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UNITED STATES PATENT OFFICE

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CONTINUOUSLY OPERATING SAND BLAST APPARATUS

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The invention relates to a sand blasting apparatus for cleaning the surfaces of large castings and other large bodies of metal, either rolled, stamped or forged, by means of abrasive particles projected against the surface. While the abrasive material now in general use is granular metal, the process is termed for convenience in the language of the art, sand blasting.

In the previous practice the sand blast table has operated successfully, but it was necessary to turn the castings by hand so that the different sides could be presented successively to the blast in order that the entire surface might be exposed to the blast and cleaned effectively, and it was further necessary in most instances to interrupt the operation from time to time in order that the sand blast tank might be replenished or a new tank connected to the nozzles.

The present invention provides a continuously operating apparatus by means of which large castings as internal combustion motor cylinder blocks and other cylinder blocks, boiler sections and the like, are treated in a continuous operation, the necessity for handling being reduced to the extent that the castings to be treated are merely placed on a continuously operating conveyor or presented to such a conveyor which carries them through the sand blasting zone, the castings being fed to the conveyors by means of rollers or other antifriction or power driven conveying and supporting means, or manually presented at the convenience of the operator, it not being necessary to stop the conveyor.

To this end the machine consists of sand blasting nozzles above and below the work, mounted to swing across the path of the work, which is presented to the nozzles by means of a continuously operating conveyor which carries it through the sand blasting zone between the nozzles, the nozzles being reciprocated or oscillated on paths above and below the work, moving back and forth transversely of the path of the work so that it is exposed on all sides to the blast of abrasive issuing from the nozzles. An important point is that the conveyor is so constructed that the bottom surface of the work which rests thereon is fully exposed to the blast, the area of the surface which might be supposed to be shielded from the blast by the supports being on examination as to the quality of the work found to be indistinguishable from the surface which is fully exposed at points where the blasting is unobstructed. The nozzles are shown as assembled in two clusters or groups, one above and one below the conveyor in work supporting position, the nozzles in each group being arranged at different angles contributing to the desired result, that all points on the surfaces of the work be reached by the abrasive.

In addition to the sand blast cabinet containing the continuously operating conveyor and the continuously reciprocating or oscillating nozzles, the apparatus includes a continuously operating pressure tank in which the pressure in the lower chamber is maintained while the abrasive is replenished. A continuous supply of abrasive under air pressure is thus provided. This is directly connected to the upper and lower nozzles.

The apparatus includes means for oscillating the nozzles with a harmonic motion giving a tendency to dwell at each end of the lateral path of the nozzles so that they treat the side surfaces of the castings as fully as the upper and lower surfaces. This harmonic motion is used when it is desirable on account of the arrangement of the surfaces or for any reason to concentrate the blasting effect on the outside of the work. The disclosure also includes a cam motion for operating the nozzles, and, by conforming the cam surfaces to the desired result, the blasting effect may be concentrated at the center or a greater or less intensity of the blasting effect on any section may be obtained.

In the accompanying drawings I have illustrated so much of a sand blasting apparatus embodying the features of the invention as is believed to be necessary to a full understanding of the invention and to the manner of applying, constructing, operating and using the same.

In the drawings:

Figure 1 is a top plan view of the entire apparatus drawn on a reduced scale, illustrat-

ing the manner of presenting a casting to the machine.

Figure 2 is an end elevation looking at the apparatus from the left in Figure 1.

Figure 3 is a fragmentary elevation showing the central portion of the apparatus looking from the side remote from the observer in Figure 1.

Figure 4 is a section on the line 4—4 in Figure 1, looking in the direction of the arrows, i. e., toward the observer in Figure 1.

Figure 5 is a top plan view showing a fragment of the conveyor by which the work is presented to the nozzles.

Figure 6 is a vertical section on the line 6—6, Figure 5, showing one of the supporting bars of the conveyor in elevation.

Figure 7 is a detail view showing in a fragmentary way the mechanism for swinging the nozzle arms, a cam being substituted for the crank shown in Figure 1.

Figure 8 is an elevation in the plane of Figure 6 showing the nozzle and the work, the latter being in the form of engine cylinder castings resting on the supporting base of the conveyor.

Figure 9 is a section at right angles to Figure 8 showing the same subject matter.

Referring to the drawings by numerals, each of which is used to indicate the same or similar parts in the different figures, the construction shown comprises a sand blast cabinet 1, a moving support or table in the form of an endless conveyor 2, sprayer heads 3 and 4 above and below the conveyor in work supporting position, swinging pipe arms 5 and 6, supporting the respective sprayer heads 3 and 4, continuously operating sand blast tank 7, delivery table or conveyor 8 and feed table or conveyor 9.

In accordance with the details of the preferred structure shown, the cabinet 1 consists of a rectangular enclosure constructed of any suitable material as boiler plates or the like, and having opposed openings 9 and 10 at the front and rear for the moving work support or conveyor, said openings extending high enough above the conveyors to provide for the passage of the work on the conveyors in entering and leaving the cabinet. Each of these openings is provided with a vestibule or passage 11 closed by a series of curtains 12, preferably arranged in pairs as indicated to prevent the escape of the abrasive.

