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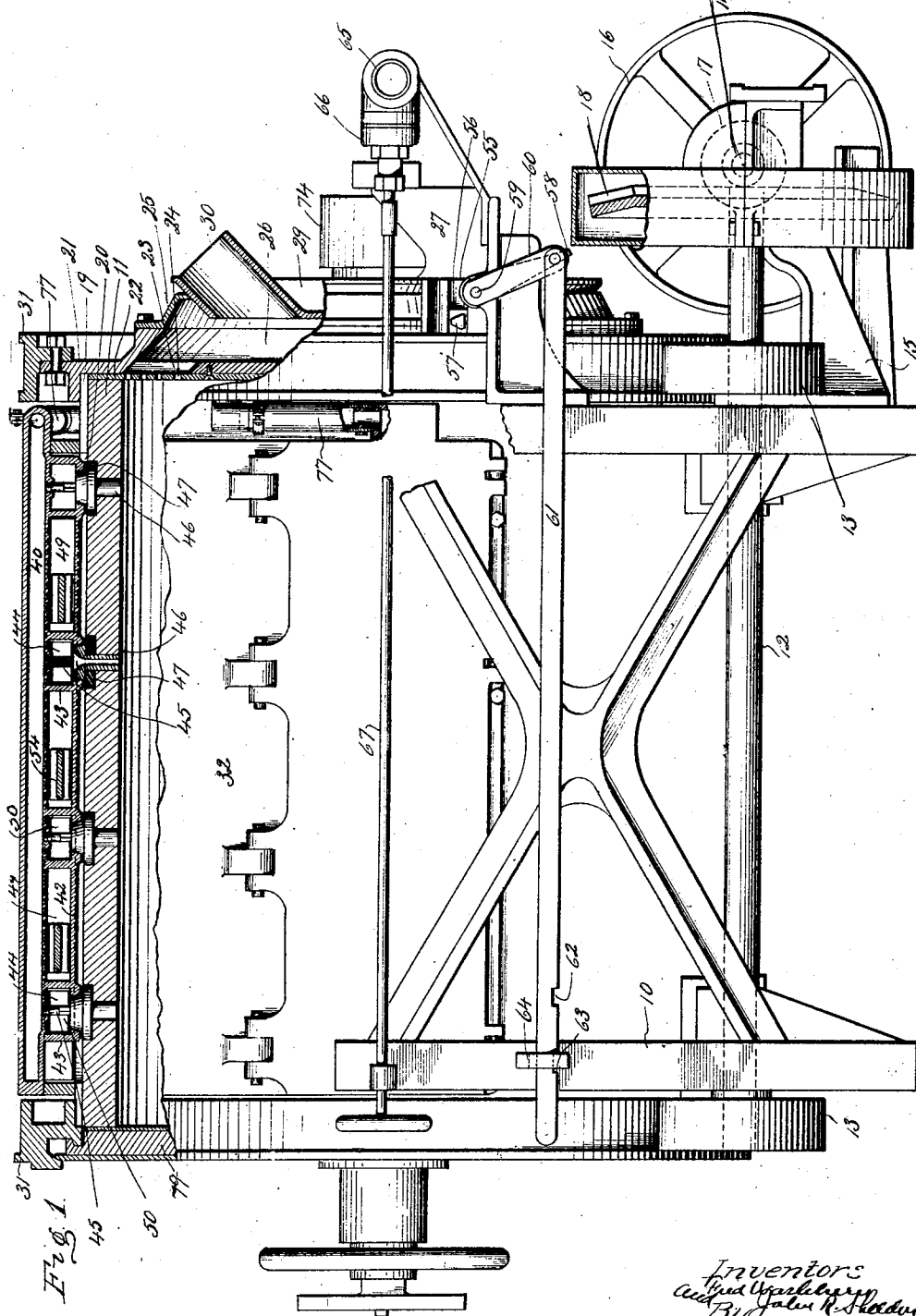
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F. WASHBURN ET AL

SAND BLAST MACHINE

Filed Sept. 26, 1919

5 Sheets-Sheet 1



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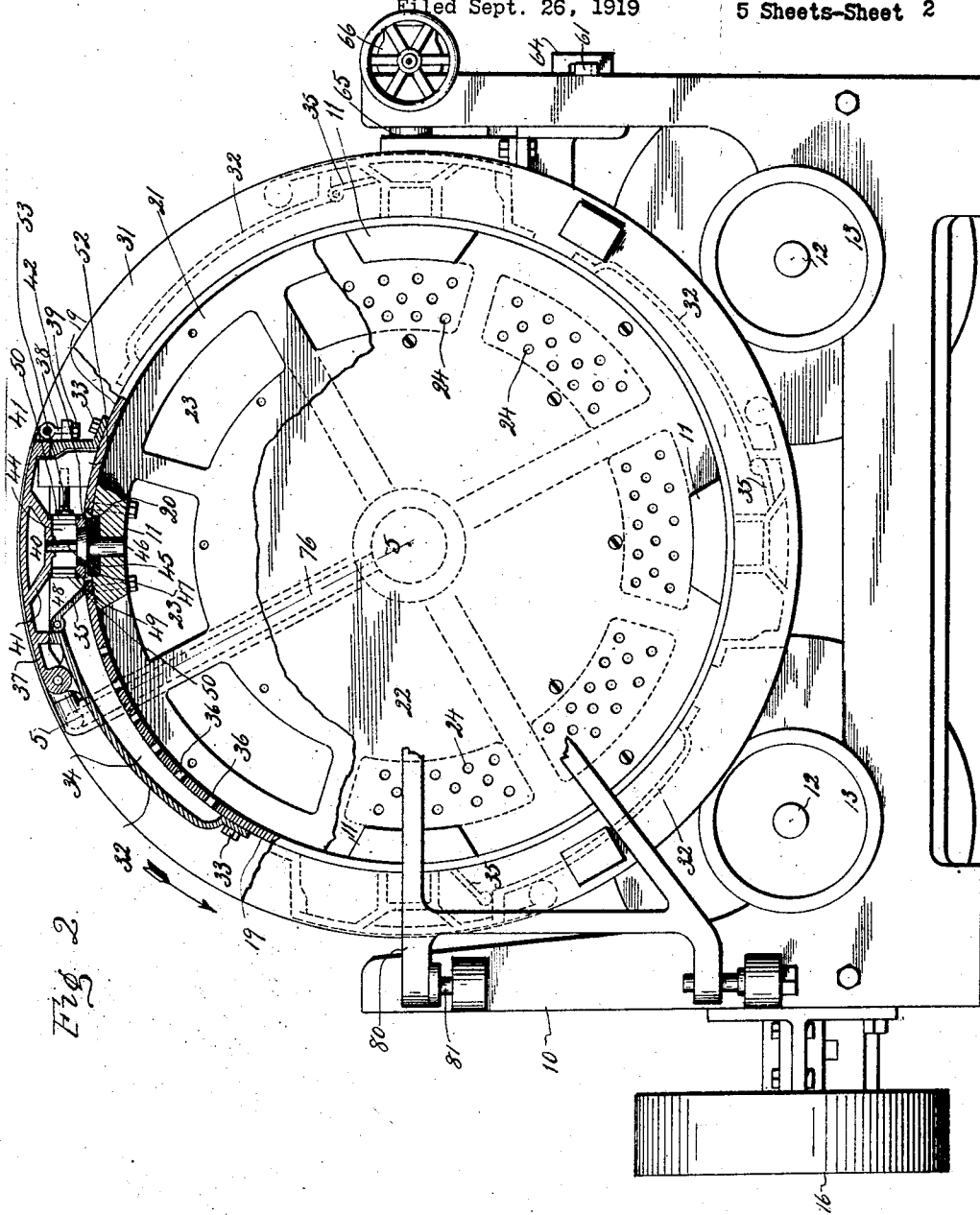
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SAND BLAST MACHINE

