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W. D. CROAKE ET AL

2,642,781

PAPER MACHINERY

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2 Sheets-Sheet 1

Fig-1

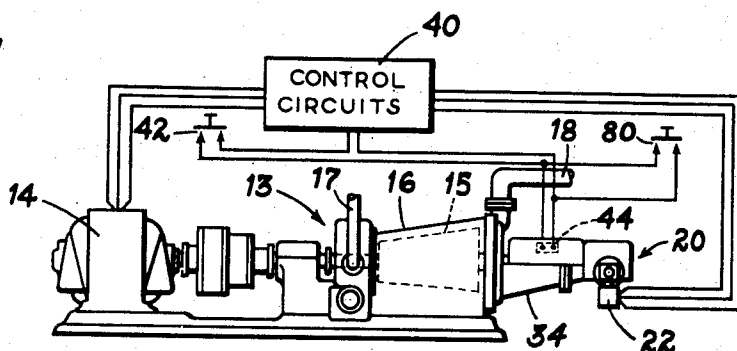


Fig-2

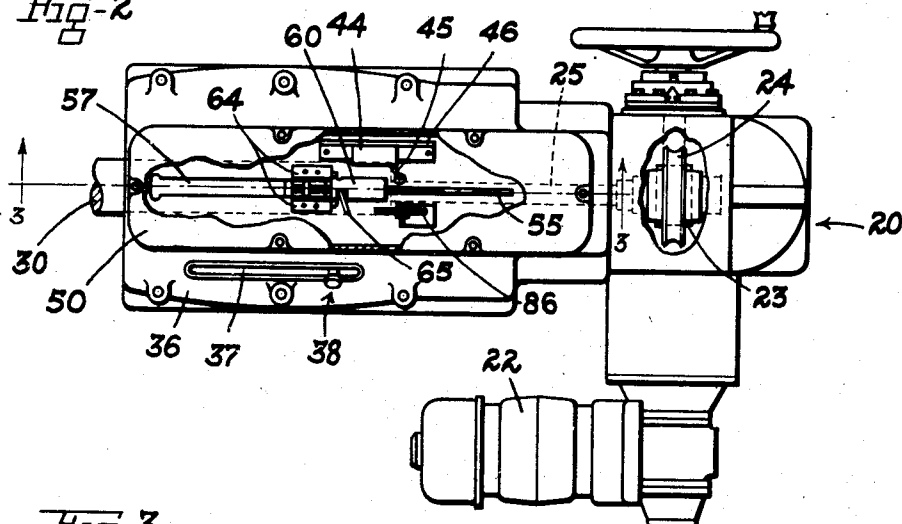
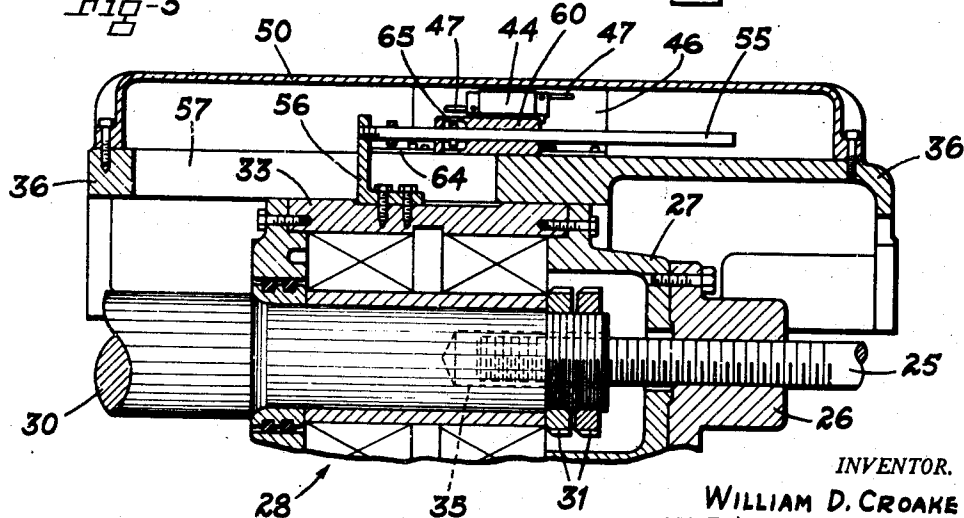


