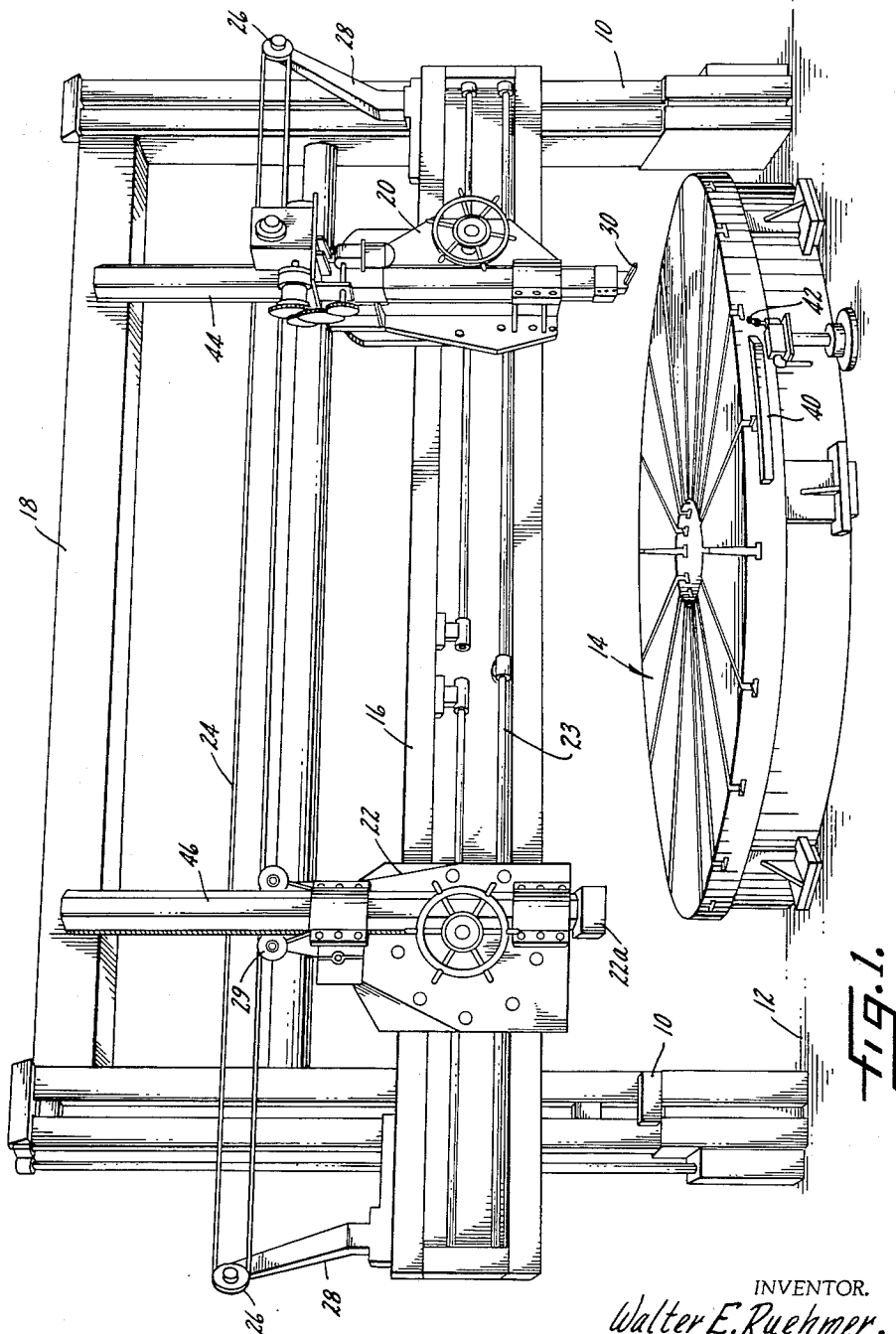


fig. 1.

