May 1, 1934. C. T. WEIR ET AL 1,957,186

SAND BLASTING MACHINE

Filed April 13, 1929 6 Sheets-Sheet 1

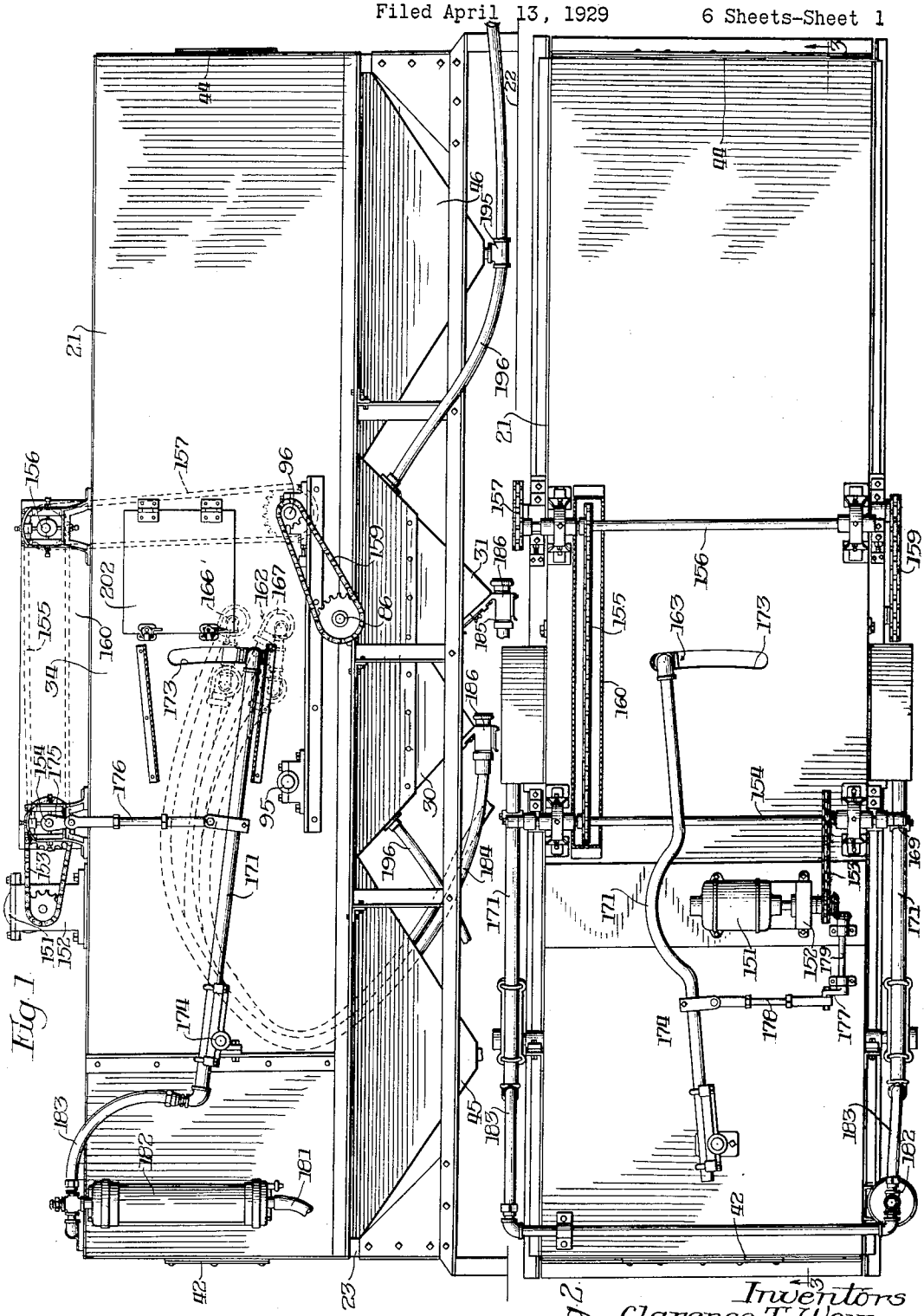


Fig 1

Fig 2

Inventors
Clarence T. Weir
Hans J. Dernehl.

By Cromwell, Greist & Warden Attys.

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SAND BLASTING MACHINE

Filed April 13, 1929 6 Sheets-Sheet 2

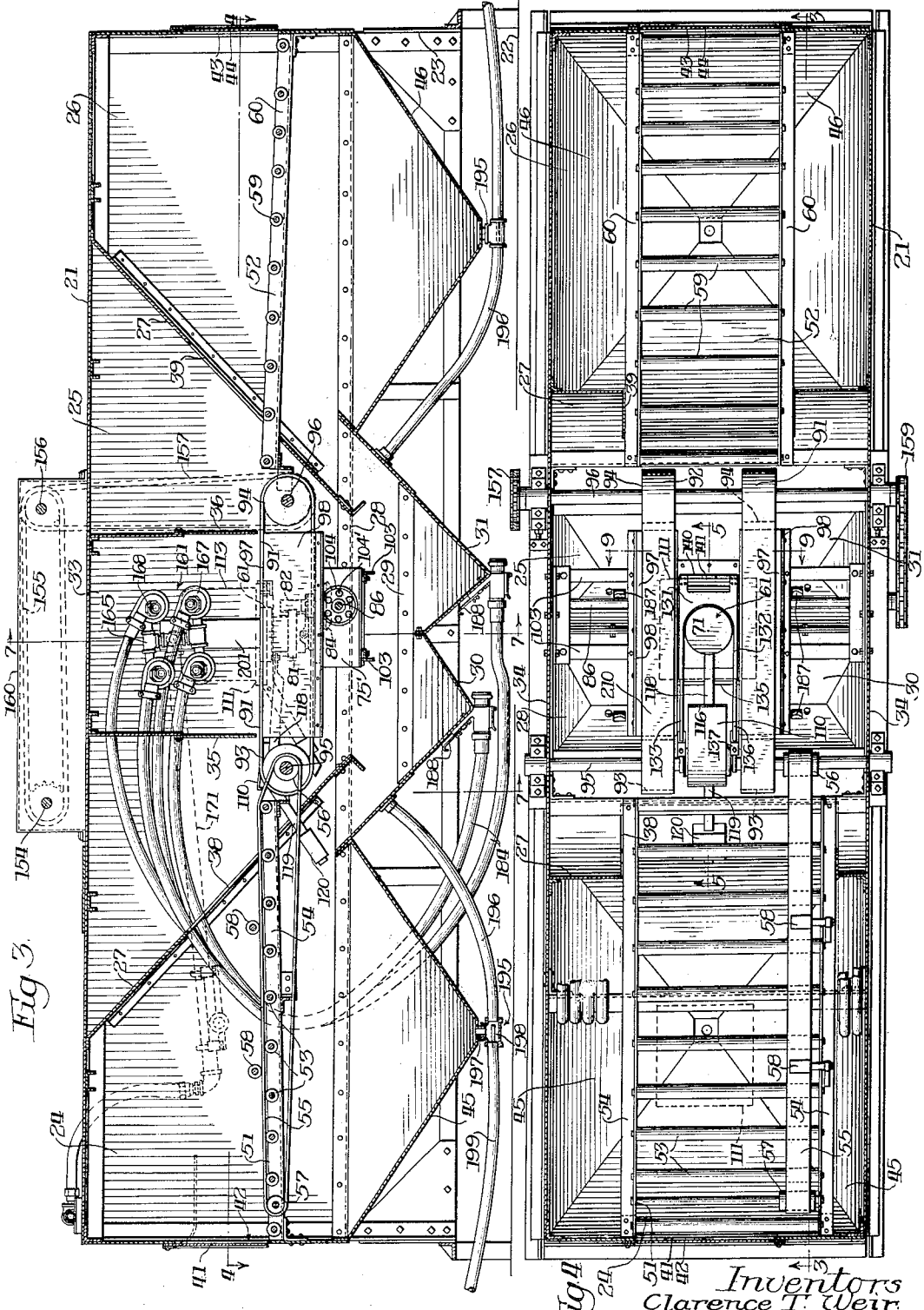


Fig 3.