Fig-3



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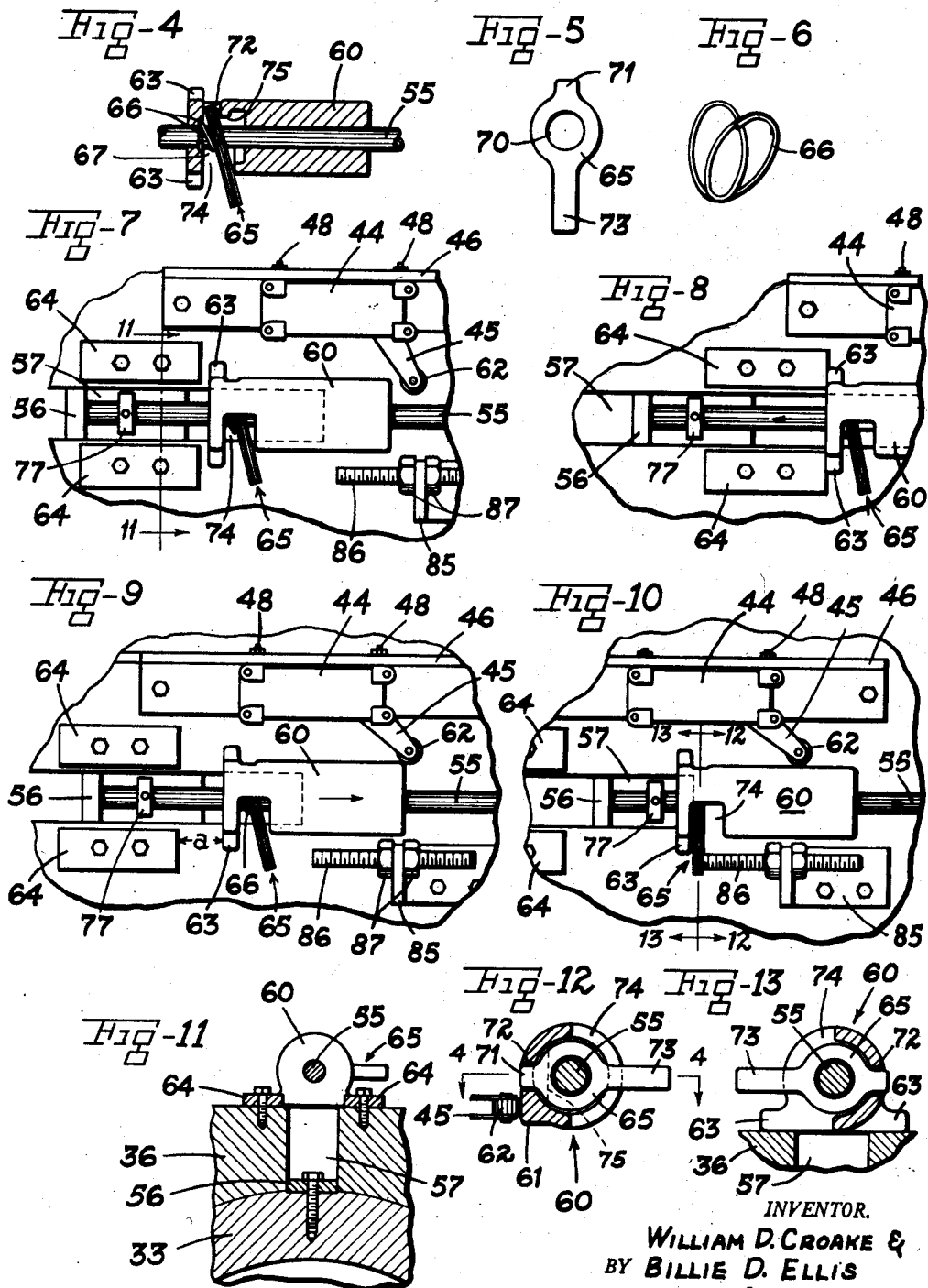
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PAPER MACHINERY

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8 Claims. (Cl. 92-27)

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This invention relates to apparatus for controlling the operation of refiners such as jordans, attrition mills and the like having juxtaposed relatively rotating refining elements.