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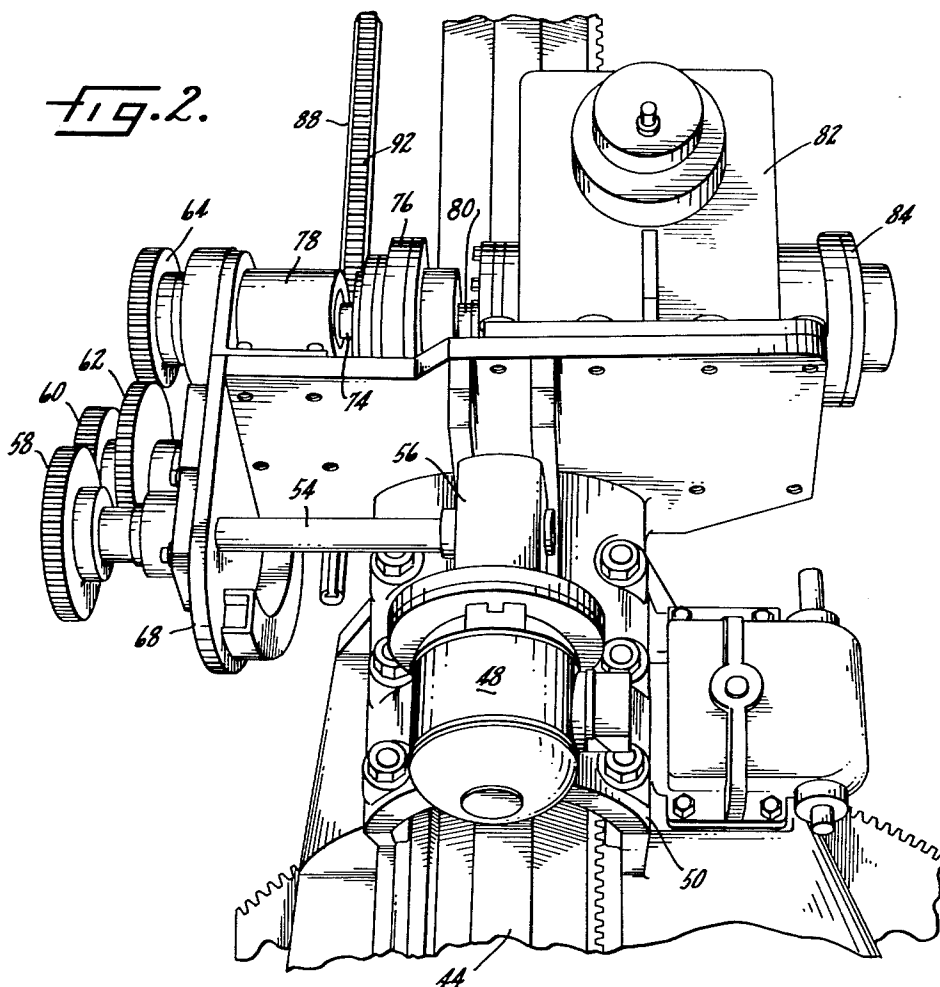
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7 Sheets-Sheet 3

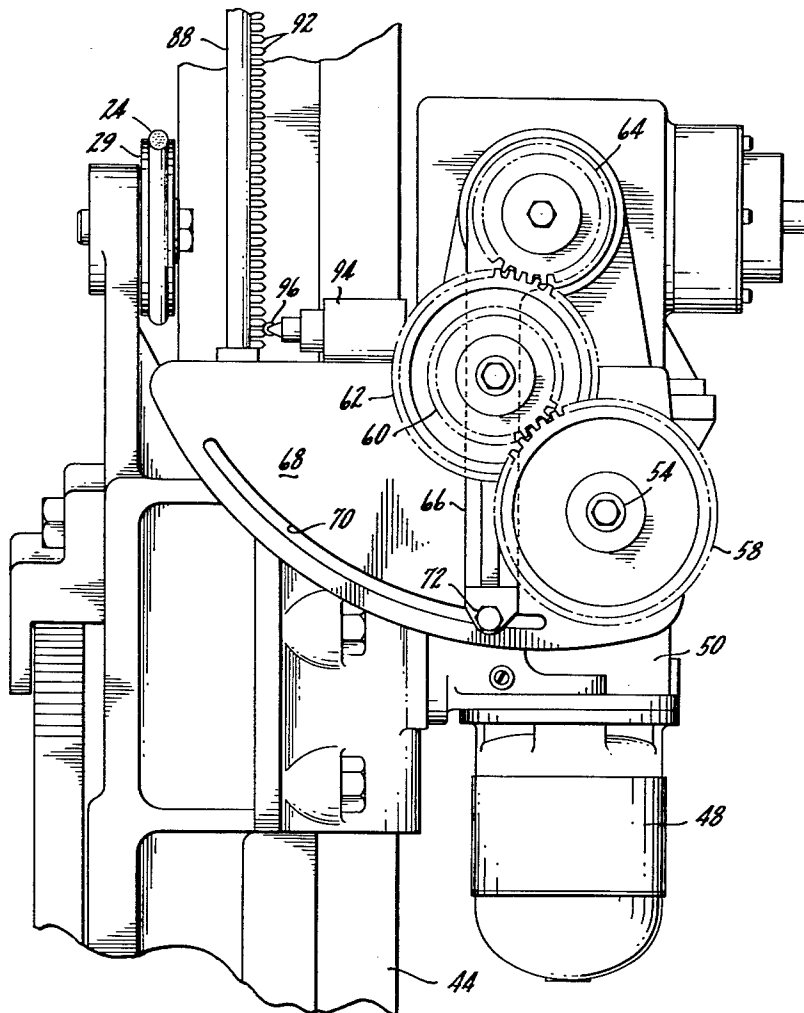


Fig. 3.