The walls of the cabinet 1 extend well below the conveyor 2 into contact with the walls of the base 13, which is funnellike, the front and rear walls 14 and 15 being inclined downwardly toward a central trough 16, containing a screw or equivalent conveyor 17 for removing the used abrasive and moving the same toward the elevator or upright chain bucket conveyor or the like by which it is returned to the tank 7. The walls of the cabinet below the work supporting level of the conveyor at 2 are provided with opposed openings 19 and 20, for the bottom or return portion 21 of the work support or conveyor 2 and at the top the cabinet is formed with a roof or top closure 22 having a stack or uptake for the dust laden air within the conveyor, the same being indicated by reference character 24. This stack may lead to a suitable dust arrester or air filter not shown.

Referring now to the moving work support which is of great importance not only on account of the fact that it operates continuously and therefore contributes to the continuously operating features of the machine, but because of its features which provide for the presentation of the work to the blast in such a manner that the entire surface of the work is so exposed to the impact of the abrasive that no portion of the surface of the work when treated shows any evidence of having been protected from the abrasive by the work support or otherwise. In fact, the side of the work resting on the support cannot be identified in this way.

This work support consists of a series of transverse bars 26, Figures 5 and 6, which bars are of a cross section which is elongated vertically, being comparatively thin laterally. These bars preferably have their top edges serrated so that they are provided with a series of upwardly projecting supporting points 27 spaced in the direction of their length or they may be otherwise provided with supporting edges, points or surfaces, which are reduced to the minimum.

These supporting bars 26 are in the preferred form of the invention illustrated, transversely arranged as to the path of the work and supported at their ends and moved through the cabinet along the path selected for the presentation of the work to the abrasive stream by means of chains 28 and 29, one on each side of the conveyor or work support. These chains consist each of successive sets 30 and 32 of short bars. All of these bars are shown as flat and of narrow elongated cross section as are the work supporting bars, the long dimension being placed vertically. The bars of the sets 30 are arranged in threes, side by side spaced apart, the ends of each set of three bars 30 being joined by pins 33 on which are mounted spacing and journal sleeves 34 and 35 by which the bars are spaced. On these sleeves in turn are mounted suitable rollers 36 between the ends of the inner bars 30′, 30″.

These rollers are flanged at 37 on their axial ends which are on the side of the chain nearest the center of the conveyor. Between the outer two bars 30″ and 30′ at the center the illustration shows a single roller 39 mounted on a short pin 38 which may have a suitable journal sleeve. This roller is shown as flanged on its outer axial end sur-

face so that the two sets of rollers 36 and 39, for this arrangement is repeated throughout the length of the chain, are flanged on their opposite or outer surfaces, i. e. toward the sides of each chain. The chain comprises alternately arranged with the sets of three bars 30, corresponding and cooperating sets 32 of two bars 40, 40′ connecting the sets 30. These bars are connected to the pins 33 at the ends of the sets 30. The inner bars of both sets 30, 32 carry angular brackets or angle irons 41, each having one leg secured to the ends of the respective chain bars 30″ and 40′ the other leg which is the longer, projecting inwardly is secured to the ends of the transverse supporting bars 26 in any suitable manner as by means of bolts 42.

The work support or conveyor as shown runs on suitable guides or guide and supporting rails 44. At the front the chains are respectively engaged and driven by sprockets 45, the guides at the rear being curved downwardly and forwardly to receive the bottom half of the chain and lead it upwardly to the plane in which the work is supported. The curved portion of the guide is indicated by reference character 46. As shown, the curve is arcuate.

The sprockets 45 may be driven in any suitable manner. In accordance with the arrangement of the elements in the form of the machine illustrated, the sprockets 45 are driven through reducing gearing to be described, from an electric motor 50 mounted on a base, and having a small sprocket 51 on the motor shaft which sprocket drives a chain 52, having a driving engagement with a relatively large sprocket 53 on the shaft of which is a small sprocket 54 which drives by way of a chain 55 a relatively large sprocket 56 on the transverse shaft 57 on which the sprockets 45 are mounted and by which they are driven.

The continuously operating sand blast tank 7 described in applicant's Patent No. 1,710,619, provides a continuous supply of mixed air under pressure and abrasive to the cabinet. To this end the tank 7 is provided with a mixing valve 58 at the bottom from which a stream of air under pressure and abrasive is led by way of a horizontal pipe 59 to a T 60 to which is connected a riser 61 leading by way of a fitting 62 to a horizontal pipe 63 which is connected laterally to a T 64 to the bottom arm of which T 64 a flexible hose 65 is connected by way of a swivel fitting 66. This hose 65 is connected at its opposite end to the upper swinging pipe arm 5 carrying nozzle head 3.

The lower nozzle arm 6 is provided with a continuous supply of mixed air under pressure and abrasive by way of a pipe 68 connecting the T 60 to a T 69 which is plugged at one end, as are several of the T's just described, the other end being connected to a drop pipe 70, leading to a T 71. One arm of this T is closed, the other arm being connected to a horizontal pipe 72 which is connected at its other end to a T 73, which is, in turn, connected as is the T 64 to a hose 75 which leads upwardly and forwardly to the lower nozzle arm 6.

