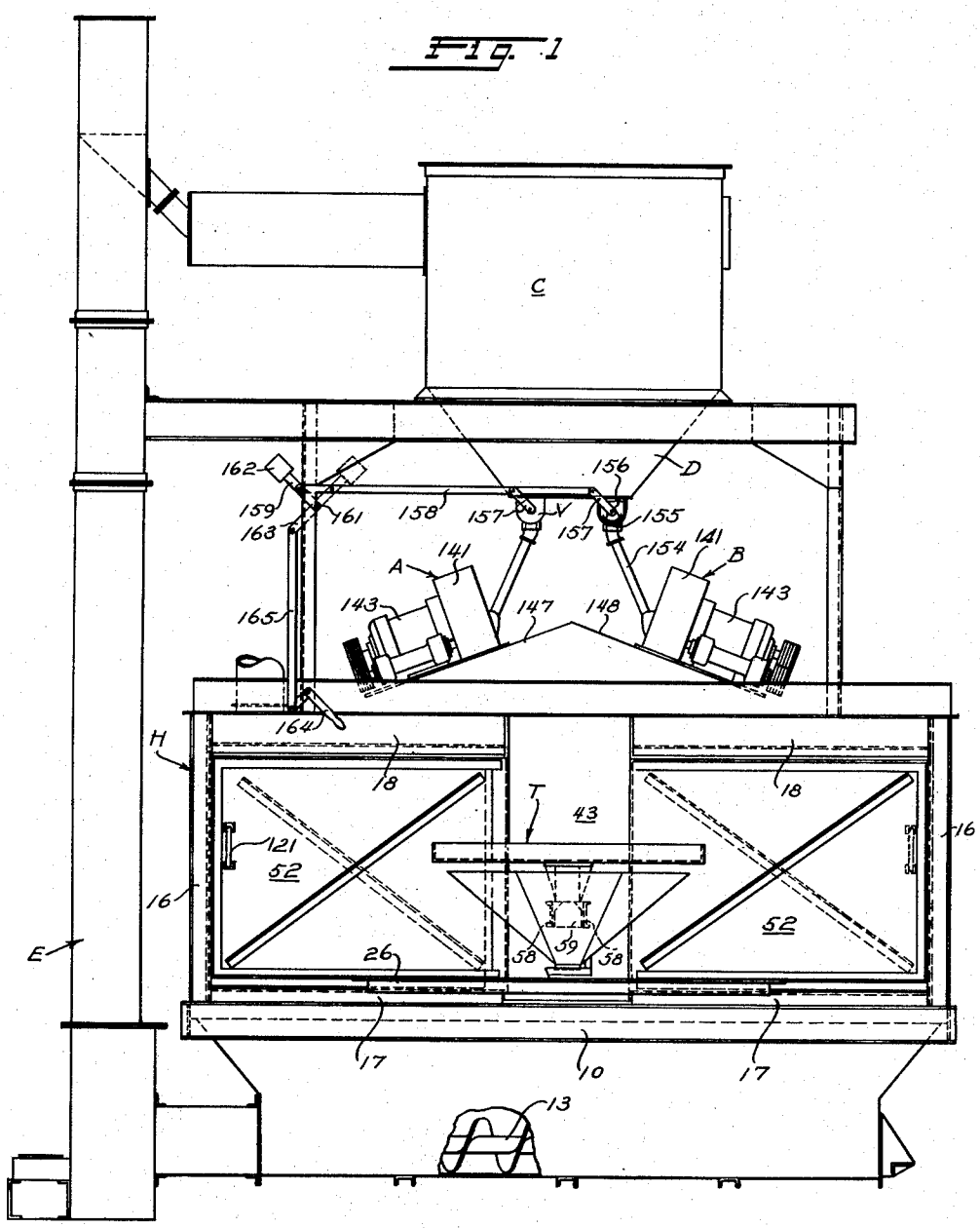
Feb. 18, 1941. W. A. ROSENBERGER 2,231,951