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7 Sheets-Sheet 4

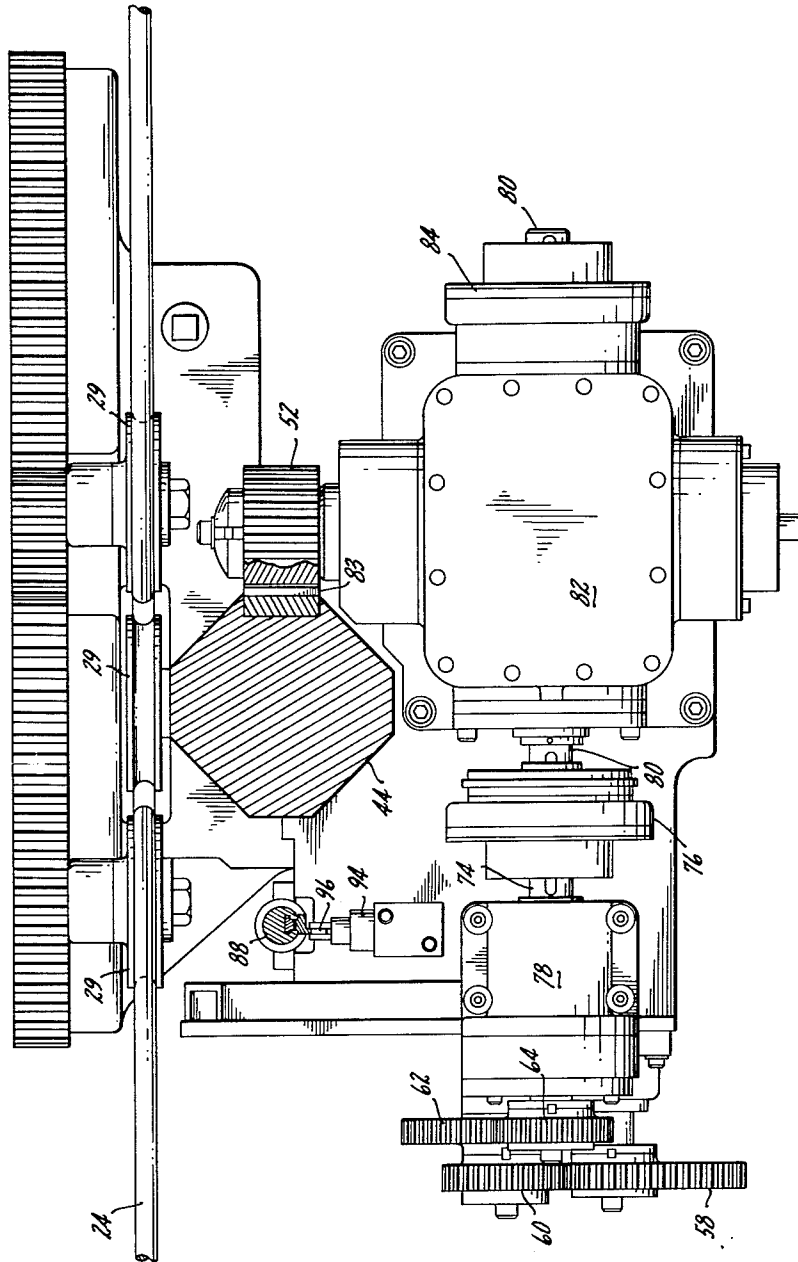


FIG. 4.