The invention has special relation to control of the axial adjustment of the relatively rotating refining elements in a refiner provided with a motor driven adjusting mechanism for regulating the relative axial positions of the refining elements in accordance with desired refining conditions as measured by the load imposed on the drive motor of the refiner. In apparatus of this character, the proper load on the refiner motor for desired refining conditions may be predetermined by the operator, and the axial positions of the refining elements are adjusted accordingly, which may be done automatically by suitable controls responsive to change in the load conditions to actuate an adjusting motor or which may be effected by manually operating control switches for the adjusting motor in accordance with observed changes in the load conditions. Thus at the start of a refining operation in a jordan or like conical refiner, the plug is usually at its greatest spacing outwardly of the shell and is gradually advanced into closer spacing with the shell as the refining proceeds.

At the conclusion of a batch refining operation, it is important before the next operation begins to retract or separate the refining elements a sufficient distance to prevent overloading the refining motor at the start of the next operation, since if there is insufficient clearance of the parts when the refiner is again started, the resulting high starting torque may burn out the motor. However, since an adjusting mechanism for this purpose is commonly so geared that a considerable time interval is required to produce a relatively small axial movement of the parts, in order to assure adequate precise adjustment of their positions in operation, it is desirable to limit retracting of the parts to a relatively small axial distance because over-travel beyond the essential minimum distance results in lost time for resetting at the start of the next batch. On the other hand, since the axial positions of the parts at the conclusion of a given operation is variable, being subject to change by any of several factors including the nature of the stock, the degree of refining desired, and wear of the working surfaces of the refining elements requiring compensatory adjustment, the position to which the retractable member should be retracted is similarly variable.

It is accordingly one of the principal objects of

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the present invention to provide an adjusting apparatus for the relatively rotating refining elements of a refiner of the above character which will control adjustment of the parts following a refining operation in such manner as to assure retraction or separation thereof to substantially the minimum proper distance for the start of the next operation irrespective of the extent of the advancing movement of the parts during the previous operation from their starting positions and irrespective of whether the previous advancing movement was occasioned by change in consistency or freeness of the stock reflected by reduction in the load on the refiner motor or was necessitated by wear of the refining elements requiring compensatory adjustment.

For example, in an installation in accordance with the invention on a jordan, a switch controlling a circuit effective to cause retracting movement of the plug is positioned for actuation by an operating member carried by the plug. However, this operating member is mounted on the plug by means of a one-way clutch connection, and a fixed stop for this operating member is located in desired spaced relation with the switch such that the total travel of the operating member in normal operation of the refiner is limited to approximately the minimum proper distance for retraction of the plug between refining operations. As a result, when the plug advances during operation of the refiner, it carries the switch operating member forward only until it contacts the stop therefor, and thereafter the clutch disengages to prevent further forward movement of the operating member even if the plug continues to advance. Then when the plug is retracted at the conclusion of the refining operation, the clutch reengages to cause the switch operating member to retract with the plug until it reaches and actuates the control switch.

It is accordingly another object of the invention to provide apparatus for controlling the retracting movement of the refining elements of a refiner by means of a switch operated by a member carried by one element and connected therewith by a one-way clutch arranged for cooperation with a fixed stop to limit forward movement thereof with the element to a predetermined limited distance such that irrespective of the full extent of forward movement of the element from its starting position during operation, the switch will operate to terminate retraction of the element after it has traveled only through the limited distance of travel of the switch operating member.

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It is also an object of the invention to provide control apparatus for the refining elements of a refiner as outlined above which embodies additional mechanism under the control of the operator for causing the movable refining element to retract beyond the position established by operation of the switch and its operating member without affecting operation of the switch or its operating member when the element is again moved forward.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings—

Fig. 1 is a schematic view illustrating the operation of the control apparatus of the invention in conjunction with a conical refiner having a motor driven control for adjusting the axial position of the plug in accordance with the load on the refiner motor;

Fig. 2 is a plan view, partly broken away, showing the control apparatus of the invention and the operating unit for adjusting the refiner plug;

Fig. 3 is an enlarged fragmentary section on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged detail view of the switch operating member in the apparatus of the invention, the view being approximately in section on the line 4—4 of Fig. 12;

Fig. 5 is a detail view of a part of the one-way clutch connection for the operating member of Fig. 4;

Fig. 6 is a detail view in perspective showing the spring member of the one-way clutch;

Figs. 7 to 10 are fragmentary views illustrating different positions of the switch operating member in the normal operation of the refiner;

Fig. 11 is a fragmentary section on the line 11—11 of Fig. 7; and

Figs. 12 and 13 are fragmentary sections on the lines 12—12 and 13—13 respectively of Fig. 10.