Filed Sept. 26, 1919

5 Sheets-Sheet 2



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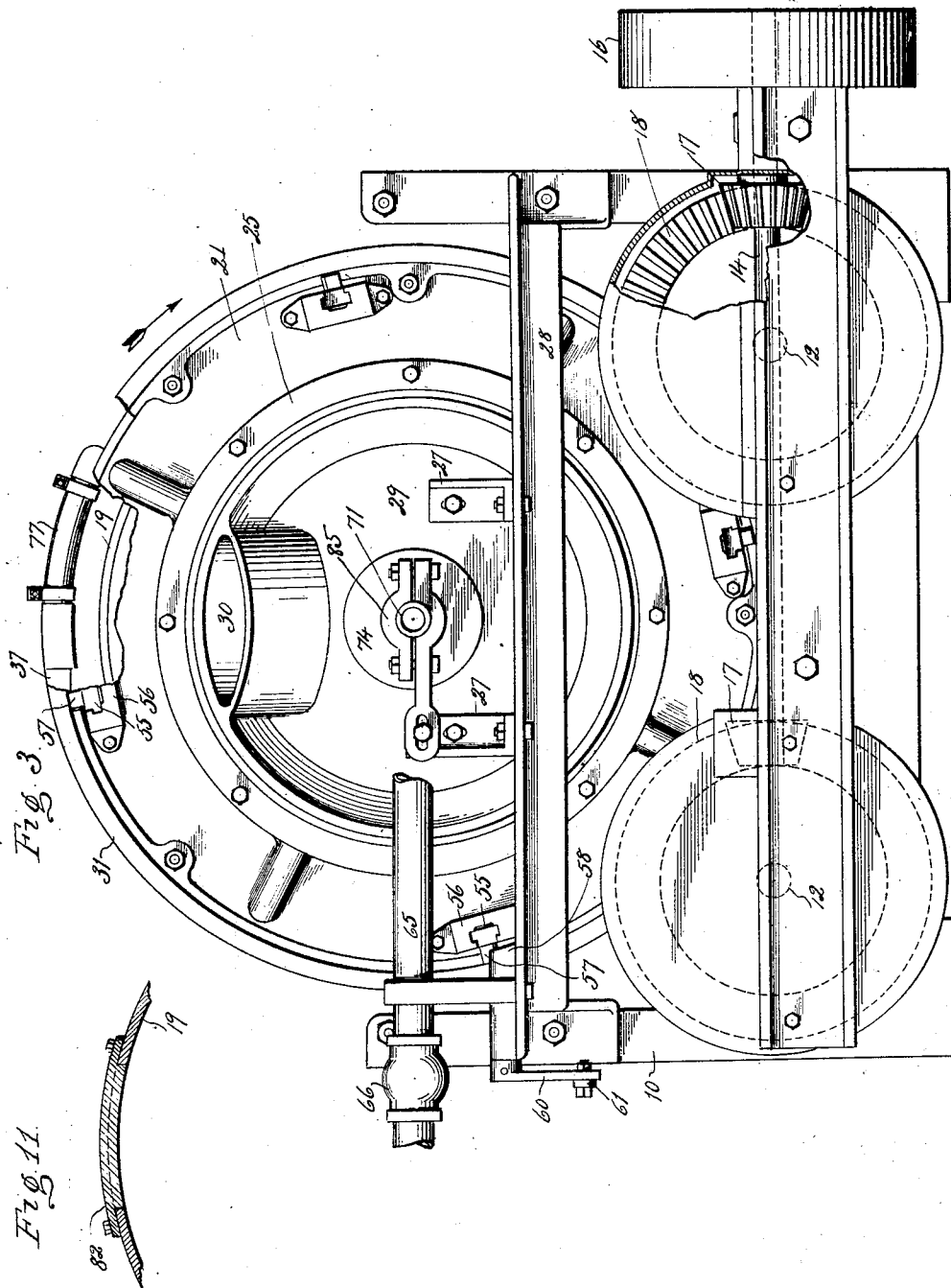
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SAND BLAST MACHINE

