This invention relates to apparatus for abrasive treatment of metal articles, and more particularly to apparatus for cleaning and treating castings, forgings and similar metal articles capable of being rolled on a supporting surface or surfaces.

According to this invention, the metal article to be cleaned or treated is given a rolling or spinning movement, and is simultaneously advanced in a linear direction through a stream of abrasive particles. The abrasive particles are projected with suitable velocity and in a suitable direction, preferably by a centrifugal abrasive projecting machine or wheel, to subject desired portions of the surface of each article to be treated to the abrasive effect of the stream of particles. The abrasive particles in the stream may be projected at various angles by the wheel, so that, as the articles are moved through the abrasive stream, any desired, or all portions of the surface of the articles, including exterior and interior surfaces and the surfaces of projections and depressions, are struck by the abrasive particles.

In a preferred embodiment of the invention, the articles to be treated are supported on a suitable conveyor comprising a plurality of substantially parallel rolls, each of which has a helical abutment adapted to bear against the peripheral portion or portions of the article. Driving means is provided for rotating the rolls, whereby the articles supported upon the rolls are given a rotary movement, and, simultaneously, are advanced in a linear direction along on the rolls. An abrasive projector, preferably of the rotary centrifugal type, is mounted in position to project a stream of abrasive particles against the rotating articles to treat predetermined portions of the surfaces of the articles. Two rolls are generally sufficient to properly rotate and linearly advance most rollable articles, but if the article is not sufficiently symmetrical to remain upright on the rolls, a sufficient number of rolls is provided to engage the article at three or more spaced portions of the periphery to maintain it in a suitable position to be moved in the direction of its axis of rotation.

The invention also provides a suitable mechanism whereby the articles to be treated can be automatically supplied to and placed in engagement with the conveyor in the proper position and at the proper time for initiating rotation and forward movement of the articles. Mechanism is also provided for removing the articles from the conveyor when they reach the discharge end of a conveyor.

Various other features and advantages of the invention will be apparent from the following particular description and from an inspection of the accompanying drawings.

In the accompanying drawings there is shown, for the purpose of illustration, apparatus suitable for carrying out the process according to the present invention, in which:

Fig. 1 is a view showing a vertical, longitudinal section through one form of the apparatus;

Fig. 2 is a front elevational view of the apparatus;

Fig. 3 is a rear elevational view of the apparatus;

Fig. 4 is a view showing a horizontal section taken along line 4—4 of Fig. 1;

Fig. 5 is a fragmentary view showing a transverse vertical section taken along line 5—5 of Fig. 1;

Fig. 6 is a fragmentary view showing a section taken along line 6—6 of Fig. 5;

Fig. 7 is a longitudinal cross-sectional view taken through another form of apparatus;

Fig. 8 is a transverse sectional view taken along line 8—8 of Fig. 10;

Fig. 9 is a rear elevational view;

Fig. 10 is a horizontal sectional view taken along the line 10—10 of Fig. 7;

Fig. 11 is a fragmentary view showing a modified form of roll having two different articles thereon for illustrating the operation of this type of roll;

Fig. 12 is a diagrammatic side elevational view illustrating the progress of an article through the abrasive stream and the manner in which the various surfaces are exposed to the stream; and

Fig. 13 is a diagrammatic front elevational view corresponding to Fig. 12.

Referring now particularly to Figs. 1 to 6, the apparatus shown comprises a suitable supporting framework 1, which serves to support the operating mechanism, a substantial portion of which is contained within a closed housing 2. Mounted on the top wall of the housing 2 is an abrasive projector, preferably in the form of an abrasive throwing wheel 3, rotatably mounted on a shaft 4 journaled in bearings 5 and driven from a motor 6 through a driving belt 7. Preferably, the wheel 3 is of the rotary centrifugal type having means for controlling the direction of discharge of the thrown abrasive, and may comprise a pair of spaced parallel side plates 10 carrying radially extending blades 11.
to which abrasive is supplied by a relatively stationary tubular control member and an impeller 12 rotatable with the side plates 10, or of the type generally disclosed in Felk Patent No. 1,659,568.

8. The wheel 3 is adapted to project a stream of abrasive a downwardly into the housing 2, which stream spreads out fan-wise throughout approximately 90°, and having a relatively elongated impingement pattern. The wheel 3, preferably, is housed in a guard having 12 having a suitably shaped guard liner 16.

