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METHOD AND APPARATUS FOR SEPARATING WASTE PARTICLES FROM MEDIA USED IN SAND BLASTING

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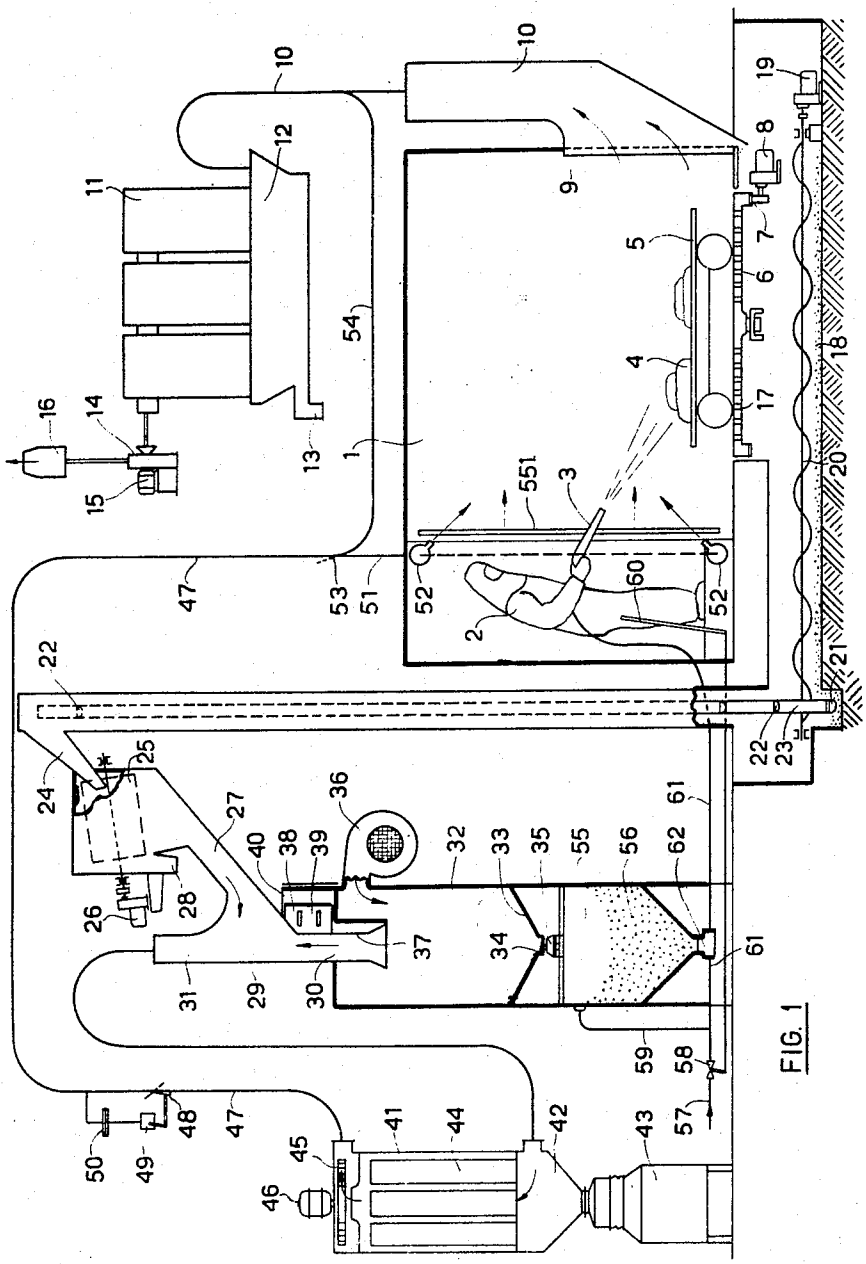


FIG. 1

INVENTORS
ERIK RAGNAR LJUNGDELL
KARL GUSTAV EVERT KRANTZ

BY
Howson & Howson
ATTYS.