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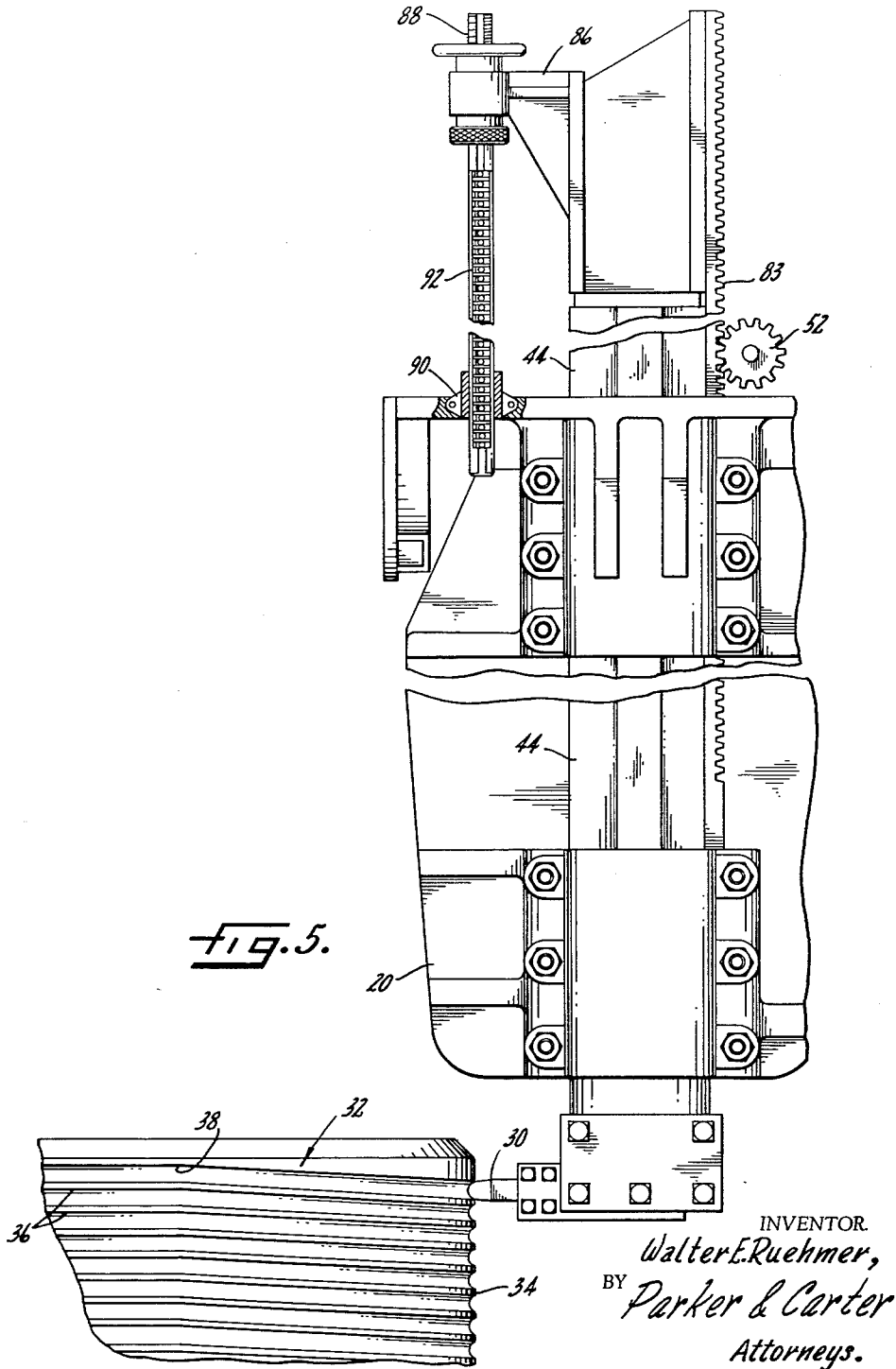
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7 Sheets-Sheet 6

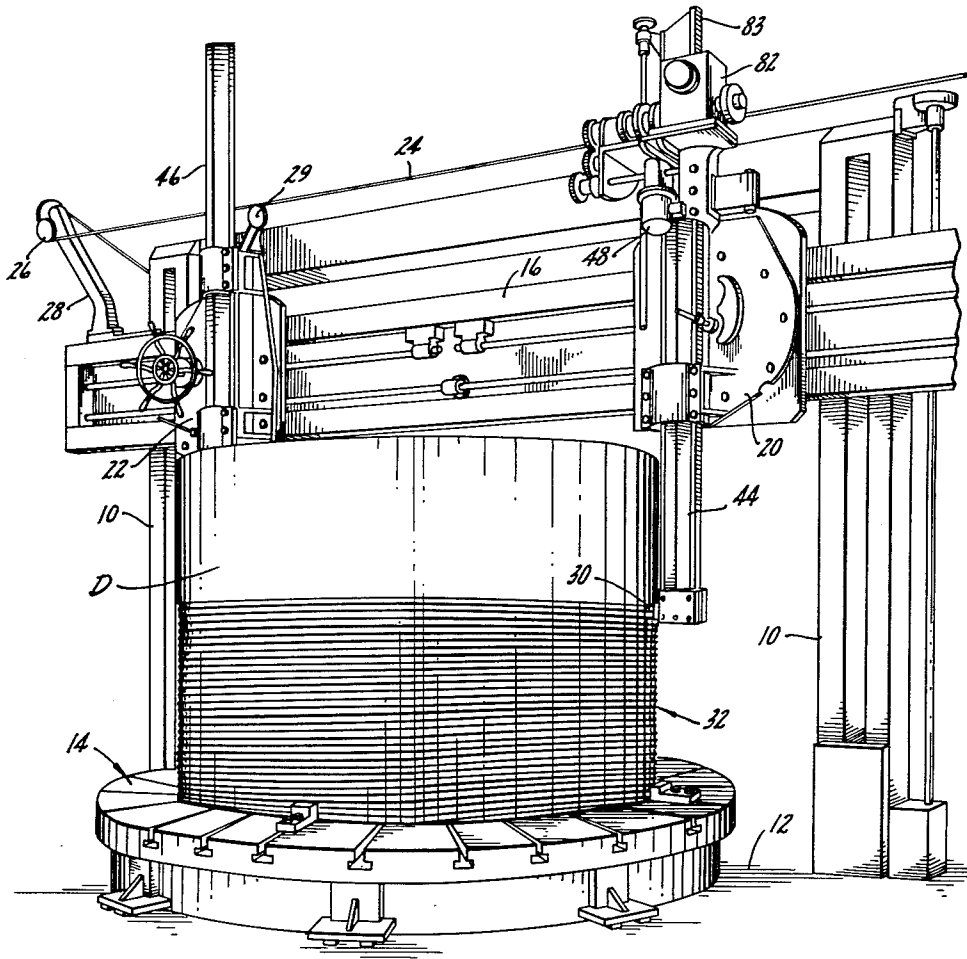


Fig. 6.

