(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 282 937 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88103965.5**

(22) Date of filing: **12.03.88**

(51) Int. Cl.⁴: **F26B 7/00** , F26B 15/26 , B24B 31/073 , F26B 17/26

(30) Priority: **17.03.87 IT 1972987**

(43) Date of publication of application: **21.09.88 Bulletin 88/38**

(84) Designated Contracting States: **AT BE CH DE ES FR GB GR IT LI LU NL SE**

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(54) Vibrating machine for the drying of metal pieces by means of hot air and absorbing material.

(57) The machine described is a vibratory unit for the drying of metal pieces and consists of:

a) a drying section essentially consisting of a tubular ascending scroll constructed in polymeric material; of a semi circular trough for the charging of the pieces to be dried and for the charging and the control of the granulometry of the absorbing material and of a separation system of the dry pieces and the absorbing material;

b) a non vibrating section essentially consisting of media for the heating and for the circulation of the air, this section being connected to the tubular scroll by means of flexible hose.

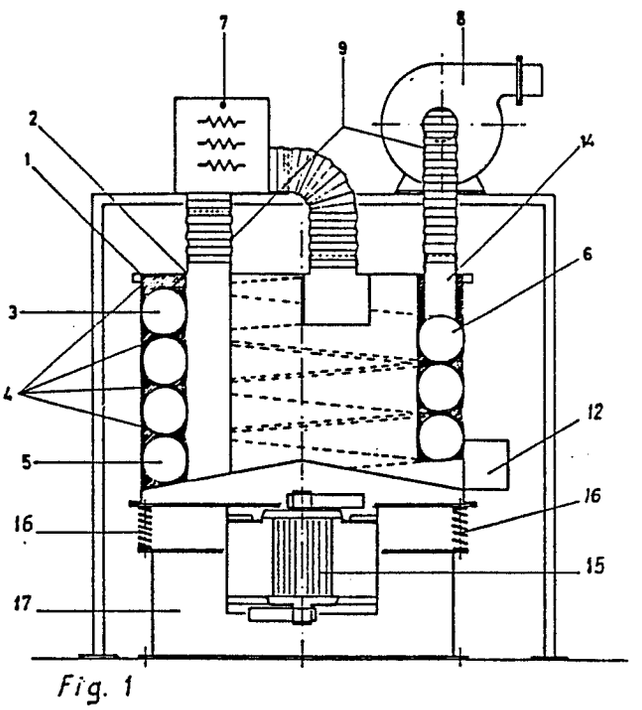

Fig. 1

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"VIBRATING MACHINE FOR THE DRYING OF METAL PIECES BY MEANS OF HOT AIR AND ABSORBING MATERIAL"

The present invention concerns a vibrating machine for the drying of metal pieces by means of hot air and absorbing material.

In the mechanical industry, particularly in that part which is concerned with the production of mechanical small parts, the problem of cleaning, degreasing, pickling and other similar processes constantly presents itself after the forming process of the parts.

The aggregate of the above mentioned processes, commonly given the name of "finishing", is ever more frequently effected with machines, particularly with vibrating machines, which give excellent surface finishes in a simple and automatic fashion.

Normally, the finishing processes are effected by using water solutions and/or suspensions of various chemical compounds with detergent, pickling, abrasive or colouring action and they must, therefore, always be completed with a washing cycle of the finished pieces. The washing cycle, which normally employs water, must always be followed by a drying cycle of the washed pieces before these are packed for despatch or submitted to subsequent terminal processes such as painting or punching.

The water, in fact, tends to adhere to the surface of the metal pieces in the form of small drops which may leave calcareous residue (if normal water is used for the final wash) or stains, but in any case the drops favour surface oxidation of the pieces if these are made from metals or from alloys subject to oxidation.