Fig II

Inventors
Clarence T. Weir
Hans J. Dernehl
By Cromwell, Greist & Warden Attys.

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SAND BLASTING MACHINE

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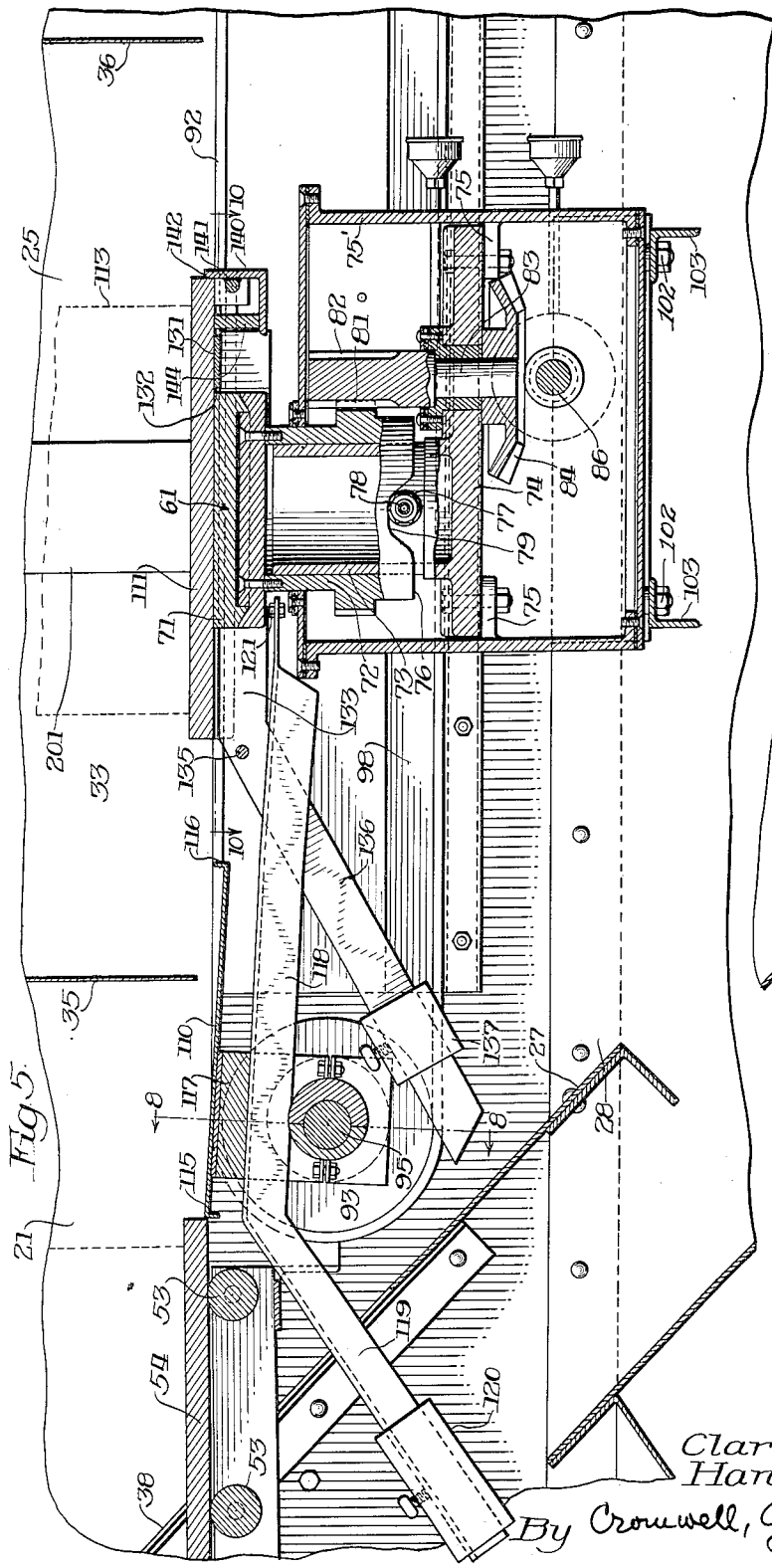


Fig 5.

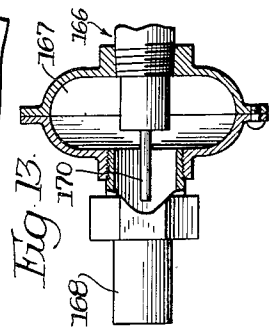


Fig 13.

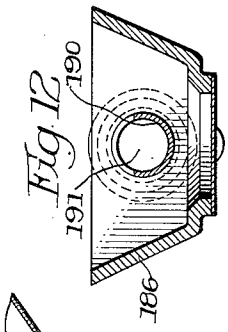


Fig 12.

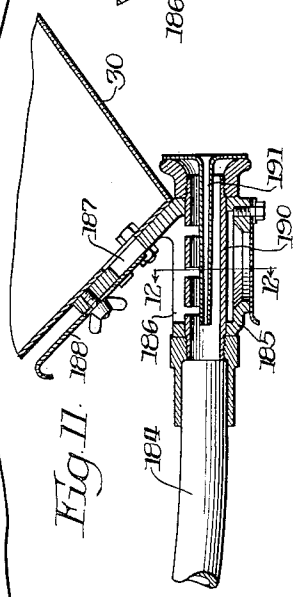


Fig 11.

Inventors
Clarence T. Weir
Hans J. Dernehl.
By Cromwell, Greist & Warden
Attys.

May 1, 1934. C. T. WEIR ET AL 1,957,186

SAND BLASTING MACHINE

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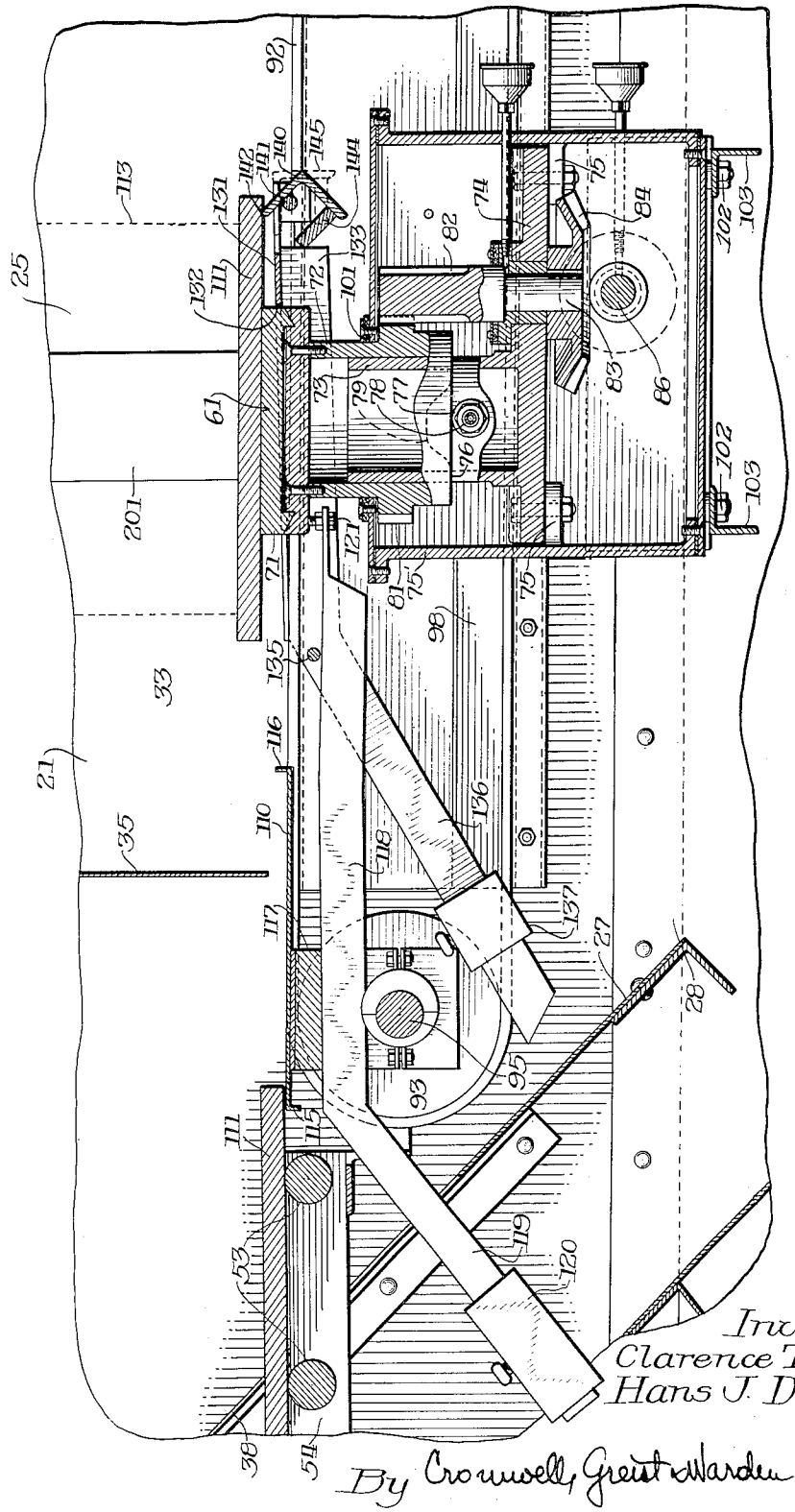


