Aug. 29, 1950 J. A. SARGROVE 2,520,566

GRIT BLASTING APPARATUS AND THE LIKE

Filed Feb. 25, 1948 2 Sheets-Sheet 1

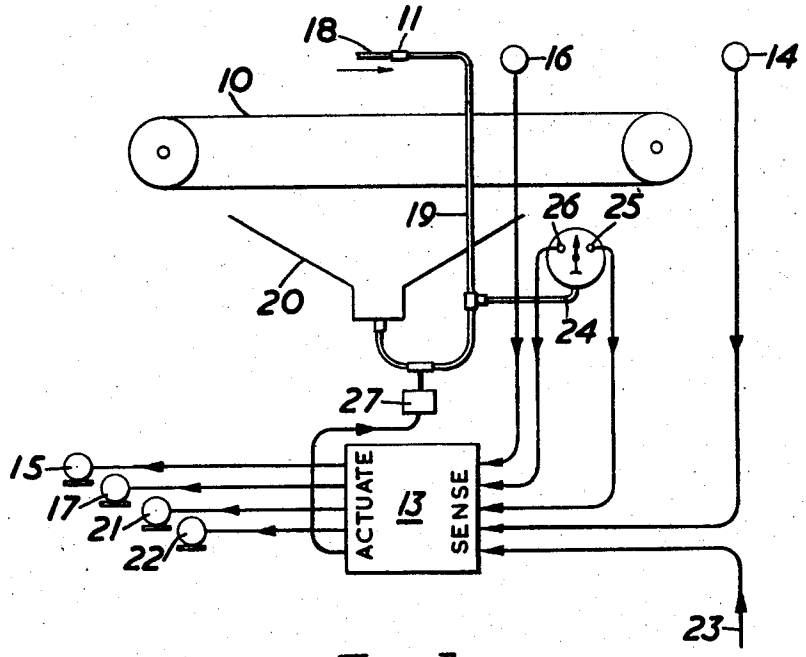


FIG. 1.

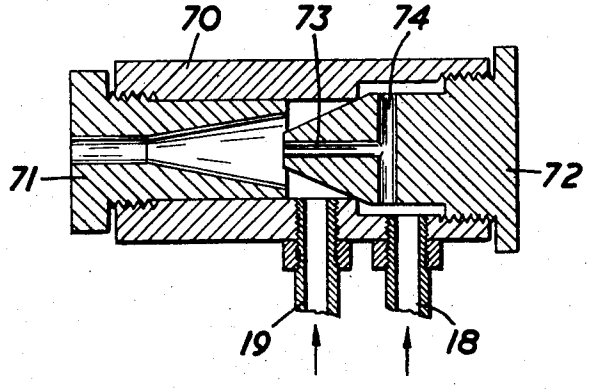


FIG. 4.

