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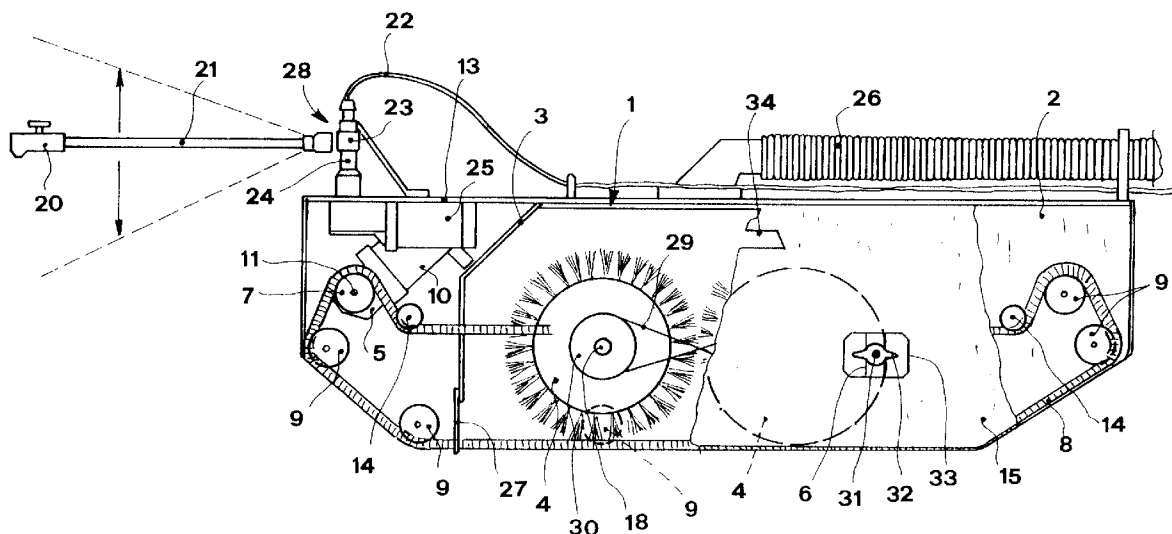
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BE CH DE ES FR GB IT LI(30) Priority: **11.06.1996 IT FI960141**(71) Applicant: **Milani Colori S.n.c. di Milani Corrado &****C.****52100 Arezzo (IT)**(72) Inventor: **Milani, Corrado****52040 Civitella In Val Chiana (Arezzo) (IT)**(74) Representative: **Bardini, Marco Luigi et al****c/o Società Italiana Brevetti S.p.A.****Corso dei Tintori, 25****50122 Firenze (IT)**(54) **Apparatus for cleaning and painting panels used for roofing buildings**

(57) Apparatus for cleaning and painting roofs of buildings, comprising a self-propelling motorized mounting structure with a case (3). Case (3) houses a set of brushes (4) acting on the roof surface and spray means (21) which distribute the liquids for the treatment of this surface, and which can be attached to and removed from the structure and which are connected to a containing and feeding unit for these liquids. Similar

spray means (21) for distributing a painting substance, also connected to a containing and feeding unit and which can be attached to and removed from the structure in place of the first set of spray means. In addition, the apparatus comprises a remote-control unit for the structure, for the set of brushes (4) and for controlling the various operations. The apparatus is especially designed for the reclamation of asbestos-cement roofs.

Fig. 1**EP 0 814 217 A2**

Description

The present invention relates to an apparatus for cleaning and painting the roofs of buildings. Specifically, this invention relates to an apparatus designed for reclaiming roofs made with materials containing asbestos, such as corrugated asbestos-cement panels, in order to make them unalterable.

It is a well-known fact that materials containing asbestos are not safe and represent a health risk when handled and processed. The tiny asbestos fibres, released during these operations and dispersed in the atmosphere, may cause serious illnesses, especially to the respiratory system, if inhaled. In recent years, the manufacture and distribution of such products has therefore been banned and very strict rules have been set for the demolition and disposal of existing asbestos-cement products.