Fig. 6

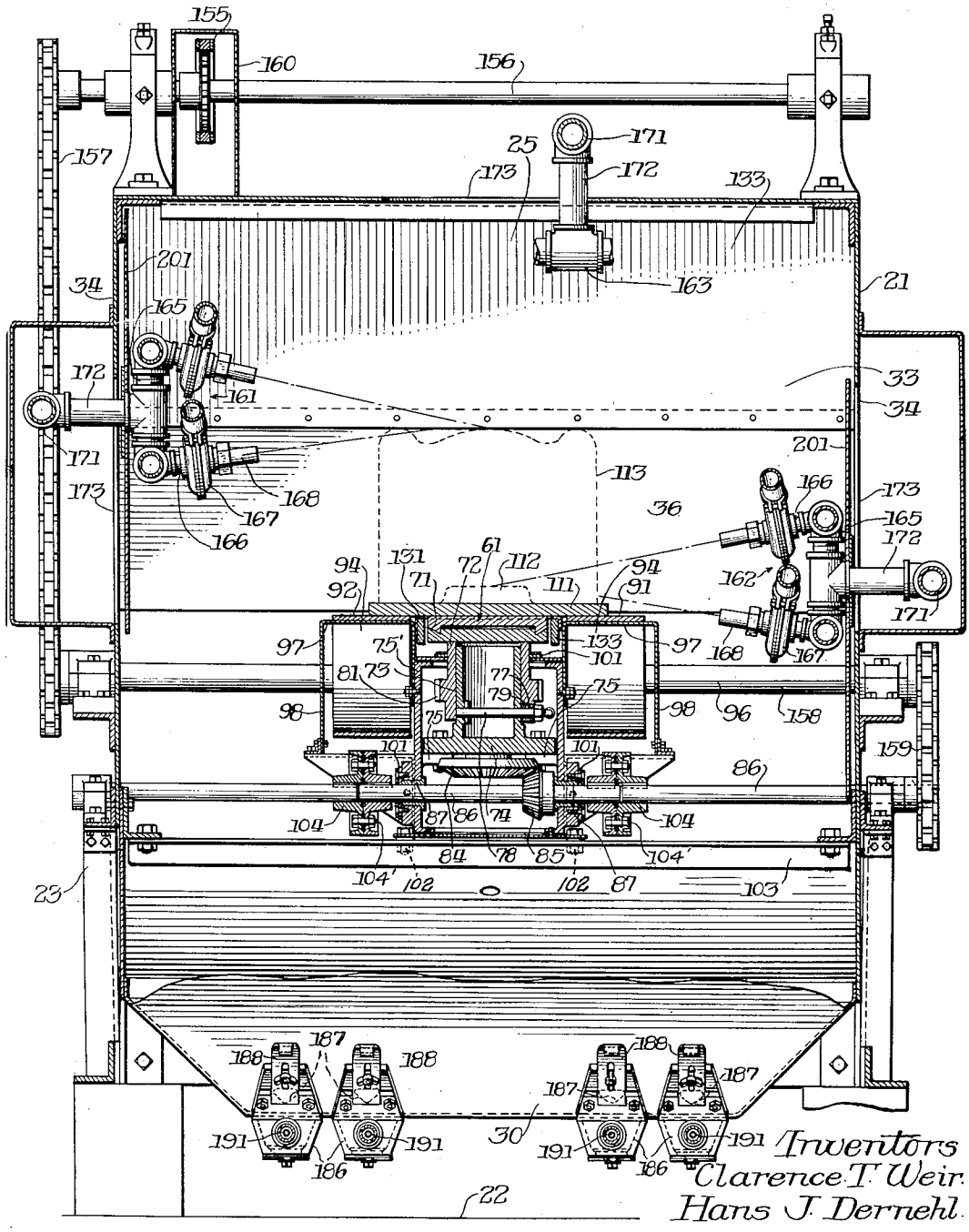
Inventors
Clarence T. Weir
Hans J. Dernehl
By Cromwell, Greist & Warden Attys

May 1, 1934. C. T. WEIR ET AL 1,957,186

SAND BLASTING MACHINE

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Fig. 7



Inventors
Clarence T. Weir
Hans J. Dernehl

By Cromwell, Greist & Warden Attys

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Fig. 8.

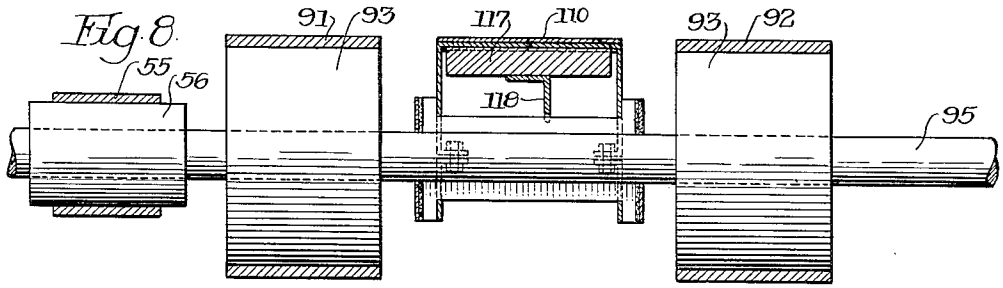


Fig. 9

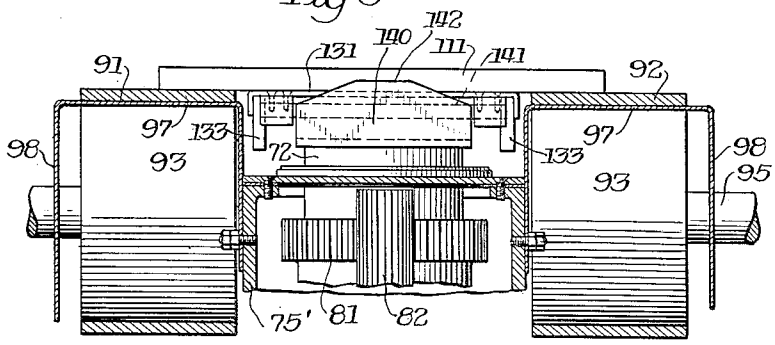


Fig. 10.