Inventor
John Adolph Sargrove

By Pierce, Schuffler & Parker
Attorneys

Aug. 29, 1950 J. A. SARGROVE 2,520,566

GRIT BLASTING APPARATUS AND THE LIKE

Filed Feb. 25, 1948 2 Sheets-Sheet 2

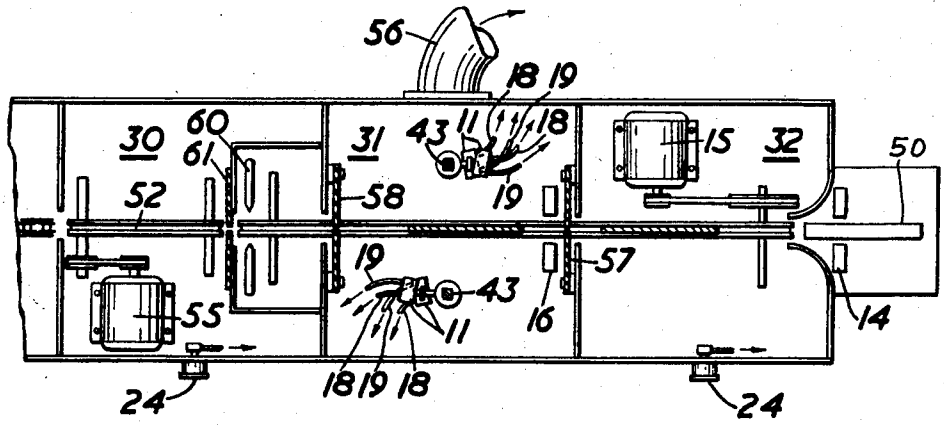
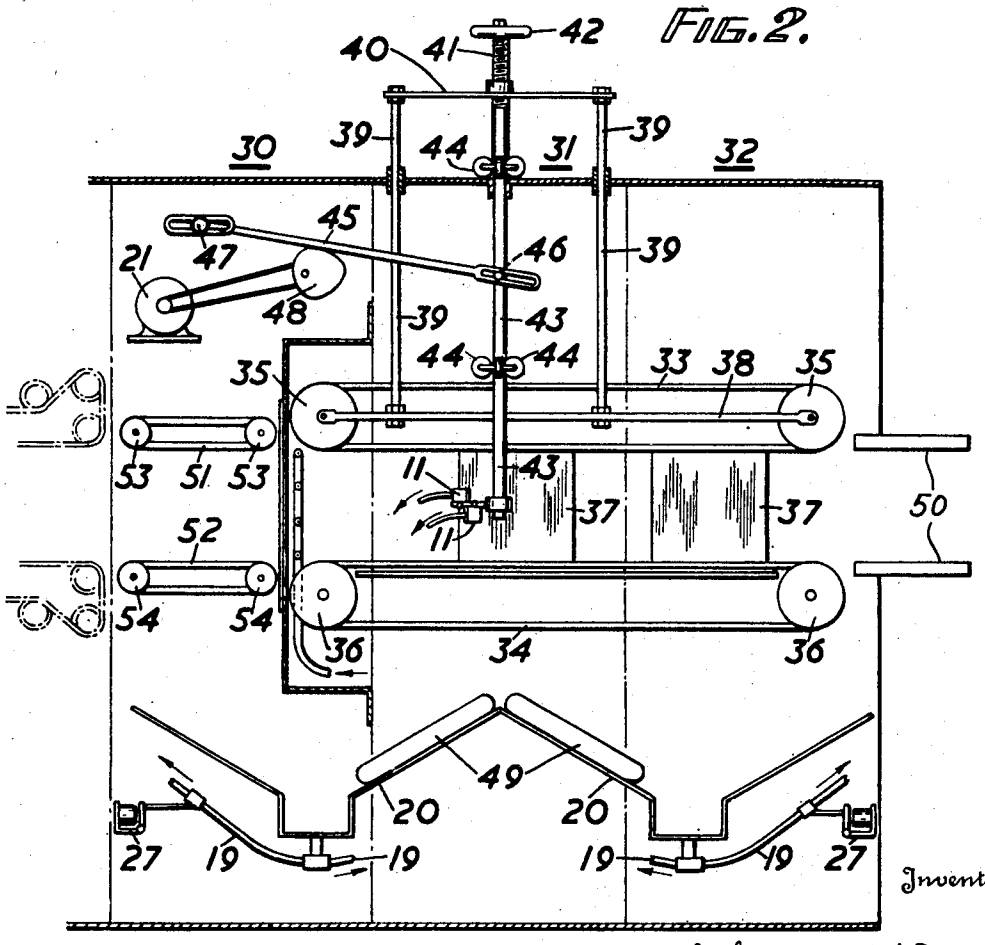


FIG. 2.



Inventor

John Adolph Sargrove

FIG. 3.

By Pierce Scheffler & Parker

Attorneys

Patented Aug. 29, 1950 2,520,566

UNITED STATES PATENT OFFICE

2,520,566

GRIT BLASTING APPARATUS AND THE LIKE

John Adolph Sargrove, Middlesex, England, assignor of one-half to Sargrove Electronics Limited, Middlesex, England, a British company

Application February 25, 1948, Serial No. 10,701
In Great Britain February 19, 1947

Section 1, Public Law 690, August 8, 1946
Patent expires February 19, 1967

5 Claims. (Cl. 51—14)

1

This invention relates to apparatus for cleaning or abrading by means of projected particles of grit such as sand, "carborundum" or other abrasive material. The invention relates more particularly but not exclusively to a process in which such apparatus is controlled automatically, and has for its primary object to provide an improved form of apparatus of this kind. The invention is however applicable to other systems in which suction is used to convey granular or pulverulent material.

According to one feature of the invention a Venturi or like suction device is used to suck a supply of abrasive or granular or pulverulent material from a hopper or the like, for delivery to another point, which in the case of a grit blaster may be a projector nozzle or jet and means are provided responsive to the pressure existing in the supply path between the hopper and the suction device for indicating and/or controlling the supply of material.