The ends of the nozzle arms 5 and 6, to which the hose 65 and 75 are connected, are mounted on suitable vertical trunnions 76 carried in bearings 77 and supported on I beams 74. Each nozzle arm 5, 6 is shown as braced laterally by tension members 78 secured at one end to a collar 79 on the arm near the swinging end and at the other end to the ends of a cross bar 80 through which the particular pipe arm 5 or 6 is passed. This cross bar is in turn braced by a tension member or strap 81 passed about the trunnion and apertured to pass the rear end of the pipe arm. This strap is secured at each end to the ends of the cross bar 80. The nozzle arms enter the cabinet by way of slots 82 formed in inwardly curved panels 83 in the sides of the cabinet, the curved panels 83 covering the slots 82 at all positions of the pipe 5 to prevent the escape of abrasive and at the forward or swinging end, each nozzle arm is supported by a roller 85 running on a track or way 86.

The roller 85 is carried on the arm by means of a depending bracket 87.

The arms are vibrated by means of links 89 connected to the arms by means of brackets 90 carrying suitable bearings for the pins 91 on the ends of the links. These links are, in turn, actuated by crank pins 92, which in the form of the invention shown in Figure 1, are carried by upper and lower crank discs 93, mounted on a vertical shaft 94 driven by worm wheel 95 which is engaged by a worm or worm gear 96 on the shaft 97 carrying a spur gear 98 which meshes with spur gear 99 on the shaft of an electric motor 100, which is energized by current from any suitable source.

In Figures 1, 2 and 4, I have illustrated the manner of returning the abrasive from the cabinet by way of screw conveyor 17 and chain bucket conveyor 18. This latter may be driven in any suitable manner. In accordance with the illustration an electric motor 110 carries on its shaft a small spur gear 111 which meshes with a larger gear 112 on a transverse shaft 114 which carries at its opposite end a sprocket 115 driving a chain 116 which, in turn, operates a larger sprocket 117 on a shaft 118 carrying a drum or pulley 119 which engages and operates the bucket conveyor.

Figure 7 shows the details of a cam drive for the nozzle arms, it being understood that by means of the harmonic motion resulting from the use of the crank pin drive, the blasting is concentrated on the outer edges of the work, i. e., the upright sides of the work which

are not so fully exposed as the horizontal surfaces are exposed to the blast for a greater period than are corresponding areas of the horizontal surfaces or more particularly the central portion of the work. Otherwise stated, the sand blasting effort is concentrated on the outer edges of the work and lesser blasting is done at the center. By use of the cam disc, the blasting effect may be concentrated at the center with the lesser effect on the edges.

In his connection, it will be noted that the location of the nozzles on the ends of the swinging arms and their inclination and the number of the nozzles makes it feasible to cover all of these surfaces of the work, an important feature being that the swinging nozzle arms and nozzle heads are located both above and below the work.

Referring again to the construction illustrated fragmentarily in Figure 7, a crank arm 178 is secured to a fin 176, mounted in suitable bearings 175 on the frame. This pin has secured to it a follower arm 174, carrying cam followers 179, engaging two sides of cam rib 180 on a cam 181, on shaft 170 which is driven by a worm 182, engaging a worm gear 183 on the shaft 170. The worm 182 is carried by a shaft 184 driven by a large toothed gear 185 which meshes with a smaller spur gear 186 carried on and driven by the shaft 187 of a motor 188. This cam drive may be substituted for the crank pin drive, cams 181 being substituted for discs 93, giving any desired distribution of the sand blast, particularly when it is desired to concentrate on the central portions of the work rather than on the lateral surfaces or edges.

In Figures 8 and 9, I have shown the work in the form of internal combustion engine cylinders supported on the conveyor or work support, in the process of treatment by the sand blast as the work passes through the cabinet. It is of interest to note the manner of supporting the work on the points or supporting surfaces 27 of the transverse bars 26, and the manner in which the abrasive is focussed on the work coming in contact equally with the top, bottom and side surfaces of the work, and it is of particular interest to note that the bottom surface 120 is in no wise shielded by the supports which contact the work at points 27 only supporting bars 26 being serrated as to their top surfaces and of extremely narrow width in a horizontal plane and transversely to the direction of feed.

It is also of importance that by merely feeding the work to the continuously operating conveyor and supplying the abrasive to the tank the operation of cleaning castings is carried on continuously without the necessity for turning the work or handling it in any way other than in presenting it to the conveyor or support 2 while in motion.

I have thus described specifically and in detail a single embodiment of my invention with slight modifications in order that the nature and manner of constructing and operating and using the same may be clearly understood, however, the specific terms herein are used descriptively rather than in a limiting sense, the scope of the invention being defined in the claims.

What I claim as new and desire to secure by Letters Patent is:

1. The combination in a sand blasting machine of a conveyor for moving the work, the conveyor having upwardly tapered spaced supporting points for the work of extremely small area, so that practically the entire bottom surface of the work is exposed, and means above and below the conveyor for directing a blast of abrasive materials against the work from the top and bottom, said means comprising groups of nozzles rigidly connected and arranged in converging relation and means for reciprocating the nozzles transversely to the motion of the conveyor.