In the past, this type of product had been widely used as an insulating material and especially for the roofing of urban, rural and industrial buildings made of prefabricated asbestos-cement units, such as corrugated, fretted, and plane sheets or tiles. For the reclamation of these kinds of structures it is possible to remove them directly or, in order to reduce the cost of removal and disposal, and of rebuilding the roof with other materials, the workpieces can be isolated by applying a special kind of paint which prevents their fibres from scattering.

The latter solution is certainly easier and less expensive, but has considerable practical drawbacks, as mildews, musks, lichens and scales, which may have formed, must first be removed from the roof. This is an arduous task and is not without risks for the operator who must work on the building's roof for a long time in a precarious state of balance. Similarly, the operation of painting requires the operator's presence on the roof of the building with the same risks and inconveniences.

A water-cleaning machine for roofs has been suggested, with a configuration similar to that of traditional water-cleaning machines for floors; however, this does not solve the problem that the operator must stay on the building's roof and move the machine back and forth.

It is an object of the invention to provide an apparatus allowing the reclamation of asbestos-cement roofs on buildings without having to remove them, without the risk of environmental pollution and under safe conditions for the operator.

Another object of the invention is to provide a self-propelling apparatus for cleaning and painting the roofs of buildings, which can be remote-controlled by the operator.

These objects have been achieved with the apparatus according to the present invention comprising a self-propelling motorized structure with a case fixed to it housing brush means for acting on the roof surface, first spraying means detachably mounted on the structure for distributing the liquid used for treating said surface and communicating with a liquid containing and

feeding unit, second spraying means for distributing a painting substance and communicating with a containing and feeding unit for said substance and which can be attached to said structure in place of said first spraying means, a remote-control unit for said self-propelling structure, for said brush means and for controlling the various operations.

Other characteristics and advantages of the apparatus according to the present invention will be apparent from the following description of its embodiment, which is to be intended only as an example and not a limitation with reference to the drawings enclosed:

- Figure 1 is a side view with a partial section of the apparatus according to the invention;
- Figure 2 is a plan view with a partial section of the apparatus of figure 1.

With reference to the above figures, the apparatus according to the present invention comprises a supporting frame 1 consisting of two parallel, spaced apart side frames 2 holding a case 3 having a substantially parallelepiped box-type structure, open at the bottom and on the sides, which houses brushes 4. In figure 1, one of the side frames 2 has been removed to simplify the illustration. Side frames 2 are connected at the top by a covering plate 13 holding means for dispensing a cleaning liquid or a painting substance. A driving roll 7, guide and transmission rolls 9 for a belt 8, which winds up on them, are situated at both ends of side frames 2.

The rolls are arranged along it, basically following a U-shaped path, with a deviating roll 14 placed at each corner of the path and with drive roll 7 placed in line with one vertex of this path, i.e. the vertex which identifies one end section of the corresponding side frame and accordingly of the whole apparatus, and which hereafter will be simply referred to as front vertex. Rolls 7 and 9 are arranged so that belts 8 project sufficiently over the lower profile of side frames 2 and have retaining bands at their peripheral edges, which are lower than the thickness of belts 8, so that they do not trail on the roof surface to be treated.

A motor 10 is fixed in front position over case 3 and, by means of a reduction gear 5, drives a transverse shaft 11 extending between side frames 2. At the ends of shaft 11 driving rolls 7, on which drive belts 8 wind up, are keyed on. Two longitudinal protecting panels 15 are mounted on the side frames 2, on the outside of rolls 7 and 9 respectively, so that belts 8 cannot be touched from the outside.

Two L-shaped brackets 17 are fixed to the inside of side frames 2, in the space delimited by case 3, holding two couples of bearings 12 arranged in a line for shafts 18 carrying brushes 4. One of the shafts 18 extends out of frame 1 passing one side frame 2 and its protecting panel 15, for engaging in a reduction gear 16 of a motor 19 mounted on the outside of side frame. The other shaft 18 is rotated through a transmission belt 29 and pulleys

30.

