Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 1

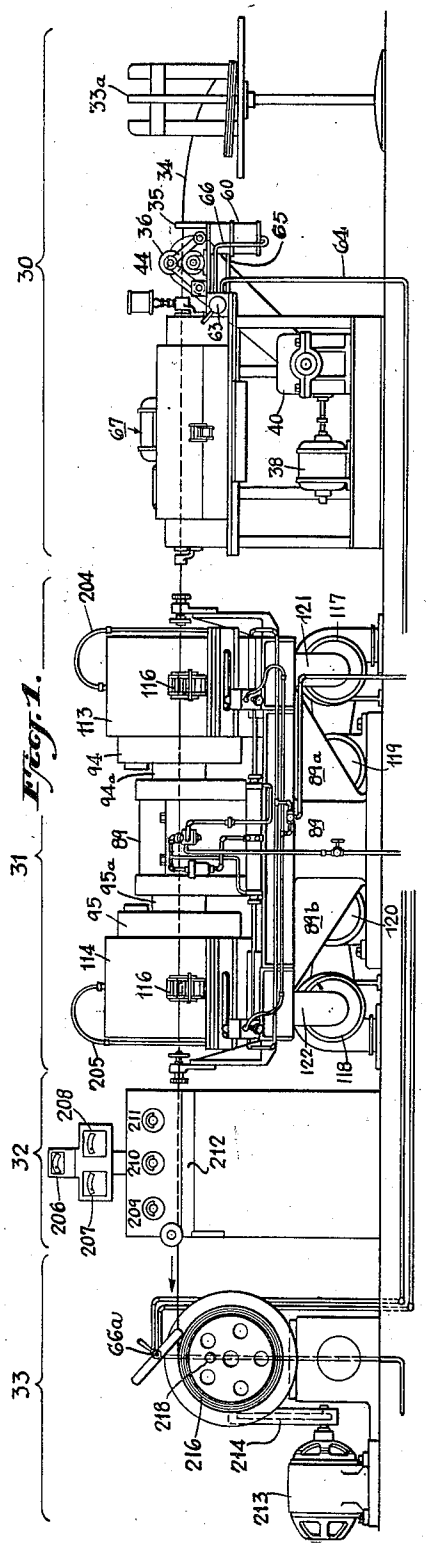


Fig. 1.

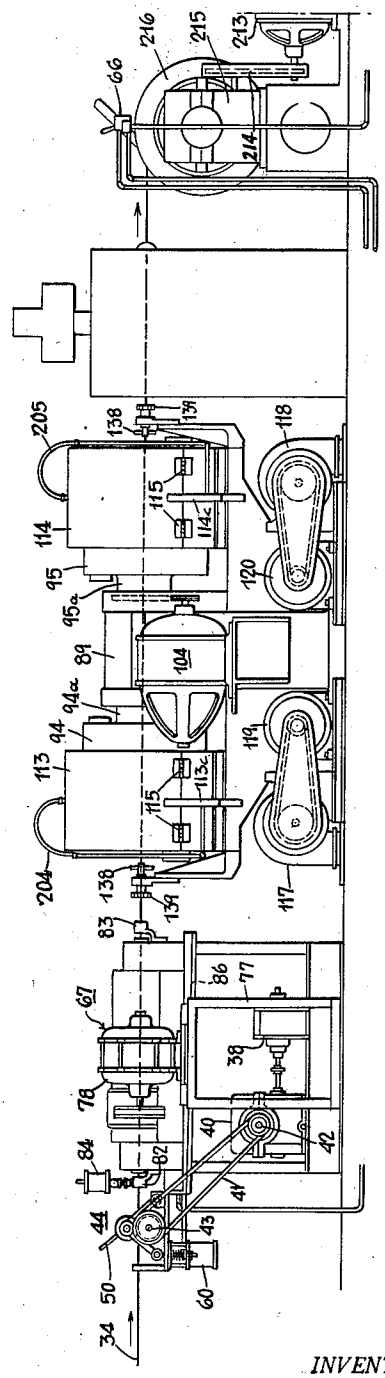


Fig. 2.

INVENTOR.
WALLACE K. LOWE.
BY
Ward, Cressy & Ward
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 2

Fig. 3.

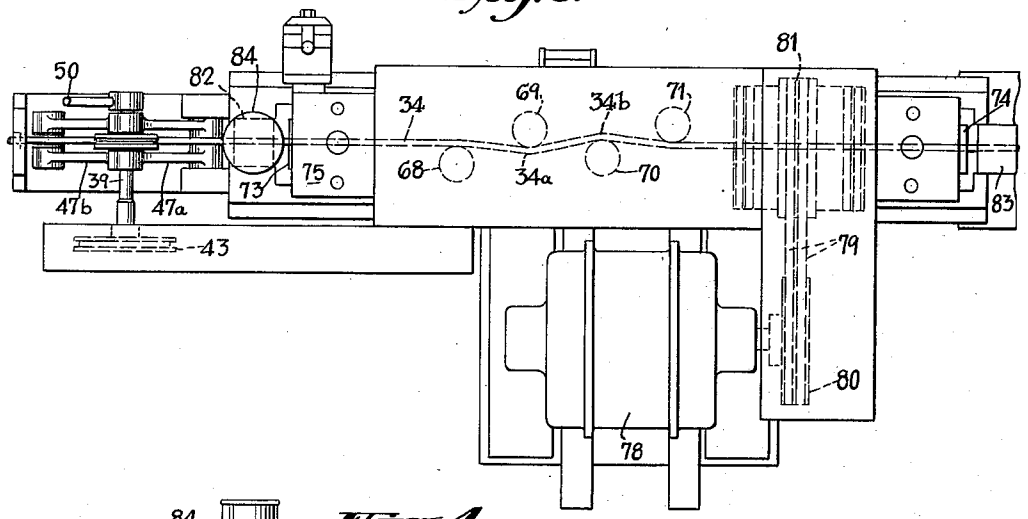
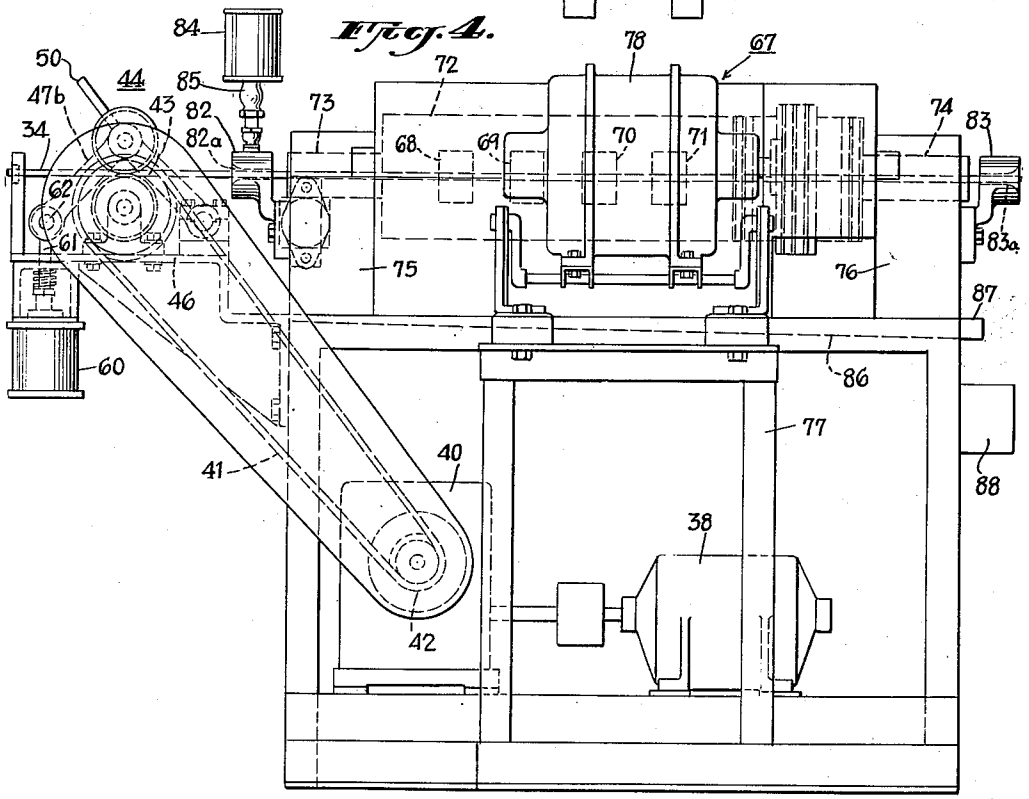


Fig. 4.



INVENTOR.
WALLACE K. LOWE.
BY
Ward, Crosby & Neal
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 3

Fig. 5.

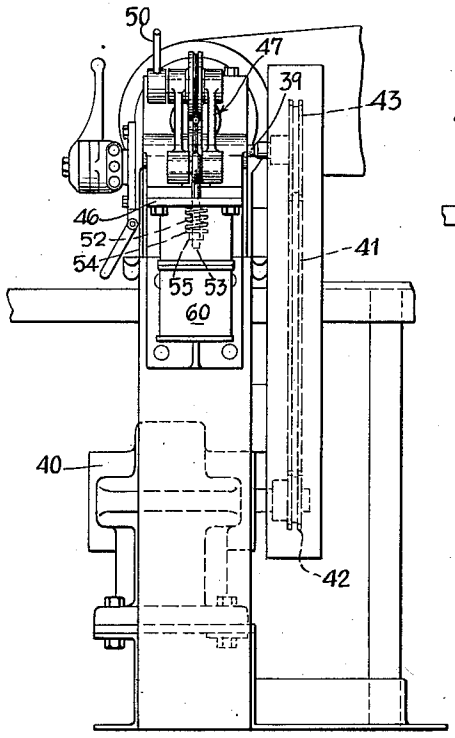


Fig. 6.

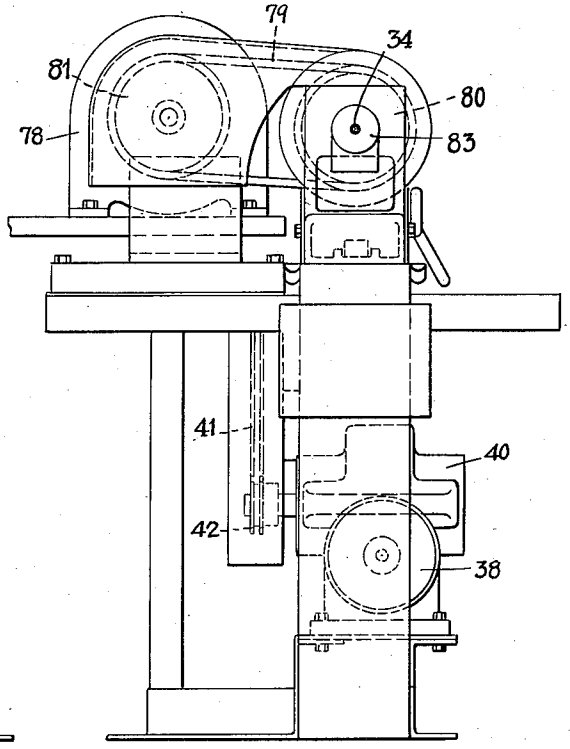


Fig. 7.