2. The combination in a sand blasting machine of a continuous conveyor and sand blast nozzles above and below the conveyor directed toward the conveyor, the conveyor having drive chains at the sides and transverse supporting members connecting the chains, said supporting members being of reduced horizontal dimension at the top in work supporting position and elongated vertical dimension in work supporting position and having supporting portions of further reduced area.

3. The combination in a sand blasting machine of a continuous conveyor and sand blast nozzles above and below the conveyor directed toward the conveyor, the conveyor having roller chains at the sides including a series of longitudinal bars connecting the rollers, transverse supporting members connecting the bars, said supporting members being of reduced horizontal dimension at the top in work supporting position and elongated vertical dimension in work supporting position, and a top work supporting edge which is serrated to reduce the area of contact with the work and obviate interference of the support with the sand blast directed at the bottom surface of the work.

4. The combination in a sand blasting machine of a continuous conveyor, transversely oscillating sand blast nozzles above and below the conveyor directed toward the conveyor, the conveyor having drive chains at the sides and transverse supporting members connecting the chains, the outer portion of said supporting members being of reduced horizontal dimension in the direction of the length of the chain, sprockets for driving the chains at the forward end of the top traverse, and stationary guiding and supporting members only, for the chains at the rear end of the top traverse with which stationary members

the chains pass in sliding contact, the resistance due to this contact and the weight of the bottom traverse of the conveyor serving to tighten the top traverse of the conveyor, obviating the necessity for other takeup means.

Signed by me at Hagerstown, Maryland, this 13 day of December, 1929.

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P141

May 2, 1933. F. J. HULL 1,907,198

CONTINUOUSLY OPERATING SAND BLAST APPARATUS

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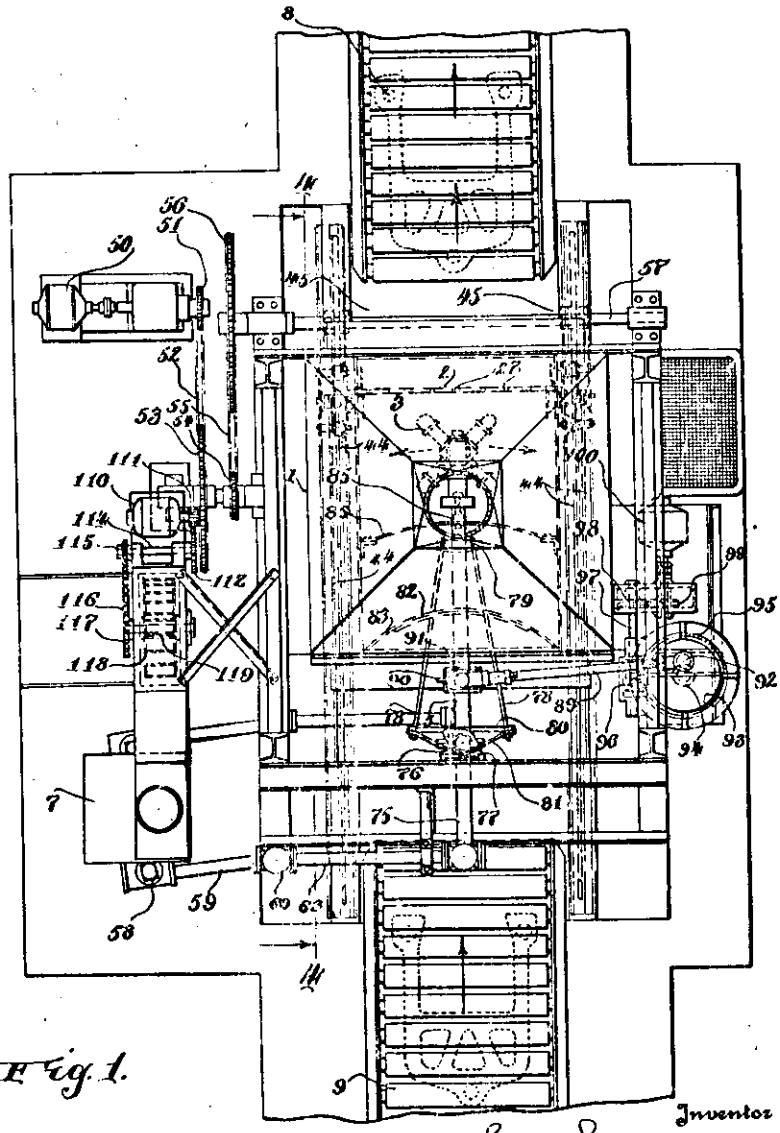

Fig. 1.

