May 9, 1967 E. JACOBI ETAL 3,317,947

PNEUMATIC CLEANING INSTALLATION

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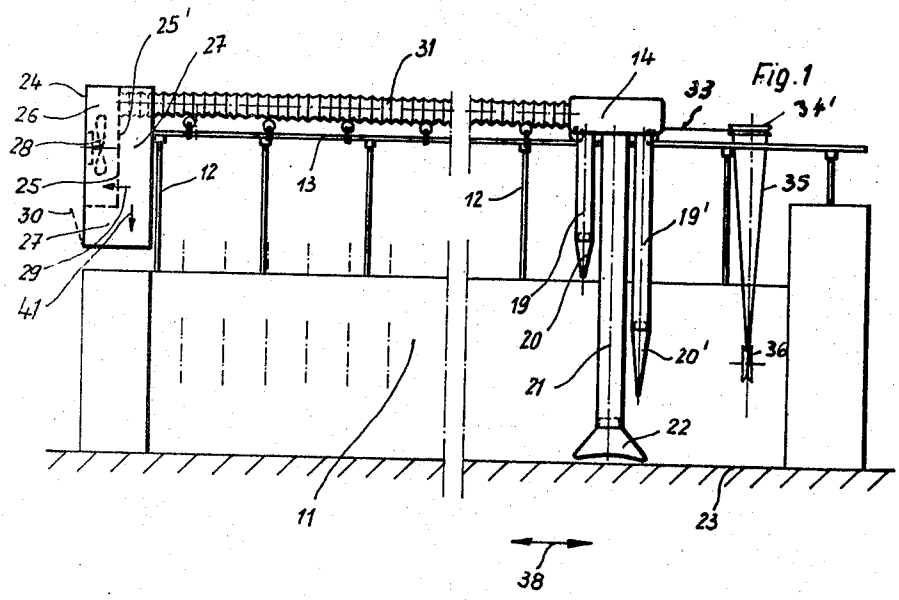