Abrasive is supplied from a supply hopper 15, through a conduit 16, having a control valve 17, to a feed spout 18 from whence the abrasive is supplied to the impeller 12. The impeller 12 throws the abrasive into the path of the blades 19 rotatable with the side plates 10, which project the abrasive at high velocity in a stream having a predetermined shape and direction. Disposed within the housing 2 is a collecting hopper 19 having a depending trough 20 in which is disposed a conveyor screw 21 extending longitudinally of the housing 2 and adapted to transport abrasive from both ends of the trough 20 toward the conveying thereof. A suitable deflector 22 may be disposed above the screw 21. A transverse trough 23 extends from the center of the trough 20 to the side of the housing 2, and is provided with a conveyor screw 24 adapted to transport abrasive to a suitable elevator 26.

The elevator 26 may have an endless belt 27 carrying a plurality of buckets 28, and may be trained over upper and lower drums 29 and 30. The elevator 26 is driven from a motor 31 driving a belt 32, which in turn rotates a pulley 33 connected to the drum 29. The drum 29 drives a shaft 34 carrying a sprocket 35 having trained thence a driving a sprocket 36 carried on the shaft 37 of the transverse conveyor screw 24. Thus, upon energization of the motor 31, both the elevator and the transverse conveyor screw 24 are operated.

The shaft 37 carries a bevel gear 38 meshing with a bevel gear 39 carried on a shaft 40 journalled in a housing 41. The shaft 42 drives a sprocket 43 driving a chain 44 which rotates a sprocket 45 carried on the shaft 47 of the screw 21. Thus, the screw 21 is driven from the screw 24.

50. Rotatably mounted within the housing 2 is a conveyor constituted by a plurality of preferably parallel rolls 46, each provided with a helical abutment means, as for example the helical groove 48, the pitch of which is selected in accordance with certain dimensions of the articles to be treated, as will hereinafter be explained. Each roll 46 is carried on a shaft 47 extending longitudinally of the housing 2 and journalled in pillow blocks 48 mounted at the ends of the support 49. Each pillow block 48 has a base portion 50 provided with a flared portion 51 adjustable in and forming a dove-tailed joint with a groove way 52 of a track member 53. The track members 53 are supported on a beam 54 carried on suitable portions 55, 56 of the support 49.

Threaded oppositely through the base portions 54 of the pillow blocks 53, at each end of the conveyor, is a screw 58 which is also threaded through a stationary block 61 rigidly mounted on the support 49. The screw 58 at the forward end is as viewed in Fig. 1) end of the support 49 is provided with a hand wheel 62, and carries a bevel gear 64 meshing with a bevel gear 65, carried on a shaft 66 journalled in bearing 67. The other end of the shaft 66 at the rear end of the support 49 (right-hand end as viewed in Fig. 1) carries a similar gear 68 meshing with the gear 64 carried on the screw 58 at the rear end of the apparatus. Upon suitable rotation of the hand wheel 63, the pillow blocks 53 at the front end of the apparatus can be moved closer together or farther apart. Simultaneously, the screw 58 at the rear end of the apparatus is actuated in a similar manner to give the pillow blocks 53 at that end a similar movement to the pillow blocks at the forward end. Thus, the spacing of the rolls can be adjusted without disturbing their parallel relationship.

The rolls 66 are driven from a motor 70 driving a pulley 71, preferably of the variable speed type, over which is trained a belt 72, also trained over a pulley 73 driving a speed reducing unit 74. The unit 74 drives a sprocket 75 which drives a sprocket 76, through a chain 77. The sprocket 77 is carried on the end of the right-hand shaft 78 (as viewed in Fig. 1), and rotates the same together with the roll 46 toward the conveying thereof. A gear 79 adapted to mesh with a gear 80 carried on a stub shaft 81, rotatably supported in the ends 82 of link members 83 which have their other ends receiving and secured to the shafts 84. The supporting arrangement for the gear 80 insures that it will be in mesh with the gear 79 throughout the entire range of adjustment of the rolls 66, whereby the rotation of the shaft 82 by the sprocket 77 is transmitted through the gear 78, and the gear 80 to the second gear 79 to rotate the second shaft 82 in the same direction as the first shaft 82. It will be seen that, upon adjusting movement of the shafts 82, the gears 79 will move vertically in a suitable plane so as always to be in engagement with both of the gears 79. This arrangement permits the spacing of the rolls to be adjusted to accommodate readily articles of various sizes.