Witness

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May 2, 1933. F. J. HULL 1,907,198

CONTINUOUSLY OPERATING SAND BLAST APPARATUS

Filed Dec. 28, 1929 7 Sheets-Sheet 2

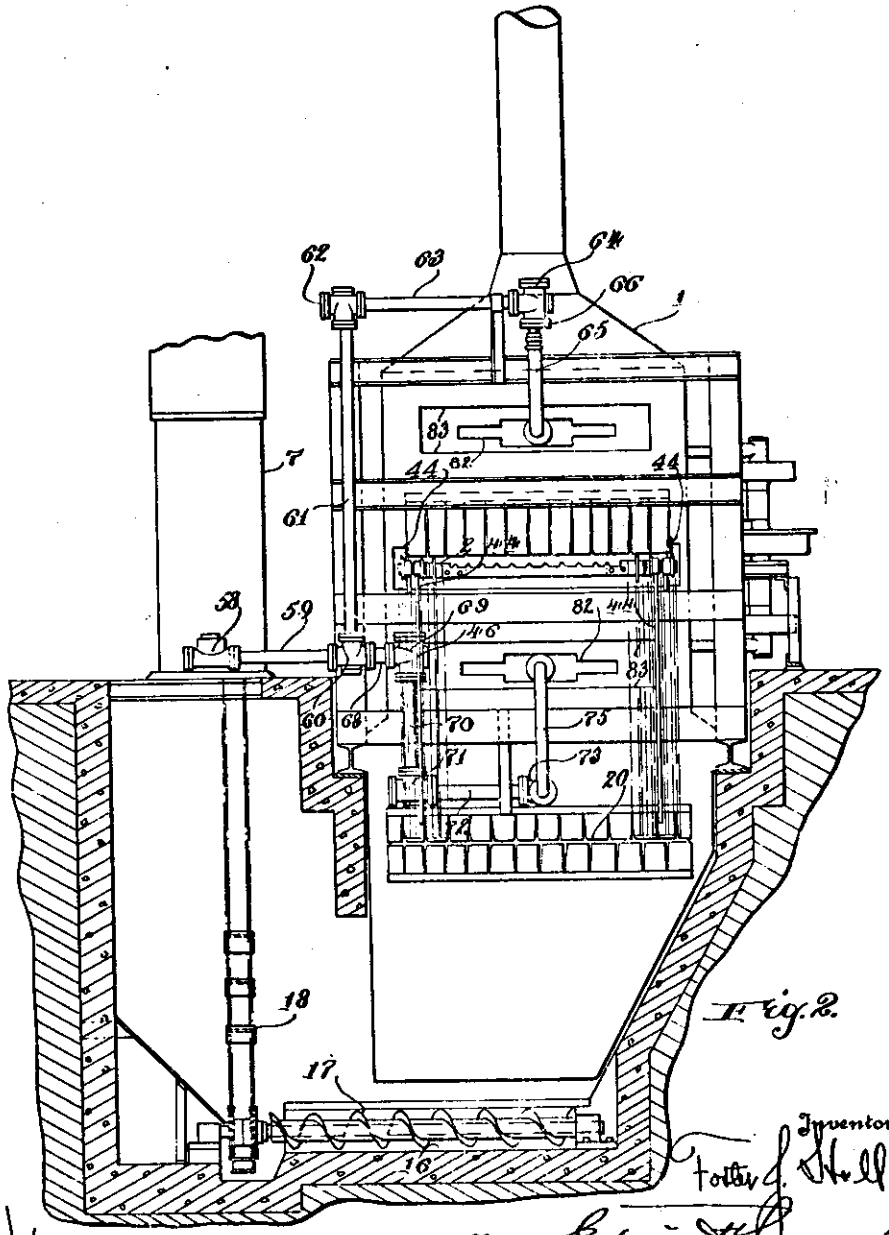

Fig. 2.