Advantageously, shafts 18 rotate in opposite directions, thus assisting in conveyance of the removed particles towards a suction port placed in the higher part of case 3, described below. The rotation in opposite directions of shafts 18 is obtained by crossing belt 30. A cross belt transmission 29 and pulley 30 near both side frames 2 should be preferred in order to obtain a better balance of forces. The two L-brackets 17 are fixed removably to side frames 2 with threaded bolts 31, passing through corresponding slots 6 which extend vertically on side frames and can be tightened to them with wing nuts 32 which are screwed on said bolts. The height of the brushes with respect to the surface to be cleaned can be adjusted by loosening wing nuts 32, allowing for the brushes' wear during use, while the brushes and their brackets 17 can be removed from case 3 by completely unscrewing wing nuts 32; this is necessary when the layer of paint has to be applied, as will be described below.

Windows 33 are formed on protecting panels 15 in correspondence to slots 6 to give access to wing nuts 32 and are used to adjust the brushes' height or remove them. In the middle of both panels 15, a hole 34 is also provided for lifting and moving the apparatus manually.

One of the embodiments includes a row of disk-shaped brushes 4 with different diameters, mounted on both shafts 18 on planes perpendicular to shafts 18 and arranged to give the set of brushes a corrugated configuration reproducing the profile of the surface to be treated. Another embodiment, which is currently preferred because it is lighter, includes spaced disk-shaped brushes which are arranged on planes sloping with respect to the axis of said shafts 18. All brushes belonging to one shaft tilt in opposite direction compared to the brushes of the other shaft. In this way the same amount of brushes can brush a larger surface compared to perpendicularly mounted brushes.

The arrangement of the brushes obviously depends on the roof surface to be treated; e.g. for fretted surfaces, the set will be formed alternating brushes with a larger and smaller diameter and with a width equal to that of the surface's crests and grooves. In particular, brushes tilting according to different angles can be provided, to be chosen and mounted on their shafts depending on the characteristics of the surface to be cleaned.

Distributors for the cleaning liquid and the painting substance are mounted at the front of plate 13, and in both cases basically consist of a lance 21, with a spray nozzle 20 on the top, detachably connected to a liquid feeding pipe 22 and extending in the direction of movement of the apparatus, from a support 28 mounted at the front of the plate.

Support 28 comprises a pivoting vertical rod 24 to which lance 21 is attached with a conventional articulated joint 23. Joint 23 enables the lance to move from the horizontal position and incline it; the lance can be locked in the desired position with a locking screw, not shown in the drawing. Rod 24 is driven by a variable speed mo-

tor 25 fixed under plate 13, giving it an alternating angular movement with a fixed maximum travel, so that nozzle 20 could be adjusted in height and have a continuous angular displacement in a horizontal direction, driven by motor 25.

The same spraying lance can be used for dispensing sterilizing and fixative substances, whereas for painting another lance is used which has to be replaced before use. The lance is fed through feeding hose 22 connected to one or more tanks through a pump, said tanks being placed at a distance and not shown in the drawing. In particular, when the lance for sterilizing and fixative substances is used, pipe 22 passes through a three-way joint which branches off to two tanks respectively, each with its own feed pump and hose, passing a check point where the operator selects the liquid to be fed.

From suction port at the top of case 3 and plate 13 respectively, a suction hose 26 leads to the housing of brushes 4, delimited by the case 3. The hose 26 is connected to a suction system, not shown, situated away from the machine and which sucks up the particles removed by the abrasive action of the brushes.

To improve suction power inside the brushes' housing, two semiflexible plates 27, shaped like the surface profile, extend from the lower edge of case 3, practically skinning the surface to be treated, thus assuring a sufficient seal and preventing potentially noxious material from leaking. In addition, the nebulization of the sterilizing solution delivered from nozzle 20 provides a further barrier against any possible diffusion of particles lifted by the brushes. The suction system also has an automatic closing system for the sack containing the particles produced, so that the operator is not exposed to the removed fibres when he has to change the sack.

The apparatus according to the invention also comprises a control station, not shown, which comprises the tanks for the fixative, sterilizing and painting liquids as well as their pumps. The control station has a control board with operating controls for the apparatus and for checking the various functions. It also comprises a current transformer unit from mains voltage to 12-24 volts, and all the necessary safety and alarm devices.

Moreover, spray guns, placed within the operator reach, are connected to the feeding pipes for the various treating or painting liquids and enable the operator to finish the work in the areas that cannot be reached by the apparatus. Similarly, a suction device is situated within the operator's reach and is connected to the suction system to eliminate any remains of dust, which might accidentally escape from the apparatus and fall on surrounding structures.