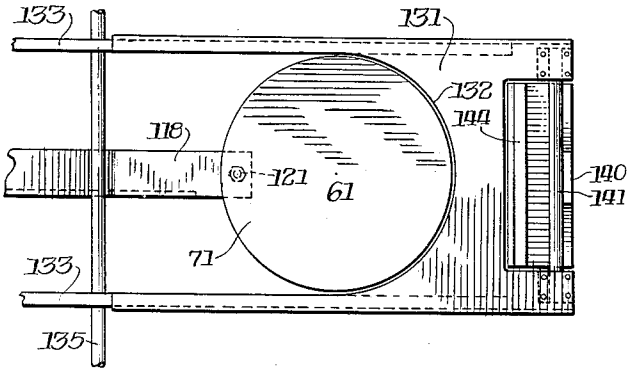
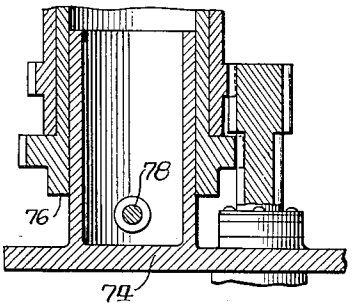


Fig. 14.



Inventors.
Clarence T. Weir.
Hans J. Dernehl.
By Cromwell, Greist & Warden Attys

Patented May 1, 1934 1,957,186

UNITED STATES PATENT OFFICE

1,957,186

SAND BLASTING MACHINE

Clarence T. Weir and Hans J. Dernehl, Chicago, Ill., assignors to Mott Sand Blast Mfg. Co., Chicago, Ill., a corporation of Illinois

Application April 13, 1929, Serial No. 354,754

14 Claims. (Cl. 51—15)

This invention relates to sand blasting machines and it has among its objects the provision of a machine which automatically loads into the same objects that are to be sand blasted, performs the blasting operation, and discharges the objects operated upon, without requiring manual handling of the various operations.

Other objects of the invention are the various detailed features of the machine which contribute to its efficiency and serviceability, as pointed out hereinafter.

Although sand blasting has been, for many years, recognized as one of the most dangerous occupations, heretofore, to our knowledge, almost all of the sand blasting had to be carried out by hand. Such manual sand blasting not only endangers the health of the workers but also makes it necessary to hold down the intensity of the blasting operation, and causes great annoyance by reason of the dust and grits penetrating everywhere in the neighborhood of the blasting space. As a result, such operations not only affect public health but are also slow and require much personnel, space, and time for a given output, with consequent great expense.

According to our invention the dangers and inefficiency of sand blasting operations requiring manual performance or control of the operations are eliminated by the utilization of progressive automatic feeding of the objects to be blasted into a blasting chamber. Provisions are made for retaining the object in the chamber for a period of time. Upon the performance of the blasting operation, the machine automatically discharges the blasted object from the blasting chamber and loads the next following object into the chamber. Because of the tendency of the blasting sand or grits to penetrate into all spaces adjacent the blasting chamber, the construction of such automatic machines presents unusual difficulties.

The novel features of our invention will be best understood from the following description of an exemplification thereof, reference being had to the accompanying drawings, wherein

Fig. 1 is a side elevation of a sand blasting machine of our invention;

Fig. 2 is a plan view of the machine in Fig. 1;

Fig. 3 is a vertical sectional view through the machine along the line III—III of Figs. 2 and 4;

Fig. 4 is a horizontal sectional view through the machine along line IV—IV of Fig. 3;

Fig. 5 is an enlarged vertical sectional view through the center portion of the machine along the line V—V of Fig. 4 showing the position of the several parts at the moment when a new object has just been brought on the rotary table of the blasting chamber;

Fig. 6 is a view similar to Fig. 5 showing the several parts a moment later, with the rotary table carrying the object to be blasted in elevated position;

Fig. 7 is a transverse sectional view through the machine along the line VII—VII of Fig. 3;

Fig. 8 is an enlarged transverse vertical sectional view through the portion of the machine along the line VIII—VIII of Fig. 5;

Fig. 9 is an enlarged vertical sectional view through the portion of the machine along line IX—IX of Fig. 4;

Fig. 10 is an enlarged horizontal sectional view through the machine along line X—X of Fig. 5;

Fig. 11 is a vertical sectional view through the lower end of the main sand hoppers with the feed nozzle attached thereto;

Fig. 12 is a transverse sectional view along the line XII—XII of Fig. 11;

Fig. 13 is a sectional view through a blast nozzle; and

Fig. 14 is a sectional view similar to the view shown in Fig. 5 illustrating a modified form of the table driving mechanism.

The sand blasting machine exemplifying the invention, as shown in the drawings, comprises an elongated rectangular casing 21 made of sheet metal plates and angle irons to constitute a rigid and substantial structure, the casing 21 being supported above the floor level 22 by an angle iron framework 23.

The casing 21 consists of several sections, namely, a loading section 24 at the front of the machine, a blasting section 25 in the center of the machine, and a discharge section 26 at the rear of the machine. The blasting section has the form of a large hopper formed by two inclined sheet metal plates 27 converging downwardly toward the center and having a wide opening 28 at the bottom into a lower extension 29 formed into two hopper sections 30 and 31. Directly above the opening 28 of the main hopper 25 there is formed a blasting chamber 33, the two side walls 34 of the machine casing constituting the side walls of the chamber and flexible walls or aprons 35 and 36 constituting the front and rear walls of said chamber. The inclined front wall 27 of the hopper 25 has an opening 38 through which the objects to be blasted are loaded from the loading section 24 into the blasting chamber 33. The inclined rear wall 27 of the hopper 25 has a similar opening 39 through which the objects blasted are dis-

charged into the discharge section of the casing after performance of the blasting operation. At the front wall of the casing 21 there is provided an entrance opening 41 into the loading chamber 24, the opening being closed by a curtain 42 of yieldable material, such as rubber. The rear wall of the casing has a similar opening 43 for removing the objects blasted from the discharge section 26, this opening being closed by a curtain 44 like the opening 41. The bottom wall of the loading section 24 is formed into a hopper 45, designated here as the loading hopper, and the bottom wall of the discharge section is formed into a hopper 46, designated here as the discharge hopper.

In order to carry the objects to be blasted from the entrance opening 41 toward the blasting chamber 33, there is provided a loading track 51 extending through the loading section 24 in the direction toward the opening 28 into the blasting chamber 33. A discharge track 52 disposed on the other side of the blasting chamber 33 and extending through the discharge section 26 serves to carry away the objects blasted.

The loading track 51 comprises a set of cylindrical rollers 53 extending between two side bars 54. The rollers are arranged to be rotated by means of a driving belt 55 which is driven at the inner end by a driving pulley 56 and is trained at the other end over a pulley 57. The belt is held pressed against the rollers by means of auxiliary rollers 58 pressing downwardly against the upper side of the belt. Because of the rotation of the rollers 53 objects having flat bottoms will be carried forward from the entrance opening 41 towards the blasting chamber 33. As seen in the drawings, the rollers 53 are so mounted that the track formed by them is inclined in a direction toward the entrance on the track so as to avoid forward movement of the objects loaded by gravity, and to rely merely on the rolling action of the rollers 53 for carrying the objects forward toward the blasting chamber. The discharge track 52 is likewise formed by a series of rollers 59 supported between two side bars 60. The rollers 59 form a plane inclined in the direction toward the discharge opening 43 so that the objects placed thereon will move by gravity toward said discharge opening. In the center of the blasting chamber 33 there is mounted, at about the height of the loading and discharging tracks, a rotary table 61 by means of which the objects that are to be blasted are rotated during the blasting operation. This rotary table and the associated parts are shown in detail in Figs. 5, 6 and 7.