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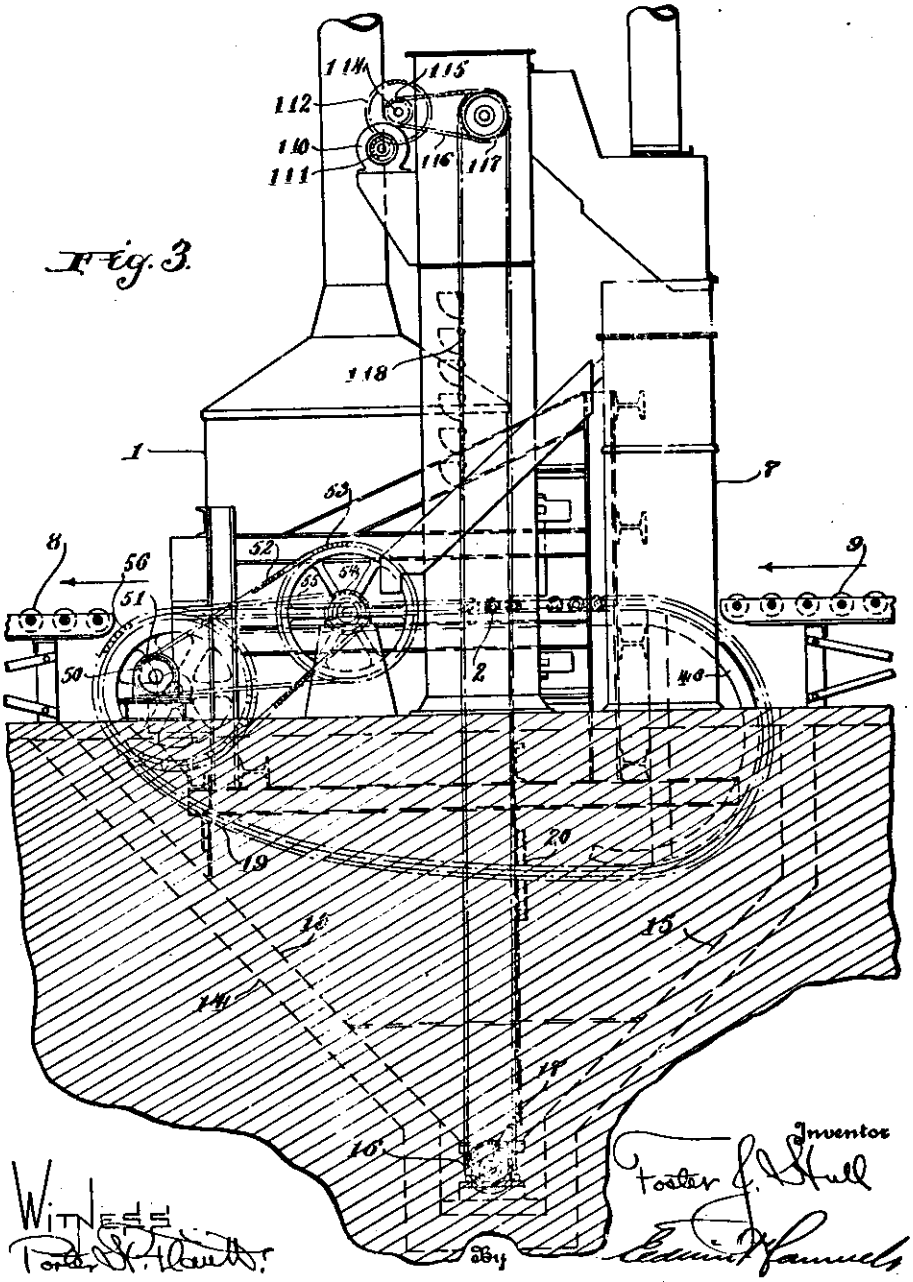
CONTINUOUSLY OPERATING SAND BLAST APPARATUS

Filed Dec. 28, 1929 7 Sheets-Sheet 3

Fig. 3.

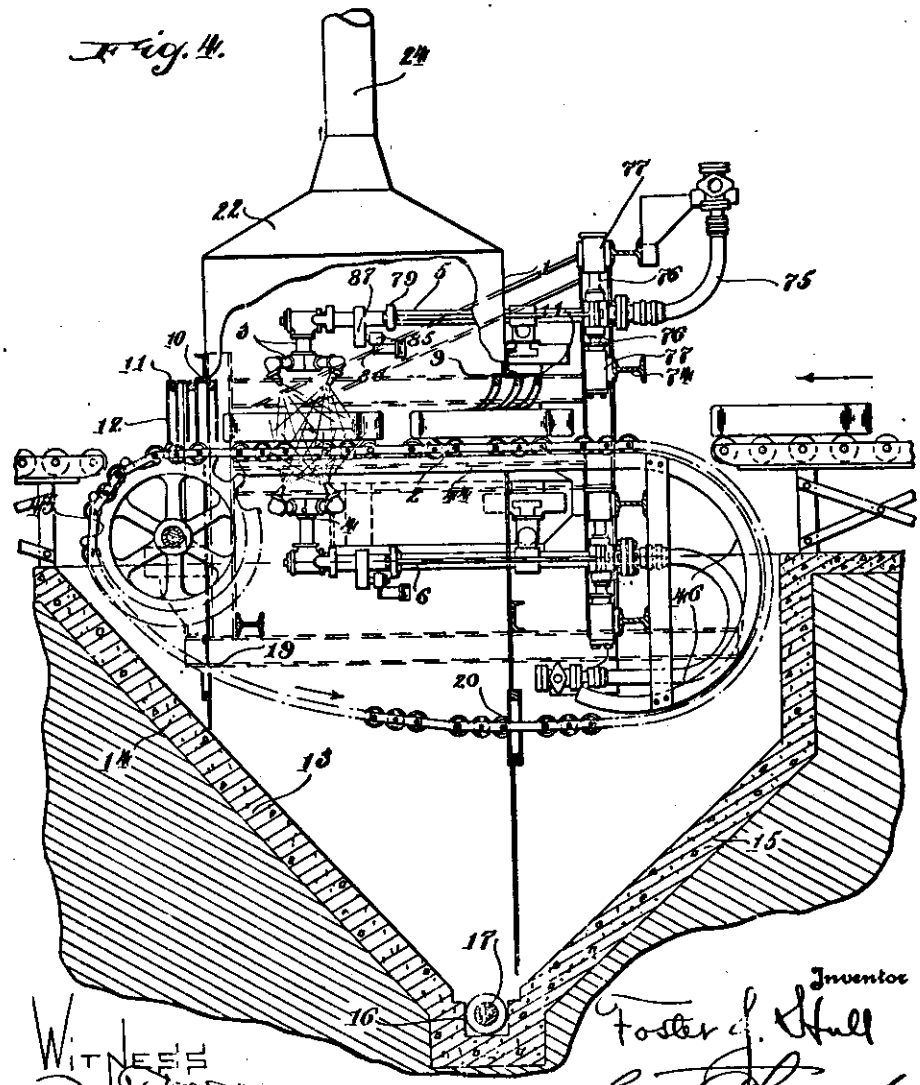


May 2, 1933. F. J. HULL 1,907,198

CONTINUOUSLY OPERATING SAND BLAST APPARATUS

Filed Dec. 28, 1929 7 Sheets-Sheet 4

Fig. 4.