Among the many possible systems of drying metal pieces, the one that has asserted itself, particularly in the field of metal small parts, is the system which uses solid absorbing material, broken down into small particles, such as wood sawdust or other synthetic and natural materials. These materials have the power to absorb a great quantity of water in proportion to their own weight and, furthermore, they exercise a very slight abrasive action on the surface of the pieces processed, without interfering with the finishing specifications and, indeed, they perfect the polish.

The water soaked drying material is then heated to remove the water absorbed, after which it can be recycled.

For drying, as well as for other metal finishing processes, the use of vibrating machines with a supporting base has become established. These machines have a vibrating thoroidal body, with ascending scroll, which rests on the base and is connected to it by elastic means such as springs or similar, and a vibrating motor which operates the part supported on springs.

The pieces to be dried are put into the vibrating machine and yield the humidity to the drying material.

At the end of the drying cycle, the dry pieces are separated from the drying material and discharged from the machine by screening.

The heating system can be either by contact with a hot plate or by elements in contact with the drying material or, by the more modern system of the input of hot air into the vibrating ring as, for example, described in a preceding patent application by the same inventor.

The vibrating bowl is obtained out of a metal construction, for the simpler models with a one turn scroll, but the construction can be obtained also in polymeric material, generally of the elastomer type, using a mould which produces the ring shaped bowl.

The construction in polymeric material has only one turn because of moulding reasons and the thoroidal bowl is open to the light.

The metal construction can have an ascending scroll which makes more one turn, but the turns are limited by the weight of the scroll which dictates the use of very powerful vibrators and with great amplitude of vibrations. The great amplitude of the vibrations can cause damage to the pieces being dried.

In some cases, for instance with delicate pieces, a plastic lining is required for the metal scroll to prevent the pieces from becoming damaged, such a lining is very difficult to carry out if the scroll has more than one helix.

In other cases, a continuous process is required with only one passage of the pieces in the machine, but this with a sufficiente stay of the pieces within the machine to guarantee complete dryness or cleanliness; it would therefore be necessary to have a long scroll. but the attempt to lengthen the scroll to form more turns, 3-4, has given unsatisfactory results because, as already stated above, the excessive weight requires the use of very powerful vibrators which give the drying material and the pieces an uncoordinated and inefficient movement. This, in practice, limits the length of the metal scroll to 2 helixes, which is the minimum limit to make them functional. However, there are problems of very high construction costs, of bowl lining, as it is inaccessible at some points, problems of efficient heat exchange, danger of breakages as also the heating system is subjected to vibrations.

Another problem of vibrating driers which use drying material is given by the fact that, normally, the granulometry of the material must be controlled in order to prevent it from nestling into the small holes or fissures in the pieces to be dried. Given that the material reduces in size during the drying, because of the grinding effect of the pieced being processed, it is constantly necessary to remove the smaller particles of drying material. Therefore, both the dust (drying material so reduced in size that it remais suspended in the air) and the particles of such a size as may become lodged in the holes and fissures of the pieces being processed must be removed; the latter particles do not usually remain suspended in the air, but they accumulate at the bottom of the vibrating scroll.

Finally, the metal driers are noisy and require a soundproofing cover to prevent excessive disturbance in the places where they are installed.

The machine described in the present invention resolves all the problems of traditional vibratory driers and, furthermore, has a definitely low cost.

According to a fundamental specification of the present invention, the machine for drying metal pieces by means of hot air and absorbing material comprises:

a) a vibrating section essentially consisting of two vertical concentric cylinders made of metal which form a cavity wall which contains an ascending tubular scroll made of polymeric material; of a semi-circular trough gutter, which is connected to the lower part of the tubular ascending scroll, for the charging of the pieces to be dried and of the absorbing material; the trough has a gridded section for the elimination of the particles of absorbing material with unsuitable granulometry, and of a semi-circular trough gutter with a gridded bottom, connected to the upper part of the tubular ascending scroll, which serves for the separation of the dried pieces and the absorbing material and their discharge from the machine;

b) a vibrating section essentially consisting of air heating and circulation equipment, this section is connected to the tubular scroll by means of flexible hose.