Fig.1

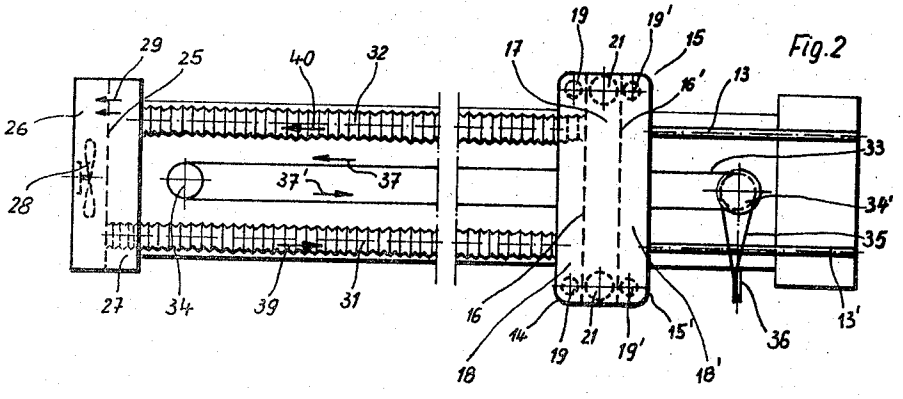

Fig.2

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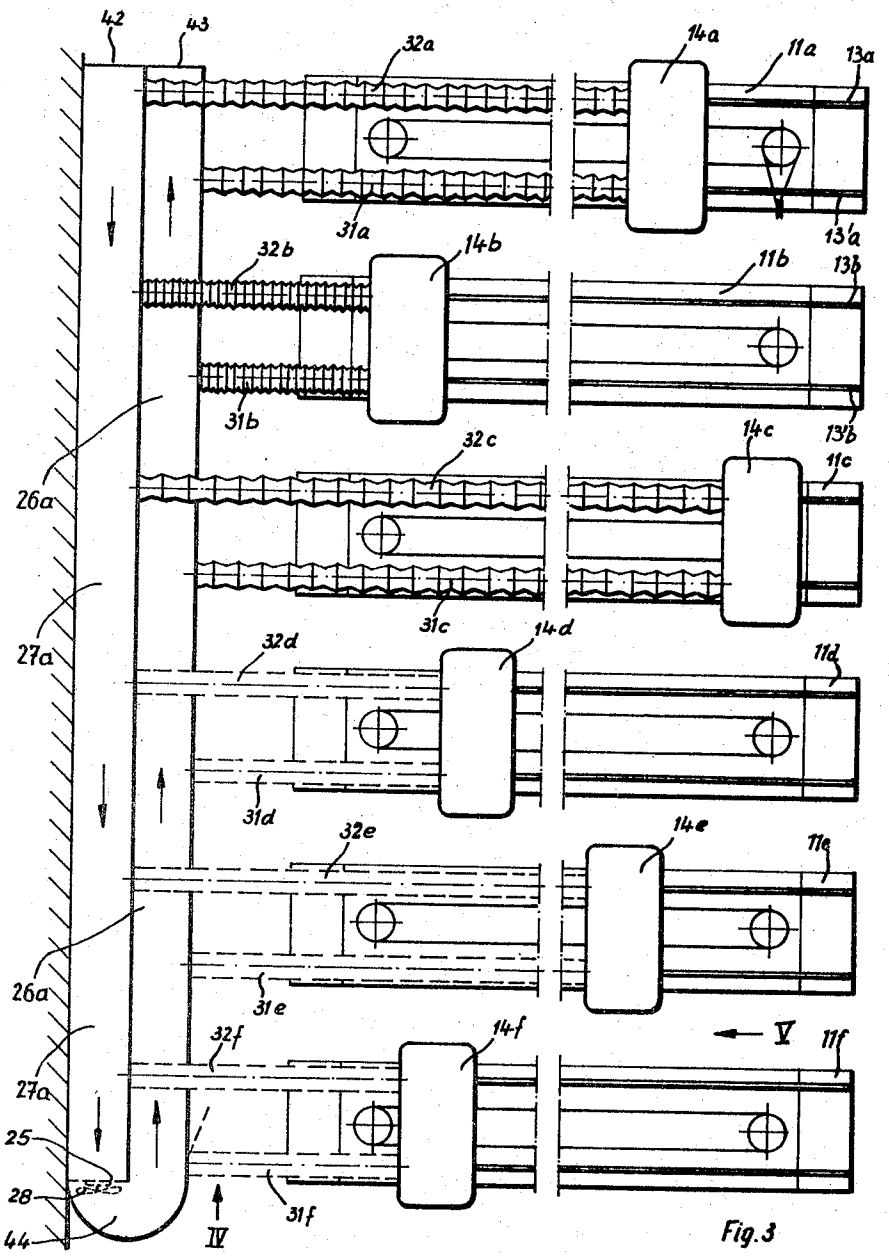

Fig.3

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PNEUMATIC CLEANING INSTALLATION

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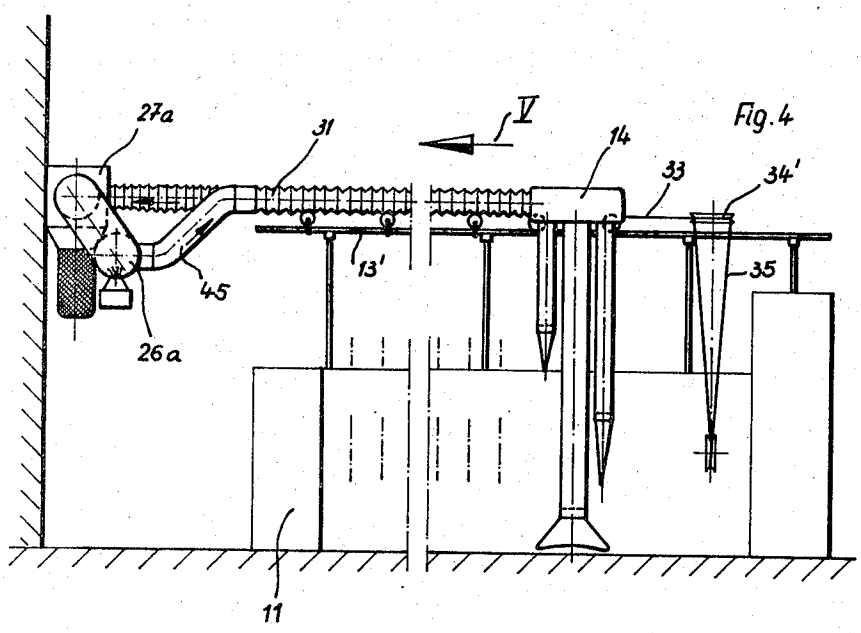