ABRADING APPARATUS

Filed May 13, 1938 5 Sheets-Sheet 1

FIG. 1



Inventor

William A. Rosenberger

By Strauch & Hoffman

Attorneys

Feb. 18, 1941. W. A. ROSENBERGER 2,231,951

ABRADING APPARATUS

Filed May 13, 1938 5 Sheets-Sheet 2

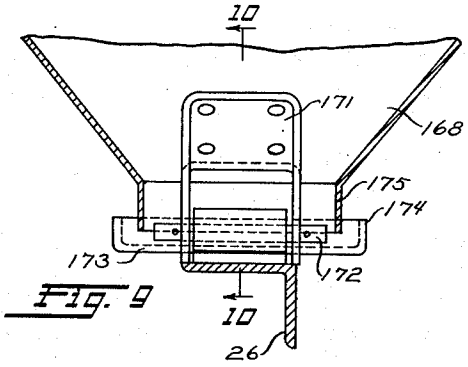


Fig. 9

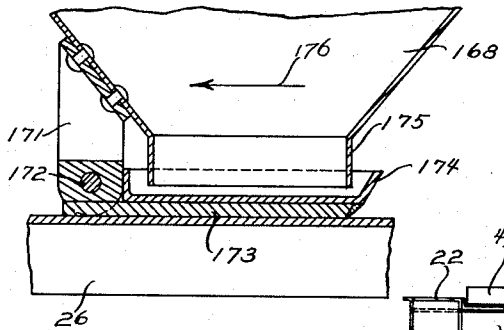


Fig. 10

Fig. 2

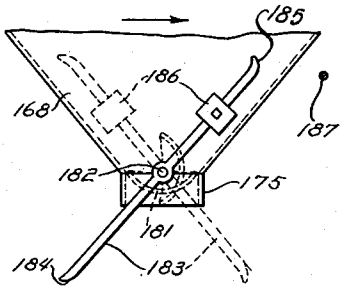


Fig. 14

Inventor

William A. Rosenberger

By Strauch & Hoffman

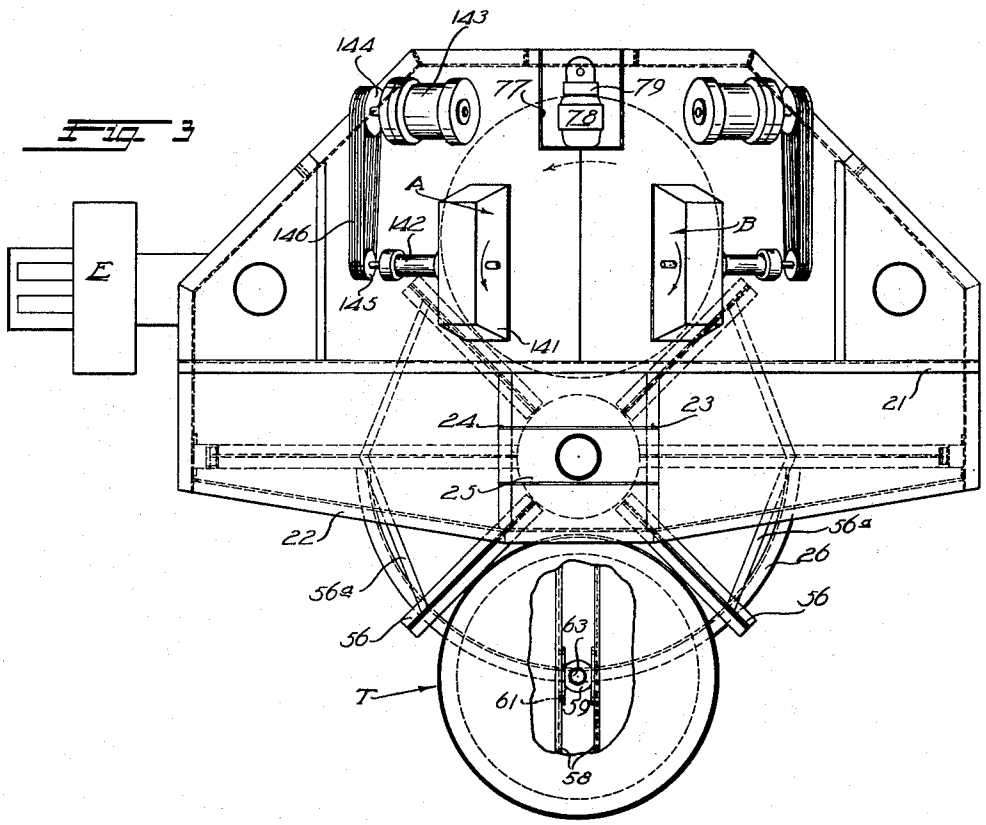
Attorneys

Feb. 18, 1941. W. A. ROSENBERGER 2,231,951

ABRADING APPARATUS

Filed May 13, 1938 5 Sheets-Sheet 3

Fig. 3



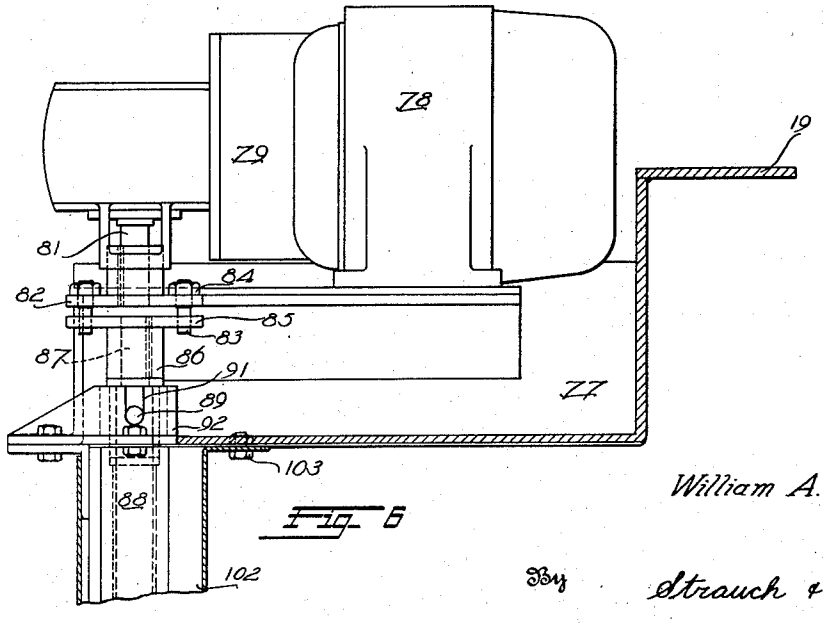


Fig. 6

Inventor

William A. Rosenberger

By Strauch & Hoffman

Attorneys

Feb. 18, 1941. W. A. ROSENBERGER 2,231,951

ABRADING APPARATUS

Filed May 13, 1938 5 Sheets-Sheet 4

Fig. 4

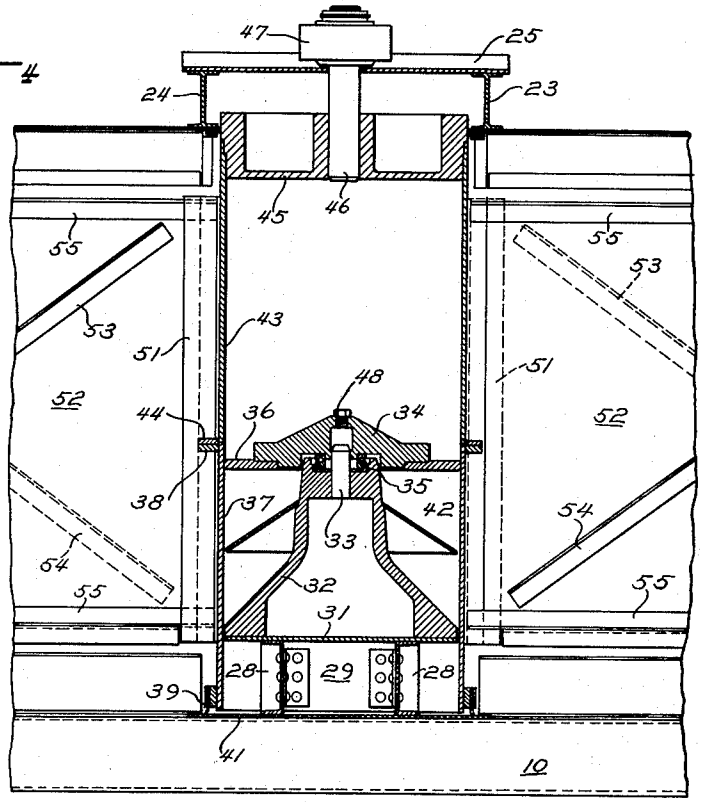
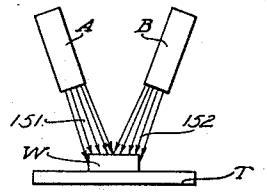