A loading vestibule 86 is mounted on an extension 81 of the housing 2 adjacent to the forward end of one side, and is closed by one or more flexible curtains 82. The floor or platform 83 of the vestibule projects into the housing 2 to a point well beyond the centre of the right-hand roll 84. Disposed opposite the end of the vestibule 86 is a swing 85 comprising a pair of parallel arm portions 86 supported from a pivot 87 journalled in brackets 88 secured to the housing 2. The arms 88 terminate in a seat 89 adapted to engage the periphery of an article to be treated, which, for the purposes of illustration, is shown as a drum d, having spaced flanges e, and being a preliminary casting from which brake drums are formed. Preferably, the pitch of the groove 51 of each roll is equal to the distance between the flanges e so that when the drum d is disposed on the rolls, the flanges e are received in adjacent turns of the grooves.

The swing 85, when in the position shown in Fig. 5, cooperates with the end of the floor 83 in holding the drum d out of contact with the rolls 66. The free end of the swing 85 is provided with a roll 101 rotatable on a pin 102, and adapted to be engaged by a cam 103 carried on a shaft 106 rotatable in a bracket 108. The shaft 106 is driven from the shaft 78 by a sprocket 109, a chain 107 and a sprocket 102. The cam 103 generally is driven at one-tenth the speed as the rolls 66, and is so adjusted that it permits the swing 85 to swing to the left, as viewed in Fig. 5, away from the end of the floor 83, thus permitting the drums d to be lowered onto the rolls 66.
at the proper intervals and at the times when the grooves $41$ are in position to engage the rims $c$ of the drums. The swivels $88$ and associated mechanism may be designated as the loading mechanism.

The loading vestibule is connected to the roll spacing mechanism for movement therewith so that the end of the floor $50$ has the same position relative to the subjacent roll $90$ as per all positions of adjustment of the rolls $50, 58$. Referring to Figs. 2, 3 and 4, a member $120$ is rigidly connected to the pillow block $53$ nearest the vestibule $82$ and is linked to a lever $131$ pivoted to the support $1$. The lever $131$ is connected by a link $132$, of adjustable length, to a frame $133$ which latter is pivoted at one end to the support $1$ and at the other end to the vestibule $82$.

When the spacing of the rolls is varied, as will occur when the hand wheel $53$ is actuated, the frame $133$ is rocked about its lower pivot and slides the vestibule in the same direction as the subjacent roll $58$. The vestibule $80$ may be locked in position, when the adjustment is completed, by the lock nut $140$. Through suitably placed openings $135$ in the vestibule and corresponding openings (not shown) in the portion $81$.

Disposed adjacent to the rear ends of the rolls $50$ is a suitable chute $119$ for receiving the drums $d$ as they pass from the ends of the rolls $50$ and directing the drums $d$ to a discharge vestibule $117$ on the second floor. If desired, the rear $50$ and $58$ or more flexible curtains $116$. Spaced from the ends of the rolls $50$ is a deflector $110$ having a rotating jacket $120$ for directing the brake drums $80$ into the chute $119$.

The operation of the apparatus is as follows: The motor $6$ is energized to rotate the wheel $5$, and abrasive is supplied to the wheel $5$ from the hopper $18$, whereby the wheel projects a stream of abrasive downwardly into the housing $2$, and between the rolls $50$, in a stream having a substantially elongated impingement pattern, which may be of less width than the space between the rolls $50$. The motor $50$ is also energized to return abrasive from the hopper $10$ to the supply hopper $10$.

The motor $10$ is energized, and rotates the rolls $50$ in a manner which will be apparent from the foregoing description. A drum $d$, to be treated, is disposed in the loading vestibule and impelled forwardly with sufficient force to roll it past the end of the floor $50$ and into engagement with the rolls $50$. The operation of the loading vestibule may be inclined sufficiently to cause the drum $d$ to roll therealong, due to the gravity. As soon as the rolls $58$ are in proper position to receive the drum $d$, the swing $56$ is retracted and allows the drum $d$ to be lowered onto the rolls $50$.

The rims or flanges $c$ of the drum $d$ are received in a small portion of two consecutive turns of each groove $51$ of each roll $50$, whereby, as the rolls rotate, the drum $d$ is caused to rotate about the "cone axis", and is also urged forwardly along in the housing $2$.