According to another feature of the invention, in a grit blasting machine of the type referred to, grit which has been projected from the projector nozzle or jet is collected by means of a hopper or the like disposed beneath the articles which have been abraded, and the hopper walls are heated or have heating means attached thereto. By this means the grit is maintained in a fluid condition and the occurrence of packing or choking of the grit is substantially reduced.

In one embodiment of the invention there is provided a grit blasting apparatus which is applicable to the manufacture of radio and like apparatus such as is described in copending United States patent application Serial No. 549,770, filed August 16, 1944, now Patent No. 2,474,988. In this process moulded panels or plates of thermosetting insulating material are sprayed by a metallising process to deposit in and upon depressions in the plate a suitable metallic coating, which thereby forms components of the apparatus together with interconnecting leads. In carrying out this process however it has been found that if good adherence of the sprayed coating to the insulating back is to be obtained it is necessary to give to the normally highly polished surface of the plates a degree of roughness, and for this purpose grit blasting is very suitable.

In carrying out the process of the earlier specification it is desirable that the successive stages of manufacture should be as automatic as possible, so as to require a minimum of human supervision or handling, since the costs of manufacture are substantially increased thereby. At the

2

same time it is equally important that should any stage of a fully automatic process cease to function properly an alarm circuit and/or a stop device be operated, in order that the number of reject articles be minimised.

This invention is therefore primarily concerned with an arrangement which is applicable to a grit blasting apparatus, which, while suitable for the process referred to, is also suitable for other applications in which an automatic supervision and/or indicator device is required.

In the accompanying drawings there is illustrated by way of example an embodiment of the invention which is suitable for incorporation in a fully automatic apparatus certain component stages of which are described and shown in my co-pending United States applications Ser. No. 8,042 filed February 13, 1948, and No. 10,702 filed February 25, 1948. In these drawings Figure 1 is a schematic diagram showing the arrangement of the grit blasting stage as a whole; Figure 2 is a diagrammatic plan view of the machine; Figure 3 is an elevational view of the apparatus of Figure 2 and Figure 4 is a sectional view through one of the spraying nozzles.

Referring first to Figure 1, which shows the general control arrangement of the complete stage, the stage comprises a conveyor 10 adapted to transport past the spraying nozzles 11 the panels which are to be grit-blasted. The various parts of the stage are under the control of a main control unit 13; this unit has a number of input terminals Sense which respond to conditions in the apparatus and a number of terminals Actuate by which functions are performed. One of the Sense terminals is connected to a presence detector 14 which may be a trolley switch, photo-electric cell or the like, and which is arranged to respond to the presence of a panel presented to the apparatus. In response to an indication given by the detector 14 the control unit 13 is arranged to energise an electric motor 15 which drives the conveyor 10. In this way, the conveyor is automatically started when a panel is offered the machine. The conditions of operation of the nozzles 11 are extremely arduous, and it therefore is desirable that they should be used only when a panel is in position in front of the nozzles and ready to be sprayed. There is accordingly provided a second presence detector 16 arranged immediately in front of the spraying station; this second detector, like the first, is connected to the control unit 13 and in response to an indication by the second detector the control unit supplies air under pressure to the spray-

ing nozzles to start the grit-blasting operation. While this may be done in various ways in Figure 1 the control unit is shown as starting an electric motor 17 which is assumed to drive an air compressor to supply air under adequate pressure to the air inlet 18 of the nozzles.

The nozzles 11 are so constructed that when air is applied to them suction is created by a Venturi action, and this suction is employed to draw into the nozzle the grit which is to be projected against the panels. The grit is supplied to the nozzles over a conduit 19 from a hopper 20 arranged beneath the nozzles; after being once used the grit falls back into the hopper and the supply of grit is thus maintained.

To ensure that the panels are uniformly subjected to the grit blast the nozzles are oscillated in the vertical plane and with this object the control unit is arranged to energise an electric motor 21 by which through a suitable mechanical coupling this oscillation is produced. Further, the control unit is arranged to energise an electric motor 22 driving a suitable air exhaust fan which serves to draw off air from the enclosure in which the grit blasting takes place, and thus prevents the escape of grit to the surrounding space.

The supply of grit from the hopper to the spraying nozzles is effected solely by the suction produced by the Venturi action of the nozzle, and ordinarily the grit must be maintained in a very fluid condition if choking or packing is not to occur either in the hopper itself or in the conduit 19 between hopper and nozzle. Such choking results in the panels not being properly abraded, and it is therefore necessary to provide some indication of this failure. One method of detecting such failure it by means of a photoelectric examination of the processed panel; if the surface gloss of the panel is incompletely removed the examination device "warns" the control unit 13 over, say, a control line 23. Such an examination device must examine as much of the panel, usually the whole surface, as is to be subsequently metallised; the panel is therefore scanned for example by suitable relative motion of panel and photocell, or by electrical scanning means.