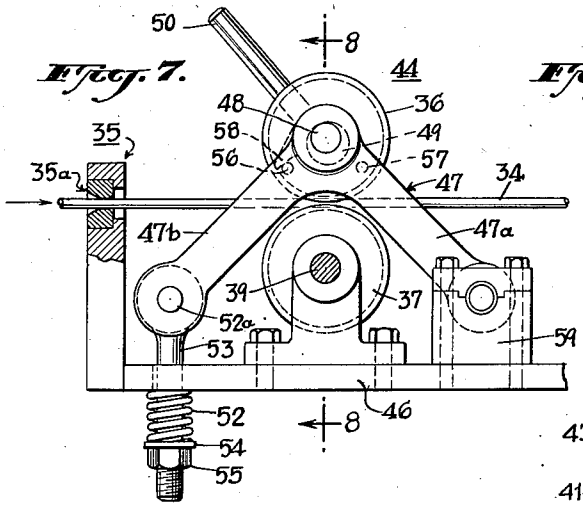
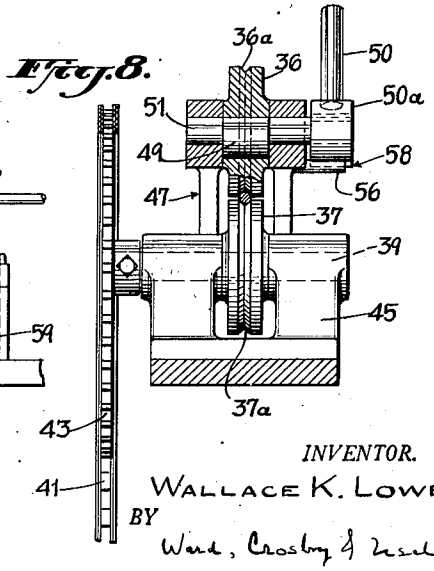


Fig. 8.



INVENTOR.
WALLACE K. LOWE.
BY
Ward, Crosby & Ward
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 4

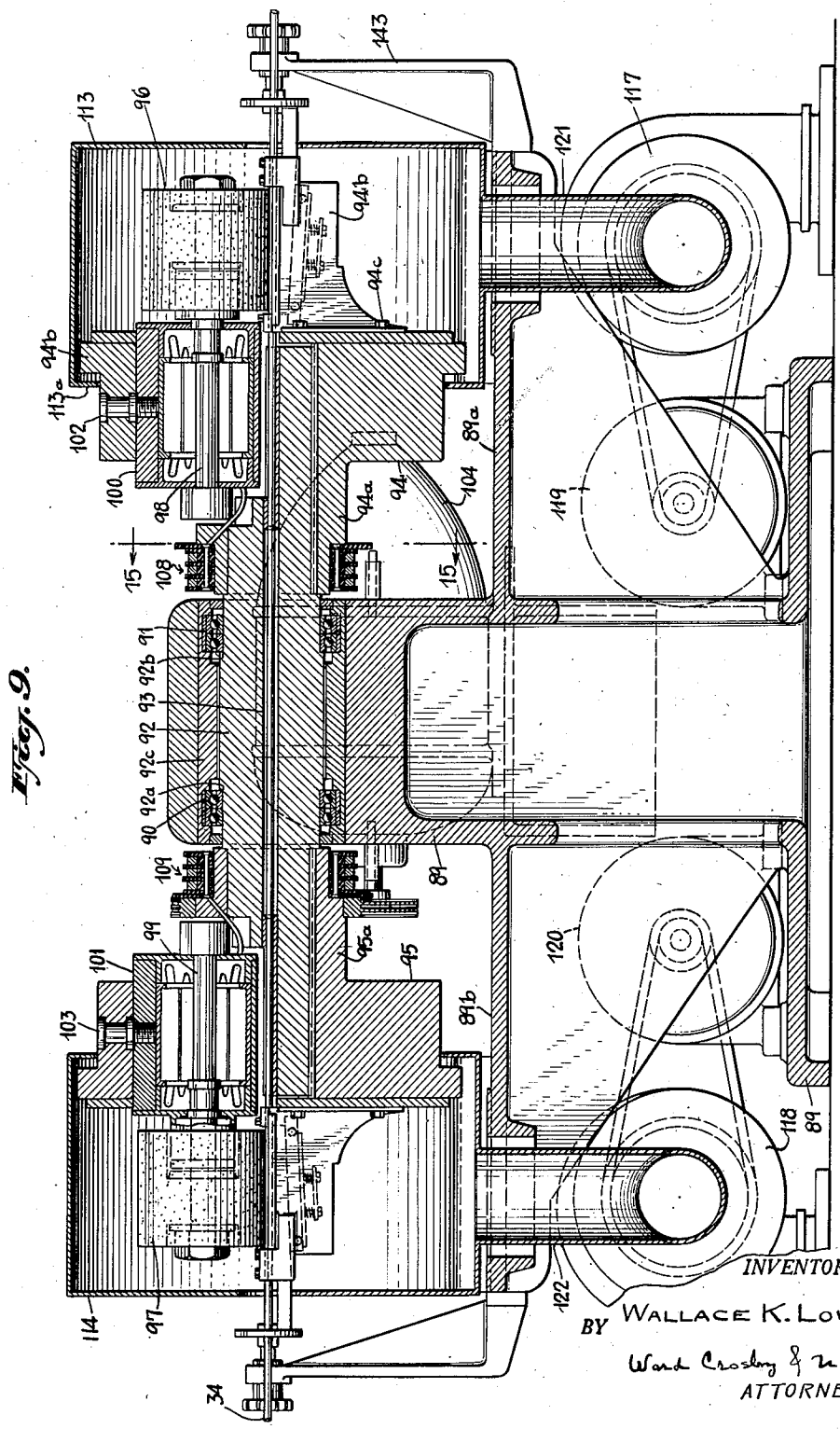


Fig. 9.

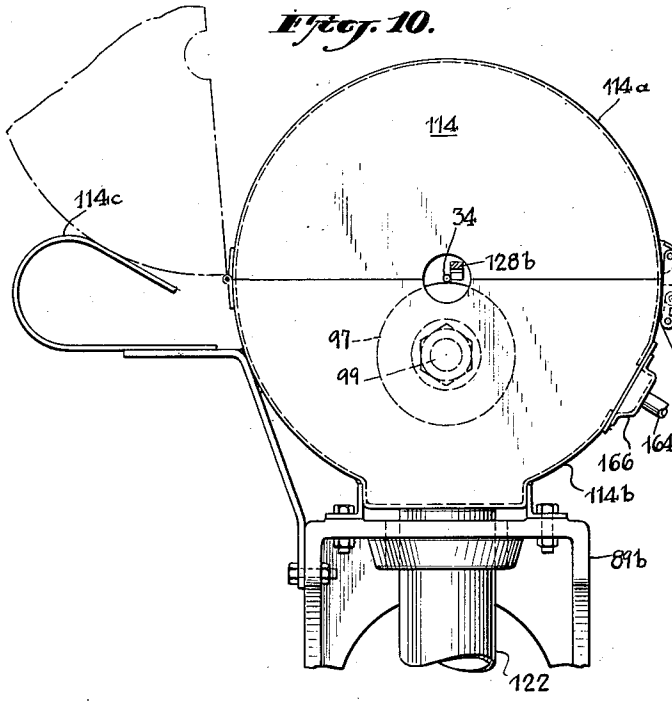
INVENTOR.
BY WALLACE K. LOWE.
Ward Crosby & Nash
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

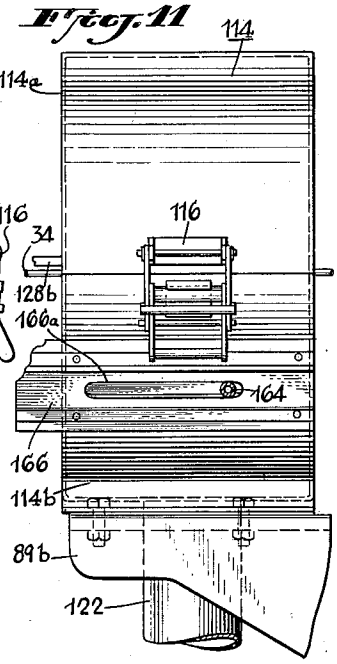
COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 5

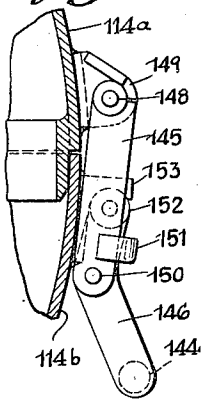
Effeg. 10.



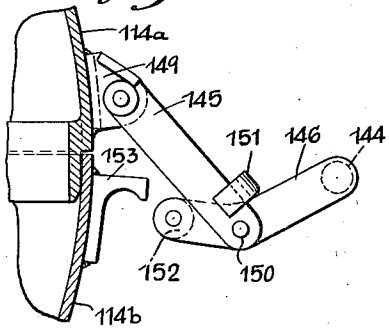
Effeg. 11



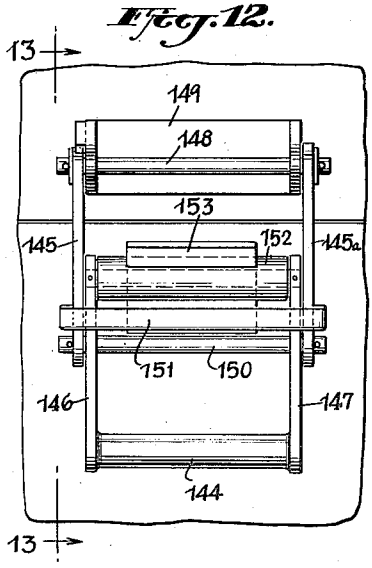
Effeg. 13.



Effeg. 14.



Effeg. 12.



INVENTOR.
WALLACE K. LOWE.
BY
Ward, Crosby & Neal
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 6

Fig. 16.