The rotary table 61 comprises a circular top plate 71 which is held on the upper end of a hollow sleeve 72 which is slidably and rotatably mounted over a hollow stud 73 projecting upwardly from a base plate 74 that is secured to lugs 75 extending from the side walls of a table driving chamber 75' which completely encloses the entire mechanism for driving the table. The lower end of the sleeve 72 forms a cam surface 76 engaging at one point a cam roller 77 which is journaled on a pin 78 secured to the hollow stud 73. The cam surface 76 constitutes a horizontal annular path having at one part of the periphery a depressed portion 79. Accordingly, the sleeve 72 will be in the lowered position, as shown in Figs. 5 and 9, during the period of the rotary movement of the sleeve when the cam roller 77 is in engagement with the depressed portion 79 of the cam surface, and the sleeve 72 with the table top plate 71 will be in raised position throughout the remainder of the rotary movement of the sleeve around the stud 73. There is further provided on the outer side of the sleeve 72 a ring gear 81 adapted to engage a pinion 82 which is mounted on the upper end of a short shaft 83 that is journaled within the base plate 74. At the lower end of the short shaft 83 is mounted a bevelled gear 84 that is driven by another bevelled gear 85 which is mounted on a horizontal table drive shaft 86 which is journaled in the bearings 87 held in the side walls of the table driving chamber 75'. The teeth of the pinion 82 are so arranged as to secure slidable engagement with the teeth of the gear 81 throughout the full length of the longitudinal movement of the sleeve 72. On both sides of the table 61 are mounted two transfer belts 91, 92 extending between the rear end of the loading track 51 and the front end of the discharge track 52. The belts are trained over two sets of pulleys 93, 94 mounted on horizontal pulley-driving shafts 95 and 96, respectively, which are journaled in bearings on the opposite side walls of the casing. On the forward pulley-driving shaft 95 there is also mounted the driving pulley 56 which drives the belt 55 by means of which the rollers 53 of the loading track 51 are rotated. As seen in Fig. 7, the upper sides of the belts 91 and 92 are supported on the underside by upper walls 97 of belt guards 98 on both sides of the table driving chamber, the lower sides of said belt passing through the interior of the enclosures formed by said belt guards and thus being protected thereby.

As seen in the drawing, all the driving parts of the rotary table that are liable to injury by sand particles are completely enclosed in the table drive chamber 75', only the sleeve 72 extending through an opening in the upper wall of the chamber, and the horizontal driving shaft 86 through the bearing members in the side walls of the chamber. Entrance of sand or grit into the chamber through the openings through which said members move is prevented by felt washers 101 suitably secured over said openings. The entire table drive mechanism may be removed as a unit from the casing 21 by loosening the screws 102 by means of which the table driving chamber is secured to cross bars 103 extending between the side walls of the casing. In order to facilitate such ready removal and, in general, the mounting of the mechanism, the horizontal driving shaft 86 of the table mechanism is made in three sections, the central section extending from the table driving chamber 75' being secured to the two side sections by means of couplings 104. After loosening the couplings 104 and the screws 104' thereof, together with the screws 102, the entire table driving mechanism may be removed as a unit.

Disposed in front of the table 61 in the space between the two transfer belts 91, 92, there is mounted a transfer platform 110 by means of which the work objects are transferred one by one from the loading track 51 to the transfer belts 91, 92. The individual objects are all arranged on flat bases 111, preferably rectangular and uniform. These bases may, for instance, be in the form of rectangular boards or pallets and may have a member 112 for holding the object 113 to be worked on in suitable position for carrying out the blasting operation.

The transfer platform 110 is made in the form of a rectangular sheet metal plate having a down-

wardly bent front edge 115 and an upwardly bent rear edge 116 for stopping the bases of the objects as they reach the respective edges. On the bottom side, the platform plate is provided with brackets 117 that are freely rotatable around the shaft 95 which serves for driving the front pulleys 93 of the transfer belts 91, 92. The bracket 117 of the platform 110 has secured thereto a lever having an actuating arm 118 and a balancing arm 119. The balancing arm 119 carries an adjustable weight 120 tending to tilt the transfer platform 110 in forward direction. The end of the actuating arm 118 engages the underside of the table top 71, a threaded stud 121 serving to adjust the point of engagement. Because of the foregoing arrangement the platform 110 will tilt forwardly in the direction toward the loading section when the table is raised and the platform will tilt rearwardly when the table is lowered.

In the drawings Fig. 3 shows the transfer platform 110 in forwardly tilted position, the table being at that moment in raised position; and Fig. 5 shows the transfer platform in the rearwardly tilted position, the table being at that moment in the lowered position. It will be noted that when the transfer platform is in the rearwardly tilted position, as shown in Fig. 5, the front edge 115 thereof is raised somewhat above the plane at which the working objects arrive so that the forward edge stops the bases and prevents them from moving farther on to the transfer belts 91 and 92. When the transfer platform 110 is tilted to the forward position, as shown in Fig. 6, the forward edge of the platform moves down and permits the base of the next working object waiting at the rear end of the loading section to be advanced forward on to the transfer belts 91 and 92. In this position the transfer platform 110 is substantially in the plane of the transfer belts and so arranged that the object with its base is carried forward until the base reaches the raised rear edge 116 of the transfer platform, as shown in Fig. 6.

The length of the base 111 is such that when its rear edge abuts against the rear edge 116 of the platform 110, the front edge of the base projects in front of the front edge 115 of the platform. The width of the base is such that the sides thereof extend beyond the platform and come in contact with the transfer belts 91, 92 so as to be frictionally carried thereby and moved in the direction from the loading section 24 to the discharge section 26. If, now, the platform in the position as shown in Fig. 6, with the base held thereon against the rear edge 116, is tilted to rearward position, the rear edge 116 drops below the level of the two transfer belts 91, 92. As a result, the base with the object carried thereby is taken up by the belts and moved away from the platform while the raised front edge 115 of the platform prevents the base which is next in line from moving in the meanwhile on to the platform.

Mounted directly around the rotary table 71 is a table platform 131 which serves to stop the base with the object carried thereby when it reaches its place on the table, and to transfer the base with the object to the transfer belts, after the performance of the blasting operation.

The table platform 131 comprises a substantially rectangular metal plate extending between the two upper sides of the transfer belts, the plate being cut out in the center to provide an opening 132 for the table top 71. The platform plate 131 is mounted on a framework formed of two bars 133 which are pivoted on a rod 135 mounted in front of the table 71 between the two belt guards 98. The bars 133 have balancing arms 136 which extend forwardly on the other side of the pivoted rod 135. Balancing weights 137 are slidably adjustable on said balancing arms. Accordingly, the table platform 131 is free to swing around the pivoting axis formed by the rod 135, and by shifting the balancing weight 137 the position of the platform 131 may be readily adjusted. This balancing weight 137 is normally so adjusted as to give the table platform 131 a tendency to tilt upwardly, as shown in Fig. 6, the upward movement of the table platform being limited, and being just sufficient to slightly assist in carrying the weight of the base 111 and the object mounted thereon, when said base rests upon the two transfer belts 91, 92 on both sides of the table platform 131, in the position shown in Fig. 5.

At the rear end of the table platform 131 there is mounted a stop member 140 consisting of an angle iron extending between the two rear ends of the supporting bars 133 and pivoted therein by means of a rod 141. The pivoting point of the stop member 140 is so chosen that when said member is freely suspended, it assumes the position shown in Fig. 6 so that its stopping edge 142 slightly projects above the plane of the platform 131. As a result, the base 111, on being moved by the transfer belts from the transfer platform 110 to the table platform 131, will catch against the upwardly projecting stopping edge 142 of the stop member 140 and swing said member to the upright position, as shown in Fig. 5, the tilting movement of said stop member being limited by a stop bar 144. Upon lifting of the base 111 by the table 71 the stop member 140 is released and swings back into the position in which it is shown in Fig. 6 so that upon the subsequent descent of the base member, the upper edge 142 of the stop member 140 is tilted downwardly to the position shown by dotted lines 145 and the transfer belts are free to carry the base with the object mounted thereon rearwardly toward the discharge track 52 of the machine.

The several mechanisms are actuated by an electric motor 151 mounted on the top of the machine casing. The motor 151 drives through a reduction gear 152 a sprocket chain 153 which in turn drives a shaft 154, the shaft 154 likewise being mounted on top of the casing. The motion of the shaft 154 is transmitted through a second sprocket chain drive 155 to a second driving shaft 156 mounted on the top of the machine casing. From the second driving shaft 156 motion is transmitted through a third sprocket chain drive 157 mounted on the side wall of the casing to the shaft 96 carrying the driving pulleys 94 of the two transfer belts 91 and 92. A fourth sprocket chain drive 159 mounted on the other side of the casing transmits the motion of the belt driving shaft 96 to the table driving shaft 86. The sprocket chain drives are all mounted outside of the spaces within the main casing 21 and may be protected by suitable enclosures or guards 160.