Referring to the drawings, which illustrate a preferred embodiment of the invention, Fig. 1 shows a schematic arrangement of control apparatus for a refiner 13 of the Jordan type which is provided with a drive motor 14 for rotating the conical plug 15 in a shell 16 having inlet and discharge pipes 17 and 18 respectively. The axial position of the plug in the shell is controlled by the adjusting unit indicated generally at 20, which is shown in greater detail in Fig. 2 as of the construction disclosed in the copending application of Stephen A. Staeger, et al., Serial No. 190,184, filed October 14, 1950, and assigned to the same assignee as this application. This unit includes a motor 22 which operates through a worm 23 to drive a worm gear 24 on a shaft 25 having a threaded end portion.

As shown in Fig. 3, the shaft 25 is threaded through the thrust nut 26 bolted to the end cap 27 of the thrust bearing assembly 28 for the shaft 30 of plug 15. The thrust bearing assembly is locked on the rearward end of shaft 30 by means of lock nuts 31 on the threaded end of the shaft, and the cap 27 is bolted directly to the bearing housing 33. The adjusting unit 20 is fixed on a portion 34 of the frame of the refiner, and thus rotational movement of shaft 25 will operate through the thrust nut 26 and bearing unit 28 to cause forward or retracting movement of the plug shaft depending upon the direction of rotation of shaft 25, the end of shaft 30 being provided with a bore 35 of sufficient diameter to receive shaft 25 freely therein. These parts are

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enclosed by a cap 36 bolted to the frame 34 and extending rearwardly to meet the housing of the control unit 20, the cap 36 having a slot 37 therein for receiving the lubricating inlet tube and breather cap 38 for bearing 28. The operation of motor 22 is controlled by control circuits indicated diagrammatically at 40 to actuate the motor 22 in accordance with changes in the load conditions on the refiner motor 14, for example as disclosed in the above noted copending application.

The control circuits 40 include a manually operated switch 42 which completes a circuit for energizing motor 22 in the direction to retract the plug, and this circuit includes limit switch 44 having a switch arm 45 which is normally closed and which is effective when open to terminate operation of the motor 22 in the direction causing retraction of the plug 15 out of shell 16. This switch 44 is mounted by means of a bracket 46 on the cap 36 for the bearing assembly 28 and its associated parts, the bracket 46 having slots 47 for receiving the mounting bolts 48 for switch 44 to provide for adjustment of the switch axially of the plug as desired. The switch 44 and its associated parts are enclosed by a cover 50 bolted to the bearing cap 36.

The operating mechanism for switch 44 includes a rod 55 carried by a bracket 56 bolted to the bearing housing 33 and extending upwardly through a slot 57 in the upper wall of bearing cap 36. The rod 55 carries an operating member 60 for the switch arm 45 which is connected with rod 55 by a one-way clutch effective to provide for free movement of member 60 on rod 55 from left to right as viewed in Figs. 3 and 4 but to engage against the rod in such manner as to prevent relative movement of member 60 thereon in the opposite direction. The member 60 includes a boss portion 61 (Fig. 12) arranged for contact with the roller 62 on switch arm 45, and at its forward end it includes a pair of wing portions 63 which ride in close relation with the portions of bearing cap 36 on either side of slot 57 to maintain member 60 in level position. Also the wing portions 63 are arranged for contact with stop plates 64 bolted to the bearing cap 36 to establish a limit for the forward movement of member 60 with rod 55.