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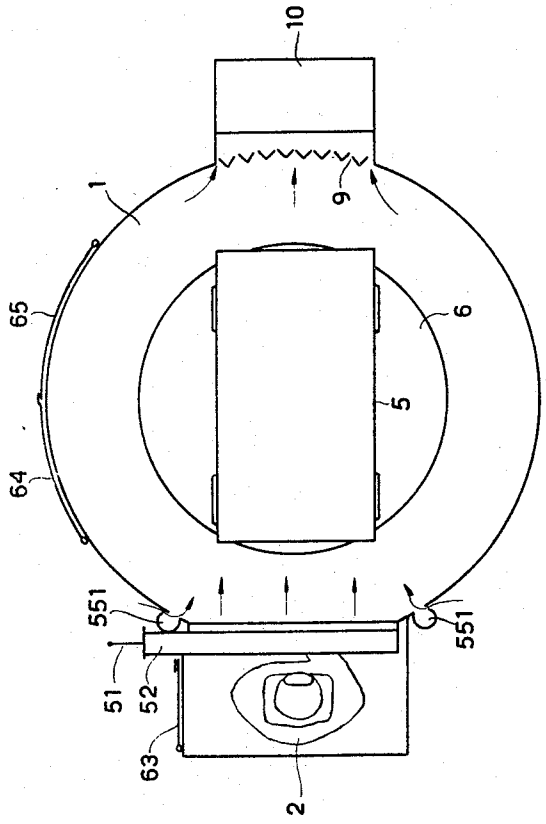


FIG. 2

INVENTORS
ERIK RAGNAR LJUNGDELL
KARL GUSTAV EVERT KRANTZ
BY Howson & Howson
ATTYS.

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METHOD AND APPARATUS FOR SEPARATING WASTE PARTICLES FROM MEDIA USED IN SANDBLASTING

Erik Ragnar Ljungdell, Bofors, Karlskoga, and Karl Gustav Evert Krantz, Stockholm, Sweden, assignors to AB Svenska Flaktfabriken, Stockholm, Sweden, and AB Bofors, Bofors, Karlskoga, Sweden

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5 Claims. (Cl. 209—139)

Sand blasting as a method for removing fixed particles such as foundry sand and scales etc. from surfaces has become extensively used in industry. The blasting medium usually consists of quartz sand or other mineral sand in natural form or artifically treated, or so called steel sand or other metallic medium. Steel sand which is most commonly used for cleansing of castings consists usually of granulated white pig iron in different grain sizes depending on use.

The reason for blasting a surface, however, is not always for cleansing purposes, but blasting is also used to improve the surface qualities by bombarding the surface by for instance shots or other media.

In the following the word "sand" is used to indicate the blasting media, it being understood that the term is intended to include all kinds of blast media used. Compressed air is the usual driving force for the sand but this force can be replaced by mechanical or other means which throw the sand against the object to be treated, it being pointed out that the use of the term blast media is not limited to compressed air, but can also comprise media other than compressed air.

In the cases described above the sand is discharged by means of compressed air or centrifugal forces with great speed from a device against the objects which are to be cleansed or treated in any other way. Then, in both cases, the sand will be mixed with particles removed from the objects or from the sand itself. For economical reasons the sand has to be collected and used once more, when the deteriorations have been removed to the greatest possible extent.

With cleansing sand, which has been used for blasting of cast steel, it has proved impossible to separate the main part of the fine dust from the blast media by the methods available. Consequently, the quantity of fine dust usually increases in proportion to the time during which the sand has been used. This has made it necessary to take away the circulating sand now and then from the circulating system of the cleansing apparatus, in order to let it pass a separate treatment, in order to remove the dust, when the proportion of same is too high. This involves expenses and loss of time in the production. In this case the dust consists of fine particles of burnt molding sand and scales and fragments of worn-out grains of sand. Among other things the dust causes decreasing efficiency of the blast and, further, the dust is unhealthy and complicates the blasting as it makes it difficult to observe the piece worked on and to judge the result of the blasting during the work.