Within the blasting chamber 33 are arranged several sets of blasting nozzles. In the embodiment of the invention illustrated in the drawings, three such sets 161, 162, 163 are used. As shown in Fig. 7, one nozzle set 161 is mounted adjacent to the left side wall of the blasting chamber, the other nozzle set 162 is mounted adjacent to the right side wall of the chamber, and

the third nozzle set 163 is mounted adjacent to the top wall of the chamber. Each set of nozzles 161 to 163 comprises an H-shaped nozzle support 165 made of pipe sections with four nozzles 166 mounted at the four ends of the H-shaped supporting members. The individual nozzles 166 are shown in Fig. 13. Each nozzle comprises a suction chamber 167 terminating into a nozzle tube 168 through which the blast of sand is discharged. A compressed air discharge tube 169 has an air discharge nozzle 170 extending through the suction chamber 167 into the nozzle tube 168. In operation, the suction chamber 167 is connected to a container with sand and a stream of air is discharged through the air discharge nozzle 170. This produces a strong suction in the nozzle 168 and sucks up the sand which is then discharged by the strong stream of air from the air discharge nozzle 170.

The nozzle supporting member 165 of each set of suction nozzles is carried upon a swinging arm 171 mounted outside of the machine casing, there being three such swinging arms, one for each of the nozzle sets. The several arms 171 are made of pipe sections and have bent end members 172 extending into the blast chamber through arcuate openings 173. The individual nozzle supporting members 165 are mounted on the ends of the arm members 172 projecting into the blasting chamber. The hollow swinging arms 171 with the hollow nozzle supports 165 serve to supply compressed air to the individual blast nozzles, and for this reason the compressed air discharge tubes 169 of each nozzle are in direct communication with the hollow spaces of the nozzle supports 165.

A swinging or oscillatory movement is imparted to the two swinging arms 171 on the sides of the casing through crank arms 175 mounted on the ends of the first shaft 154, the rotary motion of the cranks being transformed into reciprocating movement imparted to the arms 171 by means of connecting rods 176. The two cranks 175 on the two ends of the shaft 154 are offset against each other 180 degrees so that when one nozzle set is in its uppermost position, the other nozzle set is in its lowermost position, as shown in Fig. 7. The swinging arm 171 which is mounted on the top of the casing for actuating the third nozzle set 163 is oscillated by means of a crank arm 177 and connecting rod 178 which are driven by an auxiliary shaft 179 that is rotated by the motor 151.

The crank arm 177 for oscillating the top nozzle set 163 is so adjusted that the top nozzle set 163 is directed towards the point of the object to be blasted which is outside of the range of action of the other two nozzles. For instance, as shown in Fig. 7, while the nozzle set 161 is directed to the left upper end of the object to be blasted and the nozzle set 162 to the lower right-hand end of the object to be blasted, the upper nozzle 163 is at that moment directed to the upper right-hand end of the object to be blasted. In the further course of their movements, the left-hand nozzle 161 goes downwardly, the right-hand nozzle set 162 goes upwardly and the upper nozzle set 163 goes from right to left, and this staggered movement of the several nozzle sets is cyclically repeated throughout the operation of the machine. In other words, the several nozzle sets follow each other in sequence so as to uniformly cover the entire area that is to be blasted, the motion of the several sets being dephased against each other. Compressed air for the nozzle is supplied through a compressed air supply line 181 leading into a moisture separator 182 mounted on the machine casing. From the air outlet of the moisture separator, the air is supplied to the swinging arms 171 by means of flexible hose connections 183.

Sand is supplied to the suction chambers 167 of the several blast nozzles by means of a flexible sand suction hose 184 connecting the suction chambers with sand suction nozzles 185 mounted at the lower ends of the hopper sections 30 and 31 at the bottom of the blasting chamber. Such suction nozzle is shown in detail in Figs. 11 and 12. It comprises a feed box 186 mounted directly under an outlet opening 187 near the lower end of the hopper, a slide 188 serving to adjust the width of the opening. Extending through the length of the feed box there is a pipe 190 slotted at its top so as to permit entrance of sand into the pipe. The front end of the pipe 190 has connected thereto the sand suction hose 184. From the rear end of the pipe 190 there extends into the center thereof an air inlet pipe 191 having an outwardly flared end portion which forms a closure over the end of said pipe.

With the foregoing arrangement, the suction produced in the blast nozzle by the air streaming from the air discharge nozzle induces a stream of air through the air inlet pipe 191, which stream of air picks up the sand particles and carries them through the hose 184 into the suction chamber 167 and the pipe 168 of the blast nozzle.

As seen in the drawings, the several nozzles of each set are so mounted on the nozzle holder that the blast issuing from the several nozzles converge but do not quite meet in a space where the object to be blasted is mounted so as to produce a cyclonic or whirling movement of the sand particles, thereby securing a high blasting efficiency.

The hoppers 45 and 46 at the bottom of the loading and discharge sections of the machine are intended to collect sand particles getting into said sections from the blasting chamber. The sand or grits collecting in said hoppers 45 and 46 are transferred over into the main hopper sections 30 and 31 at the bottom of the blasting chamber by means of suction nozzles 195 and hose sections 196 leading from said suction nozzle to said hopper sections 30 and 31, as shown in Fig. 3. The suction nozzles 195 comprises an outer tubular chamber 197 connected to the bottom of the hoppers, and an air discharge nozzle 198 opening in the direction of the transfer hose 196, the air discharge nozzle being connected to a compressed air supply pipe 199. The jet of air blowing through the discharge nozzle 198 sucks up the sand accumulating at the bottom of the end hoppers 45, 46 and carries it over into the main hopper sections 30 and 31.

Protection is also provided against sand particles escaping from the blasting chamber through the arcuate openings 173 for the nozzle arm end members 172. To this end there is mounted at the arm end on the inner side of the opening a flexible baffle sheet 201, as shown in Fig. 7, the baffle sheet being of such width and length that it covers the adjacent opening throughout the entire range of the movement of the corresponding nozzle set.

In order to initially load the machine with the blasting sand or other blasting material, a door 202 is provided in the side wall of the blasting section. Through the opening of this door a quantity of sand or other blasting material may

be charged into the two hopper sections 30, 31 at the bottom of the blasting chamber.

In order to operate the machine, the driving motor 151 is energized and compressed air is admitted to the several nozzle arms 171 and therethrough to the blast nozzles 166. As a result, a blast of sand is sent from the three sets of blast nozzles 161, 162, 163. The rotation of the motor 151 causes the several nozzle arms 171 to oscillate and, as a result thereof, the blast of sand from the nozzles is not confined to one single point but covers a defined area of the space above the rotary table 71 in which the object to be blasted is held for the blasting operation.

As pointed out before, the several nozzle sets are so arranged that the spaces covered by the blasts of the several nozzles overlap each other to secure thorough blasting action. In addition to moving the several nozzle sets, the driving motor 151 also sets in motion the belt driving mechanism and the table driving mechanism. As a result, the two transfer belts 91 and 92 are driven in the direction indicated by the arrows 210. The movement of the driving belts 91, 92 is imparted through the pulley 56 to the driving belt 55 of the loading track 51 thereby causing the rollers 53 on the track to rotate in a direction so as to carry objects placed thereon toward the blasting chamber 33.

Simultaneously therewith the table driving shaft 86 causes the table 71 to rotate in a continuous movement, the cam 77 causing the table to move at the same time up and down once during each rotation. This movement of the table is so timed through the shape of the cam surface 76 on the table sleeve 72, that the table moves in elevated position throughout substantially the entire time of the rotation and is lowered only for a relatively short period during which the object blasted is discharged from the table and a new object loaded thereon. This up and down movement of the table 71 controls the swinging movement of the transfer platform 110 by means of which the objects to be blasted are transferred one by one from the loading track 51 onto the transfer belts 91, 92 for movement into the space above the table 71.