Fig. 4

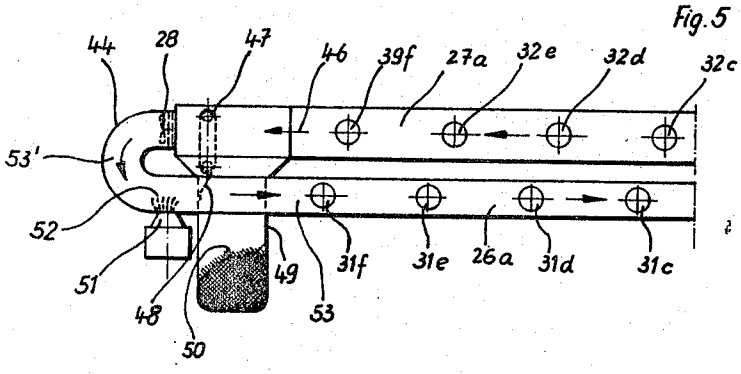

Fig. 5

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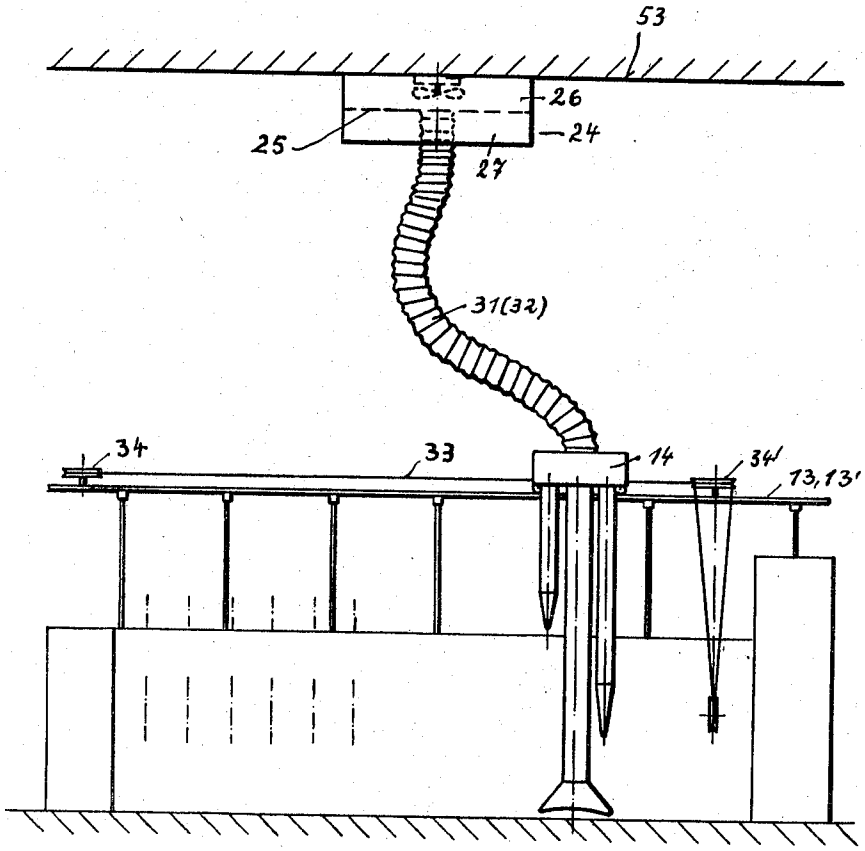

Fig.6

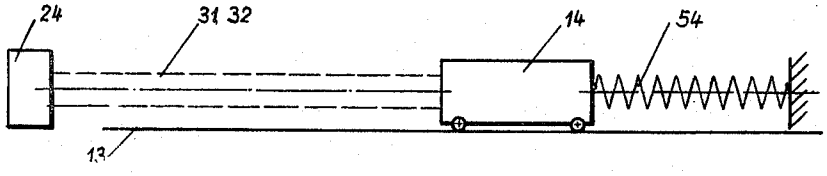

Fig.7

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PNEUMATIC CLEANING INSTALLATION

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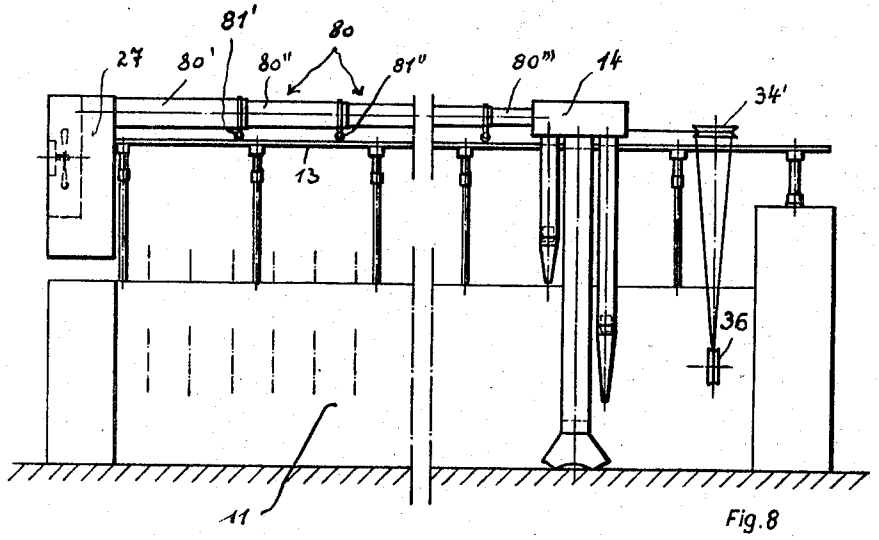