Filed Sept. 26, 1919

5 Sheets-Sheet 3



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1,660,058

SAND BLAST MACHINE

Filed Sept. 26, 1919

5 Sheets-Sheet 4

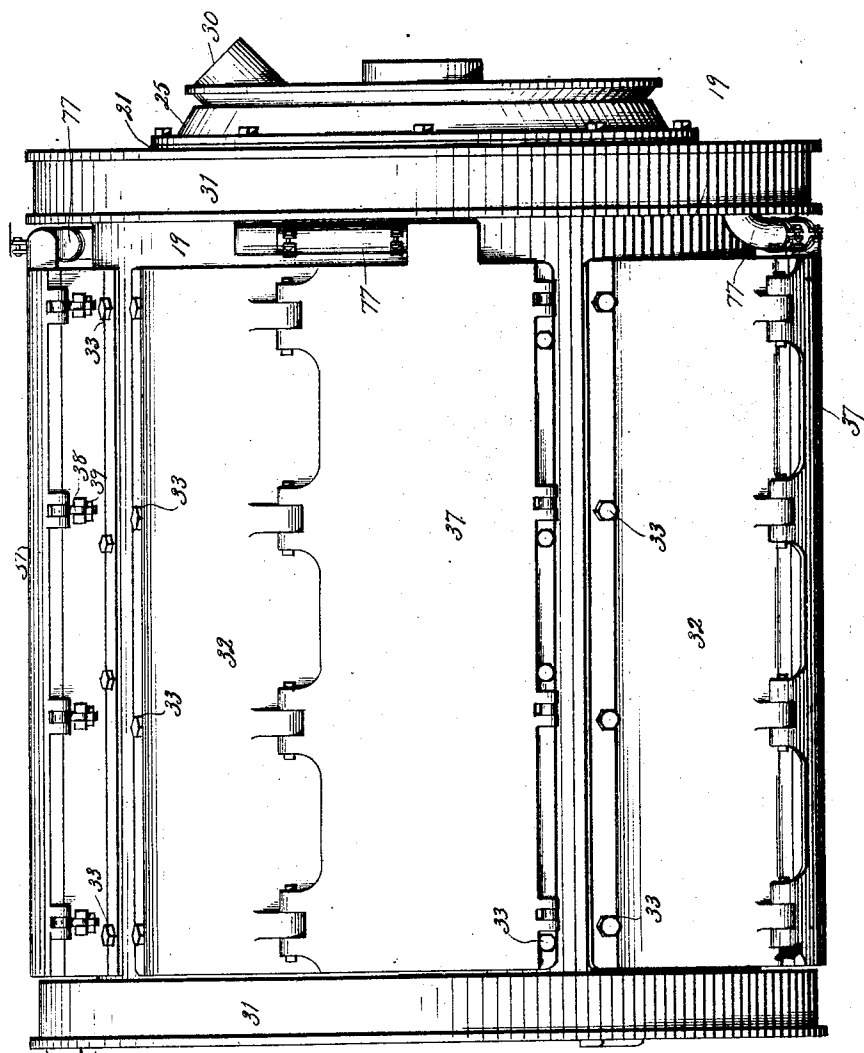


Fig. 14

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1,660,058

SAND BLAST MACHINE

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5 Sheets-Sheet 5

Fig. 7

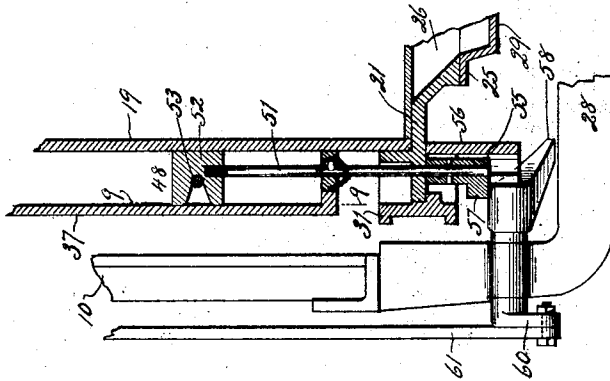


Fig. 8

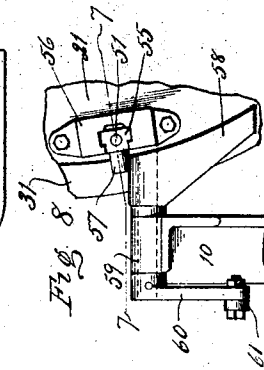


Fig. 6

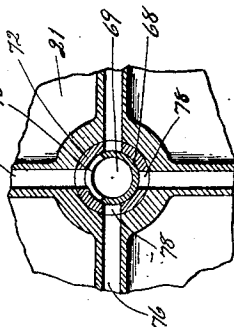


Fig. 9

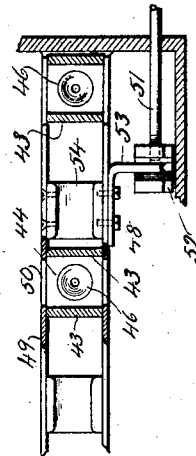


Fig. 5

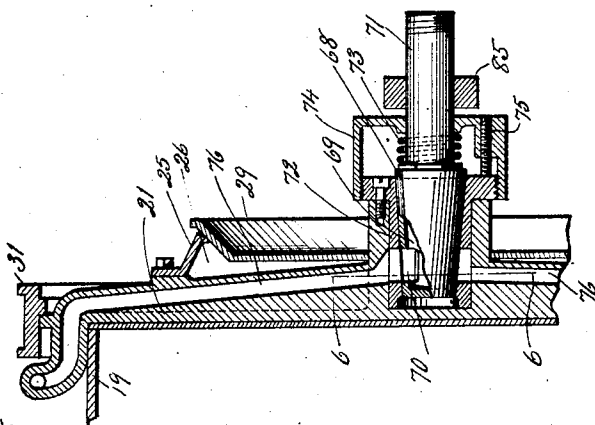
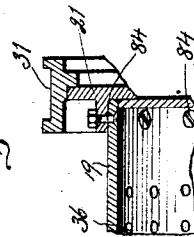


Fig. 10



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UNITED STATES PATENT OFFICE.

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SAND-BLAST MACHINE.

Application filed September 26, 1919. Serial No. 326,450.

Our invention relates to sand blast machines of the tumbling barrel type wherein sand under air pressure is driven or blasted with force against articles in the barrel.

5 In prior sand-blast tumbling barrels, the most effective blasting has been obtained by nozzles directed radially down toward the castings, as distinguished from interior blasting from nozzles directed axially upon the castings as through trunnion openings in the barrel. In such effective radial blasting it has always been considered necessary to locate the sand-blast apparatus inside the tumbling barrel. Such internal sand-blast apparatus, although providing the desired radial blasting, suffered the defect of limitation to treatment of small castings and of interference between the castings and the internal sand-blast apparatus on account of the large interior space occupied by such apparatus and the weight of the latter which for these and other reasons made barrels of large size impractical, and on account of various problems in connection with the support of such heavy apparatus inside a rotary barrel, whether through an axial opening into the barrel or on a stationary end of the barrel. The object of our invention, among other things, is to produce a sand-blast tumbling barrel which, while retaining the advantage of radial blasting, and obtain such advantage in a superior manner, may not have the sand-blast apparatus inside the barrel, nor possess the limitation to treatment of small castings or small charges of castings, or dimensions of barrel, but will be adapted to all sizes of barrel, castings and charges thereof.

40 The invention consists of a new type of sand-blast tumbling barrel substantially as shown and described, the underlying feature of which is such a direct combination of the tumbling barrel and the sand-blast apparatus that they will act as a unit, the sand-blast apparatus being revolved with the barrel and preferably mounted on the barrel and best on the outside of the barrel, so that the interior of the barrel may be free of all apparatus which might interfere with the castings or limit the size or quantity thereof.

To these, and other ends, our invention consists in the improved sand-blast machine, having certain details of construction and combinations of parts, as will be herein-

after described and more particularly pointed out in the claims.

Referring to the drawings, in which like numerals of reference designate like parts in the several figures;

Figure 1 is a fragmentary side elevation of our improved machine;

Figure 2 is an end view thereof with the closure door at one end removed therefrom and looking toward the left of Figure 1;

Figure 3 is a fragmentary end view of the opposite end of our machine from that shown in Figure 2;

Figure 4 is a side elevation of the barrel;

Figure 5 is a sectional view of one of the heads of the barrel, taken upon line 5—5 of Figure 2;

Figure 6 is a sectional view of said head taken upon line 6—6 of Figure 5;

Figure 7 is an enlarged sectional view of the mechanism shown upon line 7—7 of Figure 8;

Figure 8 is a fragmentary end view of the parts shown in Figure 7;

Figure 9 is a sectional plan view of the casing and sand valve, taken upon line 9—9 of Figure 7, and showing the means whereby the same is operated;

Figure 10 is a detail sectional view illustrating the means by which the barrel or drum is secured to the track rings; and

Figure 11 is a fragmentary sectional view of a portion of a barrel or drum illustrating one form of means that may be utilized for side instead of end loading and unloading.