The switch operating member 60 also forms a housing for the one-way clutch by which it is connected to the rod 55, and the form of this clutch shown in the drawings includes a plurality of clutch plates 65 and a spring 66 received within the open portion 67 of member 60. The clutch plates 65 are mounted loosely on rod 55 by means of an enlarged hole 70 (Fig. 5) therethrough, and each clutch plate includes a tip portion 71 received in an opening 72 in the side wall of the housing portion 67 of member 60. At the opposite end of each clutch plate 65 is an arm 73 which extends laterally through the opening 74 in member 60, this opening being of substantially greater axial extent than the opening 72.

The normal position of the clutch is shown in Fig. 4, and it will be seen that the spring 66 is arranged to bias the clutch plates 65 into relatively cocked position on rod 55, thus urging the edge portions of the holes 70 into frictional engagement with rod 55 to lock the clutch against movement on the rod from right to left as viewed in Fig. 4. However, the member 60 will slide in the opposite direction on rod 55, since such movement will have the effect of first shifting

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the clutch plates against spring 66 sufficiently in clockwise direction as viewed in Fig. 4 to release their frictional grip on the rod. This movement of the plates is facilitated by the provision of the boss portion 75 adjacent the inner end of the opening 72, which forms a fulcrum for the clutch plates.

Figs. 7 to 10 illustrate the operation of the member 60 and its clutch to control the retracting movement of the plug. Fig. 7 illustrates a typical operating position for the parts at an intermediate stage in the refining operation, with the member 60 supported by rod 55 with its rearward end spaced forwardly of the switch arm 45 and with its forward end spaced rearwardly from the stop plates 64. During the normal operation of the refiner as already described, the plug will intermittently be advanced into the shell as the refining proceeds, and during such movements of the plug, the member 60 will be carried forward with it by the rod 55 until its wing portions 63 engage the stop plate 64 as shown in Fig. 8. This terminates the forward movement of the member 60, and if further advance of the plug is required by the control circuits 40, the clutch will disengage to permit rod 55 to move forward with the plug.

As soon as the refining operation is completed and the operator closes the circuit for retracting the plug, the clutch 65-66 will reengage so that member 60 will travel rearwardly on rod 55. This movement will continue until the rearward end of the boss 61 engages the switch arm 45 as shown in Fig. 9, whereupon switch 44 will open to interrupt the operating circuit for motor 22 and stop the plug. If for any reason the clutch should fail to reengage, a collar 77 is provided on rod 55 in position to contact the forward end of member 60 and carry it back into switch operating position.

If the operator should desire to retract the plug still further, a switch is provided for short circuiting the switch 44, as indicated diagrammatically at 80 in Fig. 1. When the switch 80 is closed, the motor 22 will be reenergized to continue the retracting movement of the operating member 60 as shown in Fig. 10.

Means are provided for limiting this continued rearward movement of member 60 and for simultaneously disengaging the clutch. A bracket 85 is mounted on bearing cap 36 and carries a threaded stop pin 86 provided with lock nuts 87. This stop pin 86 is located in line with the arm portions 73 of clutch plates 65 so that if the member 60 continues to move rearwardly as shown in Fig. 10, the arms 73 will engage the forward end of pin 86 and be moved thereby into the fully disengaged position of the clutch. Thereafter when the motor 22 is energized in the opposite direction to advance the plug, the member 60 will move forward away from stop 86 until the clutch is reengaged.

It will accordingly be seen that in the normal operation of this device as shown, the maximum travel of switch operating member 60 is limited to the distance between the relative positions shown in Figs. 8 and 9 with the total distance being represented by the dimension a in Fig. 9. This distance may be readily predetermined and established by appropriate adjustment of the mounting bolts for switch 44 in the slots 47, which is ordinarily done in setting up the refiner for operation with a new filling for the plug or shell. In this operation, the plug is advanced until it is in bar to bar contact with the shell while the

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refiner motor is shut off. The member 60 is then manually moved into contact with the stop plates 64, and the switch 44 is adjusted until the distance between the arm 45 and the rearward end of boss 61 is equal to the desired dimension a for the operations of the particular refiner or mill, after which the switch mounting bolts are tightened in place. Thereafter in the normal operation of the refiner, the starting position for the plug will be with the operating member 60 just in contact with the switch arm 45, and the member 60 will move forward with the plug as the latter advances under control of the circuits 40 as described.