The several curtains 35, 36, 42 and 43 over the openings into the individual chambers or sections of the casing are down, so that each chamber is substantially closed against the other chamber and separated therefrom. At the same time the suction nozzles 195 at the bottom of the hoppers of the loading and discharge sections exercise a continuous suction or exhausting action in these spaces and carry away any dust, sand or grit particles that may get from the blasting space 33 into either one of said sections.

With the machine so operating, a row or series of objects to be blasted or worked upon are delivered into the loading opening 41 of the loading section of the machine. The individual objects are rolled into the machine through said opening either by hand or mechanically. Upon moving the object to be blasted through the opening 41 onto the track 51, the yieldable curtain 42 recedes permitting the object to enter. The rotating rollers 53 on the loading track pick up the object and start moving it forward toward the blasting chamber, the curtain 42 dropping back over the entrance opening 41 as soon as the object has passed therethrough. In this way one object after another is loaded into the entrance section and carried forward in a row on the loading track 51.

Upon moving forward on the loading track each object passes through the opening 38 in the forward wall of the hopper bounding the blasting section and is carried until the base of the object catches against the forward edge 115 of the transfer platform 110. This position of the platform corresponds to the lower position of the rotary table 71, as shown in Fig. 5. In the course of its further rotation, the rotary table 71 is raised by the action of the cam 77 and at the same time the transfer platform 110 is tilted forwardly to the position shown in Fig. 6. The forward edge 115 of the transfer platform 110 sets free the base 111, which is now carried forward onto the transfer platform 110 by the action of the rollers 53 and the other objects on the rollers, and by the belts 91 and 92.

The transfer platform, being in the position shown in Fig. 6, stops by its rear edge 116 the forwardly moving object, which is held in this position throughout the entire period of time while the rotary table 71 is rotated in the raised position. After performing such rotation, the table 71 reaches the point of its periphery where it is lowered over the cam surface depression. This downward movement of the table 71 causes the transfer platform 110 to tilt into the position shown in Fig. 5. The transfer belts 91, 92 thereupon grip the object held until then on the transfer platform 110 and move it forward over the now lowered rear edge 116 of the platform. The object is carried forward to the space above the table platform 131 and the table 71, while the next following object is still held in front of the transfer platform by the now raised forward edge 115. Upon being carried forward onto the transfer platform and rotary table 71, the rear end of the object to be worked upon catches against the edge 142 of the stopping member 140, bringing it to the upright position shown in Fig. 5, in which position the object is held against further movement. This transfer of the object from the transfer platform 110 to the table platform 131 takes place during the short period of time while the rotary table is in the lowered position. Immediately upon accomplished transfer, the table is slightly raised by the cam 77, lifting the object to be worked upon together with its base 111 within the space exposed to the action of the blast nozzle. The rotation of the table with the object carried thereby is continued. While the object is thus rotating with the table 77 the blast nozzles swing over their prescribed path so that at the end of the complete revolution thus performed by the object the entire surface thereof has been covered by the strong blast issuing from the nozzles.

This composite movement of the blast nozzles relatively to the objects to be blasted secures a scanning of the entire surface of the object to be blasted by the blasting stream and results in very efficient and thorough blasting action. At the end of the rotation of the object on the table 71 in its elevated position, as shown in Fig. 6, the table 71 is lowered, and the base 111 with the object descends upon the table platform 131, tilting the stopping member 140 to a horizontal position so that the transfer belts are free to carry the object toward the discharge track 52 in the discharge section 26 of the casing. The finished objects arriving one after another on the discharge track 52 of the discharge section of the machine member may then be removed through the discharge opening 43, either manually or by a transfer mechanism. The foregoing sequence of operations is repeated on each successive working object loaded into the machine, the machine

being thus capable of handling very large quantities of work without any manual assistance. In going through the machine from chamber to chamber, the individual objects pass readily through the yieldable curtains 35, 36, separating the chambers, these curtains returning immediately to their vertical positions as soon as the objects have passed therethrough. In this way the strong blast of sand and grit issuing from the blast nozzles in the blasting chamber 33 is substantially confined to the blasting chamber, the sand and grit dropping down into the hoppers 30, 31 from which they are sucked up through the suction pipes 184 leading to the individual nozzles.

As shown in Fig. 3, the forward and rear walls 27 of the hopper bounding the blast section 25 of the machine are inclined, forming a large hopper so that any particles of sand or grit escaping from the blasting chamber 33 are returned into the two hopper sections 30, 31 at the bottom of the blasting chamber. The sand and grit particles which get into the loading section 24 or discharge section 26, through the openings 38, 39 of the main central hopper, are collected in the auxiliary hoppers 45, 46 of said sections and carried back into the central hopper sections 30, 31 by the conduits 196.

In the arrangement described above, all the moving parts are efficiently protected against the very strong destructive action of the blast and grits. Thus, the driving mechanisms for the several shafts are placed outside of the casing compartments that are in communication with the blast chamber. The driving mechanism for the rotary table is housed in a completely closed chamber. All the openings through which moving shafts enter into the space exposed to the blast or flying grit particles are protected through washers such as shown at 101 in Fig. 7. The parts which move within the space exposed to flying sand particles, such as the belts and the driving shafts therefor and the track rollers, are all by nature of such character that they are not liable to injury or damage by the grit particles. In this way a combination of protected and unprotected moving parts is obtained which secures efficient automatic action of the blasting machine in the way described hereinbefore, the several parts being so related and of such design as to eliminate damage and necessity for frequent repair by reason of the destructive action of the dust and grits flying in the several spaces.

Since the operation of the machine is entirely automatic, a much stronger sand blast can be used than in the case where the blasting must be done partially manually, the strength of the blast in the latter case being limited by the necessity for protecting the operators against the flying grit dust caused by too strong a blast.

As seen from the foregoing, we provide by our invention a progressive automatic sand blasting machine in which the individual working objects are carried into the blasting chambers on substantially uniform bases. Chambers are provided both in front and at the outlet side from the blasting chamber and the objects blasted are automatically moved from the entrance chamber into the blasting chamber for performing the blasting operation, and are then removed from the blasting chamber into the outlet chamber upon completion of the blasting operation. The several chambers are separated and closed against each other so as to divert flying sand particles and grits and avoid their entrance into the inlet and outlet chambers of the machine. Grit and dust particles which nevertheless enter into the inlet or outlet chamber of the machine are collected and are sucked away and returned back into the main collecting hoppers at the bottom of the blasting chamber.

The blasting apparatus is so correlated with the movement of the individual objects through the machine that each object is subjected to a thorough blasting over its entire surface by causing the sand blast to move in a composite movement against the object blasted so as to cover the entire space in which the object is held in blasting position in the blasting chamber. A special mechanism for individually delivering the working objects into the blasting chamber and for discharging it therefrom is so arranged as to be substantially fool-proof and remain in operative condition notwithstanding the tremendous blast action in the space where it is mounted. The two platforms 110 and 131 of this mechanism are so arranged that they assist the belts in holding up the object that is to be blasted during the periods when the object is held by said platforms stationary on the belts, so as to reduce the friction incident to the movement of the belts past the object.

By adjusting the relative movement of the nozzles and the turn table, the period during which any portion of the working object is exposed to the blast may be readily regulated. The arrangement may be also so modified that the rotary table 71 performs several revolutions before being lowered for discharging the finished object and loading thereon the next object to be worked upon. In such case, a second sleeve is mounted within the sleeve which carries the gear 75, the second sleeve being also rotated but at a slower rate and being provided with a cam surface 76 by means of which the turn table is lifted up and down, such arrangement being shown in Fig. 14.

The machine of our invention is not confined to the use of sand but may be used with any other blasting material, such as steel grits and the like. The broad features of our invention are likewise not limited to the particular details of mechanism employed in the machine described hereinabove but many other forms of the invention will suggest themselves to those skilled in the art. It is accordingly desired that the appended claims be given a broad construction commensurate with the scope of the invention within the art.