Fig.8

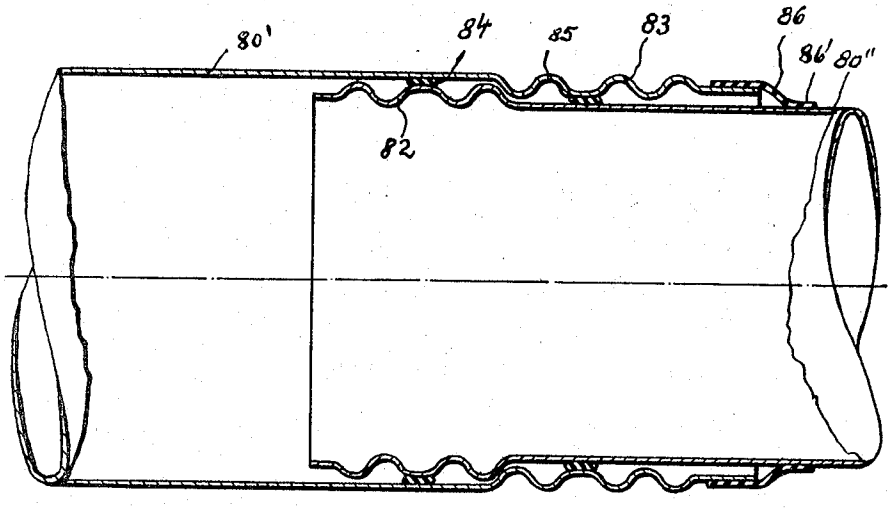

Fig.9

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PNEUMATIC CLEANING INSTALLATION

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Filed Nov. 9, 1964, Ser. No. 409,692
Claims priority, application Germany, Nov. 12, 1963, J 24,732
30 Claims. (Cl. 15—312)

The invention concerns a pneumatic cleaning installation employing a carriage adapted to travel above a textile machine and having blowing and suction members dependent therefrom. Known travelling pneumatic installations of this type usually employ a carriage which can travel over a textile machine or line thereof under the action of driving means, for example, an electric motor, incorporated on the carriage, the same or different driving means serving for the drive of a fan or fans for the production of the suction and blowing air currents, filter means and a storage chamber for collected dust, fly, lint or the like also being mounted on the carriage. Such carriage is heavy, and complicated in construction, primarily because its working parts must be disposed in close relationship. Furthermore, such a carriage has intricate inner air channels and is consequently expensive and is liable to breakdown and thus requires considerabl maintenance. In addition, not only rail tracks for the carriage, but also cables or busbars for feeding the electric motors on the carriage have to be present which further increases the complexity and cast of the installation, and decreases the reliability thereof. Thus for example, the fire hazard is increased in that the motors are supplied from a low voltage high current source, with a severe risk of sparks being produced unless the equipment is properly and expertly maintained.

It is amongst the object of the present invention to provide an improved installation which overcomes at least to some extent the disadvantages aforesaid and which moreover has certain other advantages, such as for example a decrease in the driving power required for the carriage.

The pneumatic cleaning device according to the invention includes at least one carriage adapted for movement over a line of textile machinery which carriage substantially carries only blowing and/or suction cleaning members communicating with pressure and or suction chambers on the carriage, there being pressure and/or suction pipes connecting said chambers with a stationary fan-filter unit, said pipes being of a type which permit movement of the carriage.

The invention will be further apparent from the following description with reference to the several figures of the accompanying drawings, which show, by way of example only, a number of installations embodying the invention.

Of the drawings:

FIG. 1 is a side elevation of a first embodiment for operation on a single line of textile machinery;

FIG. 2 is a top view of the embodiment of FIG. 1;

FIG. 3 shows a top plan view of an installation incorporating several carriages, each similar to that of the arrangement of FIG. 1, for operation on several lines of textile machinery;

FIG. 4 shows a side elevation of a slightly modified installation seen on FIG. 3 in a direction corresponding with that of the arrow IV;

FIG. 5 shows an elevation of the installation of FIG. 4 in the direction of the arrows V on FIG. 4;

FIG. 6 shows a variation which may be applied to any of the arrangements of FIGS. 1–5;

FIG. 7 shows a compensating device;

FIG. 8 shows side elevation of an embodiment utilizing a telescopic pipe; and

FIG. 9 shows a section of telescopic connection point of the embodiment of FIG. 8.

Referring now to FIG. 1, it will be seen that double line rail track **13**, **13'** is provided and located on supports **12** above a ring spinning machine **11**. A substantially rectangular box shaped carriage **14** is provided and adapted to run on the rail track **13**, **13'**.

The interior of the carriage **14**, which preferably extends projected laterally as at **15** and **15'** beyond the rail track **13**, **13'** (see FIG. 2), is divided by a number of walls into pressure and suction chambers. For example, as can be seen in FIG. 2, two dividing walls **16** and **16'** are provided so that one suction chamber **17** and two pressure chambers **18** and **18'** result.

The chamber **18** communicates with the chamber **18'** by means of a connection (not shown). Pressure hoses **19** and **19'** having blowing nozzles **20** and **20'** depend on each side in known manner from the pressure chambers **18** and **18'** respectively. Suction hoses **21** having suction nozzles **22** depend on each side from the suction chamber **17**, and the nozzles **22** terminate adjacent the floor **23**.

A fixed fan-filter unit **24** is located at or adjacent one end of the spinning frame **11**. The unit **24** (shown schematically) essentially comprises a box which is divided into a pressure chamber **26** and suction chamber **27** by an intermediate wall **25** formed from a perforated sheet, thereby to constitute a filter.