The extent of forward movement of the plug will vary for a given refining operation, and also as the fillings of the plug and shell are worn in use, it will be desired to start the plug in a more advanced position than when the fillings are new. The apparatus of the invention automatically compensates for this change, since even when the forward movement of the plug is greater in a given operation than the dimension a , the member 60 will still move only through this predetermined limited distance so that when the plug is retracted, its total reverse movement will be equal only to the previous forward movement of member 60. Thus the member 60 is automatically reset to compensate for wear of the plug so that the maximum retraction of the plug before operation of switch 44 is never greater than the predetermined limited distance established in the initial adjustment of switch 44 as described.

While the form of apparatus herein described constitutes preferred embodiments of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. Control apparatus for a refiner of the character described having relatively rotating refining elements and a drive for advancing and retracting one of said elements with respect to the other axially while said refiner is in operation, comprising a switch for actuating said drive to retract said one element with respect to the other, means mounting said switch in stationary relation with said other element, a member for operating said switch to stop said drive, a support for said operating member carried by said one element for advancing and retracting axial movement therewith, a stop spaced forwardly of said switch for limiting the maximum forward travel of said operating member with said support to a predetermined limited distance, and means forming a one-way clutch connection between said operating member and said support providing for continued forward movement of said support with said one element following contact of said operating member with said stop to cause said operating member to travel rearwardly with said support upon retraction of said element and to operate said switch following retraction of said element through said limited distance.

2. Control apparatus for a refiner of the character described having relatively rotating refining elements and a drive for retracting one of said elements axially with respect to the other while said refiner is in operation, comprising a switch controlling said drive, a member for operating said switch to stop said drive, a support

for said operating member carried by said one element for advancing and retracting axial movement therewith, means forming a one-way clutch connection between said operating member and said support adapted to disengage upon relative forward movement of said support with respect to said operating member, a stop positioned forwardly of said switch in the path of travel of said operating member with said support, and means for maintaining said stop and said switch in predetermined spaced relation to limit said forward travel of said operating member to a predetermined limited distance while providing for continued forward movement of said support with said one element to cause said operating member to move rearwardly with said support upon retraction of said element and to operate said switch following retraction of said element through said limited distance.

3. Control apparatus for a refiner of the character described having relatively rotating refining elements and a drive for advancing and retracting one of said elements with respect to the other axially while said refiner is in operation, comprising a switch for actuating said drive to retract said one element with respect to the other, means mounting said switch in stationary relation with said other element, a member for operating said switch to stop said drive, a support for said operating member carried by said one element for advancing and retracting axial movement therewith, means forming a one-way clutch connection between said operating member and said support adapted to disengage upon relative forward movement of said support with respect to said operating member, a stop positioned in the path of travel of said operating member with said support, said stop being spaced forwardly of said switch to limit said forward travel of said operating member to a predetermined limited distance while providing for continued forward movement of said support with said one element to cause said operating member to move rearwardly with said support upon retraction of said element and to operate said switch following retraction of said element through said limited distance, and means for adjusting the relative spacing of said switch and said stop to vary the extent of said predetermined limited distance.

4. Control apparatus for a refiner of the character described having relatively rotating refining elements and a drive for advancing and retracting one of said elements with respect to the other axially while said refiner is in operation, comprising a circuit for actuating said drive in the direction to retract said one element with respect to the other, a pair of complementary control members for said circuit adapted to stop said drive upon engagement with each other and mounted one in stationary relation with said other element and the other for advancing and retracting axial movement with said one element, means forming a one-way clutch connection between said movable control member and said one element adapted to disengage upon relative forward movement of said member with respect to said element, and a stop positioned forwardly of said stationary control member in the path of travel of said movable control member with said one element, said stop and said stationary control member being spaced a predetermined limited distance apart to limit the maximum forward travel of said movable member beyond said stationary member while providing for

continued forward movement of said element following disengagement of said clutch and to cause said movable member to move rearwardly with said element upon retraction thereof into operating engagement with said stationary control member following retraction of said element through said limited distance.