While such photoelectric examination is satisfactory in that it can be arranged to detect any defects in the abraded panel, it has the disadvantage that it detects only a panel which is a reject panel; it is desirable that there should be a monitoring device which will detect conditions which will give rise to defective processing.

By one feature of the present invention, means are provided to monitor the flow of grit to the nozzles, and this is done by means of a vacuum gauge 24 which indicates the pressure existing in the conduit 19 between the hopper and the nozzle. When the nozzles are functioning correctly there will be a vacuum pressure in the conduit which will be indicated by the gauge 24. If, however, packing of the grit should occur in the hopper or in the conduit between the hopper and the gauge the vacuum pressure indicated by the gauge will increase and by providing an electric contact 25 upon the gauge which is operated when the pressure rises above the normal range, indication can be given to the control unit 13. The control unit can then be arranged to shut down the grit blasting stage even while a panel is still being processed.

In similar manner, if the supply of grit in the hopper should for any reason become exhausted, or if choking should occur in the nozzles or in the conduit between the nozzles and the gauge, or if the air supply to the nozzle inlet should fail, the vacuum indicated by the gauge will fall and in this case contacts 26 on the gauge are operated, and give an indication to the control unit 13 as before.

The control unit 13 may also be arranged to attempt remedial action in the event of a fault occurring. The most likely fault to occur in practice is packing of the grit in the base of the hopper or in the conduit 19, and the control unit is therefore arranged to operate one or more vibrator devices 27 which are connected to flexible portions of the conduit 19. In response to actuation of contacts 25 or 26 the control unit may then vibrate the conduits in an endeavour to clear the fault, and then to stop the grit blasting stage only if the fault persists.

The control unit 13 may also be interlocked with the succeeding stages of the complete machine, for example over a further control line similar to line 23.

In Figures 2 and 3 is shown diagrammatically the general arrangement of the grit blasting stages of the complete machine. In common with the other stages, the grit blaster is built in a series of similar cubicles 30, 31, 32, through the centre of which runs a conveyor line corresponding to the conveyor 10 of Figure 1. This conveyor line comprises upper and lower belts 33, 34 respectively mounted on pairs of belt pulleys 35, 36, of which some are driven by the motor 15. The belts 33, 34 are of rubber, or similar material, to resist abrasion by the grit, and are of channel section to receive and support the panels such as 37, between the inner spans of the belts.

In order that the conveyor may accommodate panels of different vertical heights the upper conveyor belt may be adjustable. With this object the pulleys 35 are carried upon shafts mounted in a pair of cross-arms 38 held in horizontally-spaced relation, and carried upon four vertical supports 39 which project through the top of cubicle 31, and are joined by a head plate 40. The head plate 40 is engaged at its centre by an adjusting screw 41 carrying a hand wheel 42 and bearing in a threaded boss, not shown, in the top of the cubicle 31. By this means the complete assembly comprising pulleys 35 and the various members 38, 39 and 40 can be vertically adjusted by the hand wheel 42.

Also mounted in the cubicle 31 are the spraying nozzles 11; both sides of each panel is grit blasted simultaneously, and the nozzles are therefore arranged in groups on opposite sides of the conveyor line. As shown in Figures 2 and 3 two nozzles are used in each group, arranged at different angles to the plane of the panels so as to secure complete abrasion, but a different number of nozzles may be used as circumstances require.

Each group of nozzles is carried near the lower extremity of a vertically reciprocating shaft 43; these shafts are each carried in two sets of four rollers 44 carried on suitable cross-members, not shown, in the cubicle 31 or upon the top of the cubicle. These shafts are reciprocated by two arms 45 having therein slots engaging pins 46 on the shafts 43; the arms 45 are pivoted at their ends at 47 and bear against the surfaces of cams 48 driven by an electric motor 21. In this way the shafts 43 are reciprocated, and the extent of their movement can be controlled by adjustment of pivot 47.

Beneath the nozzles 11 are arranged two similar hoppers 20 which cover substantially the en-

tire area of the lower part of the cubicles 30, 31 and 32. After spraying however, the grit falls for the most part downwardly within the confines of cubicle 31, and is thus arranged to fall upon electric panel heaters 49 secured upon the hopper walls. It is found that by arranging that the grit is warmed in this way its fluidity is maintained to a high degree; as a result, the occurrence of packing or choking of the grit is very substantially reduced and the reliability of the apparatus much improved.