The present invention provides a new possibility of cleansing the sand from dust, which in practice makes the blasting operation more efficient and healthy and also makes the use of the sand more economical, as the cleansing of the sand, for instance, can be carried out continuously. The method is based on mixing an air current with a current of the cleansing medium, so that the air current meets the current of the sand and changes the direction of those particles, which are to be separated. The speed and direction of the air current is then adjusted so that the difference in the moving energy between the particles of different size and weight is made use of when changing the direction of movement of the particles to be separated, whilst the necessary particles above a certain size are not affected. The separation

might then be made in a section of the conveying system of the cleansing apparatus for the cleansing medium, so that the cleansing apparatus can work continuously with a circulating cleansing medium.

From experiments on technical scale on operating conditions with a sand blast apparatus, which worked with a quantity of steel sand of 125 kg. per minute, it has been found that all dust particles with a particle size smaller than 640μ (0.64 mm.) could be separated from the steel sand by the use of the new cleansing method. The quantity of collected dust was about 9% of the weight of the steel sand.

The method of cleansing the sand will now be described with reference to the drawings attached hereto, showing an embodiment of an arrangement according to the invention.

Fig. 1 shows schematically a blast arrangement with the cleansing arrangements for the sand and the air; and Fig. 2 shows a horizontal view of the blast cabinet in greater scale.

Referring to the drawings, **1** is the sand blast cabinet and **2** indicates the blast worker, **3** is a blast pipe and **4** represents castings to be blasted, placed on a car **5**. The car is resting on a rotatable disc **6**, which is driven by an electrical motor **8** by means of a change speed gear **7**. While the disc **6** is slowly rotated, the jet with the blast medium is directed at the objects **4** cleansing the objects. Reference numeral **9** indicates an exhausting opening for the air mixed with dust, which is produced in the blast cabinet **1** and **10** indicates a suction duct to the dust separator **11**, which is of so called tube-filter type. **12** is a dust container for gathering the dust separated from the dust separator **11** and **13** is an outlet for the separated dust from container **12**. **14** is a suction fan or any other suction-apparatus for withdrawing cleansed air from the dust separator **11**. **15** indicates an electrical motor for driving the fan **14** and **16** indicates an exhaust nozzle for the cleansed air.

The revolving disc **6** is provided with apertures **17**, through which the blast medium together with the impurities in the form of slag, scales, burned sand and the like descends to a chamber **18**, in which a screw-conveyor **20**, driven by the motor **19**, convey the contaminated medium to the pocket **21**. In this pocket **21** the medium is seized and is lifted by an endless band-conveyor **23** provided with scoops **22**. This conveyor is of known type and brings the material to the tipping chute **24**, from which the material falls down into a rotating sifting drum **25**, driven by an electrical motor **26**. The sifter **25** is so arranged that the sand and smaller particles can pass the holes or meshes of the sifter and fall down in the shoot **27**, while larger particles as spikes etc. pass in the axial direction through the shifting drum **25** and are tipped through the outlet opening **28**.

The real purifying arrangement according to the invention consists, in addition to the tube or plunge tube **27**, of a vertical pipe or tube **29**. The tube **29** has a lower open end **30** and likewise an open upper end **31** between which the pipe **27** connects. The lower part of the end **30** is enclosed by and opens into a low pressure chamber **32** provided with a conical bottom **33** having a hole **34** therein. The hole **34** co-operates with a lock valve **35** which conveniently is springloaded. To the low pressure chamber **32** is connected a pressure fan **36**, which introduces fresh air in the chamber **32**. The fan **36** is driven by an electrical motor not shown. The tube end **30** has a side wall **37**, which is adjustable so that the free flowing area of the tube end may be increased or decreased. For this purpose the side wall **37** is provided with an outer flange **38** having slots **39** for bolts (not shown) arranged in the wall **40** constituting a fixed part of the chamber **32**. The side wall **37** is thus displaceable along the slots and is fastened in different positions by means of bolts and nuts.