As the drum $d$ enters the abrasive stream, it is struck by the abrasive particles at a predetermined angle, and as the drum $d$ is advanced through the stream it is rotated completely, one or more times, to expose all portions to the action of the abrasive stream. As the drum is moved through the stream, it is struck by abrasive from angles varying throughout a considerable range, to thereby cause the abrasive to impinge upon the surface of the various cavities and projections.

When the drum $d$ reaches the end of the rolls $50$, it is forced therefrom and strikes the deflector $110$ which directs it into the chute $119$, which directs it into the discharge vestibule $117$, from which it can be removed conveniently.

The apparatus so far described is capable of modification in order to render it more suitable for varying requirements. For example, where articles are to be treated which are symmetrical about their principal axis, but unsymmetrical or unbalanced about a second axis, an arrangement may be provided whereby such articles are maintained in position for a movement along the principal axis. An illustrative form of such apparatus is shown in Figs. 7 to 10, to which reference is made.

The apparatus may comprise a suitable supporting framework $201$ and a housing $202$. Extending through the top wall of the housing $202$ is one or more abrasive projectors $208$, generally similar to the projector $3$, above described. The projectors $208$ may be driven by a suitable motor $204$, or motors, and may be enclosed in a housing $205$ and fed from a hopper $206$ through conduits $201$, cooperating with each projector $208$. Where a plurality of projectors $208$ are employed, preferably, they will be arranged to rotate in opposite directions so that their abrasive streams $209$ provide a total abrasive zone having a wide range of angularity. Various other arrangements of projectors may be made, according to the sizes and shapes of the articles to be treated, or other operating conditions.

Disposed in the housing $202$ is a hopper $210$ in which is disposed a conveyor screw $211$ carried on a shaft $212$, journaled in central bearings $215$ and $218$, the latter being protected by a hood $214$. A transverse trough $216$ extends from the central portion of the hopper $210$, and has therein a conveyor screw $218$ carried on a shaft $217$. The conveyor screws $214$ and $216$ are driven by a reduction of the motor $210$, the screw $211$ is actuated to force abrasive toward the trough $218$, and the screw $215$ forces the abrasive to an elevator $220$ which elevates the abrasive to the feed hopper $220$, preferably in a manner similar to that above-described.

Disposed longitudinally in the housing $220$ is a plurality of spaced parallel rolls $220$, each having a helical abutment means such as a groove $221$. In the illustrative embodiment, four such rolls are shown, but various numbers may be used, according to varying conditions of use. The two lower rolls are carried on shafts $222$ extending throughout the housing $222$ and journaled in pillow blocks $223$ suitably mounted on brackets $228$ and $229$ on the ends of the housing $222$; the upper two rolls $220$ are carried on shafts $234$ journaled in pillow blocks $236$ carried on the upper bracket $235$, at the rear end of the housing and in bearings $236$ supported by brackets $237$ and $238$. Screw plates $238$ partially protect the driving mechanism at the rear end of the housing.

The rolls $220$ are driven from a motor $240$ which may be mounted on the top wall of the
housing 262 and which drives the sprocket 261 driving a chain 262 rotating a sprocket 262 fixed to a stub shaft 244 journalled in a bearing 245 centered with respect to the shafts 222 and 224.

The shaft 262 carries a gear 264 which meshes with gears 247 carried on each of the shafts 222 and 224. Upon energization of the motor 248, the motor shaft 243 is rotated and drives the gear 246 which rotates the gears 247 and the rolls 238.

A loading opening 248, which may be closed by a flexible curtain 249, is provided at the forward end of the housing 262. A loading cradle 260 is provided and has depending flanges 250 carrying plow 252 carried by a plurality of arms 253 rigidly carried on shafts 254 journalled in the housing 262. The arrangement of parallel arms 253 and supporting shafts 254 provides a parallel motion mechanism whereby the cradle 260 may be moved rearwardly and downwardly to a position parallel to the position shown in Fig. 7. 1.

The cradle 260 may have an upwardly arranged arm 256, formed by a bifurcate upper end 257, and may have also a flange 258 at its forward end. Thus, the cradle is adapted to receive and support a member having a generally circular shape. For the purpose of illustration, a brake drum casting c, having a rim 235 and a hub c is shown. The flange 258 is adapted to receive the periphery of the casting c and abut the rim r and the bifurcate portion 257 is adapted to receive the hub c.