According to a favourite construction form, the tubular ascending scroll consists of a pipe with a diameter from 15 to 25 cm being the same as the cavity wall between the two concentric metal cylinders.

The pipe is wrapped round the inner cylinder to form a scroll with a sufficient number of helixes to ensure a length of run adequate for the perfect drying of the pieces being processed. Typically, the number of helixes is between two and five.

The pipe is made of polymeric material of polyolephinic, silicone, polyester or polyamide type. It is also possible to use the abovementioned materials reinforced with natural, synthetic, artificial, glass or metal fibres.

The use of a reinforcing fibre in the structure of the pipe gives it greater stiffness and mechanical resistance.

According to the most favoured form of construction of the present invention, after the spiral winding of a pipe with thin walls round the inner cylinder, the residual space in the cavity wall is filled by a casting of a liquid elastomer resin which is subsequently hardened by polymerization.

The drying processes carried out in the machine will erode the pipe and bare the polymerized elastomer resin so that, eventually it will become the actual wall of the ascending tubular scroll.

This type of construction, therefore, allows the obtainment of machines with an elastomer material scroll, without recourse to a particular type of mould; it also offers the possibility of obtaining more than one helix and a closed processing chamber and not a wide open one as in the normal machines moulded in polymeric material.

According to another fundamental specification of the present invention, the lower part of the tubular ascending scroll is connected to a semi-circular trough gutter for the charging of the pieces to be dried and of the absorbing material. A grid is inserted in the lower part of the trough to allow the elimination of the undersized particles of the absorbing material which, owing to the grinding effect of the pieces during the drying process, have been reduced to dimensions not in conformity with the desired granulometry. Another semi-circular trough gutter, with a gridded bottom, is connected to the lower part of the tubular ascending scroll and allows the separation of the drying material from the pieces, which are then directed to the packing stations or to other processes, the material is then recycled into the lower (charging) trough for further use.

Both the lower and the upper troughs are a fundamental part of the vibrating section of the machine.

There will now be a detailed description of the machine according to the present invention with particular reference to the enclosed drawing where:

- fig. 1 represents a schematic vertical section of the machine;
- fig. 2 represents a schematic plan of the semi-circular pieces charging trough.

The vibrating section of the machine consists of two concentric cylinders: 1 and 2, constructed in metal plate, resistant to vibration fatigue; a flexible pipe in plastic material (3) is wound round on the inside of the cavity wall between the cylinders to form an ascending scroll with three and a half helixes. In the remainder of the cavity wall space,

which is not taken up by the scroll pipe, a pouring of elastomer material (4) of polyurethane type is made, the material is highly wear resistant and, when polymerized, it hardens and imprisons the flexible pipe (3), which, in this way, becomes a disposable mould for the polymerized polyurethane. In this way, a completely enclosed ascending scroll is formed, which becomes the drying chamber.

The vibrating section of the machine is fixed to a supporting base (17) by means of springs (16) and is put into vibration by the motor (15).

A heating unit is fixed to a non vibrating support base outside the drier, the heating unit consists of armoured electrical elements (7) and of a suction fan (8), these are connected by flexible hose (9) respectively to points (5) and (6): entry and exit of the scroll. The air is sucked up by the fan (8), which is connected to the terminal part of the scroll and enters the heating unit (7) whose temperature is controlled by a thermostat (14), mounted in correspondence with the air suction.

The temperature of the air exiting from the scroll depends on the quantity of water evaporated, that is on the degree of humidity of the absorbing material.

The thermostat (14) allows the control of the amount of power to be supplied to the heating system (7) according to the degree of humidity desired in the absorbing material so optimizing to the maximum the power consumption.

It has also been noted that, if the absorbing material is too dry, it pulverizes more easily and therefore it is preferable to keep the material to be charged into the drying machine slightly damp.

The air heated in the heating unit (7) enters the lower part (5) and exits from the upper part of the tubular ascending scroll (6).