In the embodiment of our invention we utilize a frame 10, within which are mounted the parallel shafts 12—12 having thereon the friction rolls 13—13, upon which the barrel rotates, as will be later described. These shafts 12—12 are rotated from a shaft 14 driven through a pulley 16 and journaled in one or more brackets 15 fixed to the frame and having beveled pinions 17 thereon which mesh into beveled gears 18 fixed on the shafts 12. This mechanism just described is well known in the art and constitutes no part of our present invention.

The barrel of our improved machine is constructed with a cylindrical body portion composed preferably of a plurality of sections but may be made of a single piece, if desired. In the drawings these sections are four in number, each being designated by

the numeral 19 and are joined upon the inside of their adjacent edges by cleats 11 so as to leave an open space 20 therebetween for at least a portion of their length. These sections may be joined, however, so that their ends abut against each other if desired for their entire length. They are secured at their outer ends to the track rings 31 by the bolts 84, as shown in Figure 10. One end of the body portion of the barrel is closed by a head 21 which is secured thereto with a plate 22 therebetween. This plate within our invention can be made and secured so that it may be readily placed in position or taken down without disengaging the head from the barrel. The head 21 is provided with a plurality of openings 23 therethrough and the plate 22 opposite these openings is provided with a plurality of openings 24. Secured to the head 21 is the cover 25 in such manner as to leave an open space between it and the outside of the head 21, which open space, known as the dust box, is designated by the numeral 26. Supported upon brackets 27 fixed to a cross bar 28 that is secured at its opposite ends to the frame 10, is a cover plate 29, which is held thereby against rotation but projects through the cover 25, and through the top side of this cover plate is an opening 30 which is connected in a well known manner with suction devices so as to withdraw the dust from the interior of the barrel through openings 24, dust box 26 and opening 30. At both ends of the barrel are secured the track rings 31, which rest upon the friction rolls 13, and through which rotation is imparted to the barrel.

Mounted on the outside of the barrel are a plurality of sand-blast apparatuses which are secured over the cleats 11 by bolts 33 (Fig. 4), in this case four being shown although a greater or less number can be used as desired and as the character of the contents of the barrel may dictate. Each of these apparatuses comprises a sand hopper 32, a sand chamber 48 in communication therewith by way of the hinged gravity valve 35, or other similar mechanism, an air chamber 40, a plurality of sand and air mixing chambers 44 and a corresponding plurality of sand-blast nozzles 46. The heads of the sand-blast nozzles 46 rest upon gaskets 47 and are located in perforations in the cleat 11, so that the ends of the nozzles are directed radially toward the interior of the barrel. The barrel viewed from the end (Fig. 2) is rotated anti-clockwise (see arrow), and in this direction the forward end 32 of the sand-blast apparatus covers blasted-sand-outlet-passages 36 in the barrel, so that when the sand-blast apparatus is moved through its lower arc of revolution by the rotation of the barrel, the blasted sand in the bottom of the barrel will drop directly

through said perforations 36 into the interior 34 of the sand hopper 32. The sand chamber 48 connects with each of the plurality of mixing chambers 44. Likewise the air chamber 40 communicates with each of the plurality of mixing chambers 44 by way of a corresponding plurality of air nozzles 45. Although the sand-blast apparatus as a whole is secured to the barrel by the bolts 33, or similar means, yet a substantial portion of such apparatus is constructed as a unit 37 (Fig. 2) which is pivoted or hinged so as to be swung away from the barrel independently of the sand-blast nozzles 46 to permit convenient access to all the parts. The sand chamber 48 is formed, in the closed position of the hinged portion 37, partly by said hinged portion and partly by the barrel. The parts constructed as a unit in hinged member or cover 37 are the air chamber 40 and the plurality of mixing chambers 44 with their air nozzles 45. The hinged member 37 is secured in its closed position by a fastening bolt 38 having a nut 39 thereon. The detailed construction of the unit 37 is as follows. The underside of member 37 is provided with inwardly projecting walls 41 enclosing the air chamber 40. Integral with said walls is a platform 42 and connected therewith are a plurality of partitions 43 arranged and located so as to constitute (with said walls 41 and platform 42) a plurality of mixing chambers 44 into which project the air nozzles 45. Herein are shown four mixing chambers 44, air nozzles 45 and sand-blast nozzles 46. The admission of sand from the sand chamber 48 to the mixing chamber 44 may be controlled by the sand valve 49 which is provided with the openings 50 therethrough which register with the openings in the sides of the mixing chambers 44 (see Figure 9) and are mounted in the cover member 37 so as to slide lengthwise therein. In Figure 9 the valve 49 is shown in the position wherein the openings 50 register with the mixing chamber 44 and sand is being admitted thereto.

The mechanism for imparting motion to the sand valves 49 comprise a valve rod 51 having a block 52 secured to one end thereof and into which projects the finger 53 secured to one of the valves 49, which latter are secured together by means of the tie blocks 54, a slide head 55 having a reciprocatory movement in the slide frame 56 secured to the head 21 and having a lug 57 thereon which projects radially therefrom into the path of a cam 58 fixed on a shaft 59 rotatably connected with the frame 10 having a bell crank arm 60 thereon which is connected to one end of a manually operated lever 61 having notches 62 and 63 therein which engage the supporting loop 64 fixed to the frame 10. As shown in Figure 1, when the notch 63 engages the loop 64 the valves

are open and when shifted so that the notch 62 engages the supporting loop 64 they are closed, this movement actuating the cam 58 so as to be moved into and out of the path of the lug 57, through which reciprocatory movement is imparted to the valve rod 51, and through it to the sand valves 49. In practice these sand valves and their operative mechanism may be omitted, if desired, in which case the sand flows directly from the mixing chamber to the sand chamber, without its passage at any time being prevented by a closure element, such as the sand valve.

It will be noted that the air chamber, mixing valve, air nozzles, sand valves and adjacent mechanism are all so associated with the covers 37 as to be moved therewith when the cover is moved upon its pivot mounting, thereby exposing the sand chamber and the sand passage 34 adjacent thereto. This facilitates repairs, the removal of any foreign objects that may get into the sand passage or chamber and enables the sand nozzles to be readily removed and replaced and makes the operative parts readily accessible for whatever purpose may be desired.