The cradle 260 is actuated from one of the shafts 222 by a sprocket 270 driving a chain 271 rotating a sprocket 272 which is carried on and drives a shaft 273 journalled in a bearing 274 and driving a speed reducer 275, mounted on a suitable bracket 276 carried by the housing 262. The speed reducer 275 drives a shaft 271 which carries a cam 278 cooperating with a follower 279. The follower 279 has a head 280 slidable in a way 281, and is connected to a link 282 pivotally connected to an arm 283 fixed on one of the shafts 284. The arm 283 is normally urged forward by a spring 284 anchored to a fixed member 285. When the shaft 222, to which the speed reducer 275 is connected, rotates, the cam 278 is driven and causes the follower to be forced rearwardly, which rocks the arm 283 and the shaft 224, and causes the arms 263 to move the cradle 260 rearwardly and downwardly into a position whereby a casting c may be deposited thereon through the opening 248.

As the cam continues to rotate, it permits the cradle 260 to be moved forwardly and upwardly by the spring 284 into the position shown in Figs. 7, 8. The shaft 222 is connected to the cradle-actuating mechanism in such a way that the casting c is present on the rolls 238 at the position that the rolls themselves are brought into position to receive the rim r of the casting c, whereupon the latter is caused to rotate about its axis and to be advanced along on the rolls 238. The cradle 260 and associated mechanism may be designated as the loading mechanism.

An unloading cradle 286 is disposed adjacent the rear end of the rolls 238, and a rotatable arm 210 is mounted on a shaft 292 adjacent the upper end of the cradle 286. The arm 291 has a flange 284 adapted to engage the forward end of a casting c, and has an upward portion 291 formed with a bifurcate end 292 adapted to receive the hub of the casting c. The arm 291 is continuously rotated from the speed reducer 275 through a shaft 297 journalled in a bracket 296 and driving a gear 297 which drives a suitable transfer mechanism 286 driving a gear 299 carried on shaft 297. The arm 291 is driven at such a speed that it is adapted to engage the casting c just as the casting reaches the ends of the rolls 238 and lifts the casting up onto the upper end of the chute from whence it slides through a discharge opening 300 closed by a flexible curtain 301. The arm 291 and associated mechanism may be designated as the unloading mechanism.

The operation of this embodiment of the invention is, in general, analogous to the operation of the first form, and is as follows: The motors 284 are energized to drive the wheels 283 and project the abrasive in streams a. The motor 246 is energized to drive the rolls 238, the loading mechanism and the unloading mechanism. The motor 210 is energized to drive the screws 211 and 210. A casting c is deposited upon the cradle 260 when it is in its rearmost position, and the cradle 260 then carries the casting c upwardly and forwardly, and delivers it to the rolls 238. The grooves 231 engage the rim r, and the casting c is rotated about its axis r and longitudinally along on the rolls 238. As the casting c passes through the abrasive streams a, the various portions of the surface are subjected to the abrasive effect of the streams and thoroughly treated. When the casting reaches the end of the rolls, it is removed by the unloading device and deposited on the chute and removed from the housing.

This invention is capable of numerous modifications and is in no way limited to the specific apparatus shown or to the treatment of articles having the specific shapes illustrated. For example, the abutment means on the rolls may be modified in various ways to accommodate articles having variously shaped perimeters, and may take the form of helical ridges or flanges rather than grooves. Also, the grooves may be of sufficient size to accommodate the entire width of the periphery of the article instead of a portion only. The apparatus also is being designed in combination with suitable automatic means for supplying articles to the apparatus and removing them therefrom, whereby no manual operations are required.

Referring to Fig. 11, a roll 306 is shown having a helical upwardly flanged grooves 308 which serves as an abutment for effecting movement of the articles to be treated. The flange 306 is adapted to support an article, such as the member k, and cause movement thereof by engagement with a grooved or flanged portion l of the periphery. If the flange 306 is of suitable width, an article such as the member m may be supported only by abutment between adjacent turns of the flange 306, and is moved by abutment between the flange 306 and the end of the article m.

Referring now to Figs. 12 and 13, there is shown diagrammatically how the present invention effects a thorough treatment of the various surfaces of an article to be treated. There is shown an abrasive projector 309 and a series of grooves 310 representing numerous of the successive positions through which an article passes as it is advanced through the stream a projected by the projector 309. For the purposes of illustration, a drum 311 is shown, similar to that shown in Fig. 11 and having a peripheral or web portion 312 formed with a plurality of beads or corrugations 313, a pair of 314.
inturned rims or flanges $f$ and an internal shoe $a$.