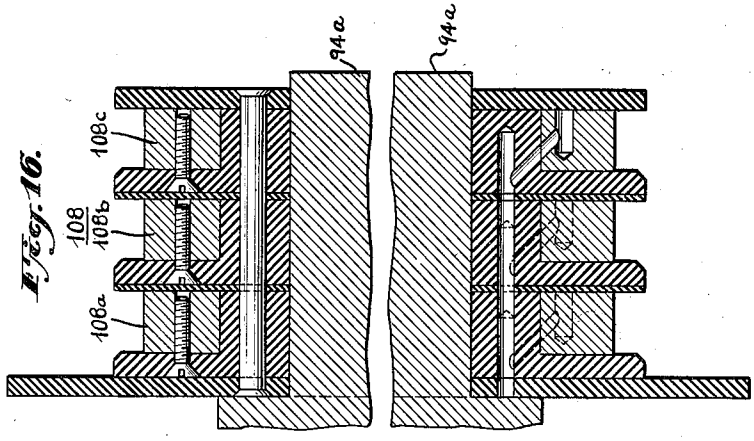
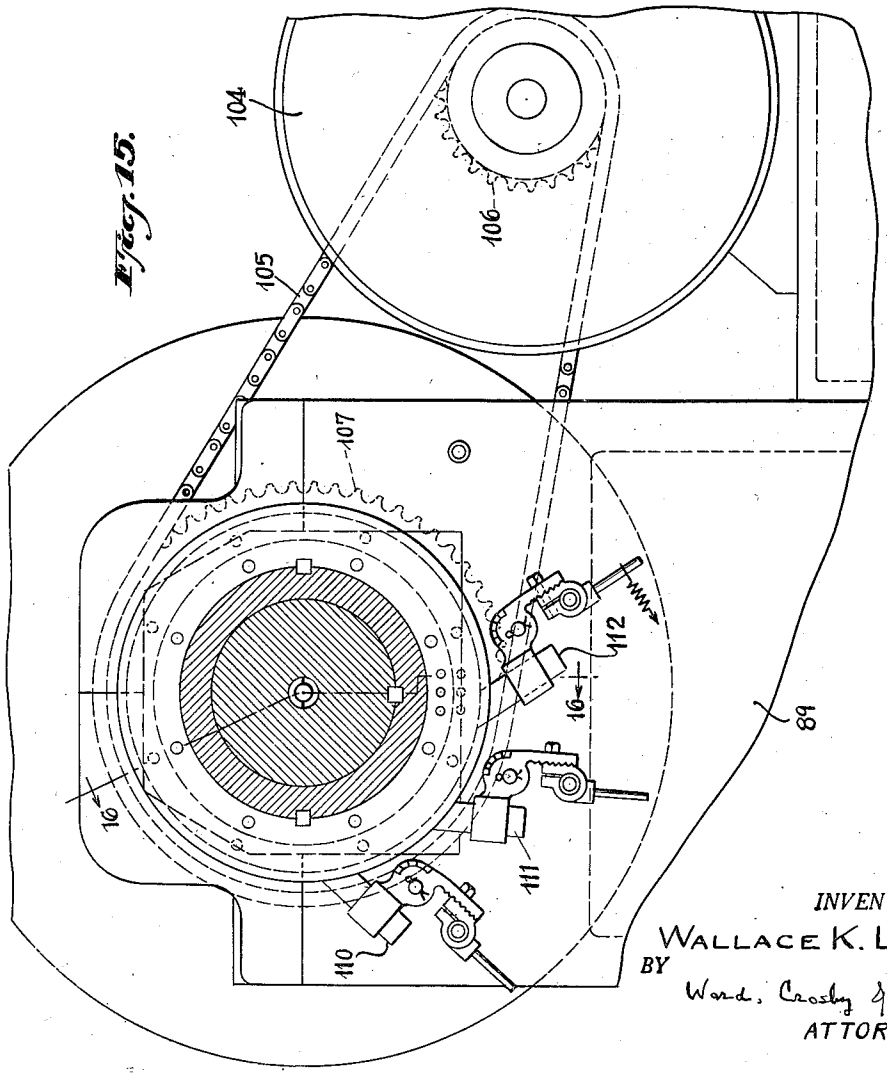


Fig. 15.

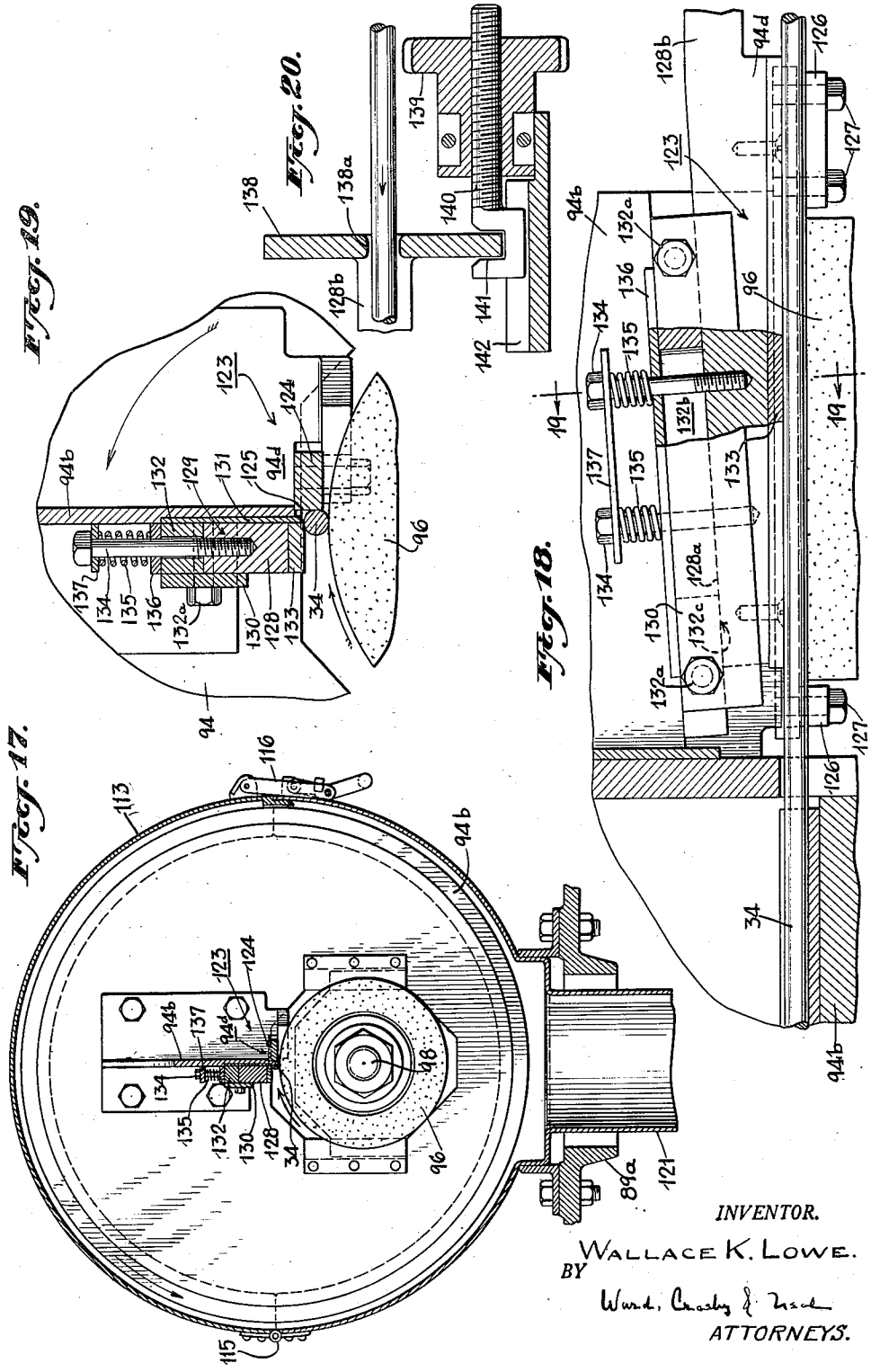


INVENTOR.
WALLACE K. LOWE
BY
Ward, Crosby & Neal
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 7



Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 8

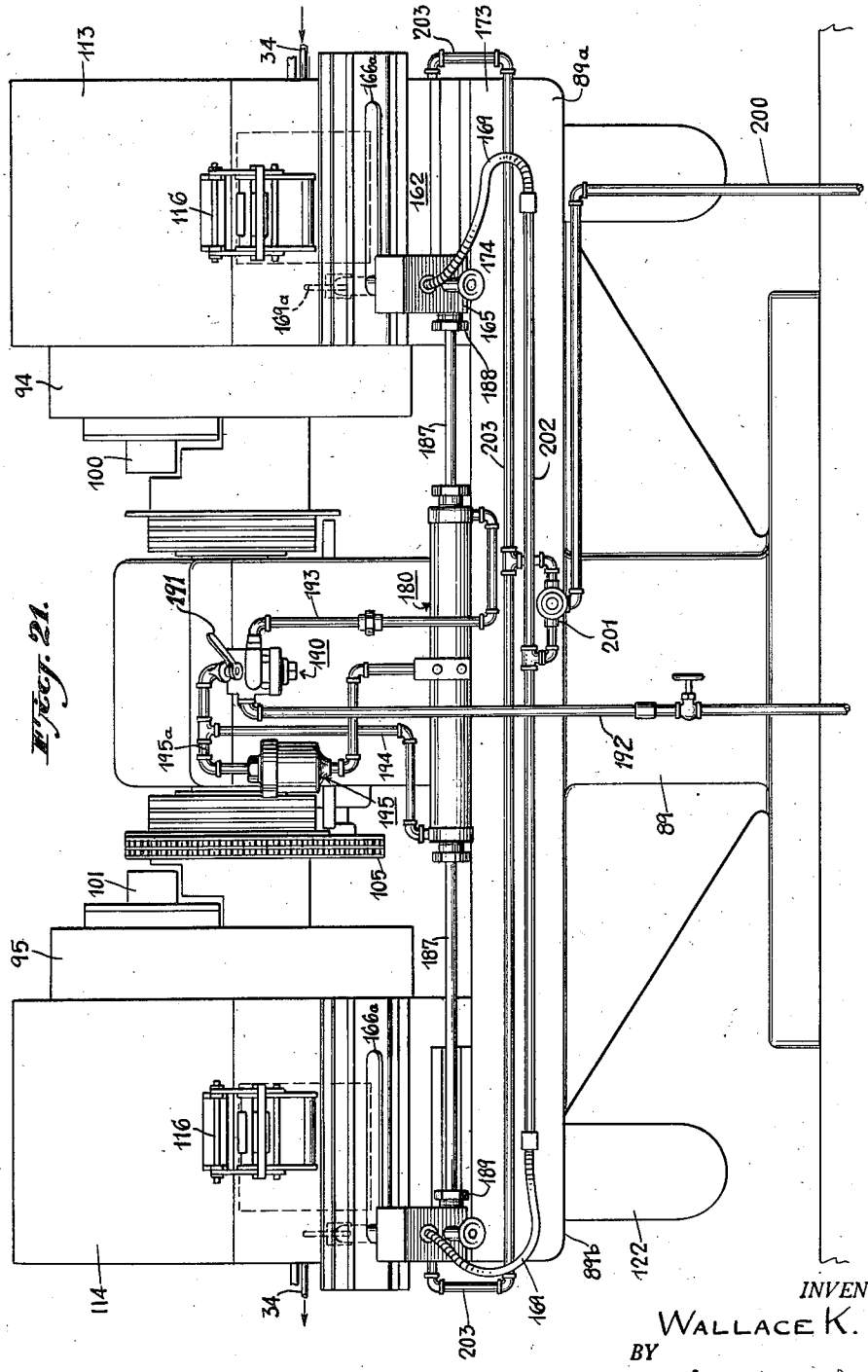


Fig. 21.