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7 Sheets-Sheet 7

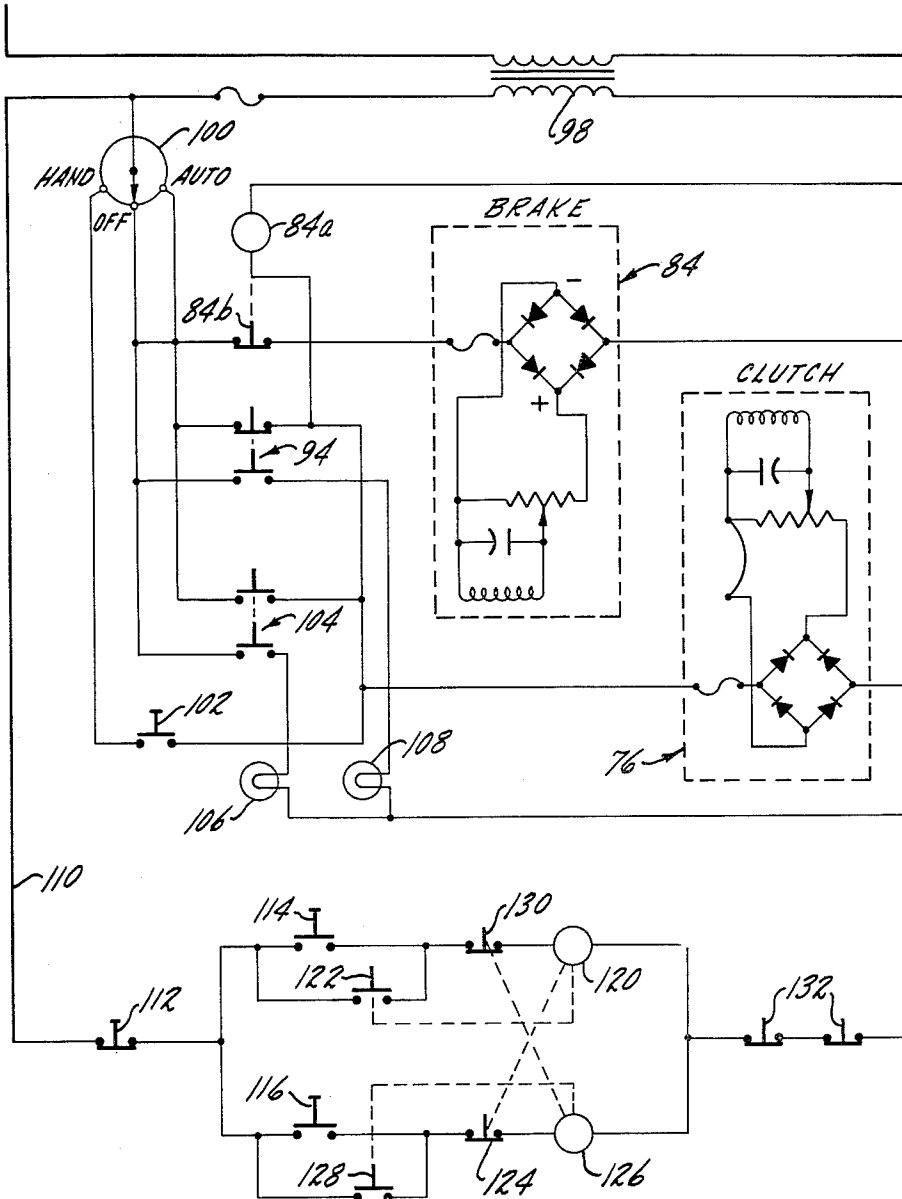


Fig. 7.

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**MECHANISM FOR GROOVING MINE HOIST
DRUMS AND THE LIKE**

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Original application Jan. 22, 1962, Ser. No. 167,790.
Divided and this application Dec. 14, 1964, Ser. No.
424,468

5 Claims. (Cl. 82-2)

This application is a division of copending application
Serial No. 167,790 filed January 22, 1962.

This invention relates to an apparatus for grooving
cable winding drums, for example mine hoist drums.

A primary purpose of the invention is an apparatus of
the type described which forms a crossover between ad-
jacent parallel grooves on the periphery of a mine hoist
drum or the like.

Another purpose is an apparatus of the type described
having improved means for controlling the operation of
the grooving tool.

Other purposes will appear in the ensuing specifica-
tion, drawings and claims.