WITNESS:

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CONTINUOUSLY OPERATING SAND BLAST APPARATUS

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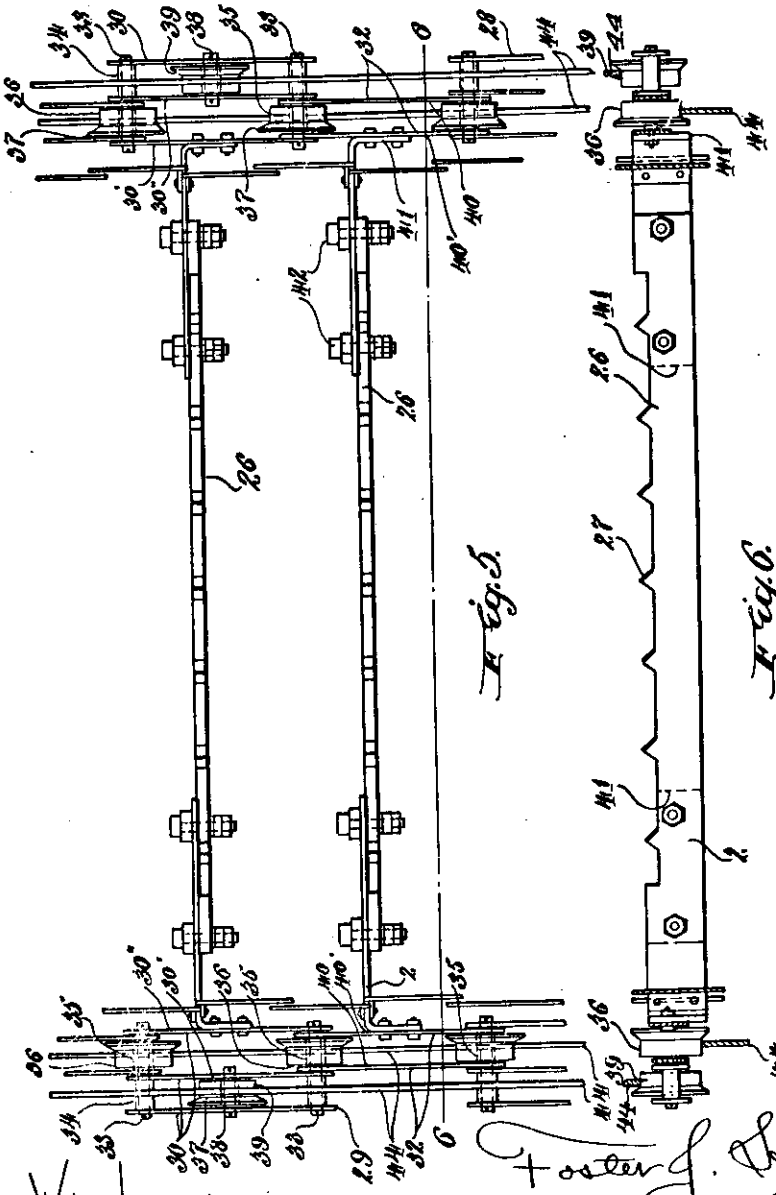

Fig. 5.

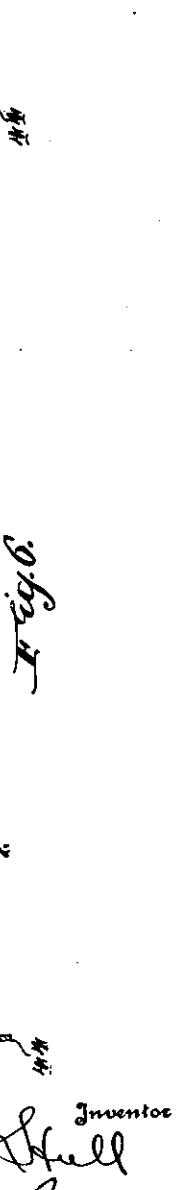

Fig. 6.

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May 2, 1933. F. J. HULL 1,907,198