The drum $k$ is rotated and advanced into the stream (from the left, as viewed in Fig. 12), and the outer face of the right-hand flange enters the stream, then the top edge of the flange $f$, and then the inner face of the shoe $a$. As the drum $k$ advances further, the inner face of the left-hand flange $f$ enters the stream, and finally the top edge thereof. Since the drum $k$ is rotated about its axis during its advancing movement, all circumferential portions of the various surfaces mentioned are exposed successively to the stream of abrasive during the course of one rotation.

When the drum $k$ advances further into the stream, the outer face of the web $w$ passes into the stream. The drum $k$ continues to advance in the stream and to rotate, thereby exposing all peripheral portions to the abrasive action of the particles. As the drum $k$ advances, the angle at which the particles strike it gradually change from an inclination on one side of the vertical, through the vertical, to an inclination on the opposite side of the vertical. Thus the surfaces of all projections and depressions in the web $w$, as for example the headed portions $i$, are exposed to the stream.

When the drum $k$ passes beyond a position under the vertical portion of the stream, the particles begin to strike it from the left and thus strike the outer face of the left-hand flange $f$. As the drum advances further, the stream enters the drum from the left, and impinges on the inner face of the right-hand rim. Thus, when the drum passes beyond a position of the stream, all of the various surfaces will have been subjected to the abrasive effects of the stream.

As will be seen from Fig. 12, the various circumferential portions of the drum $k$ pass through the stream at the same time and in the same order and three times during the course of a single rotation of the drum $k$. Hence, the article can be effectively treated, even though the stream may be of considerably less width than the diameter of the article treated. Depending upon the rate of advance through the stream with respect to the rate of rotation of the article, a very narrow stream may be used. The width and spread of the stream may be selected to suit the size and shape of the articles to be treated and other operating conditions.

From the foregoing it will be seen that the present invention provides a convenient and satisfactory apparatus for cleaning, hardening, finishing or otherwise treating articles abrasively, and is especially adapted for the treatment of articles having peripheries of such shape that the articles conveniently can be rolled on a supporting surface. The invention also provides satisfactory means for treating all portions of the surface of articles having projections, recesses, or other irregularities and permits the treatment of articles of such shape and size that they cannot conveniently be treated in a tumbling mill.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by one skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A machine for blast cleaning metallic articles including in combination, an abrasive having a generally elongated impingement pattern, and apparatus including spaced article supporting elements for rotating and advancing the articles in a direction generally transverse to the axis of rotation of said wheel, and generally parallel to the longitudinal axis of said impingement pattern, said spaced article supporting elements being out of the range of direct fire of said abrasive stream.

2. A machine for blast cleaning hollow metallic articles including, a pair of substantially parallel rolls for supporting the articles to be treated, a helical abutment on at least one of said rolls adapted to engage the articles to be treated, means for rotating at least one of said rolls to effect combined rotation of the article and forward movement of the article in the direction of its axis of rotation, an abrasive throwing wheel having its axis of rotation extending in a direction generally transverse to the direction of forward movement of the article to be cleaned, said wheel being operative to project a fan-shaped stream of abrasive having an elongated impingement pattern against the exterior and interior portions of said article while the same is being moved forward whereby to effect interior and exterior cleaning of the article. Said fan-shaped stream of abrasive, said fan-shaped stream of abrasive, and the longitudinal axis of said impingement pattern extending generally parallel to and between the longitudinal axis of said rolls.

3. A machine for blast cleaning metallic articles including in combination, an article conveyor, article-engaging means, and said conveyor for imparting a combined rotary and forward movement to the article to be cleaned, means for driving said article conveyor, loading mechanism including article supporting means and means for manipulating said article supporting means in synchronism with the movement of said conveyor for automatically placing the article in position to be engaged by said engaging means, and an abrasive throwing wheel for projecting an abrasive stream against the article on said conveyor.