The invention is illustrated diagrammatically in the
following drawings wherein:

FIGURE 1 is a front perspective view of the assembly
for grooving mine hoist drums or the like,

FIGURE 2 is an enlarged perspective of the apparatus
for controlling the movement of the grooving tool,

FIGURE 3 is a side view of the control apparatus
shown in FIGURE 2,

FIGURE 4 is a top plan view of the control apparatus
shown in FIGURES 2 and 3,

FIGURE 5 is an enlarged front view of the grooving
tool and associated control equipment,

FIGURE 6 is a perspective showing a drum to be
grooved in position on a rotating platform, and

FIGURE 7 is a wiring diagram of the control circuit
used.

This invention is particularly concerned with grooving
large mine hoist drums. One of the problems in the
formation of such grooves is to provide crossover points
so that the cable positioned in the grooves may cross over
from one groove to the next. The present invention pro-
poses a system for automatically and periodically forming
crossover grooves as the grooving tool works on the pe-
riphery of the drum.

In FIGURE 1, a pair of posts or columns 10 may be
suitably mounted on a base or floor 12. A rotating plat-
form or table 14 which mounts or supports the drum D
during the grooving operation is positioned between the
posts and is driven by a suitable motor or the like, not
shown. Mounted on the posts 10 is a crossrail 16 which
may be arranged for vertical movement on the posts. A
horizontal support 18 may be mounted between the upper
end of the posts to stabilize the equipment.

Mounted for horizontal movement on the crossrail 16
is a saddle 20, at the right-hand side of FIGURE 1,
which mounts the grooving tool. At the left-hand side
of FIGURE 1 is a similar saddle 22 which is used to
balance the drum being grooved. The saddle 22 does not
have the control equipment that is on the saddle 20, but
does have a stabilizing block or the like 22a, at its lower
end, which bears against the drum being grooved at a
point opposite the grooving tool. In this way, the pres-
sure on opposite sides of the drum is equal and there
will be no inaccuracies in the grooves being formed.
The saddles 20 and 22 may be moved horizontally by
means of a screw 23 counterweighted by a cable con-
nection 24 or the like which passes about pulleys 26
positioned on arms 28 on either side of the crossrail 16.

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Pulleys or the like 29 may be suitably mounted on each
of the saddles for connection to the cable 24.

Mounted at the bottom of the saddle 20 is a suitable
grooving tool 30. As shown in FIGURES 5 and 6, the
tool 30, which may be any one of a number of conven-
tional grooving tools, forms grooves 32 about the
periphery 34 of a cable winding drum. The tool 30 will
be held in a stationary vertical position during a major
portion of the drum rotation. The grooves formed by the
tool when in this position will be generally horizontal, or
perpendicular to the drum axis, and will be parallel to
one another. These grooves are indicated at 36 in FIG-
URE 5.

In order to form crossover grooves so that the cable
may pass from one parallel groove to the next, the tool
30 will be indexed downward or upwardly as the drum
rotates. The crossover grooves, which are somewhat
helical, are indicated at 38 in FIGURE 5. There may be
one, two or more crossover grooves during each 360 de-
grees of groove, the number of crossover grooves de-
pending upon the size of the drum and the diameter of
the cable. As shown in the drawings, there are two
crossover grooves, one each 180 degrees. Accordingly,
the tool 30 will move downward a distance slightly more
than half the width of the groove during each indexing
operation. The tool 30 will move downward a distance
equal to the width of the groove plus the space between
grooves during each 360 degrees of drum rotation.

In order to provide the proper timing for the indexing
movement, a cam surface 40, shown in FIGURES 1 and
6, may be positioned on the periphery of the platform or
table 14. The number of camming surfaces depends
upon the number of crossover grooves during each 360
degrees of groove. A follower or contact 42 is positioned
to contact the camming surface 40. Movement of the
follower 42 will close a limit switch or the like, shown in
FIGURE 7, to actuate the indexing mechanism. The
indexing operation will be stopped when the tool has
been moved a predetermined distance downward. The
means for stopping the tool will be described hereinafter.

A ram 44 may be mounted on the saddle 20 for vertical
movement and carries the tool 30 at its lower end. A
similar ram 46 may be mounted on the saddle 22. A
suitable drive motor 48, preferably continuously running
during the grooving operation, is mounted on a housing
or the like 50. The ram 44 moves within the housing 50
and is reciprocated by a drive gear 52, shown in FIG-
URES 4 and 45. The drive gear 52 is controlled by the
motor 48, through the gear, clutch and brake arrange-
ment to be described.

The motor 48 drives a shaft 54, shown in FIGURES
2 and 3. The shaft 54 runs at right angles to the motor
drive shaft and there may be suitable gearing 56 or the
like. At the outer end of the drive shaft 54 is a drive
gear 58 which is in mesh with an outer idler gear 60.
Mounted on the same shaft with the outer idler gear 60
is an inner idler gear 62 which is in mesh with a driven
gear 64. Each of the idler gears 60 and 62 is mounted on
an arm 66 which rotates about the axis of the driven
gear 64. A suitable plate 68, which may be in the shape
of a segment, has a groove 70 which may be used to
move the arm 66 to any desired angular position. A con-
ventional nut and bolt connection 72 may be used to
lock the arm in position. By having a pivotal arm which
mounts the idler gears, it is possible to use different size
drive gears and so to change the speed at which the ram
and tool move vertically.