INVENTOR.
WALLACE K. LOWE.
BY
Ward, Crosby & Neal
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 9

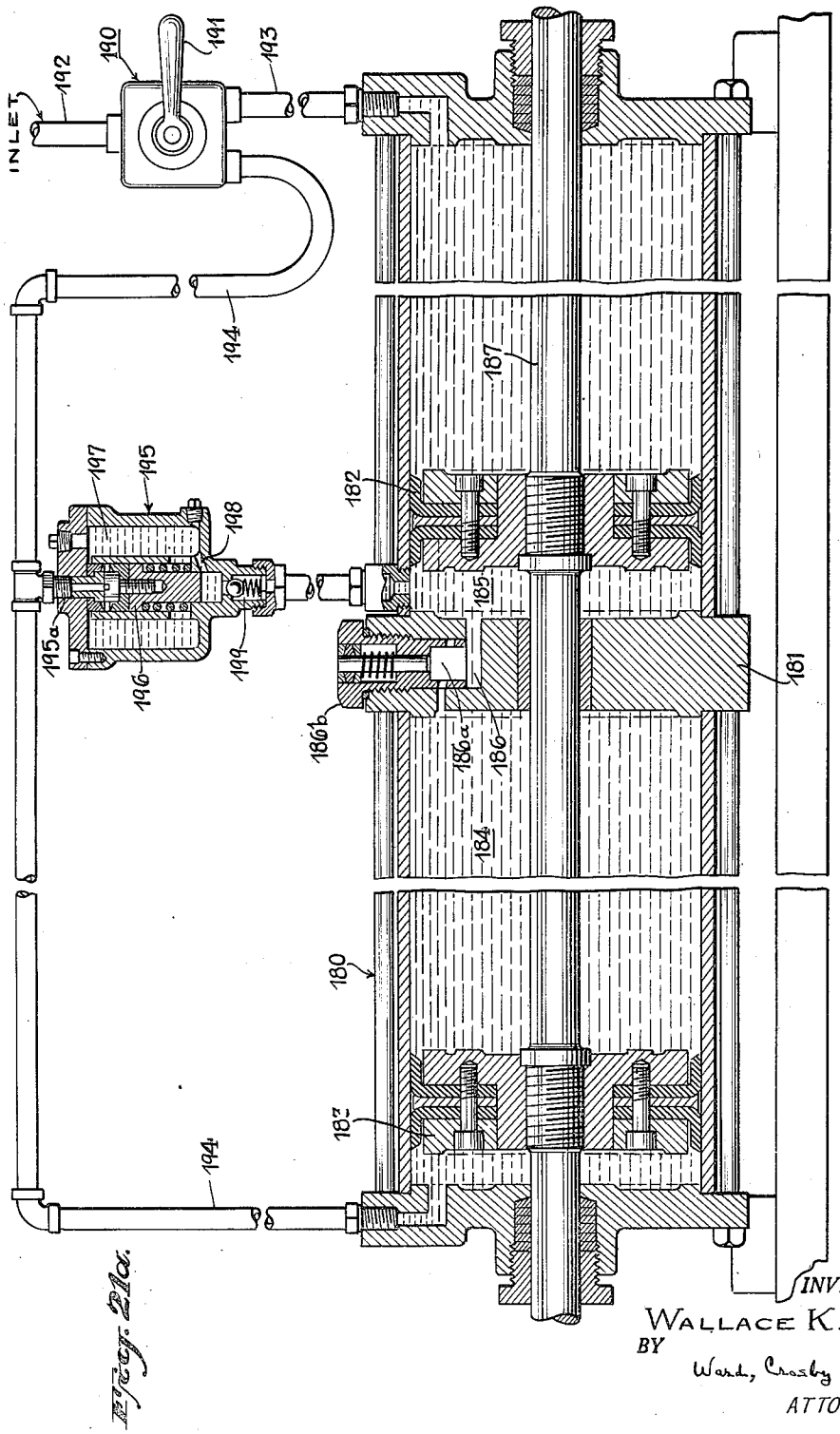


Fig. 21a.

INVENTOR.
WALLACE K. LOWE.
BY
Ward, Crosby & Neal
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 10

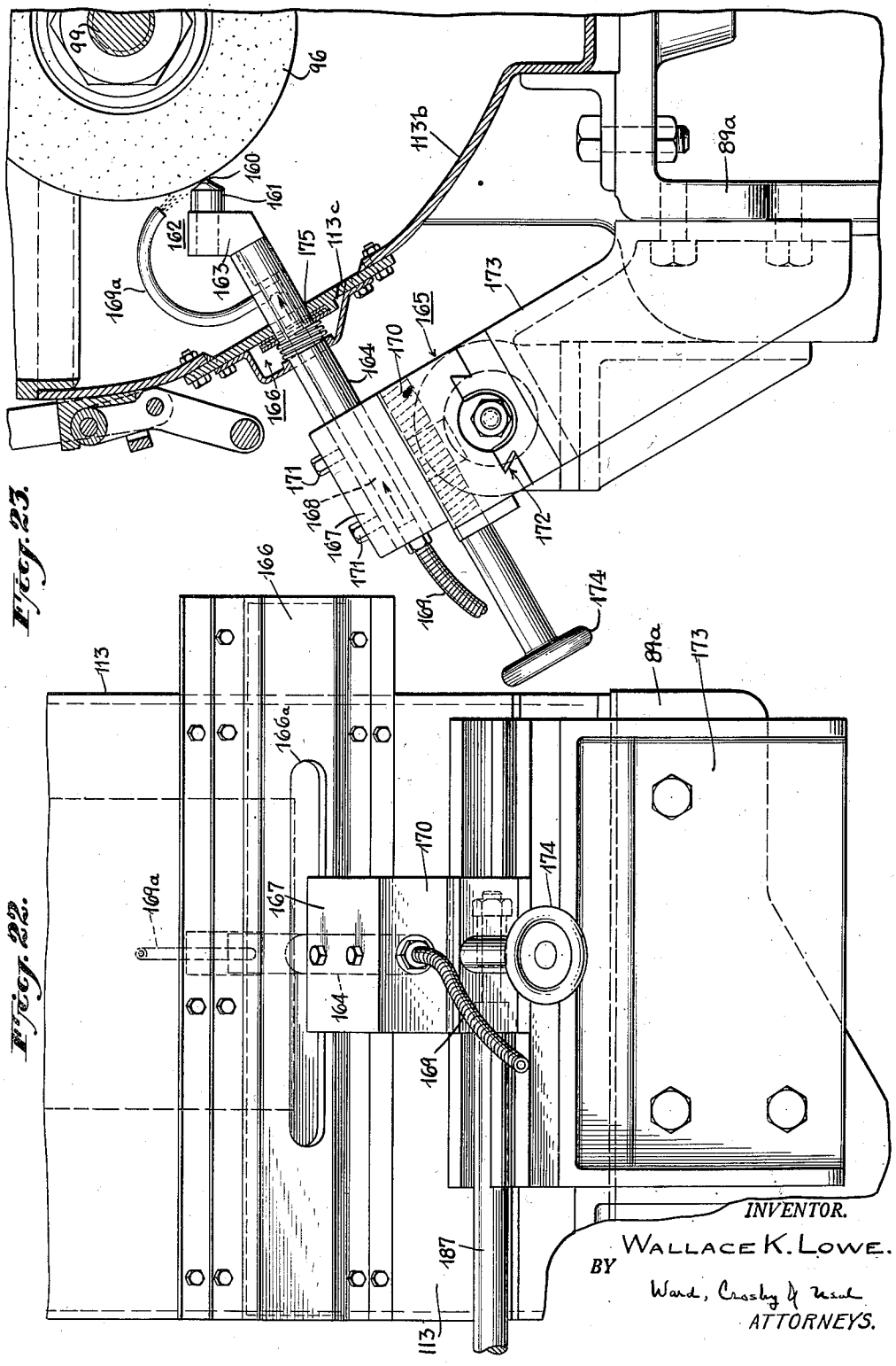


Fig. 23.

Fig. 22.

INVENTOR.
WALLACE K. LOWE.
BY Ward, Crosby & Neal
ATTORNEYS.

Oct. 7, 1952 W. K. LOWE 2,612,730

COIL GRINDING EQUIPMENT

Filed Sept. 15, 1950 11 Sheets-Sheet 11

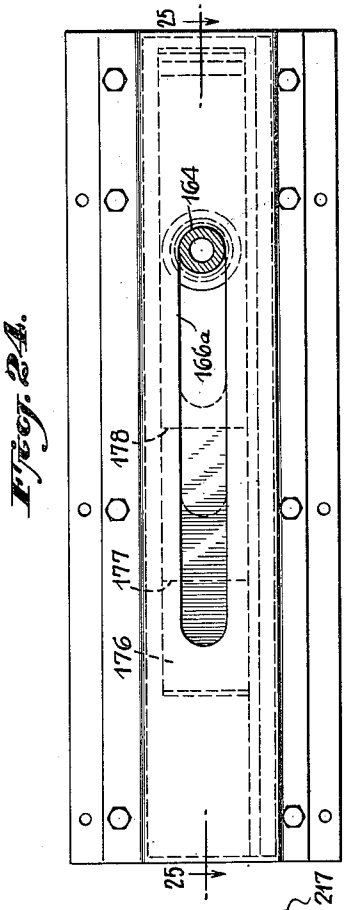


Fig. 24.



Fig. 25.

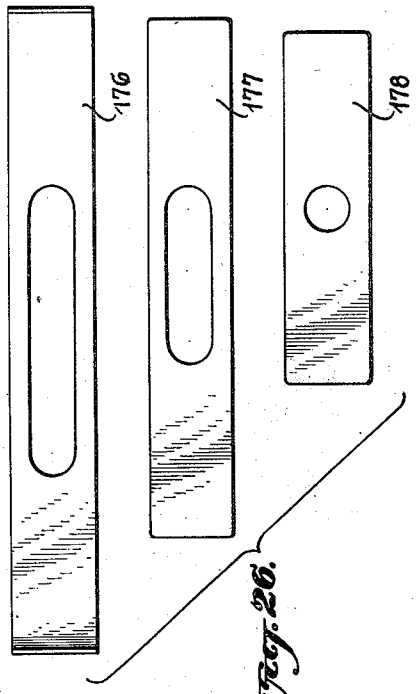


Fig. 26.

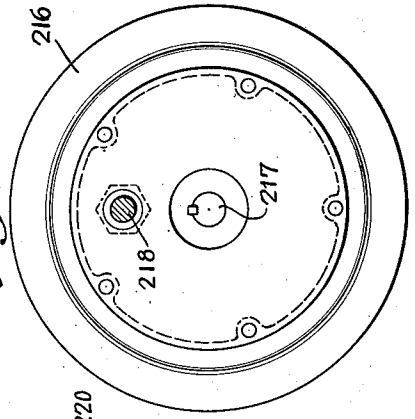


Fig. 28.

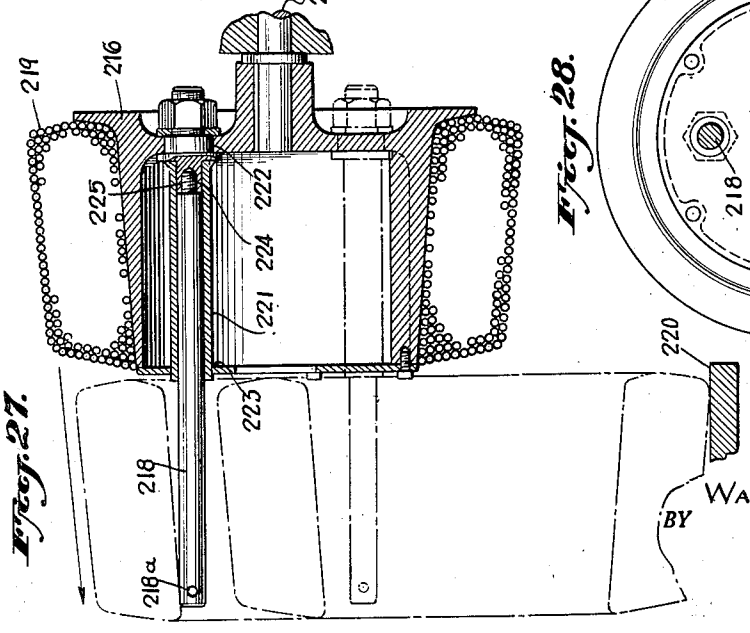


Fig. 27.

INVENTOR.
WALLACE K. LOWE.
BY
Ward, Crosby & Neal
ATTORNEYS.

Patented Oct. 7, 1952

2,612,730

UNITED STATES PATENT OFFICE

2,612,730

COIL GRINDING EQUIPMENT

Wallace K. Lowe, Syracuse, N. Y., assignor to Crucible Steel Company of America, New York, N. Y., a corporation of New Jersey

Application September 15, 1950, Serial No. 184,944

6 Claims. (Cl. 51—5)

1

The invention relates to grinding and polishing machines, and more particularly to such machines wherein an abrasive tool is simultaneously rotated about its axis and revolved about the work in pressure engagement therewith.