Fig. 11



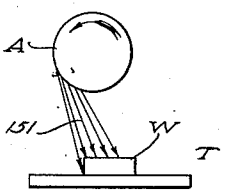


Fig. 12

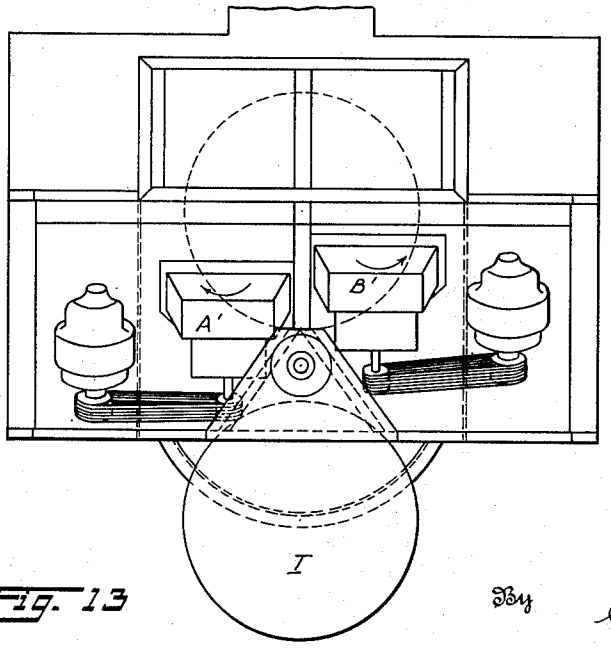


Fig. 13

Inventor

William A. Rosenberger

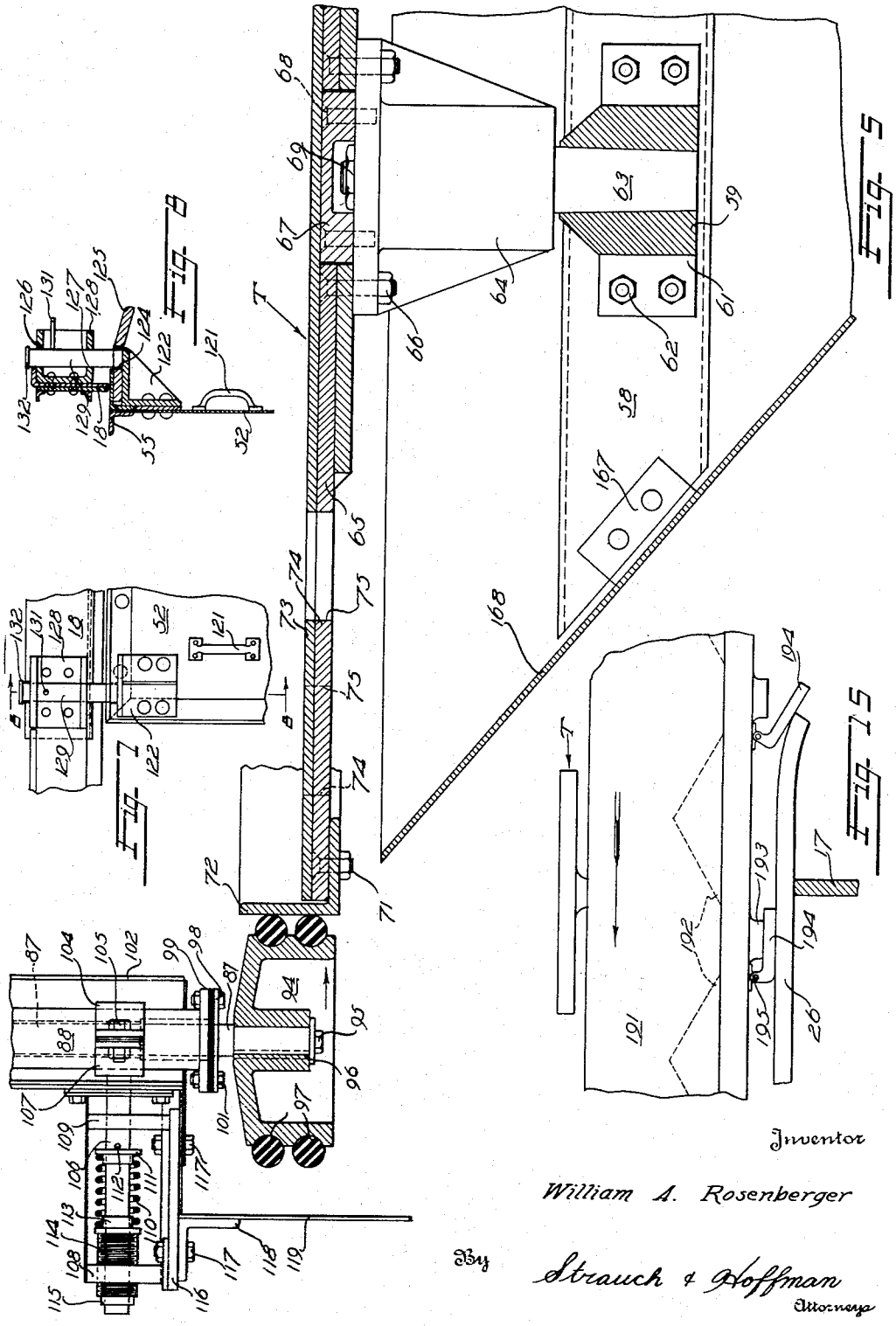
By Strauch & Hoffman

Attorneys

Feb. 18, 1941. W. A. ROSENBERGER 2,231,951

ABRADING APPARATUS

Filed May 13, 1938 5 Sheets-Sheet 5



Inventor

William A. Rosenberger

By Strauch & Hoffman

Attorneys

Patented Feb. 18, 1941 2,231,951

UNITED STATES PATENT OFFICE

2,231,951

ABRADING APPARATUS

William A. Rosenberger, Hagerstown, Md., assignor to Pangborn Corporation, Hagerstown, Md., a corporation of Maryland

Application May 13, 1938, Serial No. 207,802

11 Claims. (Cl. 51—9)

The present invention relates to abrading apparatus for blast cleaning castings or other articles and it is more particularly concerned with an apparatus embodying table like supports for rotating the castings in a stream or streams of abrasive, for subjecting them to a cleaning action.