The driven gear 64 is mounted on a suitable shaft 74
which is connected to a clutch 76. The shaft 74 may
run through a suitable bearing housing or the like 78.
The clutch may be electrical and is activated by the cam

arrangement on the periphery of the table 14. A shaft 80 extends outwardly from the clutch 76 and passes through a gear box 82. On the outward end of the shaft 80 is a suitable electrical brake 84. The brake 84 is operated when the clutch 76 is disengaged to provide instantaneous stopping of the ram once the tool 30 has traveled a sufficient downward distance. In this way, there will be no overtravel and the tool will stop as soon as the crossover groove has been completely formed. The gear box 82 may include a conventional arrangement for transferring the rotation of shaft 80 to drive gear 52. The drive gear 52 is in mesh with a gear rack 83 on the ram and is used to move the ram in a vertical direction.

The upper end of the ram 44 may mount a suitable bracket 86 which carries a vertical indexing bar 88. A suitable bracket or guide 90 may be mounted on the housing 50 to stabilize the lower end of the bar 88. Mounted along one side of the bar 88 are a series of generally equally spaced teeth or projections or buttons 92. The distance between the points of each of the teeth is the distance which the ram should travel when moving the tool 30 through one indexing operation. A suitable limit switch 94 having a cam 96 is positioned to bear against the teeth 92. The limit switch 94, as will be explained hereinafter, is effective to stop the downward movement of the ram and tool 30 by simultaneously activating the brake 84 and disengaging the clutch 76. The cam 96 will bear against the teeth 92 and movement of the indexing shaft 83 downward a distance equal to the space between teeth will cause the limit switch 94 to stop the ram. In this way, the downward movement of the tool 30 can be precisely controlled.

FIGURE 7 illustrates the electrical circuit used in controlling the brake and clutch. Power to operate the brake and clutch may come from a suitable source to a transformer indicated generally at 98, if a step down is necessary. One side of the transformer secondary is connected through a fuse to a three-position switch 100. The switch 100 adapts the system for automatic or manual operation. When switch 100 is in the "auto" position, the "off" and "auto" terminals are connected together. The various components making the electrical circuit may easiest be described by going through a sequence of operation. Considering first when indexing is to be done manually, the switch 100 is turned to the "hand" position. When switch 102 is closed by the operator, power is directed from the transformer 98 through the switch 100 to the clutch 76 and to brake relay coil 84a of the brake 84. The brake is normally holding through brake contacts 84b which are released when brake relay coil 84a is activated. The clutch will close and the ram will start downward. The ram is stopped by releasing switch 102. The clutch may be conventional and, accordingly, it is not thought necessary to describe its circuit in detail.

When the selector switch 100 is on "auto" the operation is as follows. As the ram is stationary, one of the buttons 92 will open the top contact of switch 94 and close the bottom contact. Light 108 will thus be energized. The table or platform 14 is turning and when follower 42 contacts the camming surface 40, both contacts of switch 104 will close. The top contact of switch 104 energizes clutch 76 and opens brake contacts 84b through its relay coil 84a. The bottom contact of switch 104 operates light 106. The initial movement of the ram permits switch 94 to move to the position shown in FIGURE 7 which cuts out light 108.

After the camming surface 40 has moved by follower 42, switch 104 opens. The circuit to the brake and clutch is still complete however, through the top contact of switch 94. Light 106 is now extinguished. The ram is stopped when the next ram button engages switch 94 and moves its contacts opposite to that shown in FIGURE 7. The clutch and brake are opened and light 108 is lit.

The ram is started by the follower 42 striking the camming surface 40. It is stopped by the buttons 92. In

this way the vertical distance the ram moves is precisely controlled and will not be changed by varying table speed. The buttons can be pre-set so that there will be the proper number of crossovers on each drum. The start of each crossover will be aligned, but the end may vary slightly due to a change in table speed. The important point is that all of the grooves will be placed on the drum.

In addition to the indexing operation controls, it is necessary to have motor controls to position the ram prior to the beginning of a grooving operation. Line 110 is connected directly to the transformer 98 and to a push-button 112 which will stop the motor 48 when it is pressed. In circuit with the push-button 112 are push-buttons 114 and 116, which are in parallel. Push-button 114 is effective to run the motor 48 in a direction to move the ram upward whereas button 116 is effective to move the ram downward. The motor control circuits are separate and apart from the circuits controlling the movement of the ram.

The push buttons 114 and 116 are effective to operate the magnetic starter for the motor 48. The starter has not been shown as it is a conventional circuit. Push buttons 114 and 116 are principally concerned with controlling the direction of motor travel and ram movement.