The drive belts 8 are made of resistant rubber ensuring a good hold by friction on the surface to be treated, even if it is wet, and suitable for slopes that roofs made of this kind of material usually have. Thanks to the elasticity of these belts the apparatus can easily tackle variations and inversions of the slope, such as those on

the roof ridge and grooves along the roof, up to a width of 30-40 cm. The belts may also be externally equipped with teeth that have a flared profile or suction cups to improve gripping on very steep or slippery surfaces, e. g. made of glass or metal. Moreover, to prevent slippage between belts and rolls, grooved rolls can be used with special belts toothed on the inner side.

In the use, the apparatus according to the invention must be placed on the roof to be treated ensuring that drive belts 8 are set on the bottom of two grooves of the roof surface, while the control station, which may be trailer-mounted, must be put on scaffolding near the roof, or on the ground, or in any other suitable position which ensures an absolutely safe access for the operator. The distance between the drive belts is obviously standardized according to the distance between the grooves of the corrugated panels on the market.

The apparatus is then started and delivers the sterilizing solution when it is in drive, i.e. with its front end in the running direction, while the brushes roll removing all the scales on the roof. The fixative liquid is released during the reverse drive to prevent the dispersion of asbestos fibres lifted by the brushes. Once the entire surface to be cleaned has been treated, the lance must be replaced with the lance for painting, and the brushes removed; the apparatus is restarted to distribute the paint, making it move backwards from one end of the roof to the other and moving it at the end of each section by a length substantially equal to its width. It is advisable to apply two coats of different coloured paint, to better evaluate the quality of the job and to check the amount of wear occurring in time.

Advantageously, the apparatus according to the invention can be equipped with a motor-driven disk blade - not shown - at the front, for cutting the ends of the hooking pins holding the panels to the underlying roof structure, to prevent any interference of said ends with the movement of the brushes as they more or less protrude over the surface.

The brushes are preferably made of stainless steel or very resistant plastic material.

The sterilizing solution can be chosen from products available on the market, for example STERIL SOLUX produced by IVAS or equivalent.

The apparatus according to the invention can also be used on roofs, which will subsequently be removed, for the application of special products such as AMIANT-FIX produced by IVAS or equivalent, again offering the advantage that the operator does not have to be on the roof while applying these products.

Claims

1. Apparatus for cleaning and painting roofs of buildings, characterized in that it comprises: a self-propelling, motor-driven structure supporting a case (3) housing brush means (4) for acting on a surface of

said roof; removable first spray means (21) attached to said structure for distributing liquids to treat said surface and communicating with a liquid containing and feeding unit; second spray means for distributing a painting substance, communicating with a containing and feeding unit for said painting substance removably connected to said structure in place of said first spray means; a remote-control unit for said self-propelling structure for said brush means (4) and for controlling the various operations.

2. Apparatus according to claim 1, in which said self-propelling structure comprises a frame (1) made of two longitudinal spaced side frames (2) with said case (3) mounted between them, a row of guide rolls (9) being on the outside of each side frame where a drive belt (8) winds up, said frame (1) supporting a motor (10) connected to a couple (7) of these rolls placed on both of side frames (2).
3. Apparatus according to the previous claims, in which two protecting panels (15) are fixed respectively to said side frames outside said rolls.
4. Apparatus according to the previous claims, in which said case delimits a housing for said brush means, said housing communicating with suction means (26) for continuously sucking up the particles removed from said surface.
5. Apparatus according to the previous claims, in which said first and second spraying means (21) comprise a distributing nozzle (20) for said liquids and said painting substance, which swings horizontally and can be adjusted in height.
6. Apparatus according to the previous claims, in which said brush means comprises at least two groups of brushes (4) rotating in opposite directions, shaped like the profile of the surface to be treated.
7. Apparatus according to the previous claims, in which each group of brushes (4) comprises a plurality of brushes keyed on a respective shaft (18), so that their axis is tilted with respect to the shaft, the tilt being substantially equal for brushes belonging to the same shaft and opposite for two brushes belonging each to one of a couple of adjacent shafts.
8. Apparatus according to the previous claims, in which the distance of the axis of the rotation of said brushes from the surface to be treated can be adjusted.
9. Apparatus according to the previous claims, in

which a semiflexible sealing plate (27), shaped like the surface's profile, extends along both lower edges of said case.