CONTINUOUSLY OPERATING SAND BLAST APPARATUS

Filed Dec. 28, 1929 7 Sheets-Sheet 6

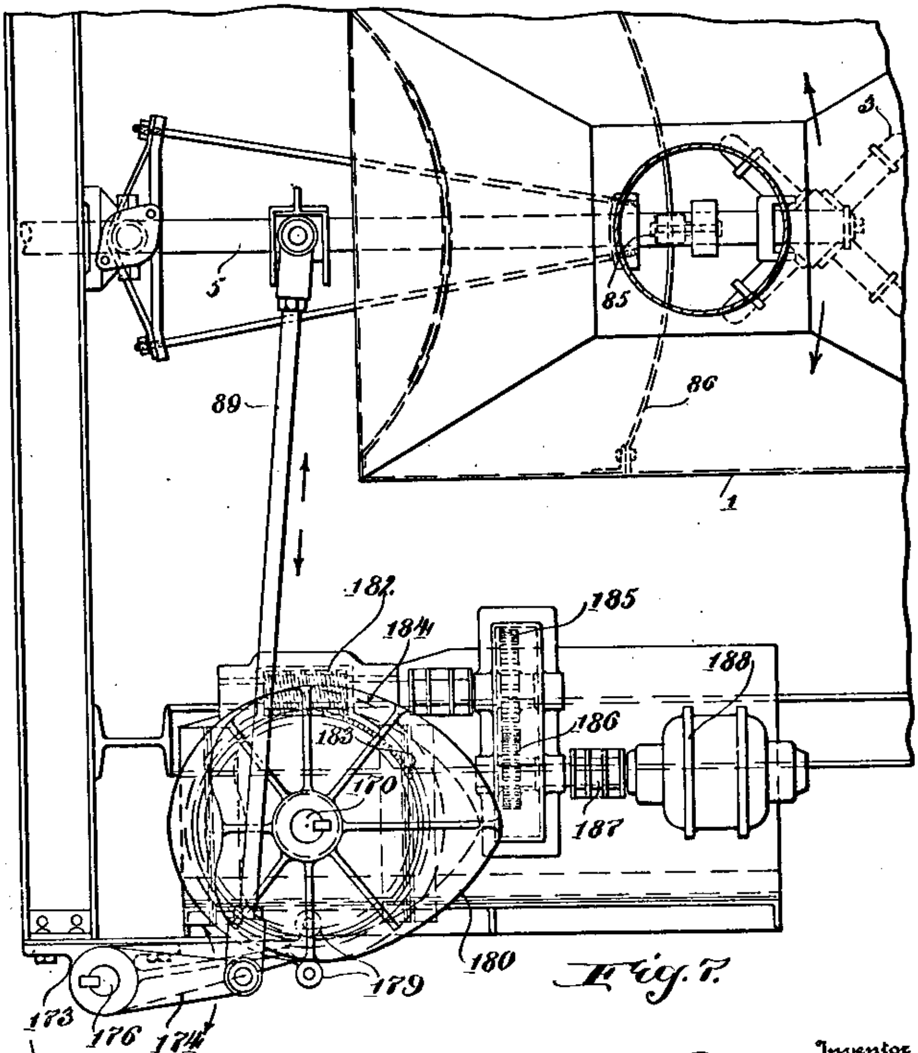

Fig. 7.

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May 2, 1933. F. J. HULL 1,907,198

CONTINUOUSLY OPERATING SAND BLAST APPARATUS

Filed Dec. 28, 1929 7 Sheets-Sheet 7

Fig. 8.

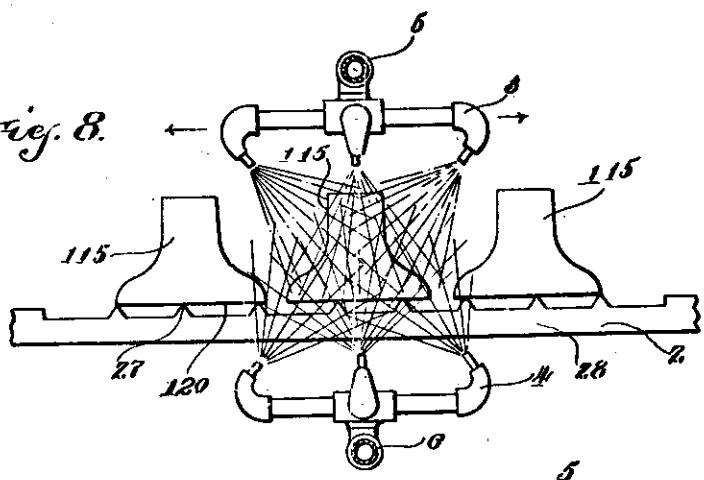
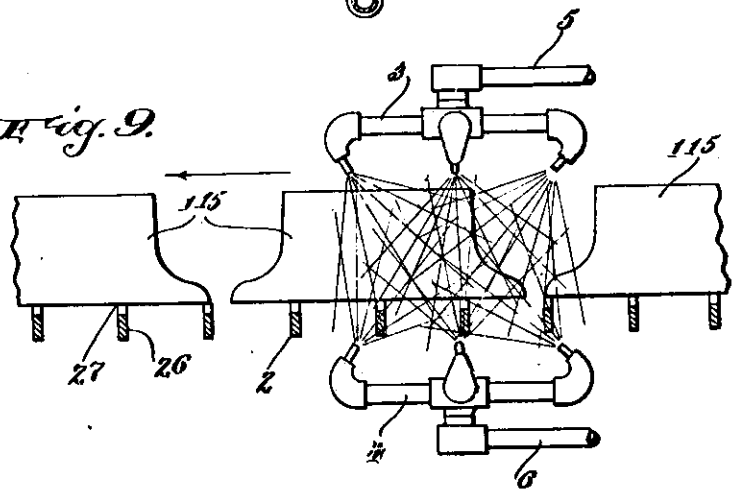


Fig. 9.



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