The fine absorbing material dust, which forms during the drying stage, is transported in suspension (airborne) by the air which passes through the scroll and is caught in the air filters (not shown in the drawing) which are placed before the suction fan (8). In this way, both the air circulation in the machine and the dust removal from the drying material, as well as the elimination of fine particles, are ensured with only one suction fan (8).

The elimination of the particles of absorbent mterial of unsuitable granulometry, but not small enough to be airborne inside the scroll, is carried out in the outside run machined on the lower part of the drier, which consists of a trough (12), with a gauged gridded bottom (13), attached to the vibrating part of the machine, which serves to separated the undersized particles of the recycled drying material issuing from the ridding grid (pieces/material) situated in the upper part of the machine (not shown in the drawing). The material exits from the cylindrical part at point (10), it is riddled and reenters at point (11) in order to be charged, once again, into the ascending scroll at point (5). Trough (12) is also the charging point for the pieces to be dried.

Claims

1. Machine for drying metal pieces by means of hot air and absorbing material comprising:

a) a vibrating section essentially consisting of two vertical concentric cylinders made of metal which form a cavity wall which contains an ascending tubular scroll made of polymeric material; of a semi-circular trough gutter, which is connected to the lower part of the tubular ascending scroll, for the charging of the pieces to be dried and of the absorbing material; the trough has a gridded section for the elimination of the particles of absorbing material with unsuitable granulometry; and of a semi-circular trough gutter with a gridded bottom, connected to the upper part of the tubular ascending scroll, which serves for the separation of the dried pieces and the absorbing material and their discharge from the machine;

b) a non vibrating section essentially consisting of air heating and circulation equipment, this section being connected to the tubular scroll by means of flexible hose.

2. The machine as claimed in 1. is characterised by the fact that the tubular ascending scroll consists of a pipe with the same diameter as the cavity wall which exists between the concentric vertical cylinders.

3. The machine as claimed in 2. characterised by the fact that the space between the outside walls of the above mentioned pipe and those of the walls of the two vertical concentric cylinders is filled with elastomer material.

4. The machine as claimed in 1. 2. or 3. characterised by the fact that the polymeric material used for the construction of the ascending tubular scroll is of the polyolephenic, siliconic, polyester, polyamide type.

5. The machine as claimed in 4. characterised by the fact that the above mentioned polymeric material is reinforced with natural, synthetic, artificial, glass, metallic fibres.

6. The machine as claimed in 3. characterised by the fact that said elastomer material is of the polyurethane type.

7. The machine as claimed in 1. characterised by the fact that the air heating media consist of electrical elements inserted in the air circulation circuit.

8. The machine as claimed in 1. characterised by the fact that the air heating media consist of a tubular steam heat exchanger, or a water circulation one or with the circulation of a special liquid for heat exchange;

9. The machine as claimed on 7. or 8. characterised by the fact that the hot air is put in at the lower part of the ascending tubular scroll and removed at the upper part of the same scroll.

10. The machine as claimed in 9. characterised by the fact that the air is removed at the upper part of the tubular ascending scroll by means of a suction fan.