Although the prior art shows machines of this general character, and they function fairly well when the surfaces of the castings are of a uniform condition, so as to require an equal cleaning time for each casting, they have proved unsatisfactory when the castings or other articles require cleaning actions whose intensities vary with each article, because the translatory speed of the tables bears a definite relation to their rotative speed. In my copending application Serial No. 207,801, filed of even date herewith, I have shown machines which represent a great advance in the art over those now in use and they are somewhat flexible as to handle various classes of articles as the advancing speed and the rotational speed of the tables may be varied to increase or decrease the length of cleaning time.

The object of the present invention is to provide a novel rotating table machine of maximum flexibility for cleaning castings or other articles which require widely different cleaning actions and in which each table may be held in the blasting zone for any desired length of time to subject the articles to an individual or specialized cleaning action.

Another object is to provide a rotatable table machine with a novel arrangement of abrasive propelling wheels which effects efficient cleaning of both the tops and sides of the articles.

In the table machines of the prior art the mechanism for removing the spent abrasive and other debris removed from the castings during the cleaning operations has been a constant source of trouble, through inability of the scrapers to sufficiently rapidly remove the material from the floor of the cabinet. Also, considerable power is required to drive the scraper mechanism. Moreover, the floors of those machines must be coextensive with the travel of the tables and hence projects out in front of the machine and constitutes a serious obstruction.

It is accordingly a further object of the invention to provide a novel abrasive collecting mechanism for use with table machines and which does not employ a scraper mechanism and requires a minimum amount of power for operation.

A further object is to provide a table abrading machine in which the cabinet terminates short of the loading and unloading zone and yet abrasive and other debris removed from the castings incident to the loading and unloading operation is efficiently collected and conveyed back into the cabinet.

A further object is to devise a novel mechanism for driving the tables of an abrading apparatus as they are successively brought into the blasting zone.

A further object is to devise a novel abrasive flow control mechanism for supplying abrasive to an abrasive wheel or other abrasive propelling mechanism.

It is another object to improve and refine further and more detailed features of rotatable table abrading machines and these and further objects will become apparent as the specification proceeds in connection with the annexed drawings, and from the appended claims.

In the drawings:

Figure 1 is a front elevational view of the abrading apparatus of the invention.

Figure 2 is a side elevational view of the machine shown in Figure 1 as it appears when viewed from the right hand side of that figure.

Figure 3 is a top plan view of the machine shown in Figures 1 and 2 as it appears when the abrasive cleaning mechanism has been removed from the apparatus.

Figure 4 is a fragmental vertical sectional view through the supporting structure or drum and it shows the partition structure in elevation.

Figure 5 is a fragmental sectional view on an enlarged scale of one of the tables and its abrasive collecting hopper, together with the frictional driving means for the tables.

Figure 6 is a view similar to Figure 5, but illustrates the upper part of the driving mechanism and the motor therefor.

Figure 7 is a front elevational view of one of the partitions and it shows the latch mechanism cooperating therewith.

Figure 8 is a view taken along the line 8—8 of Figure 7.

Figure 9 is an enlarged vertical sectional view through the lower part of one of the hoppers for the tables and shows the valve mechanism cooperating therewith, together with the valve operating track engaged therewith and holding the valve in closed position.

Figure 10 is a vertical sectional view taken along the line 10—10 of Figure 9.

Figure 11 is a diagrammatic view showing the manner in which the wheels project their abrasive streams against the work.

Figure 12 is a view similar to Figure 11 but is taken at right-angles thereto.

Figure 13 is a top plan view somewhat similar to Figure 3 but illustrates a modified arrangement of centrifugal wheels cooperating with the table apparatus.

Figure 14 is a fragmental elevational view of a modified form of hopper valve and actuating mechanism.

Figure 15 is a side elevational diagrammatic view of a modified form of hopper construction forming part of the invention.

With continued reference to the drawings, wherein like reference characters have been employed to designate like parts throughout the several views thereof, a plurality of tables T are mounted for movement in a horizontal path into and out of a semi-cylindrical housing H and when they are disposed in the housing they are acted upon by a plurality of abrasive propelling wheels A and B. The spent abrasive falls into a hopper and is conveyed to the bottom or "boot" of an elevator E, which may be of any desired construction where it is elevated to an abrasive cleaner C which also may be of any desired form, providing it removes nails and other debris from the abrasive and also cleans the abrasive of any foundry sand or dust before it is fed back to the wheels. Cleaner C is provided with a hopper portion D and a pair of valves V are associated therewith for controlling the flow of the abrasive back into the abrasive propelling wheels.

Housing construction

Housing H is supported upon a plurality of channels **10** which are recessed into a floor **11** and it is provided with a hopper bottom **12** whose walls converge downwardly to provide a trough in which a screw conveyor **13** is rotatably journaled. Conveyor **13** is driven in any suitable manner and conveys the abrasive to the left in Figure 1 to the foot of abrasive elevator E where it is elevated in a well known manner.

The housing is provided with vertical side wall portions **14**, which are preferably reenforced by angles **15** and the front of the housing is entirely open except for vertical sills **16**; bottom sills **17**; and horizontal upper sills **18**. The housing is provided with roof portions **19** and a plurality of channel members **21** which extend across the top of the cabinet for strengthening it and for jaurnalling the rotating structure to be later described. Channels **21** and **22** are connected by sub channels **23** and **24** and they are bridged by a further channel **25** in which the upper bearing for the rotating structure is mounted, as will be hereinafter fully described.

Commencing at one sill **17** and extending for approximately 180 degrees to the other sill **17** is an arcuate track **26** and it cooperates with the hopper valve mechanisms to maintain them closed while they are travelling outside the cabinet in a manner to be hereinafter pointed out.

Table supporting structure

A pair of channels **28** extend across the housing and they are rigidly connected to a cross member **29** and a plate **31**. Mounted upon this structure is a pedestal-like member **32** having a shaft **33**. Journaled on shaft **33** is a member **34** which rests upon a thrust bearing **35** carried by the pedestal. Member **34** is rigidly connected to a disc **36** which in turn is welded to a shell **37** having a flange **38**. Secured to the lower end of shell **37** is a sealing assembly **39**, which cooperates with a plate **41** to prevent abrasive and dust from working into the interior of the cylinder and into the bearings. To further guard against brasive working into bearing **35** a conical baffle surrounds pedestal **32** and at its periphery lies in close proximity to the inner wall of shell **37**.