Apparatus have been suggested in the past for grinding and polishing workpieces including wire stock having in combination a rotatable supporting head which mounts a grinding wheel, the supporting head having an axially extending passage therethrough for the wire stock. The supporting head is rotated about the wire stock and the grinding wheel is revolved in planetary movement thereabout at the same time, the grinding wheel, of course, being in operative engagement therewith. In such apparatus heretofore proposed, work holding or work rest members have been mounted in fixed relation with said supporting head in close proximity thereto for maintaining the wire stock against lateral displacement and to urge same against the grinding wheel, there being suitable means for moving said work holding member towards the grinding wheel whereby the wire stock can be maintained in engagement with the grinding wheel as the latter wears away. In addition to said single supporting head and grinding wheel mounted thereupon, it has been normal practice to employ one additional supporting head and grinding wheel, the two being mounted upon a main supporting shaft which is rotated by a common power means whereby the two supporting heads are rotated simultaneously with the wire stock passing axially through said main supporting shaft from an outlet reel onto a suitable wind-up reel. The first grinding wheel normally performs a roughing operation and the second a finishing operation. There have been employed means for causing the wire to be held under tension while it is undergoing action by said grinding means, including, for example, a tension block mounted to engage the wire prior to its engagement by a grinding wheel and a suitable guide located near the wind-up reel between the latter and the next adjacent grinding wheel and supporting head.

In setting in operation such a grinding and polishing machine thereof, of course, is a necessity for threading the wire stock through the machine from the outlet reel. In the past this has been a tedious and time consuming operation which has necessitated the manual threading of the wire through the narrow passage of the machine. In many instances this causes undue delay in the operation of the apparatus.

2

Suitable means have not been heretofore suggested for assisting in urging the wire stock through the machine.

Furthermore in the threading of a machine of this type in the past, the means which have been used heretofore for urging the initial extremity of the wire through the machine have not been under the control of adequate governing devices which facilitate the work of the machine operator. For example, in a machine of this character there is a substantial distance between the extremities thereof and an operator working at one extremity may be forced to return to the opposite extremity, for example, in order to disengage the power means for forcing the initial end of the wire through the machine. Thus in the past two men have been required to load or thread the machine. This has been believed an excessive number, there being in fact the necessity for only one man to accomplish this purpose.

Also in apparatus of this type heretofore suggested the planetary grinding wheels have, of course, been subject to a substantial wear and after a reasonable period of time it is necessary to dress such wheels. This has been done in the past by opening a protective hood for such wheels, stopping the supporting rotating head therefor and manually dressing the grinding wheel with the supporting head so arrested. This operation usually requires a coolant fluid and such dressing operation has been accomplished only with great inconvenience because of the splashing and lack of control of the coolant fluid. Furthermore there is a substantial safety hazard in so dressing the grinding wheels because of flying bits of steel or abrasive substance from the wheel. Also in apparatus of this type heretofore employed, it has been common practice to provide two grinding wheels and it has been necessary to dress these separately manually.

One of the objects of the present invention is to provide novel means for automatically and simultaneously dressing the two grinding wheels of a grinding and polishing machine of this character.

Another object of the invention is to provide improved and novel means for threading the end of a piece of wire stock through the apparatus.

An additional object is to provide novel means for controlling the grinding wheel dressing elements in conjunction with a suitable housing for containing the planetary elements whereby there

is no loss of control of the coolant fluid used in such dressing.

Another object is to a provide a power driven pinch or threading rolls which can be pneumatically operated by manual control from each extremity of the apparatus.

A further object is to provide a complete self-enclosed hood for each grinding wheel supporting head, said hoods also housing portions of the grinding wheel dressing units.

An additional object is to provide novel means for dressing such hooded grinding wheels with the hoods therefor in a "down" or closed position.

A further object is to provide novel means operable with one hand for locking or elevating the liftable portion of a hood.

The invention in one aspect thereof comprises a pair of supporting heads, each mounted upon a main supporting shaft, the latter rotatably supported in suitable ball or roller bearings. The main supporting shaft and said heads are provided with a passage therethrough for the movement of the wire stock which is to undergo grinding. Mounted upon each of the supporting heads is a grinding wheel which is connected to a suitable power means, such as an electric motor, for rotating the grinding wheels and which is positioned for moving planetarily around the wire stock and in operative engagement therewith whereby a grinding and/or polishing operation takes place. An adjustable work holding device is mounted one upon each rotatable head for association with its respective grinding wheel whereby the wire stock is maintained in pressure engagement with the grinding wheel, the work holding device being adjustable toward or away from the grinding wheel whereby the wire stock may at all times be held in engagement therewith. A rotatable wire stock straightener unit is employed upstream relative to the grinding and polishing elements, the straightener comprising a plurality of staggered bars between which the wire stock is led and through which it is pulled by means of suitable power means upon a wind-up reel. The plurality of staggered bars is mounted upon a rotatable frame and power means are provided for angularly shifting this in rotation at a desired speed, whereby the wire stock is completely straightened prior to engagement with the grinding wheels, In order to facilitate the threading of the apparatus, a pair of power driven pinch or threading rolls is positioned upstream relative to the straightener unit, there being provided, at opposite extremities of the apparatus, control means for engaging or disengaging the threading rolls whereby an operator may initiate the threading operation at the upstream extremity of the apparatus and may follow the initial end of the wire therethrough in assisting same to be threaded and thereafter may disengage such pinch rolls at the downstream extremity of the apparatus when such end reaches the wind-up reel. Suitable hoods are provided for each of the rotatable supporting heads, such heads being constructed and arranged for shielding the planetary grinding wheel which might otherwise prove hazardous to an operator. Novel means are provided for dressing such grinding wheels without opening said hoods, such novel means comprising a dressing tool or element for each of such wheels, such tool or element being secured to a mounting which is axially shiftable in the direction of motion of wire stock, that is, axially of the grinding wheel. In one embodiment of the invention where there are two such grinding wheels employed, there are, of course, two dressing tools and they are operatively associated for simultaneous reciprocative movement whereby both grinding wheels may be simultaneously dressed. Suitable fluid actuated power means are employed for automatically and reciprocatively moving the dressing tools at a desired rate.

Various, further and more specific objects, features and advantages of the invention will clearly appear from the detailed description given below taken in connection with the accompanying drawings which form a part of this specification and illustrate, by way of example, preferred arrangements of apparatus for carrying out the invention. The invention consists of such novel combinations of features as may be shown and described in connection with the apparatus herein disclosed.

In the drawings:

Fig. 1 is a side elevation showing one form of the present invention;

Fig. 2 is an elevation of the apparatus shown in Fig. 1 but from the opposite side and with certain portions omitted for purposes of clarity;

Fig. 3 is a plan view of a portion of the apparatus shown in Figs. 1 and 2 including a threading means and a rotary straightener unit;

Fig. 4 is a side view of the apparatus shown in Fig. 3;

Fig. 5 is an end view of the threading and straightening apparatus shown in Figs. 3 and 4;

Fig. 6 is an end view from the opposite extremity relative to that shown in Fig. 5 of the apparatus shown in Figs. 3 and 4;

Fig. 7 is a detailed side view, partly in section and with parts broken away, of a pair of power driven pinch rolls or threading rolls employed in the present invention;

Fig. 8 is a sectional view taken substantially on line 8—8 of Fig. 7;

Fig. 9 is a side elevation, partly in section and with parts broken away, of the grinding and/or polishing portion of the apparatus shown in Fig. 1, including a main supporting shaft, supporting heads and planetary grinding wheels, together with related parts;

Fig. 10 is a side view, partly in section and with parts broken away, of a hood or protective housing for the rotating planetary grinding wheels;

Fig. 11 is an end view of the part shown in Fig. 10;

Figs. 12, 13 and 14 are enlarged detailed views of a hand-operated latch or closure means for holding the two halves of the housing shown in Fig. 10 in a closed position;

Fig. 15 is a detailed view, partly in section and with parts broken away, taken substantially on line 15—15 of Fig. 9;

Fig. 16 is a cross-sectional view, with certain parts omitted for purposes of clarity, of a collector ring structure employed in the present invention taken substantially on line 16—16 of Fig. 15;

Fig. 17 is an end view taken in a plane perpendicular to the longitudinal axis of the apparatus showing a rotatable head, a grinding wheel and the work support or holding member for urging the wire stock against a grinding wheel, said elements being encased within a hood;

Fig. 18 is an enlarged detailed view in side elevation of the work support member shown in Fig. 17;

Fig. 19 is a sectional view, with parts broken

away, taken substantially along line 19—19 of Fig. 18;

Fig. 20 is a detailed sectional view on an enlarged scale of means for adjusting the work holding member shown in Figs. 17–19;

Fig. 21 is a side elevation of the grinding and polishing portion of the apparatus illustrating the dressing elements for dressing the grinding wheels, said elements being supported on suitable reciprocative mountings, there also being illustrated automatic means for reciprocatively moving said dressing elements;

Fig. 21*a* is a schematic representation of the power means for reciprocatively moving said dressing elements;

Fig. 22 is a detailed view on an enlarged scale of a portion of the housing for said rotating supporting head illustrating the reciprocative mounting means for said dressing tool in relation to the housing;

Fig. 23 is a transverse view, partly in section, of the parts shown in Fig. 22, illustrating the position of a dressing tool and the means for directing a coolant fluid thereupon;

Fig. 24 is a side elevation of a portion of the masking means for a dressing element, such means permitting a mounting for a dressing tool to extend movably into a housing for the rotating supporting head without the danger of loss of a coolant fluid;

Fig. 25 is a sectional view in plan taken substantially on line 25—25 of Fig. 24;

Fig. 26 illustrates several slidable plates which are employed in the masking means shown in Figs. 24 and 25;

Fig. 27 illustrates a reel employed in the present invention on which the wire is wound after being ground by the present device; and

Fig. 28 is an end view of the reel shown in Fig. 27.

Referring to the drawings in greater detail, with particular reference to Figs. 1 and 2, the apparatus is constituted in general by a feed and straightening unit indicated generally at 30, a grinding and/or polishing unit as at 31, a control unit as at 32, and a reeling unit as at 33.

An unwinding drum or frame is provided at 33*a* around which the wirestock to be ground and/or polished is wound and from which such stock is unwound and fed into the apparatus. The wire stock is illustrated as at 34 and is directed first through a guide 35. The latter is fixedly secured to a frame portion of the machine and is illustrated in greater detail in Fig. 7 and is constituted by a so-called removable carbide drawing die portion 35*a* which can be easily removed to accommodate wires of different diameters.

The die or guide 35 serves a purpose not only of a guide to facilitate the movement of the wire stock into the machine but also of steadying the wire to prevent a whip action thereof from disturbing the wire's entrance into the device, such whip action normally occurring due to rapid unwinding from drum 33*a*.

In threading the apparatus it is desirable to have some easily controlled means which can forcefully urge the wire stock from the unwinding drum 33*a* and through the apparatus. Such means are shown in detail in one form thereof in Figs. 1 and 7. Such means are designated threading rolls or pinch rolls as at 36 and 37 (Fig. 7). These rolls are respectively grooved peripherally at 36*a* and 37*a*, respectively.

The planes of rotation of the pinch rolls 36 and 37 are in vertical alignment in a common plane whereby the grooves 36*a* and 37*a* are positioned for grasping the wire stock and pulling same through the guide or die 35*a* during, for example, the threading of the apparatus.