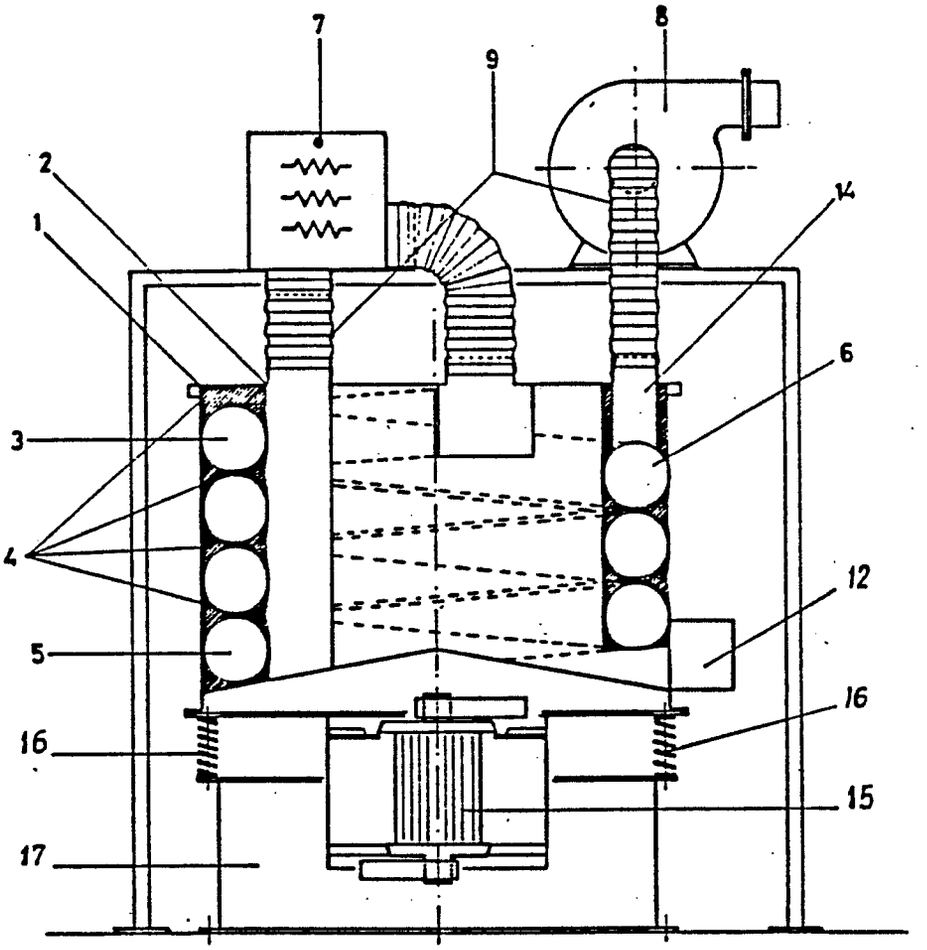

Fig. 1

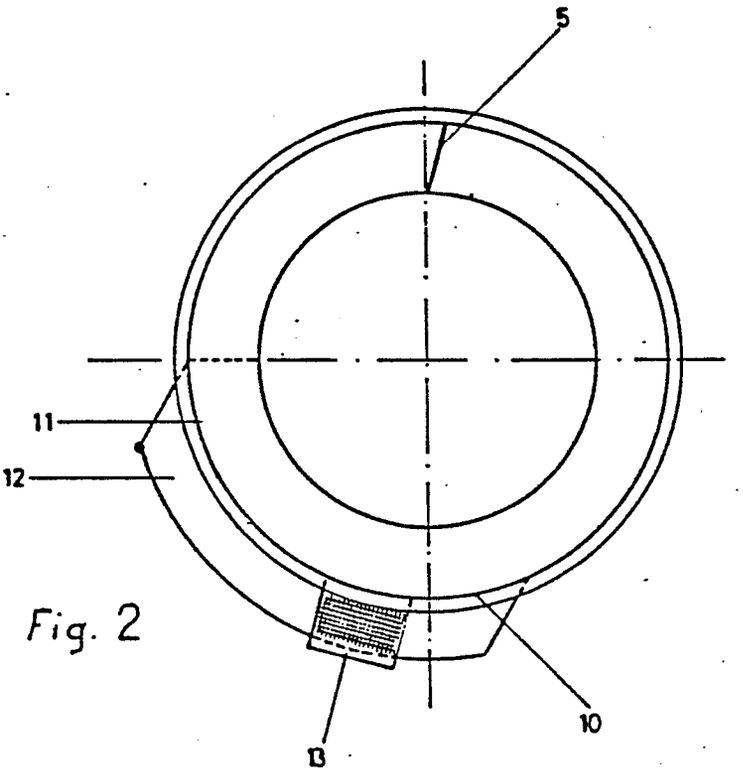

Fig. 2