Coil 120 in series with push button 114 is effective, through contacts 122, to lock in ram movement in an up direction. When coil 120 is energized, by operation of push button 114, contacts 124 will open so that push button 116 is ineffective. In like manner, coil 126, through contacts 128, is effective to lock in down movement of the ram. Contacts 130 are controlled by coil 126 to open the circuit to push button 114. Contacts 132 are opened by an overload. When it is desired to have automatic ram movement in a down direction, push button 116 is operated. Push button 114 is operated when it is desired to have automatic ram movement in an up direction. These same push buttons may be used to position the ram prior to the beginning of a grooving operation.

The use, operation and function of the invention are as follows:

It is necessary to provide crossover points in the grooves on the periphery of a mine hoist drum or the like so that the cable in the grooves will lie smooth and flat and there will be no ridges which could eventually cause wear. The present invention proposes at least one crossover point for each 360 degrees of groove circumference. The crossover points are formed during the grooving operation by indexing the grooving tool downward or upward as the drum continues to rotate. The grooving tool will move through a predetermined distance so that the crossover groove has a proper length. The number of crossover points in each 360 degrees of drum circumference may vary, but the total length of the crossovers for each 360 degrees should be slightly greater than the width of the groove. The major portion of the groove in each 360 degrees will be generally perpendicular to the drum axis, with the crossover grooves forming slightly helical connections between adjacent parallel grooves.

Because of the size of the drum D, it is preferred to groove half of the drum first. The grooving tool is moved downward as described until the top half of the drum is grooved. Then the drum is turned over and the grooving tool moves up to groove what is now the top half. The second step is shown in FIGURE 6. In the alternative, the grooving operation may begin at the middle of the drum. If the grooving tool went down through the complete height of the drum, there may be inaccuracies in the grooves.

In order to provide crossover points at predetermined locations, it is proposed to provide a cam arrangement on the side of the table supporting the drum to be grooved. When the cam 42 strikes the camming surface 40, a limit switch is closed and the ram and grooving tool start downward. The ram will continue downward until the

limit switch 94 has been closed. This switch will close after the ram has moved through a predetermined vertical distance.

The first limit switch activates a clutch which couples a continuously running motor with the ram-drive arrangement. Upon activation of the clutch, the ram will start its downward movement. The clutch will be deactivated after the ram has moved a distance sufficient to close limit switch 94. Brake 84 is operated simultaneously with the clutch. The brake normally holds and is released when the clutch is operated. In this way, there will be no overrun and the crossover groove will be formed to precise tolerances. The combination of the brake and clutch is important to precisely and immediately stop the ram after it has moved a sufficient distance to form the crossover groove.

Whereas the preferred form of the invention has been shown and described herein, it should be realized that there are many modifications, substitutions, and alterations thereto within the scope of the following claims.

I claim:

1. A mechanism for grooving cable winding drums or the like including a horizontal platform for positioning a cable winding drum to be grooved in a generally vertical position, means for rotating said platform and drum, a grooving tool and a support structure therefor, said tool being positioned to form a groove generally perpendicular to the drum axis as the drum rotates, means for moving said grooving tool in a direction parallel to the drum axis, including a drive motor, and means for controlling the axial movement of said grooving tool such that during each complete rotation of the drum it moves, in at least one increment, a distance at least equal to the width of the groove being formed, including a clutch for engaging and disengaging said drive motor, a brake arranged to stop axial movement of said tool, and means for causing simultaneous engagement of said clutch and release of said brake and subsequent simultaneous disengagement of said clutch and operation of said brake.

2. A mechanism for grooving cable winding drums or the like including a rotatable horizontal platform for supporting a drum to be grooved in a generally vertical direction and for rotating it, a grooving tool and a support structure therefor, said tool being positioned to groove the outer periphery of the drum as the drum rotates, a drive motor for moving said grooving tool in a direction generally parallel to the drum axis, a clutch for engaging and disengaging said drive motor to control the axial movement of said tool, a brake for stopping movement of said tool, means for operating the clutch

at least once during each complete rotation of the drum and at a predetermined angular position, and means for disengaging said clutch and simultaneously operating said brake after said tool has moved a predetermined distance in an axial direction.

3. The structure of claim 2 further characterized in that said clutch is engaged twice during each 360 degrees of drum rotation and at points generally 180 degrees apart.

4. The structure of claim 2 further characterized in that the means for operating said clutch includes an outstanding portion on said rotating platform and a cam positioned to contact said outstanding portion as said platform rotates, movement of said cam being effective to engage said clutch.

5. A mechanism for grooving cable winding drums or the like including a rotatable horizontal platform for supporting a drum to be grooved in a generally vertical direction and for rotating it, a grooving tool and a support structure therefor, said tool being positioned to groove the outer periphery of the drum as the drum rotates, a drive motor for moving said grooving tool in a direction generally parallel to the drum axis, a clutch for engaging and disengaging said drive motor to control the axial movement of said tool, a gear connection between the drive motor and clutch, means for changing said gear connection to vary the axial speed of said tool, means for operating the clutch at least once during each complete rotation of the drum and at a predetermined angular position, a brake for stopping axial movement of said tool, and means for simultaneously operating said brake and disengaging said clutch after said tool has moved a predetermined axial distance.

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