5. Control apparatus for a refiner of the character described having relatively rotating refining elements and a drive for advancing and retracting one of said elements with respect to the other axially while said refiner is in operation, comprising a circuit for actuating said drive to retract one of said elements with respect to the other, a pair of complementary control members for said circuit adapted to stop said drive upon engagement with each other and mounted one in stationary relation with said other element and the other for advancing and retracting axial movement with said one element, means forming a one-way clutch connection between said movable control member and said one element adapted to disengage upon relative forward movement of said member with respect to said element, a stop positioned forwardly of said stationary control member in the path of travel of said movable control member with said one element, said stop and said stationary control member being spaced a predetermined limited distance apart to limit the maximum forward travel of said movable member beyond said stationary member while providing for continued forward movement of said one element following disengagement of said clutch and to cause said movable member to move rearwardly with said element upon retraction thereof into operating engagement with said stationary control member following operation of said element through said limited distance, and means for adjusting the relative spacing of said stop and said stationary control member to vary the extent of said predetermined limited distance.

6. Control apparatus for a refiner of the character described having relatively rotating refining elements and a drive for advancing and retracting one of said elements with respect to the other axially while said refiner is in operation, comprising a circuit for actuating said drive to retract one of said elements with respect to the other, a pair of complementary control members for said circuit adapted to stop said drive upon engagement with each other and mounted one in stationary relation with said other element and the other for advancing and retracting axial movement with said one element, means forming a one-way clutch connection between said movable control member and said one element adapted to disengage upon relative forward movement of said member with respect to said one element, a stop positioned forwardly of said stationary control member in the path of travel of said movable control member with said one element, means for maintaining said stop and said stationary control member in predetermined spaced relation to limit said forward travel of said movable control member to a predetermined limited distance while providing for continued forward movement of said one element to cause said movable control member to move rearwardly with said element upon retraction of said element for operating engagement with said stationary control member following retraction of said element through said limited distance, means under the control of the operator for causing continued operation of said

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drive following operation of said control members to effect further retraction of said one element and said movable control member, and means in the path of said further retraction of said movable member for effecting disengagement of said clutch to limit said further retraction of said movable member while providing for still further retraction of said one element.

7. Control apparatus for a refiner of the character described having relatively rotating refining elements and a drive for advancing and retracting one of said elements with respect to the other axially while said refiner is in operation, comprising a circuit for actuating said drive to retract one of said elements with respect to the other, a switch controlling said circuit, a member for operating said switch to stop said drive, a support for said operating member carried by said one element for advancing and retracting axial movement therewith, means forming a one-way clutch connection between said operating member and said support adapted to disengage upon relative forward movement of said support with respect to said operating member, a stop positioned forwardly of said switch in the path of travel of said operating member with said support, means for maintaining said stop and said switch in predetermined spaced relation to limit said forward travel of said operating member to a predetermined limited distance while providing for continued forward movement of said support with said one element to cause said operating member to move rearwardly with said support upon retraction of said element and to operate said switch following retraction of said element through said limited distance, means under the control of the operator for causing continued operation of said drive following operation of said switch to effect further retraction of said element and said operating member, and means in the path of said further retraction of said operating member for effecting disengagement of said clutch to limit said further retraction of said operating member while providing for still further retraction of said one element.

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8. Control apparatus for a conical refiner of the character described having relatively rotating refining elements and a drive for advancing and retracting one of said elements axially with respect to the other while said refiner is in operation, comprising a switch controlling said drive and mounted in stationary relation with said other element, a clutch housing forming an operating member for said switch to stop said drive, a supporting rod for said housing carried by said one element for advancing and retracting axial movement therewith, a plurality of clutch plates supported on said rod within said housing, a spring in said housing for biasing said clutch plates into frictional engagement with said rod to clutch said housing to said rod and providing for disengagement of said clutch plates upon movement thereof against said spring, said spring and clutch plates being arranged to cause rearward movement of said housing with said rod and said one element while providing for disengagement of said housing from said rod upon forward movement of said rod with respect to said housing, and a stop positioned forwardly of said switch in the path of travel of said housing with said rod, said stop and said switch being in predetermined spaced relation limiting said forward travel of said housing to a predetermined limited distance while providing for continued forward movement of said rod with said one element to cause said housing to move rearwardly with said rod upon retraction of said element and to operate said switch following retraction of said element through said limited distance.

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