A fan **28** is disposed in the chamber **26** and air flows through the filter wall **25** in the direction of the arrow **29**. The suction chamber **27** which is of substantially L-shaped cross-section also serves as a collection chamber for fly or the like, and can be emptied at any time by the opening of a flap **30**. Automatic or semi-automatic emptying is also possible if desired by provision of a suction pipe communicating with the chamber **27** via suitable means at a central position, the closure means being opened periodically or non-periodically, automatically or manually.

The carriage **14** is connected to the fan-filter-unit **24** by two expandable airtight pipes **31** and **32** each of concertina-type construction. The pipe **31** connects the pressure chambers **18** and **18'** of the carriage **14** with the pressure chamber **26** of the unit **24**, and the pipe **32** forms a connection between the suction chamber **27** of the unit **24** and the suction chamber **17** of the carriage **14**.

Drive means is provided consisting of an endless cable **33** which is led over pulleys **34** and **34'**, arranged adjacent to the ends of the spinning frame so that the carriage **14** can move to and fro over the whole length of the frame. The pulley **34'** is driven by a belt **35** extending over a pulley **36** which is driven from any suitable part of the mechanism of the spinning frame.

The carriage **14** is releasably linked or coupled onto the cable **33** by a pivoted or otherwise articulated member, in such manner that it is towed continuously to and fro by the cable or rope **33** in the direction of arrows **37** and **37'** (FIG. 2), the carriage running to and fro from one end of the spinning frame to the other as indicated by the double arrow **38**.

On the to and fro movement of the carriage **14** the pipes **31** and **32** which are constructed as coil hoses shorten or lengthen appropriately. The pipes **31** and **32** have a diameter of 20 cm., and are tightly connected by their ends to the appropriate chambers.

During the whole travel of the carriage **14** in both directions, blowing air flows out of the pressure chamber **26** through the pipe **31** into the pressure chambers **18** and **18'** of the carriage and thence through the blow-

ing hoses 19 and 19' and nozzles 20 and 20' onto parts of the spinning machinery, which can be selected as desired, by adjusting the lengths of the hoses 19 and 19' and the type of nozzle 20 and 20'. The air flow is indicated by the arrow 39. At the same time suction air, which is drawn through the suction pipes and nozzles 21 and 22 and is laden with fly (fibrous dust), flows through the pipe 32 in the direction of the arrow 40 and enters the suction chamber 27 and thence passes as shown by arrow 29 through the filter wall 25 into the pressure chamber 26 whence it is passed out through the pipe 31 as blowing air. Thus a substantially closed air flow results which is only modified by the distances between the nozzles 20 and 20' on the one hand and 22 on the other. The same amount of air is always sucked up as shown by the arrow 40 as is blown out as shown by arrow 39.

On passage through the filter wall 25 the fibrous fly settles thereon. Scrapers or the like, blowers, brushers or similar devices can be provided at 25', to convey the fly from the filter wall 25 in the direction indicated by arrow 41 into the lower part of the suction chamber 27. From there the dust and fly can be removed through the flap 30 or by other means as already stated.

Referring now to FIG. 3, wherein like parts are indicated by like reference numerals, a very advantageous, economical development of the invention, is shown. Carriages 14*a*, 14*b*, 14*c*, . . . are in each case arranged on the rails 13*a*, 13*b*, 13*b'*, 13*c*, 13*c'*, . . . on, for example, six spinning machines set up parallel to one another and at the normal distance apart. Each carriage has two concertina-type pipes 31*a*, 32*a*, 31*b*, 32*b*, ... The carriages are shown in various positions of travel. For example the position of carriage 14*b* is substantially one of the end positions wherein the pipes 31*b* and 32*b* are greatly compressed. The position of carriage 14*c* is substantially the other end position wherein the pipes 31*c* and 32*c* are fully expanded.

It should be noted that the suction chamber 27 of the arrangement of FIGS. 1 and 2 is here extended into a suction channel 27*a* which is as long as the total length of the group of machines. In the same way the pressure chamber 26 of the arrangement of FIGS. 1 and 2 is extended to a pressure channel 26*a* which is as long as the channel 27*a*. Both channels are closed at one end by end walls 42 and 43. At the other end a curved connector 44 is provided which incorporates the fan 28 and filter wall 25.

It should be mentioned that the fan 28 is preferably arranged behind the filter 25 in the direction of flow, since the fan will forward air which is already filtered. All the pipes 32*a*, 32*b*, 32*c*, . . . of the carriages 14*a*, 14*b*, 14*c* are attached to the suction channel 27*a*, and all the pipes 31*a*, 31*b*, 31*c* . . . are attached to the pressure channel 26*a*. From this it results that all the pressure chambers 18 and 18' of all the carriages 14 are fed with air from the pressure channel 26*a* and that all the suction chambers 17 of the carriages 14 supply fly laden air to the suction channel 27*a*.