When the fan **36** is in operation the contaminated sand falling down through the plunge tube **27** meets a stream of air from the fan **36** in the tube end **30**, the force and velocity of the air being adjusted to carry away the impurities in the sand but not the sand itself (the cleansing medium) and conveys these impurities out

through the upper pipe end 31 to a dust separator 41. The cleansing medium or the sand on the other hand falls down into the chamber 32 and is collected there in a substantially clean condition.

The dust separator 41 consists of a hose filter the lower chamber 42 of which receives the separated deteriorations, falling down from said chamber into transportable dust containers 43. The purified air passing through the filter hoses 44 is exhausted by suction by means of a fan 45, driven by an electrical motor 46, and continues through a pipe 47. In the pipe 47 a valve 48 is arranged, regulated by a motor 49 for a pressure regulator 50 for regulating the velocity of air. The pressure regulator 50 is used for regulating the air velocity in the tube end 30. It is important that the fan 45 always exhausts more air than is forced in by the fan 36.

The difference in air volume is taken in through the opening 28 and the pipe 27. The regulator 50 opens and shuts the valve 48 in dependence on the choking of the hose filters 44 in such a way that the valve 48 is opened more by increased choking of the filter 44 and is powerfully throttled by newly cleaned filters 44. The purified air in the tube 47 is led to the blasting chamber 1 and is distributed by a tube 51 to special nozzles 52, which constitute an air curtain of blown air in the blast chamber as a protection for the blast operator 2 against the whirling dust and sand in the chamber 1. A throttle 53 in the tube 47 regulates the quantity of air to the tube 51. The surplus of air is led into a shunt 54, which is connected to the tube 10. As air is exhausted from the chamber 1 through the tube 10, it is necessary to prevent the evacuation of the chamber 1. The chamber is therefore provided with openings 551, which admit air from out side the chamber into the chamber 1.

Under the chamber 32 there is a high pressure chamber 55, in which the cleansed steel sand or the cleansing medium 56 is collected in order to be conveyed from there by means of compressed air to the blast jet 3. If the valve 35 is spring-loaded it keeps the opening 34 closed until the weight of the steel sand conteracts the spring and opens the valve 35, when the sand falls down into the chamber 55. Alternatively the valve 35 can be air pressure loaded. In the latter case a compressed air duct 57 is drawn over a valve 58 and a duct 59 into the chamber 55. Then the air pressure in the chamber 55 must be higher than in the chamber 32. The valve 58 is controlled by a bar 60 for the passing on the air partly to the duct 59 and partly to a shunt 61 from same, leading to the blast jet 3. The shunt or duct 61 goes through a high pressure ejector 62, connected to the bottom of the chamber 55, through which the air current in duct 61 transports the steel sand or other purified cleansing medium from the chamber 55 and ejects this through the blast jet 3. The blaster 2 is placed in a separate part of the blast chamber 1, to which there is a direct door 63, whilst the truck 5 is led into the blast chamber box through an opening, which is shut by the doors 64 and 65.

While in the foregoing a preferred embodiment of the invention has been described and shown it is to be understood that the method and arrangement is susceptible of any alterations and modifications which fall within the scope of the appended claims. The current of air, which is directed against the cleansing medium to be purified, thus ought not to be directed exactly against the movement direction of the cleansing medium. It is important that each current has a direction deviating from that of the other one, so that when the currents meet, the air current can pass through the current of the cleansing medium and from this can blow away through a convenient outlet such impurities, which as regards its mass are of such a light character that these deteriorations, but not the cleaning medium, are separated from the current.