The air under pressure is admitted to the air chamber 40 through an inlet pipe 65 having a valve 66 associated therewith, that is, opened and closed manually through a rod 67, as is shown, a plug 68 having a chamber 69 therein with a radial opening 70 through the wall thereof and having a hollow shank 71 thereon that is connected with the pipe 65. Rotation of the plug 68 is prevented by the clamp 85 fixed to one of the brackets 27. The plug 68 is seated in a bushing 72 secured in the head 21 and held on its seat by the spring 73, which surrounds the shank 71 and abuts against the enlarged portion of said plug at one end and the inside of a cap 74 at the other end which is threaded onto the bushing 72 (see Figure 5). A screw 75 threaded through said cap 74 is the equivalent of a lock nut to prevent accidental disengagement of the cap 74 from the bushing 72.

In the head 21 are a plurality of radial air passages 76 corresponding in number with the air chambers 40, which air passages are connected by a flexible hose connection 77 with the air chambers 40, this flexible connection permitting the covers 37 to be moved upon their pivot mountings without breaking the air passage connection.

The bushings 72 are also provided with radial ports 78 corresponding in number with the air passages 76 and registering therewith.

The end of the barrel opposite the head 21 is entirely open and is closed by a door 79, which is connected with a supporting bracket 80 pivotally mounted at 81 to the frame 10. This door and its mechanism of engage-

ment with and locking to the barrel is old and constitutes no part of our present invention, and therefore is not shown or described in detail.

In operation, if the barrel is to be loaded from one end, the door 79 is swung upon its pivot mounting so as to expose the interior of the barrel and the articles are placed therein, after which the door is closed and locked in position and the barrel then rotated through the shafts 12 which are at rest when the barrel is being loaded.

As the barrel rotates air is admitted into the plug 68 and thence through one of the ports 78 in the bushing 72 and into that one of the air passages 76 in register with the radial port 70 in the plug 68, thence through the flexible connection 77, into the air chamber 40 and through the air nozzle 45. The sand valves 49 being open, the sand from the sand chamber 48 passes into the mixing chamber 44 and the air drives it through the sand nozzles 46 into the interior of the barrel where it contacts with the work in a well known manner. As the barrel rotates, the sand at the bottom of the barrel drops through one of the series of openings 36 into the hopper that happens at that time to be on the underside of the barrel and then flows through the sand passage 34 of the casing 32 past the valve 35 which lies open at that time, being moved to its open position by gravity, as shown in Figure 2, and thence passes into the sand chamber 48. As the hopper last mentioned moves during the rotation of the barrel any sand that may be left in the passage 34 passes through into the sand chamber until gravity closes the valve 35, at which time all of the sand will be out of the sand passage. When in its uppermost position the valve 35 is closed and the sand within the sand and mixing chambers is driven into the interior of the barrel again, as above described. Whenever the air blast through the air nozzles is continuous some of the sand is driven through the sand nozzles, almost as soon as it enters the hopper.

During the agitation of the sand and articles in the barrel the dust that rises in the barrel is withdrawn therefrom through the perforations 24 in plate 22, vent openings 23 in head 21, dust box 26 and opening 30, as heretofore described. If perchance any sand should enter the dust box, it will return to the barrel through the openings 24. It will be noted that no sand can escape from the interior of the barrel into the hoppers until the hopper is at the lower portion or underside of the barrel and as there are no openings through the sections 19 between the several hoppers save the blast nozzles, such sand as accumulates on the bottom of the barrel always passes through the openings 36 into the next succeeding hopper. As

shown herein the radial opening 70 covers an arc of about 120° so that the blast of the sand from each series of nozzles is effective during about one-third of the rotation of the barrel, at which time the next series of nozzles will be in operation. Hence the sand blast is continuous and each nozzle is in operation while moving through a circular path, substantially 120° in length. The length of this circular path may, of course, be increased or diminished, as may seem advantageous. By reducing the length of this path the series of nozzles will be in operation intermittently. By making the opening 70 extend substantially around the entire periphery of the plug all of the sand blast nozzles can be in operation at one and the same time. In such case it may be desirable to shorten the plug 68 and leave it entirely open at its inner end. Of course any substantial degree of air blast when the apparatus lies beneath the sand on the bottom of the barrel, although not very useful in blasting the castings, nevertheless will prevent the disadvantage of sand dropping through the sand nozzles 46 to and through the air nozzles 45 to the air chamber 40.

If it is desired to operate upon articles of unusual length, such as pipe, rods, etc., or even for other classes of articles, the barrel may be loaded and unloaded from the side instead of through the swinging doors 79. To accomplish this, one or more doors 82 are provided in the side of the barrel between the hopper casings 32. After the articles in the barrel have been subjected to the sand blast for a sufficient length of time the sand valves 49 are closed through manipulation of the lever 61, thus shutting off the admission of sand to the mixing chamber, but the air continues to pass through the air nozzles into the barrel and cleans the castings or articles from any accumulated sand or dust, the latter being withdrawn from the barrel in the manner above described and the sand all being exhausted therefrom into the several hoppers so that when the article is removed from the barrel it is entirely clean and free from both sand and dust.

Of course the initial charging of the machine with sand is effected by placing a substantial quantity thereof in the barrel through the door, sufficient in amount to charge the successive blast apparatuses, whereupon the rotation of the barrel as above described will charge the latter with this sand. In time, after operation, and as some sand escapes through the vent, replacement sand may be shoveled into the barrel as initially.

The advantages of the invention are those of the above stated objects thereof, i. e., principally the freedom from limitation to treatment of castings of small size or to internal dimensions of the tumbling barrel. Owing

to the mounting of the sand blast apparatuses on such a practicable support as the barrel itself, the latter may be constructed in any size and of any capacity desired without any resulting difficulty involved in the method of supporting the blasting apparatus; and as the latter is mounted preferably on the outside of the barrel, the latter can be made of very small size for small castings or charges of castings, as well as of very large sizes for large castings or charges thereof. Also, not only is the advantage retained of a blast acting radially instead of diametrically (and this with sand-blast apparatus located outside the barrel), but such blasting effect is greatly enhanced by the sweeping movement of the revolving blasts above the castings. Also, the construction of the machine as a whole is greatly simplified as the result of the combination of the perforated barrel and sand-blast apparatus in such manner as to constitute a self-closed system, thereby obviating the necessity of any outer enclosing casing around the barrel.

Although a preferred embodiment of the invention is disclosed herein, yet wide departures may be made therefrom within the spirit and scope of the invention; for it is believed that this invention is the first wherein the sand-blast apparatus has been mounted to revolve with a tumbling barrel, and that the various important features involved in an embodiment of revolving sand-blast apparatus are also entirely novel.

Having described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. A sand-blast machine comprising a rotary barrel, a sand-blast apparatus mounted thereon to be revolved thereby, and means for operating said blasting apparatus during its movement of revolution.

2. A sand-blast machine which comprises a rotary tumbling barrel and a sand-blast apparatus mounted to be revolved therewith and having its blast nozzle directed into the interior of the barrel; means for supplying air to the sand-blast apparatus, and means for completing the circulation of the blasted sand between the barrel and the sand-blast apparatus.