It is convenient for the pipes 31, 32*a*, . . . to run substantially at right angles to the channels 26*a* and 27*a*. This is not however absolutely essential and is largely determined by constructional conditions. Thus, the angle may be other than a right angle for an installation in a room having inclined walls.

As shown in FIG. 4, the channel 26*a* can be disposed in downwardly inclined relationship with respect to the channel 27*a*. In this case it is convenient to provide a rigid pipe 45 between each pipe 31 and the channel 26*a*.

The suction channel 27*a* may for example, if desired also have a square cross-section. As shown particularly in FIG. 5, a filter 47 in the form of an endless band is provided in place of the wall 25, and is positioned in front of the fan 28 seen in the direction of air flow 46. The filter 47 is adapted to revolve continuously and is scraped at a suitable position by a scraper 48 so that the fly collected thereon falls into the suck or similar container 49 and deposits itself therein as indicated at 50. The waste container 49 is removable for emptying purposes, but may be arranged for automatic emptying if desired.

A feature which favours good operation of the cleaning installation and also the spinning process is the addition of a dampening member 51, which, seen in the direction of flow is advantageously located after or behind the fan 28 and correctly conditions the blowing air by spraying in liquid 52.

If desired, an air heating or air cooling device may be provided in addition, at any suitable position, such as for example at positions 53 or 53' in the pressure channel 26*a*. It can also be arranged that the liquid or water spray 52 and/or the heating or cooling of the air 53 is adjusted or regulated in proportion to one or more predetermined or desired values.

Under some circumstances it is not absolutely necessary for the pipes 31, 32 to run horizontally. If desired, a rise as shown in FIG. 1 from bottom right to top left may take place if the pipes 31, 32 have some flexibility or if their attachments with the carriage and fan-filter unit are pivotal.

As shown in FIG. 6, the units 24 may be suspended substantially centrally above the machines 11, for example, from the ceiling of the spinning room so that the pipes 31 and 32 swing to and fro in the fashion of a pendulum as the carriage travels to and fro along the track, lengthening and shortening correspondingly. Such an arrangement may also be used for a group of machines as in FIG. 3. In these cases each fan-filter unit 24 is fixed to the ceiling of the spinning room. The chambers 26 and 27 of the unit 24 are connected with concertina-type flexible pipes 31 and 32 which leads in the manner already described. The difference here as against the embodiments previously described is that the pipes 31 and 32 enter the box or casing of the carriage 14 from above. In this case too, the carriage 14 is moved to and fro, by a cable 33, along the track rails 13 and 13'.

FIG. 7 shows how any lateral force exerted on the carriage 14 by the pipes 31 and 32 in extension or compression thereof may be compensated. Thus, by way of example, a counter spring 54 may be provided which is turned to the resilient forces of the pipes 31 and 32.

FIGS. 8 and 9 show an embodiment wherein the expandable pipes are of telescopic construction.

Thus FIG. 8, shows, by way of example, an arrangement substantially as that of FIGS. 1 and 2, but wherein the pipes 31 and 32 are replaced by telescopic units.

The carriage 14 which may be designed and built in the manner already described runs on a rail 13 which is located adjacent to or above the spinning machine 11. Telescopic pipe units are arranged between the carriage 14 and the chambers 26 and 27, of the fan-filter unit 24. Each pipe consists of a plurality of individual telescopic pipes 80', 80'' and so on which can be pushed into and drawn out of one another, the telescopic pieces 80' on the extreme left (FIG. 8) being secured to the chambers 26 and 27 and the pieces 80''' at the extreme right being attached to the carriage 14. When the carriage 14 moves to the left, the individual telescopic pieces 80', 80'' . . . push into one another, and conveniently and advantageously support rollers 81', 81'' . . . are arranged on the ends of same or all of the telescopic pieces 80', 80'' etc. . . . The support rollers may run on the rail 13 or on a separate rail, which is present in any case and ensures the alignment of the individual telescopic pieces 80', 80''. . . .

A connection between the telescopic pieces 80', 80'' is shown by way of example in detail in FIG. 9 on an enlarged scale. Such connection points are in each case present between adjacent telescopic pieces. As shown in FIG. 9 the inter-embracing ends 82 and 83 of the

telescopic pieces 80' and 80'' can be formed with corrugations. The difference in diameter between the pieces 80' and 80'' substantially corresponding with the weight of the corrugations. The end 82 carries at a suitable position on the periphery thereof a sliding seal ring 84, consisting of a flexible, resilient material for example a rubber of suitable shore-hardness, or a plastic. The seal-ring 84 is in sliding contract with the inner wall of the piece 80' and moreover in the uncorrugated part thereof. The end 83 carries an inner seal-ring 85 which is adapted to slide on the uncorrugated part of the outer wall of the piece 80. A sufficient seal is thus produced by these seal-rings 84 and 85. However other methods of sealing may of course be used.