Rigidly secured to the shell **37** as by bolting, welding or riveting, is an upper shell **43** having a flange **44**. Shell **43** is rigidly secured to a drum **45** which rigidly carries a shaft **46**. Shaft **46** is journaled in an anti-friction bearing **47** and the outer member of bearing **47** is rigidly secured to member **25**.

Shells **37** and **43** are accordingly rigidly connected and are mounted for synchronous rotation about a vertical axis. Bearing **47** may be of the so-called permanently lubricated type and lubricant may be supplied to bearing **35** and shaft **33** by way of an opening in member **34** closed by cap screw **48**. These shells support all of the rotating parts of the table conveying mechanism as will be now pointed out.

Welded to shells **37** and **43** are a pair of angle members **51** and secured thereto as by welding or the like are a pair of partition members **52** and each of them is reenforced by a pair of angle iron cross members **53** and **54**. The partitions are also reenforced at their margins by angle iron members **55**. The partition members cooperate with sills **16**, **17** and **18** to completely close the front of the housing when they are disposed in the positions shown in Figures 1, 2 and 3, so as to prevent abrasive from rebounding out of the blast chamber.

Secured to shells **37** and **43** either side of partitions **52** are a pair of baffle members **56** which are omitted in Figures 1 and 2 in order to simplify the disclosure. Baffle members **56** are each braced by a pair of members **56** which are secured to each partition **52**. These baffles are of the same height as the partitions and function in the abrading chamber to catch abrasive ricocheting from the work and direct it back toward the table, thereby preventing the abrasive from abrading other parts of the apparatus.

Secured to shell **37** at diametrically opposite points intermediate partitions **52** are pairs of plates **57** and secured to each plate is a channel member **58**. As seen in Figures 1 and 2, the flanges of channels **58** face outwardly and secured to them adjacent their outer ends is a bearing member **59** having a pair of securing portions **61**. Referring to Figure 5, the portions **61** of the bearings are secured to channels **58** by means of nut and bolt assemblies **62** and each support **59** is provided with a tapered aperture in which a shaft **63** is frictionally fitted.

Mounted for rotation on shaft **63** by any suitable form of anti-friction bearing is a hub member **64** which carries a table supporting member **65** and is secured thereto by bolt and nut assemblies **66**. A centrally located disc **67** closes the opening in member **65** and is removably held therein by screws **68** for sealing the bearing assembly against abrasive. When it is desired to remove the bearing, screws **68** may be loosened and cap **67** removed to allow access to a nut **69**, which holds the assembly in place on shaft **63**.

Secured to the periphery of member **65** by means of a plurality of nut and bolt assemblies **71** is a rim member **72** which functions to prevent articles from being inadvertently centrifugally thrown from the tables and it also cooperates with the driving means for rotating the

tables as will be hereinafter pointed out. A removable wear member 73 rests upon member 65 and it is provided with a plurality of slots 74 which align with similar slots 75 in member 65 so as to permit the spent abrasive to freely drain from the tables.

The two tables T are accordingly mounted for rotation about vertical axes upon the supporting structure and as the latter is successively operated to bring them into the blasting chamber H they are rotated about their axes and simultaneously subjected to the abrading action of one or more streams of abrasive. The mechanism I preferably employ to rotate the tables in the blast zone will now be described.

Table rotating mechanism

Referring to Figures 5 and 6, supported in a recessed portion 77 of the roof of housing H is a motor 78 carrying an integrally connected speed reducing mechanism 79 of any desired form. Extending from speed reducer 79 is a shaft 81 having a disc 82 rigidly secured thereto. A pair of stud-like driving members 83 are threaded into disc 82 and are locked thereto by nut 84. Members 83 extend loosely through a pair of openings in a flange 85 having a hub portion 86 rigidly secured to the upper end of a driving shaft 87. The upper end of shaft 87 is journaled in the upper end of a tube 88. Tube 88 carries a pair of transverse trunnions 89 which fulcrum in a pair of notches 91 formed in a bracket 92 carried by the upper part of housing H.

As seen more clearly in Figure 5, tube 88 projects down adjacent the path of translatory movement of tables T and shaft 87 projects below it and has a drum 94 secured thereto by a screw 95, and it is keyed thereto by a key 96. The periphery of drum 94 is provided with a plurality of grooves in which a pair of annular frictional members 97 are fitted. Members 97 may be of rubber or any other suitable material and are capable of establishing a frictional drive between drum 94 and rim 72 of the tables when brought into the blasting zone.

In order to protect the bearing for shaft 87 within tube 88 against abrasion, a seal member comprising a plate 98 and a plurality of sealing members 99 are secured at the lower end of tube 88 by means of bolt and nut assemblies 101 and members 99 sealingly cooperate with shaft 87. To prevent abrasive from finding its way out of the machine a sleeve-like housing 102 surrounds sleeve 88 in spaced relation thereto and is secured to the roof of the housing H by bolt and nut assemblies 103.

In order to insure a positive frictional grip between the parts I preferably apply spring pressure to them in the following manner.

Rigidly secured to tube 88 by means of a cap member 104 and bolt and nut assemblies 105 is a plunger member 106 having a bifurcated end 107. Member 106 is mounted for guiding movement from left to right in Figure 5 by passing through a pair of apertures in members 108 and 109. A compression spring 110 encircles member 106 and acts against a thrust member 111 and a pin 112 on member 106. Spring 110 reacts against a thrust member 113 which abuts the end of a sleeve 114 which is threaded into support 108 and guides the sliding movement of member 106. Sleeve 114 is provided with a squared portion 115 in order that it may be adjusted within member 108 so as to increase or decrease the spring pressure on the parts.

The assembly just described is mounted on a plate 116 which is secured without the blast chamber by means of bolt and nut assemblies 117 and an angle member 118 to a wall 119 of the housing.