4. A machine for blast cleaning rollable metallic articles including in combination, an abrasive throwing wheel operative to throw a fan-shaped stream of abrasive particles, and an apparatus for conveying the rollable articles in a direction generally transverse to the axis of rotation of said wheel, said apparatus including a rotatable member for supporting the rollable articles to be cleaned, a helical article-engaging abutment on said rotatable member, means for rotating said member to produce combined rotation of the articles in said stream and forward movement of said articles through said stream, and means for feeding said articles to said member in accordance with the predetermined position of said abutment.

5. A machine for blast cleaning rollable metallic articles including in combination, an abrasive throwing wheel operative to throw a fan-shaped stream of abrasive particles, and an apparatus for conveying rollable articles in a direction generally transverse to the axis of rotation of said wheel, said apparatus including a rotatable member for supporting the articles to be cleaned, a helical article-engaging abutment on said rotatable member, means for rotating said member to produce combined rotation of the articles in said stream and forward movement of the article through said stream, and means for feeding said articles to said member in accordance with the...
A machine for blast cleaning rollable metallic articles including in combination, an abrasive throwing wheel for projecting a fan-shaped stream of abrasive having a longitudinally extending impingement pattern, and spaced means for imparting a combined forward and rotary movement to the article, the forward movement of said article being in the general direction of the longitudinal axis of said impingement pattern, said article being spaced generally outside of the impingement pattern extending generally between said spaced means, means for controlling the direction of flight of the abrasive to define a fan-shaped abrasive stream having portions diverging outwardly and defining a generally elongated impingement pattern, means for advancing the article to be cleaned successively through the divergent portions of the abrasive stream, and spaced means including a member rotatable about an axis extending in the general direction of forward movement of said article for rotating the said article in the stream whereby side and end wall sections of the article are impinged by the abrasive during the forward motion of said article for rotating the article through the stream, the longitudinal axis of said impingement pattern extending generally between said spaced means.

Apparatus for cleaning metallic castings, forgings and like metallic articles including, an abrasive throwing wheel, rotatable members for supporting the article to be cleaned, members engaging all of said driving members, means for varying the spacing of said rolls, and links connected at one end to said rolls and at the other end to said transmission member for retaining said transmission member in engagement with said driving members in all positions of said rolls.

A machine for blast cleaning rollable metallic articles including in combination, a plurality of substantially parallel rolls adapted to engage at least three spaced substantially co-planar portions of the periphery of the rollable article to be cleaned to support the article in a predetermined position relative to said rolls, means on at least two of said rolls for imparting a translatory movement and forward movement of said article, and an abrasive throwing wheel for projecting a stream of abrasive having a generally elongated impingement pattern against the article supported by said rolls, the longitudinal axis of said impingement pattern extending generally between the longitudinal axis of said rolls.

A machine for blast cleaning hollow metallic articles including in combination, an abrasive projector of the rotary centrifugal type having means for controlling the direction of projection of the abrasive and operative to project a fan-shaped stream of abrasive particles having various portions diverging outwardly from said projector and defining a generally elongated impingement pattern, spaced means for advancing an article to be cleaned through said stream, and means for rotating said article about an axis extending in the general direction of advance movement of the article and in a direction generally parallel to and spaced generally between said spaced conveying means.

A machine for blast cleaning metallic articles including in combination, an abrasive throwing wheel operative to project a fan-shaped stream of abrasive particles, a conveyor for ad-
vancing the article to be cleaned through said stream, and means for removing the article from said conveyor, said means including a pivoted arm adapted to engage the article and lift the same from said conveyor, and means for actuating said arm.

16. A machine for blast cleaning hollow metallic articles including in combination, an abrasive projector operative to throw a stream of abrasive particles at blasting velocities, a conveyor for advancing the article to be cleaned through said stream, means for lifting said article from the conveyor and tilting the article to permit the abrasive deposited in the hollow article to be discharged therefrom, an abrasive hopper beneath said lifting and tilting means, and means for actuating said lifting and tilting means.

17. A machine for blast cleaning metallic articles including in combination, an abrasive projector operative to throw a stream of abrasive particles at blasting velocities, a conveyor for advancing the article to be cleaned through said stream, means associated with said conveyor for engaging the article, and means for feeding the article to said conveyor in accordance with the predetermined position of said engaging means, said article-feeding means including a pivoted lever for maintaining said article out of engagement with said conveyor in accordance with the predetermined position of said engaging means, and a cam driven in synchronism with said conveyor for actuating said pivoted lever to cause said article to be deposited upon said conveyor when said engaging means is in a predetermined position relative to said article.

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