Suitable power means are provided for rotating at least one of the pinch rolls 36 and 37, such means being illustrated as at 38 (Fig. 1) and constituting an electric motor, for example, of 1 H. P., 25 cycle A. C., capable of 1500 R. P. M. The motor 38 is operatively associated with a shaft 39, upon which the roll 37 is secured, through the intermediary of a reduction gear 40 and a suitable sprocket chain as at 41 which passes over suitable sprocket wheels 42 and 43, respectively secured to the output shaft of the reduction gear 40 and the shaft 39.

The pinch roll assembly or pinch roll unit is generally indicated as at 44 (Figs. 1, 2) and may be either one of two types, namely, manually controlled or pneumatically controlled. That is, the pinch rolls 36 and 37 may be operatively associated with one another in wire stock grasping relationship by hydraulically controlled or manually controlled means. In the form shown in Fig. 1, the pinch rolls 36 and 37 are urged toward and away from one another under the influence of suitable fluid actuated power means. In the form shown in Fig. 7, a manual device is shown for controlling the movement of these rolls toward and away from one another.

If desired, of course, both types of control of the pinch rolls may simultaneously be employed as indicated in Fig. 4 as will be described hereinafter.

Referring now to Figs. 7 and 8, the shaft 39 of the pinch roll 37 is journaled in a suitable bearing 45 which is secured to a frame portion of the apparatus as at 46. The pinch roll 36, on the other hand, is mounted upon a so-called pinch roll idler arm as at 47. In this embodiment the pinch roll 36 is of the so-called idler variety and has no power directly communicated to its shaft. The pinch roll idler arm 47 is in the nature of a bell crank having arms 47*a* and 47*b*. The pinch roll 36 is mounted upon such idler arm as at 48 through the intermediary of an eccentric 49 which is under the influence and which is angularly shiftable by a handle 50 secured to a shaft 51, the latter supporting said eccentric 49 and having the latter secured thereto. It will be seen that by angularly shifting the handle 50 the pinch roll 36 can be shifted toward and away from the pinch roll 37 because of the eccentric action of the supporting means therefor. The outer extremity of the arm 47*b* of the idler arm 47 is urged downwardly as viewed in Fig. 7 under the influence of a spring 52 which is associated therewith by means of a bolt 53 which is pivoted as at 54 to such arm 47*b*. The spring 52 bears at opposite extremities thereof, respectively, against the frame member 46 and a washer 54 which is held in place upon the bolt 53 by means of an adjustable nut 55. The extent of the angular motion of the handle 50 is determined by the location of a pair of limit-stops or limit-stop pins as at 56 and 57 which cooperate with a finger 58 which is rigidly secured to a hub 50*a* of the handle 50.

The compression of the spring 52 is so adjusted by the nut 55 that there is substantial pressure downwardly upon the pinch roll 36 when the finger 58 is in the position shown in Fig. 7. Thus the wire stock 34 is firmly grasped between the pinch rolls and urged to the right as viewed in

this figure. When the handle 50 and the finger 58 are moved clockwise (Fig. 7) to the point where finger 58 contacts the stop pin 57 the spring 52 will no longer be under compression and there will be no positive gripping by said pinch rolls of the wire stock 34.

The lower extremity of arm 47a is, of course, pivotally secured in suitable pillow blocks as at 59, the latter being secured to the frame member 46.

When the apparatus is being loaded, that is, when the wire stock is being threaded therethrough, it is desirable to be able to employ remote control means for the pinch rolls 36 and 37 whereby the actuating pressure thereupon may be easily governed remotely relative thereto, that is, whereby the pressure of roll 36 acting toward roll 37 may be so controlled. In the form shown in Fig. 1, elements of which are also shown in Figs. 3 and 4, the outer extremity of idler arm 47b instead of being operatively associated with a spring means, as at 52, is under the influence of a fluid actuated power cylinder which may be controlled by suitable hand valves. Such a fluid actuated power cylinder is shown as at 60 (Fig. 4). The bolt 53, shown in Fig. 7, has a counterpart therefor as at 61 in Fig. 4 comprising a piston rod of the power cylinder 60, such piston rod being pivotally associated as at 62 with the outer extremity of the idler arm 47b.

The fluid actuated power cylinder 60, for example, may be under the influence of air pressure as controlled by a hand-operated valve 63 (Fig. 1). Air under pressure is conducted to said valve 63 by conduit 64, the valve being in operative association with the power cylinder 60 by means of conduits 65 and 66.

The power cylinder 60 not only may be controlled by the hand-operated valve 63 at the so-called upstream extremity of the apparatus but also may be controlled by a hand-operated valve 66a which is at the so-called reeling unit, that is, at the downstream or wind-up extremity of the apparatus.

By careful control of either one of the hand-operated valves 63 or 66a the grasping pressure of the pinch rolls upon the wire stock may be finely controlled. Thus an operator of a machine may initiate the threading of the wire stock 34 by actuating the valve 63 and when the machine has been fully threaded and such operator has followed the end thereof to the left, as viewed in Fig. 1, down to the reel unit 33, the operator can thereafter shut off or arrest the operation of the pinch roll unit 44 by actuating the valve 66 whereby the force urging such rolls together is withdrawn.

After the wire stock has passed through the pinch roll unit 44, it is thereafter directed through a straightener unit indicated generally at 67 and best shown in Figs. 3 and 4. The straightener unit consists in general of a plurality of staggered straightener bars as at 68, 69, 70 and 71. These straightener bars 68–71, inclusive, are positioned to form two slight bends in the wire stock 34 as at 34a and 34b when such stock is pulled therethrough by the reeling unit 33. The straightener bars are mounted upon a rotatable carriage 72 which is journaled as at 73 and 74 in suitable supports 75 and 76, the latter two supports in turn resting upon a table or supporting frame 77.

The straightener carriage 72 with the bars 68–71 secured thereto is rotatable separately by means of a straightener motor as at 78 through the intermediary of suitable belts as at 79 which pass over a pulley 80 secured to a shaft of the motor 78 and over a suitable pulley 81 which embraces a portion of the carriage 72. The motor 78, for example, may be of 3 H. P., 25 cycle A. C. and capable of 1500 R. P. M. As is shown in Fig. 6, the pulleys 80 and 81 are approximately of the same diameter and consequently the carriage 72 is rotated at a speed substantially equal to that of the straightener motor 78.

In view of the rapid angular velocity of the straightener bars 68–71, inclusive, and in view of the axial speed of the wire stock 34, it is desirable to lubricate the latter prior to its engagement by the straightener bars 68–71. As is best shown in Fig. 4, suitable downstream and upstream guides as at 82 and 83 are provided at opposite extremities of the straightener unit for facilitating the entry and exit of the wire stock. Such guides are in the form of rings having suitable central bores therein as at 82a and 83a, respectively, for this purpose. It has been found desirable to direct the lubricating fluid to the wire stock 34 as it passes through the guide 82 and for this purpose an oil cup 84 is mounted about the guide 82 and connected thereto by a conduit 85. The flow of lubricant to the wire stock can be controlled in any suitable manner as by a regulating valve (not shown) in the conduit 85 or by suitable wick means.

The lubricant thus applied to the wire stock will largely be scraped therefrom by means of the rotating staggered bars 68–71 and will fall into an inclined oil pan shown as at 86, the latter having an outlet as at 87 for directing the lubricant into a pail as at 88.

The wire stock thereafter passes through the grinding unit 31 which is shown in section in Fig. 9.

In the form shown the grinding unit is constituted by a main supporting frame or pedestal 89 having, as viewed in Fig. 9, a righthand and lefthand shelf portion indicated respectively at 89a and 89b.

Supported by the frame member 89, in ball bearings as at 90 and 91, in a main supporting shaft 92 having a central bore therethrough as at 93 for the passage of the wire stock 34. The main shaft 92 is held firmly against axial displacement by virtue of the ball bearings 90 and 91 being mounted adjacent shoulders 92a and 92b, respectively, formed upon said shaft. The opposite or outer races of said ball bearings engage suitable fixed shoulders formed in a fixed sleeve 92c, the latter being firmly secured to the frame 89. On the main shaft 92 there are supported, on opposite extremities thereof, as at 94 and 95, so-called "supporting heads" or "rotating heads." These elements 94 and 95 provide support for the planetary grinding wheels abovementioned which are herein indicated at 96 and 97, respectively, that is, they are associated respectively with the supporting heads 94 and 95. Wheel 96 may be for "roughing" and wheel 97 for "finishing" the wire stock.

The grinding wheels 96 and 97 are secured to suitable shafts 98 and 99, respectively, said shafts comprising the rotor shafts of grinding wheel motors 100 and 101, respectively.

The grinding wheels 96 and 97 may be, for example, 9 inches in diameter with a face of about 8 inches. Said grinding wheels are coaxial, together with the motors therefor, in such a manner that the faces thereof are in operative or grinding association with the wire stock 34 which passes centrally through the main shaft 92.

It will, of course, be understood that the motors 100 and 101 are mounted in suitable recess in the supporting heads 94 and 95 and if it is desired, said motors 100 and 101 may be radially shifted in small amounts in order to move their respective grinding wheels toward the wire stock, such movement normally being necessary in order to adjust for wearing of the grinding wheels. Such radial movement may be accomplished by any suitable means, for example, by means of suitable radial adjustment screws 102 and 103, respectively associated with the motors 100 and 101. The recesses in the heads 94 and 95 for receiving such motors are constructed and arranged to permit such radial adjustment of these motors.

The main shaft 92 is rotated by suitable power means, such as an electric motor 104 (Figs. 9 and 15) by means of a sprocket chain 105 which passes over a motor pulley 106 and a main shaft pulley 107.

The main shaft power motor 104 is preferably of about 5 H. P., being driven by D. C. and capable of speeds between about 500 and 1500 R. P. M.

Power is communicated to the grinder wheel motors 100 and 101 by separate collector rings 108 and 109 respectively (Fig. 9), the former being shown in greater detail in Fig. 16.

As shown in Fig. 9, it will be seen that the rotating heads 94 and 95 are provided with inwardly extending sleeve portions 94*a* and 95*a*, respectively, which embrace the portions of the main supporting shaft 92 which extend outwardly from the portion of the pedestal 89 which embraces same. The collector rings 108 and 109 are respectively mounted not upon the main shaft 92 proper but instead upon the sleeve portions 94*a* and 95*a*, respectively, as is well shown in Fig. 9, whereby removal of a head as at 94 will also remove the related collector ring 108.

Referring now to Fig. 16 it will be seen that the collector ring 108 is constituted by three separate subsidiary rings 108*a*, 108*b* and 108*c*. These rings convey, for example, three phase alternating current to the grinder wheel motor 100, it being understood that an analogous arrangement is provided for the grinder motor 101 by means of the collector ring 109. Each of the subsidiary collector rings 108*a*, 108*b*, and 108*c* is insulated one from the other and the group is suitably insulated from the head sleeve portion 94*a*.

Suitable brushes for the collector rings above described are indicated in Fig. 15 at 110, 111 and 112, such brushes being held by suitable conventional means, preferably in angularly separate positions as shown.