3. A sand-blast machine which comprises a rotary tumbling barrel and a sand-blast apparatus mounted to be revolved therewith and having its blast nozzle directed into the interior of the barrel; means for supplying air to the sand-blast apparatus, means for completing the circulation of the blasted sand between the barrel and the sand-blast apparatus, and means to prevent the substantial return of sand to the barrel after it has reached the sand blast apparatus except through the sand-blast apparatus.

4. A sand-blast machine comprising a rotary barrel; a sand-blast apparatus mounted

thereon to be revolved thereby; and means for supplying sand to said barrel during its movement of revolution and thence to the blasting apparatus.

5 5. A sand-blast machine comprising a rotary barrel; a sand-blast apparatus mounted thereon to be revolved thereby; and means for supplying compressed air to said barrel during its movement of revolution and
10 thence to the blasting apparatus.

6. A sand-blast machine comprising a rotary tumbling barrel, a sand-blast apparatus mounted on the periphery thereof to be revolved therewith thereby keeping the ends of
15 said barrel free; one end of the barrel being constructed to be opened to receive the articles to be treated; and a vent opening through the other end of the barrel.

7. A sand-blast machine comprising a rotary tumbling barrel and a sand-blast apparatus mounted on the outside thereof to be revolved thereby and in direct sand-receiving communication with the interior of the
20 barrel.

8. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted thereon to be revolved thereby, the wall of the barrel constituting one wall of the sand-blast apparatus.

9. A sand-blast machine comprising a horizontal rotary tumbling barrel and sand-blast apparatus mounted peripherally of the barrel to be revolved thereby and having its blast nozzle directed inwardly of the barrel.

35 10. A sand-blast machine comprising a rotary tumbling barrel having a sand-blast inlet and a used-sand outlet through its lateral wall; and a sand-blast apparatus mounted on the lateral wall of the barrel to be revolved thereby and communicating with and
40 enclosing said inlet and outlet.

11. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted on the outside of the barrel to be revolved thereby; and means for operating said sand-blast apparatus while it is being moved in its upper arc of revolution; the barrel and sand-blast apparatus being in direct gravity-sand-receiving communication
50 with one another to permit sand to be dropped from the interior of the barrel to the interior of the sand-blast apparatus while the latter is being moved by the former through its lower arc of revolution.

12. In a device of the character described, the combination with a rotary barrel; of sand blast nozzles arranged in different radial positions about the axis thereof and rotatable therewith; means for supplying sand
60 to said sand blast nozzles at predetermined portions of the rotation thereof; and air nozzles for said sand blast nozzles registering therewith.

13. A sand-blast machine comprising a rotary tumbling barrel and sand-blast ap-

paratus mounted thereon to be revolved thereby and including a plurality of sand-blast nozzles arranged in succession longitudinally of the barrel.

14. A sand-blast machine comprising a rotary tumbling barrel, a sand-blast apparatus mounted thereon to be revolved thereby and comprising a sand hopper, a sand chamber, means between said hopper and sand chamber that opens and closes during the
70 rotation of the barrel and controls the escape of sand from the hopper to the sand chamber, an air chamber, a plurality of mixing chambers communicating with said sand and air chambers and a corresponding plurality
75 of sand-blast nozzles, the latter being directed into the interior of the barrel.

15. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted thereon to be revolved thereby and comprising a sand hopper, a sand chamber, an air chamber, a plurality of mixing chambers communicating with said sand and air chambers and a corresponding
80 plurality of sand-blast nozzles, the latter being directed into the interior of the barrel.

16. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted thereon to be revolved thereby and comprising a sand hopper, a sand chamber, an air chamber, a plurality of mixing chambers communicating with said sand and air chambers and a corresponding plurality of sand-blast nozzles, the
85 latter being directed into the interior of the barrel, means that prevent a substantial return of the sand from the sand chambers to the sand hoppers.

17. In a device of the character described, the combination with a barrel; of a sand blast apparatus on said barrel, movable therewith and having a plurality of mixing chambers and nozzles therein with a sand valve operably mounted adjacent to said mixing chambers, whereby the movement of sand into a plurality of said mixing chambers is controlled at one and the same time and a sand nozzle for each of said mixing chambers, rotatable with said barrel.

18. A sand-blast machine comprising a rotary tumbling barrel having perforations through its sides and one end; sand-blast apparatus mounted on the outside of the barrel and covering said side perforations, one of the side perforations receiving the sand blast nozzle of the sand-blast apparatus, and another side perforation co-operating with the sand blast nozzle to permit the circulation of the sand between the sand-blast apparatus and the barrel by blasting and gravity successively, said sand blast apparatus being constructed to form a conduit for used sand passing thereto from the interior of the barrel; and means for supplying compressed air to the sand-blast apparatus, the
110 115 120 125 130

said end perforations of the barrel serving as a vent for the blasted air.

19. A sand-blast machine comprising a rotary tumbling barrel and a sand-blast apparatus mounted on the outside of the barrel to be revolved thereby, the sand-blast nozzle thereof being directed into the interior of the barrel and the side of the barrel being perforated in communication with the interior of the sand-blast apparatus which latter is constructed to receive and pass to the nozzle used sand from the barrel when the sand blast apparatus is returned by the barrel to a position that will permit gravity to return the sand thereto; and means for supplying air to the sand-blast apparatus and its sand-blast nozzle.

20. A sand-blast machine comprising a rotary tumbling barrel provided with a vent opening, and sand-blast apparatus mounted on the barrel to be revolved thereby; said barrel and apparatus having direct communication with one another for circulation of the sand, the remainder of the barrel when in operation being closed save for the vent, whereby the barrel and sand-blast apparatus alone constitute an operative self-closed system.

21. A sand-blast machine comprising a rotary tumbling barrel; a mixing chamber for sand and compressed air rotating therewith; a blast nozzle supplied from said chamber and directed into the interior of the barrel; means for supplying compressed air to said mixing chamber; and means, including a hopper mounted on the outside of the barrel and in sand-communication between the barrel and the mixing chamber, to cooperate with the blasting nozzle in circulating the sand within the machine.

22. A sand-blast machine comprising a rotary tumbling barrel, a sand-blast apparatus mounted thereon to be revolved thereby, said barrel and apparatus being in gravity-sand-transferring communication with one another to permit sand to drop from the barrel into the said apparatus; and means to prevent the substantial return of sand to said barrel, after it has reached the sand blast apparatus except through said sand-blast apparatus.

23. A sand-blast machine comprising a rotary tumbling barrel having a blasted-sand outlet through its lateral wall; and sand-blast apparatus mounted on said wall to be revolved thereby and having a forward portion in the direction of revolution which covers and is in communication with said blasted-sand outlet; said barrel having a sand-blast inlet in communication with a rear portion of said sand-blast apparatus.

24. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted thereon to be revolved thereby; and means for supplying compressed air

from outside the barrel to said sand-blast apparatus, said barrel and apparatus being in gravity-sand-transferring communication with one another to permit sand to be supplied to said apparatus from the inside of the barrel.

25. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted on the outside thereof to be revolved thereby; an air-connection mounted stationary outside the barrel but in line with the axis of rotation thereof; and an air-supply conduit mounted on the barrel to be revolved thereby and arranged in air communication between said air-connection and the sand-blast apparatus.

26. A sand-blast machine comprising a rotary tumbling barrel; sand-blast apparatus mounted on the outside of the barrel to be revolved thereby; means for supplying compressed air to the sand-blast apparatus, the latter having its blast nozzle directed into the interior of the barrel, and the barrel and sand-blast apparatus being in sand-communication with one another in series with the blast nozzle whereby the blasted sand drops back into the sand-blast apparatus from the barrel when the barrel by its rotation returns the sand-blast apparatus to a position substantially beneath it.

27. A sand-blast machine comprising a rotary tumbling barrel; sand-blast apparatus mounted on the outside of the barrel to be revolved thereby, its blast nozzle being directed into the interior of the barrel; the barrel and sand-blast apparatus being in blasted-sand-communication in series with the blast nozzle; and means for supplying compressed air to the sand-blast apparatus and comprising a stationary air connection mounted axially and outside of the barrel near an end thereof, and an air conduit mounted on said end of the rotating barrel and in revolving communication with said air connection and also in communication with said sand-blast apparatus.

28. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted on its periphery to be revolved thereby; an exhaust box mounted on the end of the barrel to rotate therewith and communicating with the interior of the barrel; and a stationary cover for said box and provided with an exhaust outlet.

29. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted on the outside of the side of the barrel to be revolved thereby; a dust box; an end of the barrel being mounted to rotate therewith and formed with perforations constituting a vent for the interior of the barrel; a stationary exhaust connection arranged to close said dust box save for an exhaust outlet upon one side of the axis of said barrel.

30. A sand-blast machine comprising a ro-

tary tumbling barrel and sand-blast apparatus mounted on the outside of the barrel to be revolved thereby; an air-supply connection located stationary with respect to the rotary barrel and in line with the axis of rotation thereof; an end of the barrel being mounted to rotate therewith and constructed with a passage in air-receiving communication with said air-connection; and an air conduit extending from said passage in the barrel end to the sand-blast apparatus.

31. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted on the outside of the side of the barrel to be revolved thereby and having its sand-blast nozzle directed into the interior of the barrel, the revolving sand-blast apparatus being in gravity-sand-receiving communication with the interior of the barrel; an end of the barrel being mounted to rotate therewith and formed with a vent passage communicating with the interior of the barrel; an exhaust connection mounted stationary with respect to the rotating barrel and forming a dust box with said rotary barrel end.

32. A sand-blast machine comprising a rotary tumbling barrel having an end mounted to rotate with it; and sand-blast apparatus mounted on the outside of the barrel to be revolved thereby and in communication with the interior of the barrel for blasting the sand into and removing it from the barrel to the sand-blast apparatus; the end of the barrel having passages communicating, respectively, with the sand-blast apparatus to supply compressed air thereto, and with the barrel to serve as a vent for the air blasted therein.

33. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted on the outside of the side of the barrel to be revolved thereby, the barrel having an end fixed to rotate with it; an air-supply connection and an exhaust connection both located stationary with respect to the rotating barrel and outside the barrel, the air-supply connection being mounted in line with the axis of rotation of the barrel; said barrel end being constructed with a passage in air-receiving communication with said air connection; and an air conduit from said passage to the sand-blast apparatus; said rotary barrel end being constructed also with a vent passage from the interior of the barrel to said exhaust connection.

34. A sand-blast machine comprising a rotary tumbling barrel, the sides of the barrel consisting of sections extending longitudinally of the barrel with longitudinal spaces between them, and cleats lying inside said sections and secured to and joining them and closing said spaces; and sand-blast apparatus mounted on the outside of the barrel and covering a cleat and revolved by the

barrel, the sand blast nozzle of said blast apparatus extending through the cleat and directed into the interior of the barrel.

35. A sand-blast machine comprising a rotary tumbling barrel consisting of a shell and sand-blast apparatus mounted thereon to be revolved thereby and having its sand-blast nozzle projecting inside the shell; a cleat secured to the inside of the shell and receiving and surrounding said nozzle; the shell having blasted-sand-outlet-perforations in advance of and near to the cleat in the direction of revolution of the sand-blast apparatus, and said apparatus being in gravity-sand-receiving communication with the interior of the barrel through said perforations.

36. A sand-blast machine comprising a rotary tumbling barrel consisting of a shell formed of longitudinal sections with longitudinal spaces between them; cleats located longitudinally inside the shell and secured to adjacent sections to close up said spaces; sand-blast apparatus secured to the outside of the barrel in position over a cleat and having its sand-blast nozzle extending through the cleat and directed into the interior of the barrel; a perforated exhaust plate located at an end of the rotary barrel to be revolved thereby; and a head secured to said end of the barrel to be revolved thereby, and holding said perforated plate against the ends of said cleats.

37. A sand-blast machine comprising a rotary tumbling barrel and sand blast apparatus mounted on the outside of the side thereof to be revolved thereby; the nozzle of said sand-blast apparatus being mounted in the wall of the barrel and directed into the interior thereof, and the remainder of the sand-blast apparatus being separable from the nozzle and movable from the barrel independently thereof.

38. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted on the outside of the side of the barrel to be revolved thereby, the sand-blast nozzle of said apparatus being mounted in the wall of the barrel and directed into the interior thereof, said sand-blast apparatus including also a sand-hopper, a sand-chamber, an air-chamber, and a mixing chamber; the sand hopper of said apparatus being mounted in gravity-sand-receiving communication with the interior of the barrel; and the sand-chamber, air-chamber and mixing-chamber of the sand-blast apparatus being constructed as a unit and having a hinged mounting.

39. A sand-blast machine comprising a rotary tumbling barrel and a unitary sand-blast apparatus mounted on the outside of the side of the barrel in hinged relation thereto revolved thereby, one side of said apparatus being closed by said barrel; and

means for supplying compressed air to the sand-blast apparatus which includes a flexible hose connected with the parts having the hinged mounting.

40. A sand-blast machine comprising a rotary tumbling barrel and sand-blast apparatus mounted on the outside of the side of the barrel to be revolved thereby; means for supplying compressed air to said apparatus; said sand-blast apparatus comprising a sand hopper in sand-receiving communication with the barrel; a sand chamber in sand-receiving communication with the hopper, an air chamber, a mixing chamber in sand-receiving communication with the sand chamber and in air-receiving communication with the air chamber, and a sand-blast nozzle communicating between the mixing chamber and the interior of the barrel; the sand-blast nozzle being mounted in the wall of the barrel independently of the rest of the sand-blast apparatus; and the construction which comprises the sand-chamber, the air-chamber and the mixing-chamber comprehending a unit which is movable from its co-operative association with the barrel independently of the sand hopper and of the sand-blast nozzle.