The twofold arrangement of rings, namely 84 and 85 also ensures a proper alignment of the pieces 80' and 80''.

It is advantageous to provide a very resilient sealing lip or sealing lip ring 86 which is tightly secured on the end of piece 80'—i.e., the telescopic piece of larger diameter in such a way that the free end 86' of the lip ring 86 is capable of sliding on the outer wall of 80'' with resilient contact.

It has become evident that with such telescopic pipes a very wide range of alteration in length is obtainable, ratios of 1:10 between the shortest and longest lengths being readily available. It should also be added that, according to invention it is possible not to take the drive for the carriage from the textile machine itself, but to provide, in place thereof, for the direct drive of the cable pulleys 34' an electric motor mounted on the textile machine frame or elsewhere. A similar electric motor can be arranged in the same way for the cable pulley 36 for example co-axial with the pulley 36. Such drive by electric motor would be chosen, for example, if for particular reasons, taking the drive from the textile machine itself is not possible or impractical. The use of expandable pipes opens up an interesting possibility, in that the low pressure produced within the pipe unit due to the stationary suction (sucking from the chamber 27) can draw the carriage in the direction of the fixed pipe end, as a result of the force which according to FIG. 8, then acts on the carriage from right to left, this force being calculated substantially from the difference between the atmospheric air pressure and the smaller pressure ruling in the low pressure telescopic pipe, the total pushing or drawing force being the product of the cross-sectional surface of the pipe and the pressure difference.

If for example two concertina-type pipes similar to those in FIG. 2 of the drawing wherein the one feeds pressure air and the other suction air are present, then by suitable switching of the air currents (if desired controlled in a manner depended on travel of the carriage), to effect complete or partial closure for the attachment area of the concertina-type pipes to the carriage, a purely pneumatic drive can be obtained for the carriage, wherein (see FIG. 2) in the one case the excess pressures pushes the carriage to the right and in the other case the low pressure draws the carriage to the left. The working will however generally be such that, for example, with a pendulating the textile machine will only be sucked (with full closure), or sucked and blown to a lesser degree, during one direction of travel and only blown (with complete closure), or (with partial closure) blown and sucked to a lesser degree during the opposite direction of travel.

The new principle of using or making available the high and low pressures in the pipes for the movement of the carriage, can be employed when the pipes are of a type which have a tendency to bulge out or move out laterally, in which case guides to keep the pipes straight should be provided.

It will be appreciated that it is not intended to limit the invention to the above examples only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof.

What we claim is:

1. A travelling pneumatic cleaning installation for textile machinery and the like comprising in combination, at least one carriage adapted to be moved over a line of the machinery to be cleaned; at least two chambers on said carriage; a fixed stationary fan-filter unit in the vicinity of said machinery, said fan-filter unit having a suction inlet end and a pressure outlet end; at least two collapsible and extensible pipe means, one of said pipe means being permanently connected at one end thereof to said suction inlet end of said unit and at the other end thereof with one of said chambers and the other of said pipe means being permanently connected at one end thereof to said pressure outlet end of said unit and at the other end thereof with the other of said chambers, whereby said chambers are held at a pressure different from atmospheric pressure and the pressure in one chamber different from the pressure in the other chamber; and a number of ducts communicating at one end thereof with said chambers, respectively, and each having an other open end directed towards said machinery so as to produce between said open ends of said ducts currents of air for cleaning purposes.

2. A travelling pneumatic cleaning installation according to claim 1 wherein said pipe means extend substantially horizontally between said carriage and said fan-filter unit.

3. A travelling pneumatic cleaning installation according to claim 2 wherein each pipe means includes a plurality of telescopically interconnecting pieces, each of tubular section.

4. A travelling pneumatic cleaning installation according to claim 3 wherein support rollers are provided on at least some of said pieces.

5. A travelling pneumatic cleaning installation according to claim 4 wherein the ends of said telescopically interconnecting pieces are formed with corrugations.

6. A travelling pneumatic cleaning installation according to claim 5 wherein external and internal sealing rings are provided for each said piece, said rings being capable of sliding on the uncorrugated areas of the corresponding inner and outer surfaces of said pieces, respectively, thereby to form an airtight seal therebetween.

7. A travelling pneumatic leaning installation according to claim 6 wherein an annular sealing lip is provided on one end of each said piece, said lip projecting substantially thereover, the free end of said lip being adapted to slide to form a resilient seal on the outer surface of the following telescopically interconnecting piece of smaller diameter, the lip consisting of a resilient material.

8. A travelling pneumatic cleaning installation according to claim 3 wherein the ends of said telescopically interconnecting pieces are formed with corrugations.

9. A travelling pneumatic cleaning installation according to claim 8 wherein external and internal sealing rings are provided for each said piece, said rings being capable of sliding on the uncorrugated areas of the corresponding inner and outer surface of said pieces, respectively, thereby to form an airtight seal therebetween.