In view of the rapid rotation of the supporting heads 94 and 95, thereby imparting a planetary motion to the grinding wheels 96 and 97, it is necessary to have suitable housings over portions of said heads and grinding wheels, and as best shown in Fig. 9 such housings are respectively indicated at 113 and 114. For example, considering housing 113 it will be seen that it is supported upon the shelf 89*a* of the frame or pedestal 89 and that it envelopes a portion of the head 94 and covers entirely the orbit of the planetarily moving grinding wheel 96. Upon the supporting head 94 there is provided a flange as at 94*b* which is adapted for cooperating with an inwardly extending flange 113*a* of housing 113. Head 95 and housing 114 are similarly flanged.

Each of the housings are divided into halves along a horizontal plane and the upper half is hinged at 115 to the lower one and removably secured thereto by a suitable latch as is best shown at 116 in Fig. 17.

In the roughing and finishing of the wire stock 34 it may be desirable to direct a coolant or lubricant fluid onto same, that is, while being acted upon by the grinding wheel. In order to provide safety and to prevent a loss of or splashing about of such coolant or lubricant, the housings 113 and 114 are provided. Thus said housings serve not only to reduce the safety hazard resulting from the rotating grinding wheels but also to aid in recovering the lubricant or coolant fluid. Also the lubricant fluid is prevented from escaping from the housings by a suitable vacuum forming device, such as that shown at 117 and 118, respectively, for the housings 113 and 114. These vacuum devices are pumps which act as exhaust fans for their respective housings to maintain same under a negative pressure thereby inhibiting the escape of the coolant or lubricant fluid. Each of the exhaust fans or pumps 117 and 118 is powered by a separate motor shown respectively as at 119 and 120. The exhaust pumps 117 and 118 are respectively connected to their housings by conduits 121 and 122.

As is best shown in Figs. 9 and 17–20, inclusive, means are provided for urging the wire stock into operative engagement with each of the grinding wheels 96 and 97, the means shown in Figs. 17–20 being so employed with the grinding wheel 96. Such means are generally designated as an adjustable work holder or work rest and is indicated at 123 (Fig. 19). The work holder is mounted upon a bracket 94*b* which in turn is secured to the outer face of the supporting head 94 by suitable bolts 94*c*. The bracket 94*b* extends substantially perpendicular to the face of the head 94 and has secured thereto a back-up bar 124 having a face 125 against which the wire stock 34 is urged. The back-up bar 124 is held between a portion 94*d* of the bracket 94*b* and supporting fingers 126, the latter being secured by bolts 127 to bracket 94*b* at opposite extremities of the periphery of the grinding wheel 96.

The face 125 of the backup bar 124 is substantially parallel to and spaced from a plane passing through the axis of the grinding wheel 96 and of the main shaft 92, the distance between said face and said plane being approximately equal to one-half of the diameter of the wire stock 34 whereby the axis of the latter will, in normal operation, be substantially coaxial with that of the main supporting shaft 92. Consequently the wire stock 34 will remain substantially coaxial with the supporting head 94.

A so-called pressure bar 128 also comprises a portion of the work holder 123 and tends to urge the wire stock into pressure engagement with the grinding wheel 96. The pressure bar 128 is longitudinally or axially shiftable within a channel 129, the latter being formed by a pair of guide plates 130 and 131 which are held in spaced relationship by a spacing block 132. Said guide members and spacing block may be held to the bracket 94*b* as by bolts 132*a*. Secured to the lower face of the pressure bar 128 (Fig. 19) there is preferably a so-called wear plate 133 which is directly in contact with the wire stock 34 and which preferably is of a length greater than the length of the face of the grinding wheel 96 whereby the wire stock is or will be urged against the wheel 96 regardless of the longitudinal position of the pressure bar 128.

The pressure bar 128 is held in the channel 129 for longitudinal movement therein by means of a pair of retaining screws 134 which are screw threaded into the bar 128 and which are movable within a slot 132b formed in the spacing block 132. The pressure bar 128 is resiliently urged against the spacing block 132 under the action of a pair of coil springs 135 which embrace respectively each of the retaining screws 134. The coil springs 135 act at the lower extremities thereof upon a retaining plate 136 which is longitudinally shiftable along the top of the spacing block 132. The upper extremities of said coil springs 135 act upon an upper retaining plate 137 which, near the opposite extremities thereof, embrace the necks of the retaining screws 134 just beneath the heads thereof.

The pressure bar 128 is movable toward or away from the grinding wheel 96 by means of a wedge structure, said bar itself being in the form of a wedge, the upper face thereof 128a, as viewed in Fig. 18, acting upon the lower edge 132c of the spacing block 132. The latter is slightly tilted relative to the axis of the main shaft 92 and the adjacent face of the spacing bar 128 is thus similarly tilted whereby longitudinal movement of bar 128 will urge the wear plate 133 toward or away from the grinding wheel 96. An arm 128b of the pressure bar 128 extends to the right thereof as viewed in Fig. 18 and has secured thereto an adjustment disc which is shown in detail in Fig. 20, such discs being indicated at 138 and being provided with a central passage 138a.

By axially shifting the disc 138, it is, of course, possible to move the pressure bar 128 toward or away from the grinding wheel 96. Suitable means are provided for so controlling the disc 138 consisting of a manually controlled knob 139 having a threaded shaft 140 extending therethrough which is provided at one extremity thereof with a grooved portion 141 for engaging opposite faces of the disc 138 adjacent the periphery thereof. The grooved portion 141 is axially shiftable in a track 142 which is rigidly held upon a suitable support as at 143 (Fig. 9), the latter comprising a bracket secured to a shelf of the pedestal 89. The threaded shaft or bolt 140 is thus restrained from rotation by means of track 142 and by adjustment of the knob 139 it will be evident that the axial position of the disc 138 may be controlled whereby the wedging action of the pressure bar 128 in turn may be controlled for urging the pressure bar against the wire stock as desired.

Referring now to Figs. 10–14, inclusive, the novel toggle latch device will now be described which is adapted for holding the upper half of the housing, such as 114, in place over the lower half thereof. Such toggle latch has above been designated generally at 116 (Fig. 17) and is constituted by a handle portion 144 which may be grasped by the hand and thrust upwardly whereby the latch may be opened. The latch, in general, is made up of primary arms 145, 145a and secondary arms 146 and 147. The first pair of arms 145 and 145a is pivotally associated with a pin 148, the latter being journaled in a suitable bracket 149 and secured to the upper half 114a of the housing 114. The lower extremities of said arms 145 and 145a (Fig. 12) have a pivot pin passing therethrough as at 150 upon which is pivotally mounted substantially at the midpoints thereof the above-mentioned secondary arms 146, 147. The arms 145, 145a are preferably rigidly held together by means of a cross-arm 151 which is secured thereto near the pin 150. A toggle roll 152 is pivotally secured to the upper extremities of the arms 146, 147 (Fig. 12) and said roll is adapted for coacting with a hook member 153 which is secured to the lower half 114b of the housing 114.

As is best shown in Figs. 13 and 14, a line extending from the axis of the pin 148 to that of the pin 150 passes to the left of the center line of the toggle roll 152 when the latter is in the position shown in Fig. 13, thereby insuring a toggle action and a closure of the two halves of the housing.

When it is desired to open the housing 114, it is not necessary to employ two hands but only one and an operator may quickly grasp the handle 144 and thrust same upwardly to the position shown in Fig. 14, thereupon the upper half 114a of the housing 114 may be lifted from the position shown in solid lines in Fig. 10 to that shown in broken lines wherein it rests upon a resilient limit-stop 114c which is secured to a suitable rigid portion of the frame of the apparatus.

Novel dressing means are provided for dressing each of the grinding wheels 96 and 97 after they have become worn as a result of contact with the wire stock. Such means are shown in Figs. 21–23, inclusive, with portions thereof being shown in Figs. 24–26.

Dressing tool means, for example, used for the grinding wheel 96, is shown in Fig. 23 and is constitued by a dressing material, such as a dressing diamond indicated at 160 which is mounted rigidly upon a suitable dressing material holder 161, the combined elements 160 and 161 normally being referred to as the dressing element proper, such element being indicated at 162. A dressing element adapter is provided at 163 for holding the dressing element 162 upon a shaft 164 which is secured for reciprocative movement outside of the housing 113 in a mounting indicated generally at 165, said shaft 164 extending into the housing 113 through a gland structure indicated generally at 166. Elements 160, 161, 163 and 164 normally are referred to as a dressing tool. The shaft 164 is rigidly grasped and held by a tool shaft holder 167. The shaft 164 is provided with a central passage therethrough as at 168 through which a coolant or lubricant fluid is directed from a flexible conduit 169. The tool shaft holder 167 is secured to a longitudinally reciprocative mounting 170 by means of suitable retaining bolts as at 171. The reciprocative mounting 170 is slidable from left to right, as viewed in Fig. 22, or axially of the direction of movement of the wire stock by virtue of a dovetail interconnection at 172 with a fixed bracket 173 which is secured to the pedestal 89 by any suitable means. The tool may be shifted axially toward or away from the grinding wheel 96 by means of a hand adjustment wheel 174 which is provided with a threaded portion within the mounting 170, angular motion of the wheel will provide axial shifting of the shaft 164 and the tool shaft holder 167, the interconnection between the adjustment wheel 174 and the holder 167 being of conventional design.

The mounting 170 for the tool shaft holder 167, of course, is shiftable from left to right, that is, axially of the grinding wheel 96, in order for the dressing tool 162 to be able to reach all portions of the face of the grinding wheel 96.

Such axial movement of the shaft 164 relative to the housing 113, of course, must be accommodated by an elongated slot in such housing

as indicated at 175 (Fig. 23). A coextensive slot 166a is provided in cover member 166. In order to prevent the loss of a coolant fluid through this slot as the shaft 164 is so shifted therein axially, slot masking means are employed comprising a series of superposed elongated slotted plates as shown in Fig. 26 at 176, 177 and 178, such plates being of gradually diminishing length and the slots therein also being of gradually diminishing length, plate 178 having its slot in the form of a circular opening which embraces closely the shaft 164. The elongated plates 176—178 are superposed one upon the other with plate 176 adjacent the housing 113 and plate 177 interposed between it and plate 178, the assembled plates being urged together and toward the housing 113 by means of a coil spring indicated at 179 (Figs. 23 and 25).

The slots in the elongated plates 176—178 are so arranged as to dimension that regardless of the position of the shaft 164 in the slot 175 there will be no substantial opening which will permit the escape of the coolant fluid.

It will be understood that an analogous dressing unit is provided for the grinding wheel 97 identical to that described in connection with Fig. 23.

A passage may be formed as at 113c (Fig. 23) in housing member 113b to permit return into the housing of fluid which collects in member 168.

In order to speed up the operation of the apparatus and in order to avoid the necessity for having to dress the grinding wheels by opening the hoods 113 and 114 therefor, the dressing tools have been so positioned to extend through the lower halves of their respective housings. The dressing tools are jointly reciprocated by means of an airdraulic or air actuated double acting power cylinder device as best shown in Figs. 21 and 21a and indicated generally at 180. Referring particularly to Fig. 21a, the double acting power cylinder device is of the so-called oil controlled variety having a central partition 181 which is interposed between pistons 182 and 183, respectively, on the right and left sides thereof. In chambers 184 and 185 formed by said partition and cylinders, a suitable control fluid such as oil is situated and it will be evident that by controlling the flow of oil through a passage as at 186 in the central partition 181, the speed of axial movement of the pistons 182 and 183 can be controlled. The latter pistons are secured to a suitable piston rod 187 which extends through the central partition 181 and is axially movable therethrough. The opposite extremities of the piston rod 187 are secured to the reciprocatively mounted dressing tools as at 188 and 189, respectively.