The grit, thus maintained fluid, falls to the bottom of the hopper, where it is drawn off through conduits 19 to the respective nozzles 11. When air is applied to the air supply conduits 18 of the nozzles, the necessary suction is created in the conduits 19 and the grit is picked up. Vacuum gauges 24 are included in the conduits 19, and are fitted with contacts as described above, and vibrators 27 are coupled to the conduits at suitable points.

To start the apparatus, panels are loaded by hand into guides 50 and are pushed past the detector 14 whereupon the main conveyor is started and also a subsidiary conveyor comprising belts 51, 52 on pulleys 53, 54, driven by a motor 55. An air exhaust fan is also started to draw off air from the cubicles through a vent 56.

The now moving conveyor belts 33, 34 accept the panel and transport it, eventually passing the panel through a rubber sealing curtain 57 into the central cubicle. As it enters the cubicle the panel operates the detector and the nozzles are brought into operation, whilst being vertically oscillated. After a predetermined time interval the grit blast is stopped (unless a second panel is closely following) and the panel passes through a second rubber curtain 58 into a small chamber where, by means of a series of powerful air jets 60 the panel is cleaned of grit particles which may still be adhering thereto. The panel then passes through a further curtain 61 onto conveyor belts 51, 52 and thence to succeeding stages of the apparatus. The separate conveyor formed by belts 51, 52, is used to avoid carry-over of grit, which would cause excessive wear.

The walls of the cubicle 31 are lined internally with rubber to reduce abrasion by stray grit, and as much of the internal mechanism as possible is similarly protected.

Figure 4 shows one form of nozzle which has been found satisfactory in use. This nozzle comprises a body 70 of square or round cross section and bored with an opening throughout its length. At the one end of this boring is inserted, either as a force fit or a screw fitting, a replaceable nozzle member 71 having a tapered boring therein. Screwed into the other end of the opening in the body 70 is a plug 72 having a central jet boring 73 communicating with a series of radial passages 74. The plug and the boring in the body are so shaped that when in position they define two separate chambers to which access is permitted through inlets 18, 19 respectively. When air is applied to inlet 18, a jet is directed into the nozzle opening creating suction on the inlet 19.

The nozzle unit 71 is subject to rapid wear,

and is therefore made of material having a resistance to abrasion as high as possible.

I claim:

1. An automatic grit blasting machine comprising a conveyor for articles to be grit blasted, means for starting said conveyor on presentation to the machine of an article to be grit blasted, means for directing a grit blast against said article and means for starting said grit blast after the starting of said conveyor, a supply of grit and means for feeding said grit to the grit blast means, and means for stopping said grit blast means if the feed of grit thereto is abnormal.

2. A grit blasting machine, comprising a nozzle through which grit is blasted by air onto an article to be treated, a grit hopper, a conduit extending between said hopper and nozzle for supplying grit to the nozzle, means for supplying air under pressure to said nozzle to create a suction on the grit in said conduit, a vibrator device cooperative with said conduit, and pressure sensitive means responsive to a condition of abnormal pressure in said conduit for putting said vibrator device into operation to thereby vibrate said conduit.

3. A grit blasting machine as defined in claim 2 wherein at least a section of said grit conduit is comprised of flexible material and said vibrator device is operatively associated with said flexible section.

4. A grit blasting machine as defined in claim 2 wherein said pressure sensitive device is constituted by a pressure gauge having electrical contact means thereon adapted to be actuated upon the occurrence of an abnormal pressure condition in said conduit, and said vibrator device is electrically controlled through said contact means.

5. A grit blasting machine comprising a conveyor for articles to be grit blasted, nozzle means disposed laterally of said conveyor for directing a grit blast against the article, means supplying grit to said nozzle, a presence detector arranged adjacent said nozzle for detecting the approach of an article, means controlled by said detector for starting the grit blast through said nozzle means, and means for stopping said grit blast should the supply of grit to said nozzle means become abnormal.

JOHN ADOLPH SARGROVE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
365,261	King et al.	June 21, 1887
727,030	Tilghman	May 5, 1903
1,073,149	Lawrence	Sept. 16, 1913
1,867,856	McCrery	July 19, 1932
1,884,791	McCrery	Oct. 25, 1932
2,345,648	Wolfskill	Apr. 4, 1944
2,431,354	Wallberg	Nov. 25, 1947

FOREIGN PATENTS

Number	Country	Date
439,982	Great Britain	Dec. 18, 1935