10. A travelling pneumatic cleaning installation according to claim 9 wherein an annular sealing lip is provided on one end of each said piece, said lip projecting substantially thereover, the free end of said lip being adapted to slide to form a resilient seal on the outer surface of the following telescopically interconnecting piece of smaller diameter, the lip consisting of a resilient material.

11. A travelling pneumatic cleaning installation according to claim 2 wherein each said pipe means is of resilient concertina-type coiled construction.

12. A travelling pneumatic cleaning installation according to claim 11 wherein resilient spring means are provided in connection with said carriage to compensate for any force placed thereon by the concertina-type pipe means.

13. A travelling pneumatic cleaning installation ac-

cording to claim 12, wherein at least one blowing pipe means and at least one suction pipe means is provided, and including means for periodically restricting at least to some extent the air flow in each said pipe means alternately, whereby the carriage is caused to move to and fro over the line of machinery under pneumatic action.

14. Travelling pneumatic cleaning installation according to claim 13 and adapted to operate on a plurality of lines of textile machinery, arranged in parallel, there being one said carriage for each said line, and including two air channels one of which is connected to said suction inlet and the other of which is connected to said pressure outlet of said fan-filter and extending from the same in a line substantially at right angles to the direction of said lines of machinery, said pipe means connecting said carriages with said channels.

15. Travelling pneumatic cleaning installation according to claim 11 and adapted to operate on a plurality of lines of textile machinery, arranged in parallel, there being one said carriage for each said line, and including two air channels one of which is connected to said suction inlet and other of which is connected to said pressure outlet of said fan-filter unit and extending from the same in a line substantially at right angles to the direction of said lines of machinery, said pipe means connecting said carriages with said channels.

16. A travelling pneumatic cleaning installation accoridng to claim 3, wherein at least one blowing pipe means and at least one suction pipe means is provided, and including means for periodically restricting at least to some extent the air flow in each said pipe means alternately, whereby the carriage is caused to move to and fro over the line of machinery under pneumatic action.

17. Travelling pneumatic cleaning installation according to claim 16, and adapted to operate on a plurality of lines of textile machinery, arranged in parallel, there being one said carriage for each said line, and including two air channels one of which is connected to said suction inlet and the other of which is connected to said pressure outlet of said fan-filter unit and extending from the same in a line substantially at right angles to the direction of said lines of machinery, said pipe means connecting said carriages with said channels.

18. Travelling pneumatic cleaning installation according to claim 1 wherein said fan-filter unit is disposed substantially centrally above said line of machinery, said pipe means being constituted by collapsible flexible hoses.

19. A travelling pneumatic cleaning installation according to claim 18 including a towing cable in the form of an endless band mounted above said line of machinery, an articulated connection between said carriage and said towing cable, and means to drive said cable, whereby said carriage moves to and fro over said line of machinery.

20. Travelling pneumatic cleaning installation according to claim 19 wherein said towing cable is arranged to be driven from the motion of said textile machinery.

21. A travelling pneumatic cleaning installation according to claim 1 including a towing cable in the form of an endless band mounted above said line of machinery, an articulated connection between said carriage and said towing cable, and means to drive said cable, whereby said carriage moves to and fro over said line of machinery.

22. A travelling pneumatic cleaning installation according to claim 21 wherein said towing cable is arranged to be driven from the motion of said textile machinery.

23. A travelling pneumatic cleaning installation according to claim 2, including a towing cable in the form of an endless band mounted above said line of machinery, an articulated connection between said carriage and said towing cable, and means to drive said cable, whereby said carriage moves to and fro over said line of machinery.

24. A travelling pneumatic cleaning installation according to claim 23 wherein said towing cable is arranged to be driven from the motion of said textile machinery.

25. A travelling pneumatic cleaning installation according to claim 1 wherein the filter of said fan-filter unit is disposed on the suction side of said fan, and including a receptacle which may be emptied by suitable means to collect material gathered on said filter.

26. A travelling pneumatic cleaning installation according to claim 25 including means for scraping material collected on said filter and delivering same to said receptacle.

27. Travelling pneumatic cleaning installation according to claim 1 wherein said fan-filter unit incorporates means for conditioning the air circulated thereby.

28. A travelling pneumatic cleaning installation according to claim 1 and adapted to operate on a plurality of lines of textile machinery, arranged in parallel, there being one said carriage for each said line, and including two air channels one of which is connected to said suction inlet and the other of which is connected to said pressure outlet of said fan-filter unit and extending from the same in a line substantially at right angles to the direction of said lines of machinery, said pipe means connecting said carriages with said channels.

29. Travelling pneumatic cleaning installation according to claim 2 and adapted to operate on a plurality of lines of textile machinery, arranged in parallel, there being one said carriage for each said line, and including two air channels one of which is connected to said suction inlet and the other of which is connected to said pressure outlet of said fan-filter unit and extending from the same in a line substantially at right angles to the direction of said lines of machinery, said pipe means connecting said carriages with said channels.

30. Travelling pneumatic cleaning installation according to claim 1, wherein said fan-filter unit includes means for moistening the air circulated thereby.

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