It is clear that by manual control of a handle 191 it is possible to move both of the dressing tools simultaneously to the left or to the right in a controlled manner by virtue of the power cylinder means 180 of Fig. 21a and its valve control and oil chamber control element.

The reciprocative movement of the power cylinder 180 is under the influence of a so-called four-way hand-operated valve 190 having a handle 191. Air under pressure is directed to this valve via a conduit 192. Such air is in turn directed either to the right or to the left extremity of the power cylinder 180 as viewed in Fig. 21a by means of conduits 193 and 194, respectively.

As above mentioned the chambers 184 and 185 located between the pistons 182 and 183, are filled with oil. By controlling the speed with which this oil can be passed from one of these chambers to the other, it is clear that the axial speed of the piston 187 can be controlled. A speed control valve is provided for metering the oil through said passage 186 comprising a valve element 186a which may be adjusted in angular position by means of an adjustment nut 186b.

There may be some leakage or dissipation of the oil in the chambers 184 and 185 and it has been found desirable to provide a so-called automatic oil filler device indicated generally at 195 and consisting of a piston member 196 which is slidable in a suitable bore in the device 195 and which is under the influence of the air in the conduit 194, via conduit 195a, which air urges said piston downwardly as viewd in Fig. 21a. Oil is located in a chamber 197 of the oil filler device and by means of an orifice as at 198 can move into a chamber directly beneath the piston 196. Whenever there is a diminishing of the volume of oil in said chambers 184, 185, the piston 196 can urge oil down into one of said chambers, for example, 185, by way of a ball check valve indicated at 199.

It will be evident from the above that by manual control of the valve 190, by means of handle 191, and also by adjusting the speed control valve 186a, 186b, it is possible to govern the reciprocative movement of the piston 187 and both of the above-described dressing tools. That is, by urging the handle 191 downwardly, as viewed in Fig. 21a, a leftward stroke of the piston 187 is effected, and by moving said handle in the opposite direction a stroke to the right is effected. When the handle 191 is in a neutral or central position, the air pressure on opposed sides of the pistons 182 and 183 may be equal and the piston rod 187 can remain stationary.

In connection with the directing of a coolant or a grinding solution to the dressing tool 162 (Fig. 23), it was mentioned above that a flexible conduit 169 is connected with a central bore in the tool shaft 164. An arcuate conduit, as at 169a, directs such fluid from the central bore 168 and into the region of contact of the dressing material and the grinding wheel.

As is best shown in Figs. 1, 2 and 21, with particular reference to the latter, a centrally controlled system is employed for feeding the coolant or grinding fluid to the apparatus, the same solution being employed for dressing the grinding wheels as is employed for lubricating the wire stock 34. As shown in Fig. 21, an inlet conduit 200 directs such grinding fluid via a selective main control valve 201 selectively to: (a) a conduit 202, the opposite extremities of which are in communication with the flexible conduits 169 on the righthand extremity of the apparatus (Fig. 21) and also to a flexible conduit 169b on the lefthand extremity of the apparatus, the latter, of course, directing the fluid to the dressing tool on such extremity which tool is analogous to that shown in Fig. 23; (b) a conduit 203 which extends to opposite extremities of the apparatus for the purpose of guiding such fluid to the upper portions of hoods 113 and 114, respectively, by means of conduits 204 and 205 (Fig. 2), respectively.

The control unit 32 above mentioned includes instruments, for example, as at 206, for indicating wheel speed, 207 for indicating the amperes to the rough grinding wheel, and 208 for indicating the amperes to the finish grinding wheel. Suitable knobs as at 209, 210 and 211 are provided for controlling the speed of the grinding wheels and

the main supporting shaft. And upon a panel, as at 212, a plurality of push buttons (not shown) may be provided for manual control of the various motors of the apparatus.

The reeling unit 33 is constituted by a reeler motor 213 which may be of 1½ H. P., D. C. type, capable of speeds between 500 and 2000 R. P. M. The reeler motor, by means of a suitable sprocket chain as at 214, transmits torque via a suitable reduction gear 215 to a reel 216 which is shown in detail in Figs. 27 and 28. The reel 216 is rotatably mounted upon a shaft 217, the latter being operatively connected to the motor 213 as above mentioned.

A reeling drum unloading device is provided for the drum 216 which in general is constituted by an unloading rod 218 which can be mounted rigidly upon the drum 216 near the periphery thereof. The unloading rod 218, when a coil of wire is wound upon the drum 216, is moved to the uppermost position in its circular orbit, as shown in Fig. 27, whereupon a heavy coil 219 of the wire stock 34 can be moved from the drum by virtue of the frusto-conical shape thereof and onto said rod 218. The latter at this time, of course, is stationary and moved to such position by careful control of the motor 213. The rod 218 bearing the coil 219 thereafter is shifted downwardly by rotating the drum 216 until the coil rests upon a suitable support, for example, a conveyor 220 which can move the coil off of the unloading rod 218.

In the form shown, the unloading rod 218 can be detachably mounted upon the drum 216 by means of a sleeve 221 which is supported at opposite extremities thereof at 222 and 223 in the front and rear faces of the drum 216. The sleeve 221 is provided therein with an interiorly threaded block 224 adapted for receiving a threaded extremity 225 of the rod 218. A transverse bore 218a is provided in the outer end of the rod 218 for the insertion of a suitable tool for tightening and loosening the rod 218 in the threaded block 224. For normal reeling of the wire onto the drum 216, it may be desirable to remove the rod 218 and to mount same in the sleeve 221, as shown in Fig. 27, only for the unloading operation.

While the invention has been described with respect to a preferred embodiment which has given satisfactory results, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, in the appended claims to cover all such changes and modifications.

What is claimed is:

1. In a continuous wire coil grinding apparatus having a main supporting shaft and a pair of rotatable heads mounted at opposite extremities of said shaft, there being an axial passage through said heads and shaft for the wire, each head having a grinding wheel mounted thereupon for planetary movement about the wire, each wheel having power means operativelly associated therewith for rotating same, means for rotating said main shaft; the combination therewith of hood means for housing at least portions of said heads thereby housing the grinding wheels and the planetary paths thereof; a pair of dressing tools positioned for engaging respective of said grinding wheels to dress the surfaces thereof when the latter are held in a preselected position of the orbits thereof, means for mounting each of said dressing tools for reciprocative movement axially of said grinding wheels, power cylinder means having a reciprocative piston therein, means for connecting said piston to both of said reciprocatively mounted dressing tools, means for controlling the reciprocative movement of the piston of said power cylinder; a main supply conduit for a grinding solution, conduit means for directing said solution into said hood means and toward the wire undergoing grinding, conduit means for directing said solution onto said dressing tools, and valve means for controlling the flow of said solution selectively into said conduit means.

2. In a continuous wire coil grinding apparatus, the combination with a rotatable grinding wheel, a rotatable head for supporting the grinding wheel, said head having an axial passage therethrough for the wire; means for continuously moving the wire through said passage; a feed and straightener unit including a pair of power driven pinch rolls, means for operating said pinch rolls from opposite extremities of said apparatus, a plurality of staggered straightener bars, and means for rotating said bars about an axis coincident with the axis of the passage through said rotatable head; means for housing said rotatable head for shielding same and the grinding wheel mounted thereon; means for directing a grinding solution into said housing toward the wire undergoing grinding; exhaust pump means in communication with a lower region of said housing means for creating a vacuum in said housing means whereby the recovery of said grinding solution is facilitated; a second rotatable head; a second grinding wheel mounted upon the last-mentioned rotatable head and adapted for axial movement about the wire, said last-mentioned rotatable head also having an axial passage therethrough for wire; a pair of dressing tools for dressing the faces of said grinding wheels; means for reciprocatively moving said dressing tools in synchronism and axially of said grinding wheels, such means including a fluid actuated power cylinder having a piston, means for operatively associating both of said dressing tools with said piston, and manually operable means for controlling the reciprocative movement of said piston.

3. In a grinding and polishing machine, a main rotating shaft having attached thereto a pair of supporting heads, one on each extremity thereof, said main supporting shaft being rotatably supported substantially in the center thereof, each of said supporting heads having an abrasive member rotatably mounted thereupon for revolving movement about wire stock and in operative engagement therewith, the axes of said abrasive members being in alignment, a pair of hood members for housing respective of said supporting heads with the abrasive members mounted thereon, a pair of abrasive wheel dressing tools mounted for simultaneous operative association with said abrasive members when the latter are at a preselected position in the orbit of their revolving movement, automatic power means for reciprocatively moving said dressing members in coordination axially of said abrasive members whereby the latter are dressed, and means for directing a coolant solution upon said dressing members, said hoods having slots formed therein through which said dressing tools are inserted.

4. In a grinding and polishing machine, the combination with a rotatable supporting head and an abrasive member operably mounted on

said head to be revolved thereby about a piece of wire stock in operative engagement therewith, of a work holder comprising a work holding member mounted in fixed relation with the head in close proximity to the operating surface of the abrasive member to maintain the work against lateral displacement incident to the action of said abrasive member, a work pressure member mounted in cooperative relation with the work holding member, means for adjusting said pressure member relative to the holding member toward the abrasive member to maintain the work in pressure engagement with said abrasive member, a pair of pinch rolls for engaging the wire stock prior to the feeding thereof to said abrasive member and said supporting head, power means for rotating said pinch rolls, means for separating said pinch rolls, means for operating said last-mentioned means from opposite extremities of said machine, and a die positioned ahead of said pinch rolls and through which the wire stock must be drawn prior to engagement with said pinch rolls.

5. In a grinding and polishing machine for wire stock, the combination with a rotatable supporting head and an abrasive wheel rotatably mounted on said head to be revolved thereby about the wire stock in operative engagement therewith, of a work holder comprising a work holding member mounted in fixed relationship with the head and in close proximity to the operating surface of the abrasive member to maintain the wire stock against lateral displacement as a result of the action of said abrasive member, a work pressure member mounted in cooperative relation with said work holding member, means for adjusting said pressure member relative to said holding member toward the abrasive member to maintain the wire stock in pressure engagement with said abrasive member, and hood means for housing at least a portion of said head thereby housing the grinding wheel as it moves planetarily, a dressing tool positioned for engaging said abrasive wheel to dress the surface thereof when the latter is held in a preselected position in the orbit thereof, means for mounting said dressing tool for reciprocative movement axially of said wheel, reciprocative power means for axially and reciprocatively moving said tool, a main supply conduit for a grinding solution, conduit means for directing said fluid into said hood means and toward the wire undergoing grinding, conduit means for directing said solution onto said dressing tool, and valve means for controlling the flow of said solution selectively into said conduit means.

6. In a grinding and polishing machine, a supporting head having an axial passage therethrough for wire stock, said passage being of greater diameter than that of said stock, means for rotating said head, means for feeding the wire stock through said opening, means for maintaining the stock in substantially coaxial relationship with said head, an abrasive wheel rotatably mounted upon said head and adapted for rotation therewith planetarily to move about the wire stock, a pair of pinch rolls, and a die positioned for acting upon the wire stock prior to the engagement thereof with said pinch rolls.

WALLACE K. LOWE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
378,063	Baldwin et al.	Feb. 14, 1888
1,020,789	Armstrong	Mar. 19, 1912
1,350,531	Thacher	Aug. 24, 1920
1,714,246	Seibert	May 21, 1929
1,984,237	Booth	Dec. 25, 1934
2,095,202	Moomaw	Oct. 5, 1937
2,178,875	Kearns	Nov. 7, 1939
2,459,707	Lewis	Jan. 18, 1949