41. A sand-blast machine comprising a substantially horizontal rotary tumbling barrel for the articles to be treated, a plurality of sand-blast apparatuses mounted thereon to be revolved thereby and arranged in succession around the periphery of the barrel.

42. A sand-blast machine comprising a substantially horizontal rotary tumbling barrel for the articles to be treated, a plurality of sand-blast apparatuses mounted in succession around its periphery to be revolved thereby, each of said sand-blast apparatuses including a plurality of blast nozzles arranged in succession longitudinally of the barrel.

43. In a device of the character described, the combination with a barrel; of a sand blast apparatus connected therewith upon the outside thereof having a plurality of mixing chambers therein; a sand blast nozzle opposite each of said mixing chambers; means for admitting air into said mixing chambers; means for admitting sand to said mixing chambers; and means for controlling the movement of sand into said mixing chambers, said means being controlled from outside of said sand blast apparatus and independently of the air admission means.

44. In a device of the character described, the combination with a barrel; of a sand blast apparatus connected therewith upon the outside thereof having a plurality of mixing chambers therein; a sand blast nozzle opposite each of said mixing chambers; means for admitting air into said mixing chambers; means, as a sand valve for ad-

mitting sand to said mixing chambers; and means for controlling the movement of sand into said mixing chambers, said means being controlled from outside of said sand blast apparatus and independently of the air admission means and including a cam, means for oscillating said cam, and a movable member connected with said sand valve, but outside of said sand blast apparatus and barrel and having a lug thereon movable in the path of said cam.

45. In a device of the character described, the combination with a barrel; of a sand mixing chamber mounted thereon and movable therewith; a sand blast nozzle having connection with said mixing chamber, and projecting through the wall of said barrel; and an air nozzle for said sand blast nozzle, said sand blast nozzle occupying a fixed position in relation to said barrel and said air nozzles mounted so as to be movable with said barrel and adjustable and removable relative to said barrel and sand blast nozzles.

46. In a device of the character described, the combination with a barrel; of a plurality of cleats secured thereto upon the inside thereof; sand nozzles mounted in each of said cleats; a mixing chamber in communication with said nozzles mounted upon and movable with said barrel; a plurality of air nozzles corresponding in number with said sand nozzles and registering therewith, projecting into said mixing chamber; and means for controlling the movement of sand into said mixing chamber.

47. In a device of the character described, the combination with a barrel adapted to be rotated; an apparatus constructed to receive used sand from the interior of the barrel, upon the outside thereof and movable therewith; a plurality of sand blast nozzles connected with said barrel in different radial positions and arranged to receive sand from said apparatus; an air nozzle for each of said sand blast nozzles and registering therewith; and means for supplying air to all of said air nozzles.

48. A sand blast machine comprising a rotary barrel; a plurality of sand blast apparatuses constructed and arranged to be revolved with the barrel and located successively around the axis of rotation thereof and having their sand blast nozzles directed into the interior of the barrel; a stationary air supply connection located outside the barrel near an end thereof and in line with the axis of rotation of the barrel; the barrel being provided with a plurality of air inlet conduits having a close moving fit with said air supply connection and leading radially therefrom and communicating with the respective sand blast apparatuses; the barrel and sand blast apparatuses being constructed and arranged to permit the gravity return

of blasted sand directly from the barrel to the sand blast apparatuses when the latter successively are revolved into position beneath the barrel; a stationary air exhaust connection located outside the barrel near an end thereof and in line with the axis of rotation thereof; the end of the barrel next said air exhaust connection being constructed and arranged to permit rotation of the barrel while maintaining a close moving fit with the said air exhaust connection.

49. In a sand blast apparatus; a rotary barrel having a partially perforated wall; a plurality of hoppers connected with said barrel upon the exterior thereof opposite said perforations and arranged to receive the sand that passes from said barrel through said perforations; a plurality of nozzles connected with the wall of said barrel adjacent to said hoppers in such relation thereto as to receive the sand from said hoppers; and an air blast delivered to each of said nozzles whereby the sand from said hoppers is driven therethrough into said barrel.

50. A sand blast machine, comprising a rotary barrel, a sand blast apparatus carried by the wall of the barrel, and means in connection with the barrel to return the abrasive directly to the sand blast apparatus.

51. A sand blast machine, comprising a rotary barrel, a sand blast apparatus carried by the wall thereof, and means providing communication between the barrel and the sand blast apparatus through which the abrasive is returned to said apparatus from the barrel during the operation of the latter.

52. A rotating tumbling barrel having a peripheral sand blast device secured thereto.

53. A rotating tumbling barrel having sand blast apparatus secured thereto, embodying a peripheral sand chamber.

54. A rotating tumbling barrel having sand blast mechanism secured thereto, embodying a peripheral sand and air mixing chamber.

55. A sand blast barrel comprising a rotary barrel body with a substantially clear interior space of approximately cylindrical shape for receiving the work, and sand blast mechanism comprising air and sand mixing instrumentalities located wholly outside of such space and secured to the barrel body.

56. A sand blast mechanism for sand blast barrels comprising a hopper body, a cover hinged thereto, and an air chamber secured to the cover.

57. A sand blast mechanism for sand blast barrels, comprising a hopper body, a cover hinged thereto, an air chamber secured to the cover, and nozzles projecting from the air chamber.

58. A sand blast barrel having a cylindrical body formed of a plurality of plates, said plates having a series of perforations adjacent one end thereof, and the remaining portion of said plates being imperforate.

59. A sand blast mechanism for sand blast barrels comprising a body portion having a hinged cover, an air chamber secured to said cover, a sand and air mixing chamber adjacent said air chamber, and air nozzles leading from said air chamber into the sand and air mixing chamber.

60. In an air valve for sand blast machines, a hollow air inlet plug having an opening in the lateral wall thereof communicating with the interior hollow portion of the plug, and a bushing surrounding said plug and having lateral openings adapted to register with the lateral opening of the plug.

61. In a sand blast machine having a rotary barrel and sand blast nozzles, means for supplying compressed air to said nozzles comprising a head for the barrel, said head having radially disposed air passages leading from the center to the periphery thereof, and means for connecting the peripheral end of said passages to the nozzles.

62. In a sand blast machine having a radial barrel and sand blast nozzles, means for supplying compressed air to said nozzles, comprising a head for said barrel, said head having a hub portion and radially disposed passages leading from the hub portion to the periphery of the head, an opening in the hub portion in communication with said radial passages, and means for connecting the peripheral end of said radial passages to said nozzles.

In testimony whereof we have hereunto affixed our signatures.

FRED WASHBURN.
JOHN R. SHELDON.