It is accordingly apparent from the discussion just given that when the supporting structure is rotated to bring one of the tables into the blasting zone, and it initially engages members 97, shaft 87 will momentarily move away from the center of the table about trunnions 89 as an axis, and compress spring 110. If the supporting structure is then brought to rest in the position shown in Figure 5, and shaft 87 is rotated, drum 94 will frictionally drive the table through engagement of rings 97 with rim 72, and spring 110 continuously maintains a predetermined resilient engagement pressure between the parts. The resilient mounting for drum 94 has the further advantage of allowing it to momentarily move away from rim 72 should abrasive or other material find its way between members 97 and rim 72 during the blasting operation.

Stop mechanism

The machine of the present invention is particularly designed for specialized work wherein articles of various classes are to be cleaned, for instance, irregularly shaped articles that require different blasting times and different treatments, and therefore I have illustrated a supporting structure that is manually operated to successively bring the tables into the blasting zone together with a stop mechanism for arresting them in the proper position.

To this end, each partition 52 is provided with an operating handle 121 which the operator may grasp and rotate the supporting structure 180 degrees to bring a fresh piece of work into the blasting chamber and simultaneously remove the article that has been cleaned.

Each partition is also provided with a bracket member 122 which supports a plate 123 having an opening 124 and an inclined surface 125. Secured to sill 18 and having a pair of aligned apertures 126 and 127 therein is a bracket member 128. Mounted for sliding movement in apertures 126 and 127 is a bolt member 129 having a laterally extending pin 131 and an abutment 132.

Abutment 132 prevents the bolt from dropping entirely out of the apparatus and as seen in Figure 8 bolt 129 is disposed in opening 124 and thereby locks the supporting structure against rotation, so as to maintain it stationary during the blasting operation against the tendency of drum 94 to rotate it. Gravity is sufficient to bring the bolt into locking engagement with opening 124, but if desired a spring or the like may be employed to positively urge it downwardly towards the path of travel of the partitions.

Assuming that the operator has placed a new piece of work on the table in the front of the cabinet, otherwise termed the loading zone, and the piece of work in the blasting zone has been sufficiently cleaned, pin 131 is grasped and lifted thereby freeing bolt 129 from socket 124 and simultaneously, handle 121 is grasped and operated to propel the supporting structure in a counterclockwise direction as indicated in Figure 3, and when the structure has passed through approximately 180 degrees pin 129 will drop into socket 124 in the diametrically opposite partition.

Under some conditions it might prove advantageous to rock the supporting structure back and forth slightly during the blasting operation to clean certain classes of work, and in that case bolt 129 is manually maintained in its upper posi-

tion to prevent it from locking the structure and if desired a latch may be used for the purpose. If blasting is carried out in this manner drum 94 will continue to drive the tables because spring 110 maintains contact of the parts providing the supporting structure is not swung too far in either direction.

Insofar as the table mechanism is concerned, any suitable means may be employed to project abrasive towards the tables in the blast chamber to clean the articles. However, I preferably employ a pair of abrasive propelling wheels for cleaning the work as it has proved to provide very efficient cleaning of the work.

Abrasive propelling mechanism

Wheels A and B may be of any desired construction but they are preferably rotors which will throw fairly concentrated fan shaped streams of abrastive downwardly in the cabinet against the work. Various forms of wheels are now on the market, and wheels A and B may for instance be considered as embodying a rotor having a plurality of blades terminating short of the center of rotation to provide a central space, together with a stationary cylindrical control feed cage having a slot in its periphery for feeding abrasive to a limited angular portion of the inner ends of the blades to thereby discharge the abrasive from a limited angular arc of the periphery. Wheels of this character are fully disclosed in Keefer Patents Nos. 2,108,005 and 2,108,006, dated February 8, 1938, and which may be referred to for a more detailed disclosure thereof. However, if desired, the rotors may assume the form of wheels shown in Keefer Patent No. 2,116,153, dated May 3, 1938, and which do not embody blades.

The wheels are identical and therefore only one of them will be described in detail. Each rotor is enclosed in a housing 141, and the rotor is journaled in a bearing assembly 142. A motor 143 is mounted on the top of the housing and drives the rotor shaft through a pair of pulleys 144 and 145, and a so-called V-belt drive 146.

Rotor A is mounted on an inclined roof portion 147, and rotor B is mounted on a similarly inclined roof portion 148. As seen in Figure 11, the wheels are inclined in opposite directions with the result that their fan-shaped streams converge downwardly. Wheel A discharges a stream 151, and wheel B discharges a stream 152, the streams being inclined so as to converge downwardly upon the work W and by reason of the opposite inclination of streams 151 and 152 they are capable of cleaning the side walls as well as the top walls of the work.

It is, accordingly, apparent that when the work is located in the blasting chamber and is being rotated about the vertical axis of the table, blast streams 151 and 152 have elongated impingement patterns at the level of the tables and sweep over the entire upper surface of the work and also clean the sides of the work, and, therefore, it is only necessary to turn the work over once in order to clean all sides thereof. However, various classes of work only require cleaning on the upper walls and side walls, and this type of work is only passed through the machine once without turning it over. Further cleaning of the sides of the work is effected by reason of the rim discharge of the wheels which incline the streams in the plane of the wheel as shown in Figure 12.

Abrasive is supplied to the wheels by means of a pair of valves V as previously described, and they communicate with a pair of conduits 154 connected to the wheels. Each valve comprises a curved valve member 155 per se, which is rockable about an axis 156 and is connected to a crank 157. Crank 157 is connected to a long actuating link 158 which is connected to a lever 159 rockable about an axis 161 and carrying a weight 162 at its free end. Rigidly connected to lever 159 is a lever 163 which is connected to a rockable bell crank actuating lever 164 by means of a link 165.

The valves are illustrated in closed position, so as to prevent the abrasive from being fed from hopper D to wheels A and B. When it is desired to place the machine in operation, motors 143 are started and handle 164 is rocked to dispose lever 159 in its dotted line position and this, in turn, through link 158, rocks arms 157 into their valve opening position. Abrasive is accordingly supplied to wheels A and B and as weight 162 is swung to the other side of "dead center" position, it positively holds the valves in open position. When handle 164 is restored to the position shown in Figure 1, weight 162 swings past dead center in the opposite direction and therefore holds the valves positively in closed position.

Therefore, by using weight 162 and the linkage shown, it is necessary to employ frictional means or detents to hold the abrasive controlling mechanism in open or closed position.