We claim:

1. In a blasting machine, a blasting chamber, a loading chamber, a discharge chamber, a loading track in said loading chamber, a discharge track in said discharge chamber, a movable support in said blast chamber for receiving and holding the objects during the blasting operation, means for controlling the movement of objects from said loading track to said support, said controlling means being controlled by said support, means for transferring said objects from said loading track to said support, nozzle means in said chamber for producing a blast of grits against the object on said support, and means for producing a relative movement between said support and said nozzle means.

2. In a blasting machine, a blasting chamber, a horizontal table support in said blasting chamber, a loading track and a discharge track communicating with said chamber and arranged at opposite sides of said support, means for producing a progressive movement of a series of objects

to be blasted from said loading track onto the support in said blasting chamber and from said support to said discharge track, nozzle means for producing a blast of grits against the object on said support, and means for producing a movement of said support in said blasting chamber relative to said nozzle means and also to the direction of movement of the objects from said loading track to said discharge track.

3. In a blasting machine, a blasting chamber, a support in said blasting chamber, a loading track and a discharge track communicating with said chamber, means for producing a progressive movement of a series of objects to be blasted from said loading track onto the support in said blasting chamber and from said support to said discharge track, nozzle means for producing a blast of grits against the object on said support, means for producing a predetermined periodical relative movement between said support and said nozzle means within said chamber distinct from the said progressive movement, and means for controlling the rate of said progressive movement in response to said periodical movement.

4. In a blasting machine, a blasting chamber, a support in said blasting chamber, a loading track and a discharge track communicating with said chamber, means for producing a progressive movement of a series of objects to be blasted from said loading track onto the support in said blasting chamber and from said support to said discharge track, nozzle means for producing a blast of grits against the object on said support, means for producing a periodical movement of said support relative to the direction of said progressive movement, and means for controlling the rate of said progressive movement in response to said periodical movement.

5. In a blasting machine, a blasting chamber, a vertically movable support in said chamber for holding a working object to be blasted, nozzle means for producing a blast of grits directed against said object on said support, means for producing a periodical movement of said support in said chamber, and means for loading and unloading working objects from said support in response to said periodical movement.

6. In a blasting machine, a blasting chamber, a loading track and a discharge track connected to said chamber, a vertically movable support in said chamber for an object to be blasted in said chamber, nozzle means for directing a blast of grits against said object on said support, means for rotating said support, means controlled by said support for effecting the progressive loading of objects to be blasted from said loading track to said support, and means controlled by said support for effecting the progressive unloading of the blasted objects from said support to said discharge track.

7. In a blasting machine, a blast chamber, a support within said chamber for the object to be blasted, loading means at one side of said support, unloading means at the opposite side of said support, means for producing a blast of grits against an object on said support, means for effecting predetermined relative movement between said support and said grit-blasting means, means for transferring the object from said loading means to said unloading means, means timed with relation to the relative movement between said support and the grit-blasting means for effecting movement by the transfer means of the object from the loading means to said support at the beginning of said predetermined movement, and means for effecting movement by the transfer means of the object from said support to the unloading means upon the termination of said predetermined movement.

8. In a blasting machine, a blasting chamber, a vertically-movable support in said chamber for holding the objects to be blasted, means for rotating said support, means for moving the support vertically during its rotation, blasting means for directing a blast of grits against the object on said support, transfer means for feeding the object to be blasted to said support and for removing the same from said support after the blasting operation, means controlled by the vertical movement of said support for rendering said transfer means operative to feed the objects to be blasted periodically to said support, and means also controlled by the vertical movement of said support for rendering said transfer means operative for removing the objects from said support after the blasting operation.

9. In a blasting machine, a blasting chamber, a vertically-movable support in said chamber for holding the objects to be blasted, means for rotating said support, cam means acting on said support for moving the same vertically during its rotation, blasting means for directing a blast of grits against the object of said support, transfer means for feeding the object to be blasted to said support and for removing the same from said support after the blasting operation, means controlled by the vertical movement of said support for rendering said transfer means operative to feed the objects to be blasted periodically to said support, and means also controlled by the vertical movement of said support for rendering said transfer means operative for removing the objects from said support after the blasting operation.

10. In a blasting machine, a blast chamber, a loading chamber, a discharge chamber, a loading track in said loading chamber, a discharge track in said discharge chamber, a movable support in said blast chamber for receiving and holding the objects during the blasting operation, conveying means arranged between said loading track and said discharge track for transferring said objects from the loading track to the movable support and from the latter to the discharge track, a tiltable transfer platform between the loading track and the movable support, means between said tiltable transfer platform and said movable support responsive to the movement of said support for tilting the transfer platform relatively to said conveying means, whereby to render the latter operative to feed the objects to said support, means for blasting the object on said support, and means responsive to the movement of said support to render the conveying means operative to transfer the blasted object from the support to the discharge track.

11. In a blasting machine, a blast chamber, a loading chamber, a discharge chamber, a loading track in said loading chamber, a discharge track in said discharge chamber, a movable support in said blast chamber for receiving and holding the objects during the blasting operation, conveyor belts arranged between said loading track and said discharge track and disposed at opposite sides of said movable support for transferring said objects from the loading track to the movable support and from the latter to the discharge track, a tiltable transfer platform between the loading track and the movable sup-

port, means between said tiltable transfer platform and said movable support responsive to the movement of said support for tilting the transfer platform relatively to said conveyor belts, whereby to render the latter operative to feed the objects to said support, means for blasting the object on said support, and means responsive to the movement of said support to render the conveyor belts operative to transfer the blasted object from the support to the discharge track.

12. In a blasting machine, a blast chamber, a loading chamber, a discharge chamber, a loading track in said loading chamber, a discharge track in said discharge chamber, a movable support in said blast chamber for receiving and holding the objects during the blasting operation, conveying means arranged between said loading track and said discharge track for transferring said objects from the loading track to the movable support and from the latter to the discharge track, a tiltable transfer platform between the loading track and the movable support, means between said tiltable transfer platform and said movable support responsive to the movement of said support for tilting the transfer platform relatively to said conveying means, whereby to render the latter operative to feed the objects to said support, means for blasting the object on said support, and a tilting member arranged adjacent the said movable support and responsive to the movement of said support at a predetermined point in such movement to render the conveying means operative to transfer the blasted object from the support to the discharge track.

13. In a blasting machine, a blast chamber, a loading chamber, a discharge chamber, a loading track in said loading chamber, a discharge track in said discharge chamber, a movable support in said blast chamber for receiving and holding the objects during the blasting operation, conveyor belts arranged between said loading track and said discharge track and disposed at opposite sides of said movable support for transferring said objects from the loading track to the movable support and from the latter to the discharge track, a tiltable transfer platform between the loading track and the movable support, means between said tiltable transfer platform and said movable support responsive to the movement of said support for tilting the transfer platform relatively to said conveyor belts, whereby to render the latter operative to feed the objects to said support, means for blasting the object on said support, and a tilting member arranged adjacent the said movable support and responsive to the movement of said support at a predetermined point in such movement to render the conveyor belts operative to transfer the blasted object from the support to the discharge track.

14. In a blasting machine, a blast chamber, a loading chamber, a discharge chamber, a loading track in said loading chamber, a discharge track in said discharge chamber, a movable support in said blast chamber for receiving and holding the objects during the blasting operation, conveying means arranged between said loading track and said discharge track for transferring said objects from the loading track to the movable support and from the latter to the discharge track, a tiltable transfer platform between the loading track and the movable support, means between said tiltable transfer platform and said movable support responsive to the movement of said support for tilting the transfer platform relatively to said conveying means, whereby to render the latter operative to feed the objects to said support, means for blasting the object on said support, a table platform arranged adjacent the said movable support, and a tilting stop member carried by said table platform and serving to arrest the movement of the objects to be blasted at a predetermined point in the movement of the support, whereby to position the objects on the movable support, said tilting stop member also serving at another predetermined point in the movement of the support to render the conveying means operative to transfer the blasted object from the support to the discharge track.

CLARENCE T. WEIR.
HANS J. DERNEHL.