10. Apparatus according to the previous claims, in which cutters mounted at the front, substantially tangent to the surface ridges, are provided for cutting the protruding ends of pins placed in said surface.

11. Apparatus according to the previous claims, in which at least the outside of the above-mentioned drive belts (8) is toothed.

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Fig. 1

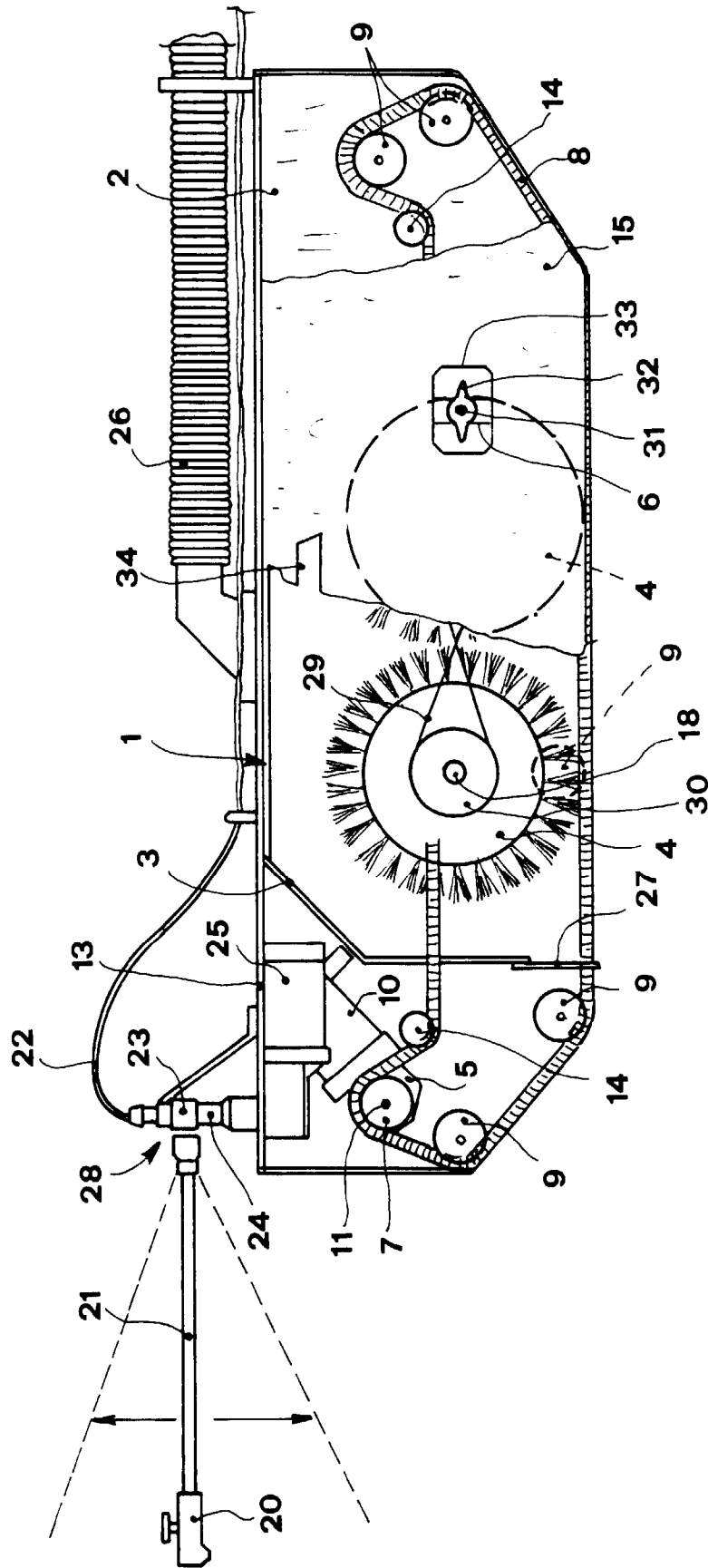


Fig. 2