In Figure 13 I have shown a modification of the invention wherein wheels A' and B' are disposed with their axes parallel and are slightly offset with respect to each other so as to project two parallel streams of abrasive down upon the work at an angle to the vertical, so as to clean the top as well as the sides of the work. These streams each have an elongated impingement pattern at the level of the tables and their major axes are substantially tangential to the path of translatory movement of the tables.

The operation of this form of the invention is substantially the same as that previously described, except that the streams are not inclined oppositely to each other but are parallel. However, since they are located on opposite sides of the table axis and rotate in the direction shown in Figure 13, they again cause opposite sides of the work to be cleaned as well as the top surfaces, as in the previously described form of the invention.

Travelling hopper construction

During the cleaning operation, foundry sand, nails, wire and other extraneous material is freed from the articles, and this material, together with part of the spent abrasive, drains through openings 74 and 75 in the tables, and although abrasive reclaiming mechanisms of various forms may be employed to handle this material, I preferably employ the novel travelling hopper construction that will now be described.

Referring to Figures 2 and 5, secured to the outer end of each channel member 58 by means of angle clips 167 is a hopper 168 having a large mouth disposed closely adjacent the bottom of table T, and located outwardly of the outermost openings 74 and 75 so as to catch all material gravitating therefrom.

Each hopper extends downwardly and terminates adjacent the lower edge of partitions 52. Referring to Figures 9 and 10, each hopper is provided with a bracket 171 and pivoted thereto on a pin 172 is a valve member 173 having a peripheral lip 174 cooperating with a spout portion 175 formed on each hopper. It is apparent

that when valve member 173 is disposed in the position shown in Figures 9 and 10 abrasive cannot escape from the hopper because a layer will build up within lip 174 and prevent further flow. The hoppers travel in the direction indicated by the arrow 176 in Figure 10 and it is observed that valve member 173 is pivoted to hopper 168 forwardly of the discharge spout 175 thereof with respect to the direction of movement of the hopper. Therefore, in the blasting zone, valve 173 will hang freely downwardly and permit all material falling in the hopper to be immediately discharged therefrom into inclined portion 12 of the blast chamber. When the structure has been rotated to bring the hopper adjacent the exit opening of the blasting chamber, valve 173 will strike track 26 and be swung into the closed position shown in Figures 9 and 10. If desired, the leading end of track 26 may be sloped downwardly so as to ease the closing action of the valve when the latter initially contacts the track.

Therefore, after the hopper valve has engaged track 26 and has swung into closed position, the hopper and its associated table moves into the loading and unloading zone outside the blast chamber and the operator removes the cleaned work and in so doing spills a substantial amount of abrasive from the work into hopper 168, where it is retained by virtue of valve 173 being closed. A fresh piece of work is placed upon the table and the supporting structure is then rotated to carry it into the blast chamber, and while this operation is being carried out valve 173 is continuously maintained in closed position by reason of track 26 extending along the entire path of movement of the tables outside the cabinet. When the table enters the blasting zone the end of track 26 is reached and valve 173 swings down by gravity into open position, thereby allowing any material that was accumulated therein during the loading and unloading operation to discharge into inclined portion 12 of the blast chamber, where it is carried away to the cleaning apparatus.

It is accordingly seen that I have provided a novel abrasive reclaiming mechanism which allows the front of the cabinet to be absolutely unobstructed so as to allow a worker to get at any portion of the work tables and for almost any angle, during the loading and unloading operation. Also, as the mechanism does not embody any scraper mechanisms for propelling abrasive and other material over the floor of the apparatus, the abrasive reclaiming mechanism does not consume any power other than that occasioned by the frictional engagement between valve 173 and track 26.

The pivot 172 is so designed that should the operator inadvertently rotate the supporting structure backwardly and engage valve 173 with track 26 the parts will not be damaged because the valve member will merely ride up on the track and pivot into a position behind the spout 175.

Although I have illustrated hoppers 168 as being carried by the same supports that carry the tables, it is to be understood that they may be supported by any other suitable parts of the mechanism so long as they travel in unison with the table structure and follow them through both the loading and unloading zone and the blast chamber. In this connection it may be pointed out that although this particular supporting structure carries the tables in circular orbits, the novel hopper construction is just as efficacious in an apparatus wherein the tables travel in straight-line or elliptical paths and the appended claims are intended to so embrace them. Also, although I have illustrated a construction wherein hoppers 168 are discharged as soon as they enter the blast chamber, it is to be understood that if desired, track 26 may extend substantially to the blasting station so that they will be discharged only at that position. The hoppers may also assume various forms other than that shown, so long as they retain the abrasive therein while they are travelling outside of the cabinet and discharge the abrasive within the cabinet.

My invention also comprehends a travelling hopper construction wherein track 26 is omitted, and a separate self-contained valve is embodied in each spout portion 175 of the hoppers. For instance, a pivoted valve similar to valve V may be mounted in each spout portion and to cooperate with a pin adjacent the exit door to close the valve and cooperate with the pin or the like at the entrance door to open the valve. In Figure 14 I have somewhat diagrammatically illustrated a construction of this character.

Mounted in spout portion 175 of hopper 168 is a pivoted valve member 181 and it is secured to a shaft 182. Mounted on shaft 182 is a double armed lever 183 having cam portions 184 and 185 and also carrying a weight 186 adjacent its upper end. The hopper travels in the direction indicated by the arrow, and in the position shown in the drawings valve 181 is closed so as to maintain the material in the hopper and the hopper is therefore travelling outside the cabinet. When the hopper has entered and attains a predetermined position inside the cabinet, cam portion 185 of lever 183 strikes a pin 187 or the like and the latter is moved into the dotted line position shown in that figure, thereby opening the valve and allowing the material accumulated in the hopper to discharge into the blast chamber. After the hopper has passed through the blast station and attains a position in the housing adjacent the exit door opening, portion 184 of lever 183 engages a pin 188 or the like which causes the lever to be restored to the full line position as shown in Figure 14, thereby closing the valve.

This construction thereby obviates the need for a track 26 and it serves to illustrate the various forms which the hopper and valve mechanism of the invention may assume. The hopper may also assume an annular form extending throughout 360 degrees and cooperate with a trough or track outside the housing to prevent abrasive from being discharged therefrom and inside the housing it will continuously discharge into the inclined trough 12. In this form of the invention no valve member is needed as the body of abrasive in the lower spout portion of the hopper prevents leakage, or may be provided with hopper gates at suitable intervals of the character previously described and operated by track 26.