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

1. In the method of separating dust and other waste particles from sand and like media used in sand blasting, the steps which comprise introducing a stream of waste sand blasting medium into a chamber located between a lower zone maintained at a predetermined pressure above atmospheric and an upper zone maintained at suction pressure, causing a current of air under predetermined positive pressure to pass through said chamber from said lower zone to said upper zone at a predetermined velocity in a direction to engage and pass through said stream of waste blast medium to entrain and carry off to the upper zone the waste particles in the medium having a size and weight less than the sand particles of the medium which are caused to pass into the lower zone, filtering from the current of air in the suction zone the entrained waste particles, and regulating the suction pressure at the downstream side of the filter in correspondence to the degree of blockage of the filter to maintain substantially constant the velocity of the current of air passing through said chamber.

2. In apparatus for separating waste particles from sand and like media used in sand blasting, a generally upstanding tube having intermediate its ends an inlet for a stream of waste sand blast medium, means including an exhaust fan to create a suction pressure zone at the end of the tube above said inlet, blower means to maintain air under positive pressure at the lower end of the tube to cause a stream of air to pass continuously upward through said tube at a predetermined velocity and through the stream of waste sand medium to entrain and carry off therewith to the suction zone the waste particles in the medium having a size and weight less than the sand particles of the medium which pass downwardly in the tube, filter means in the path of travel of the air stream through said suction zone operable to remove from the air stream the entrained waste particles, and means to control said exhaust fan and thereby regulate the suction pressure at the downstream side of said filter in correspondence to the degree of blockage thereof to maintain substantially constant the velocity of the stream of air passing through said tube.

3. Apparatus as claimed in claim 2 wherein a section of the wall of the tube portion below the waste stream inlet is mounted for sliding adjustment in a direction normal to the tube axis to vary the free flow area through said portion.

4. In apparatus for separating waste particles from sand and like media used in sand blasting, means defining an operating station having an opening of substantial size confronting the zone in which work is sand blasted, a generally upstanding tube adjacent said sand blast work zone and having intermediate its ends an inlet for a stream of waste sand blast medium, means including an exhaust fan to create a suction pressure zone at the end of the tube above said inlet, blower means to maintain air under positive pressure at the lower end of the tube to cause a stream of air to pass continuously upward through said tube at a predetermined velocity and through the stream of waste sand medium to entrain and carry off therewith to the suction zone the waste particles in the medium having a size and weight less than the sand particles of the medium which pass downwardly in the tube, filter means in the path of travel of the air stream through said suction zone operable to remove from the air stream the entrained waste particles, means to control said exhaust fan and thereby regulate the suction pressure at the downstream side of said filter in correspondence to the degree of blockage thereof to maintain substantially constant the velocity of the stream of air passing through said tube, and means to discharge the filtered air under positive pressure as a protective curtain in the opening of said operating station.

5. In sandblast apparatus, a separating chamber comprising a tubular member having an upper portion defining a suction zone and a lower portion defining a positive pressure zone, means to create a suction pressure in the upper portion of the tubular member, means to maintain a positive pressure in the lower portion of said tubular member and cause a stream of air to pass continuously upward through said tube at a predetermined velocity, inlet means for a stream of waste sandblast medium opening angularly downward into said tubular member intermediate said upper and lower portions thereof and having a rounded wall surface connecting the adjacent portions of the inlet and the upper portion of the tubular member, said inlet introducing the waste medium counter to the flow of said air stream to cause the latter to entrain and carry to and through the suction zone of the tubular member the waste particles in said medium of less than a predetermined size and weight, means to reclaim the waste sandblast medium from the sandblast apparatus and deliver same to said inlet means, means mounting a section of the wall of the lower portion of the tubular member below the waste medium inlet

for movement radially of the tube to thereby selectively adjust the free flow area of the lower portion of the tubular member, means including a filter for recirculating the separated medium from the suction zone of the tubular member to the sandblast apparatus, and means to regulate the suction pressure in the upper portion of the tubular member in correspondence to the degree of blockage of the filter to maintain substantially constant the velocity of the air stream passing through said tubular member.

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