In Figure 15 I have somewhat diagrammatically shown a further travelling hopper construction of the invention. Hopper 191 is annular in form and extends 360 degrees around the apparatus under tables T and is carried by arms 58. At intervals hopper 191 is provided with transverse partitions 192 which provide supplemental hoppers leading to spout portions 193. A valve 194 is pivoted at 195 adjacent each spout 193 and successively cooperates with track 26, as in the previously described forms of the invention to close the hoppers when they are outside the chamber in the load-

ing zone and to open the hopper when they are in the blasting chamber.

In Figure 15 the hoppers are shown leaving the blasting chamber and the left-hand valve is closed and the right-hand valve has struck the inclined end of track 26 and is starting to close.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In an abrading apparatus, a blasting chamber having an open front; a supporting structure for conveying a plurality of work supports into and out of said blasting chamber through the open front thereof; means for projecting a stream of abrasive toward said work supports in said blasting chamber for cleaning articles of work carried thereby; means provided in said blast chamber below the path of travel of said work supports for collecting the spent abrasive and other extraneous material freed from said articles in said blasting chamber; a hopper mechanism disposed under each of said work supports and travelling synchronously with said supports, for catching and retaining any abrasive or other material gravitating from said articles outside of said blasting chamber incident to removing and replacing articles on said work supports; and means for automatically effecting discharge of said hoppers into said means for collecting abrasive.

2. The abrading apparatus defined in claim 1, wherein said last-named means is operable to automatically effect discharge of the contents of said hoppers upon entry of their respective work supports into said blasting chamber, whereby any abrasive gravitating into said hoppers during the cleaning operation will freely gravitate therefrom.

3. In an abrading apparatus a blasting chamber having an open front; a supporting structure mounted for rotation about a substantially vertical axis; a plurality of arms radiating from said supporting structure; a table member adapted to support articles of work carried by each arm and mounted for rotation about a substantially vertical axis thereon; said supporting structure being so located with respect to said chamber that upon rotation thereof it will successively convey said table members into and out of said blasting chamber through the open front thereof; means for projecting a stream of abrasive toward said table members in said blasting chamber, said blasting chamber having an inclined bottom for collecting spent abrasive; and a hopper carried by each of said arms and disposed under the table members thereof for catching the spent abrasive or any extraneous material freed from said articles by said stream of abrasive; and valve means located at the bottom of each hopper and normally open when the latter is in said blasting chamber, for allowing the spent abrasive to freely gravitate to said inclined bottom, and means for automatically closing said valve means when said hoppers pass out of the open front of said blasting chamber, for causing them to retain any material that gravitates therein while said hoppers are outside said blasting chamber.

4. The abrading apparatus defined in claim 3, wherein said means for automatically closing said valve means comprises a track-like member extending outside said blasting chamber in a direction parallel to the path of movement of said hoppers and cooperating in riding engagement with said valve means.

5. The abrading apparatus defined in claim 3, wherein arms each comprise a member extending through one wall of said hopper, and said table member is supported on said member inside said hopper.

6. In an abrading apparatus, a blasting chamber; a plurality of work supports mounted for travelling movement in a substantially horizontal plane into and out of said blasting chamber; means for projecting abrasive toward said supports in said blasting chamber; a hopper mounted for synchronous movement with each of said work supports and located thereunder for catching spent abrasive, each hopper having a spout portion and a pivoted valve associated therewith; said valve being pivoted to said spout portion forwardly thereof with respect to the direction of travelling movement of said work supports, said valves normally hanging freely downwardly so as to open said spouts when they are disposed in said blasting chamber and allow spent abrasive to gravitate from said hoppers; and control means for automatically swinging said valves closed and maintaining them in closed position when said hoppers are travelling outside said blasting chamber.

7. The abrading apparatus defined in claim 6, wherein said control means comprises a stationary track extending outside said blasting chamber in a direction parallel to the path of movement of said work supports and coextensive therewith for engaging said valves and successively swinging them into closed position as they pass out of said blasting chamber.

8. In an abrading apparatus, a supporting structure mounted for rotation about a substantially vertical axis; a plurality of tables carried by said supporting structure remote from said axis and mounted for rotation about substantially vertical axes; said supporting structure being operable to convey said tables in a substantially circular horizontal path when it is rotated; means mounted adjacent said path, for rotating said tables about their axes when they successively attain a predetermined blasting position, said means comprising a rotatable friction member cooperating in frictional driving engagement with a part of said tables and mounted for limited movement toward and away from the path of said tables, means for resiliently urging said friction member toward said path; and means for rotating said friction member, said tables each comprising a disc-like supporting element having a cylindrical outer wall, said friction member cooperating in direct frictional engagement with the cylindrical outer wall of said supporting elements.

9. In an abrading apparatus, a plurality of work supports mounted for movement in a horizontal path into and out of a blasting zone; means for propelling abrasive streams toward said work supports in said blasting zone; a hopper mechanism disposed under said work supports throughout the path of travel thereof and adapted to travel synchronously therewith; a plurality of valve means for controlling the flow of material from said hopper mechanism; and automatic control means for causing said valve means to be opened in said

blasting zone and to be closed outside of said blasting zone.

10. In an abrading apparatus, a work support mounted for travelling movement into and out of a blasting zone; a hopper disposed under said work support and adapted to travel synchronously therewith for receiving spent abrasive; a movable valve element mounted in said hopper at the lower portion thereof for controlling the flow of abrasive therefrom; a control member connected to said valve element and operable when in one position to maintain said valve element in open position and in another position to maintain said valve element in closed position; actuating means located adjacent the path of movement of said hopper and cooperating with said control member for automatically moving said valve element into closed position when said hopper is moved out of said blasting zone and for automatically moving said valve element into open position when said hopper is moved into said blasting zone.

11. In an abrading apparatus a blasting chamber; a plurality of work supports mounted for travelling movement in a substantially horizontal path into and out of a blasting chamber; means for projecting abrasive toward said supports in said blasting chamber, and abrasive receptacle means mounted for travelling movement in the same general path as said supports, for catching and retaining any abrasive or other material gravitating from said supports or articles of work carried thereby when said supports are outside said blasting chamber, and for conveying it to, and automatically discharging it in said blasting chamber.

WM. A. ROSENBERGER.