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Meyer

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[54] **DRUM-TYPE MACHINE FOR THE TREATMENT OF TEXTILE MATERIAL**

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[51] **Int. Cl.** **D06f 37/08**

[58] **Field of Search** 68/20, 58, 142–146, 68/210; 34/109, 129; 432/106; 259/3; 51/164

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[57] **ABSTRACT**

Drum-type machine operating in a continuous mode of operation for the batchwise treatment of textile material or similar goods, particularly for the drying of laundry, comprising a drum which is mounted to be rotatably driven about an approximately horizontal axis in a stationary housing. The drum is provided with carrier ribs and a treatment medium is present in the drum to treat the material. Radial, axially adjustable separating disks which cover part of the drum cross section are disposed within the drum. In order to convey the material to be treated batchwise separately through the drum, a plurality of separating disks together form a partition covering the drum cross section, and at least one separating disk of each partition is axially adjustable in parallel with the drum axis by means of servo-driven adjusting mechanisms.

39 Claims, 8 Drawing Figures

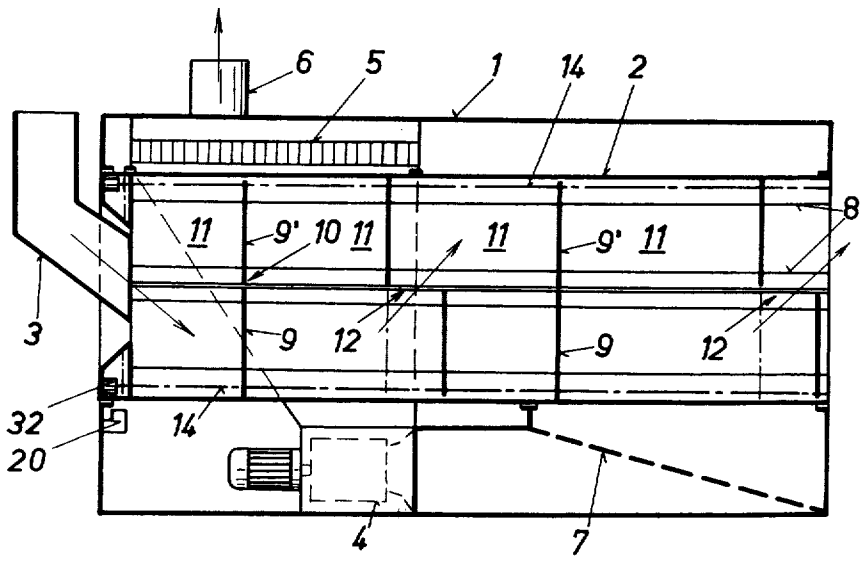


FIG. 1

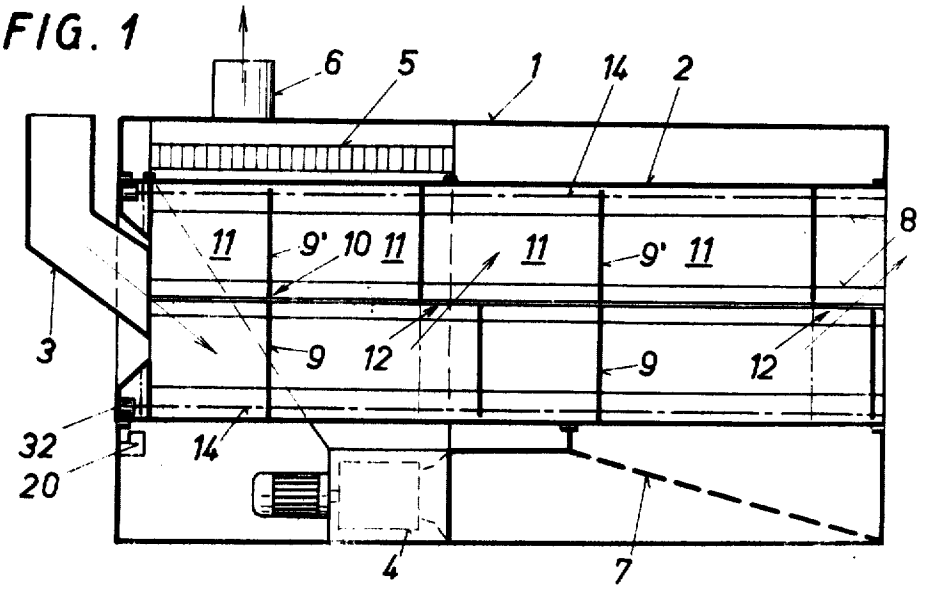


FIG. 2

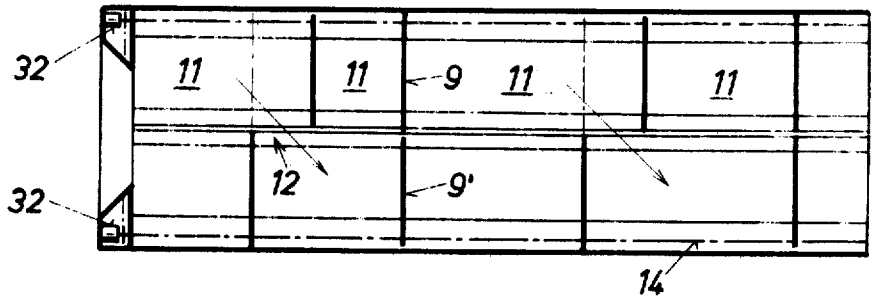


FIG. 3

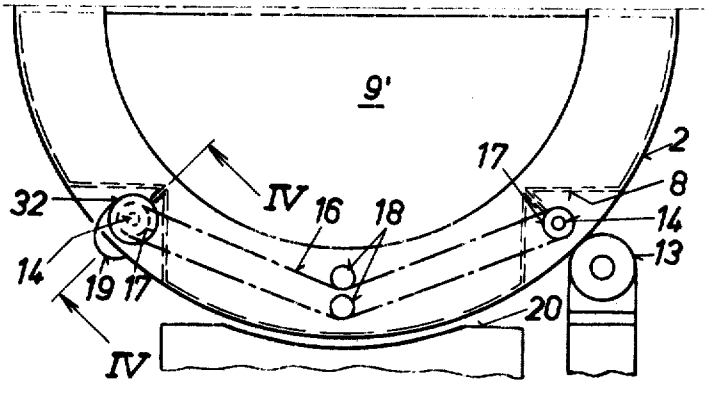


FIG. 4

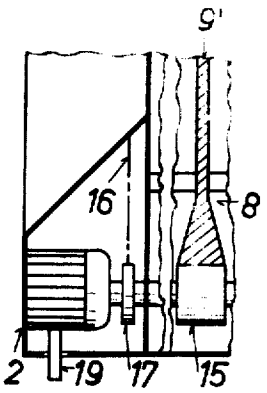


FIG. 5

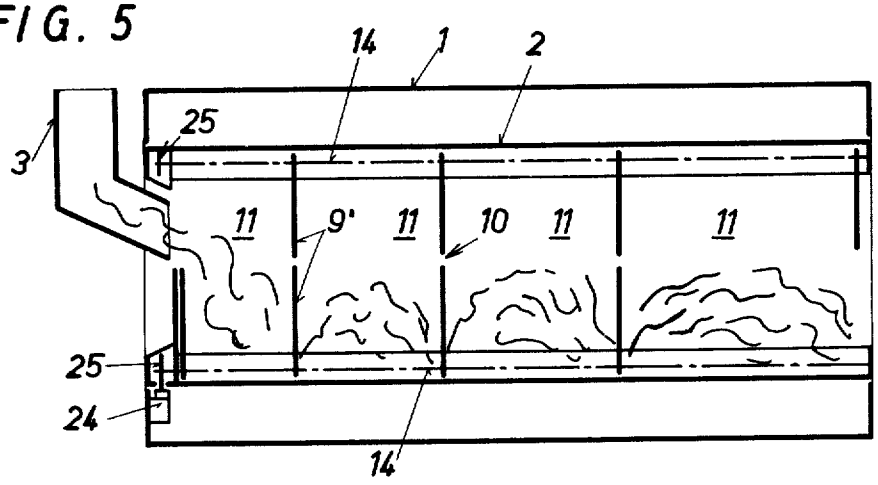


FIG. 6

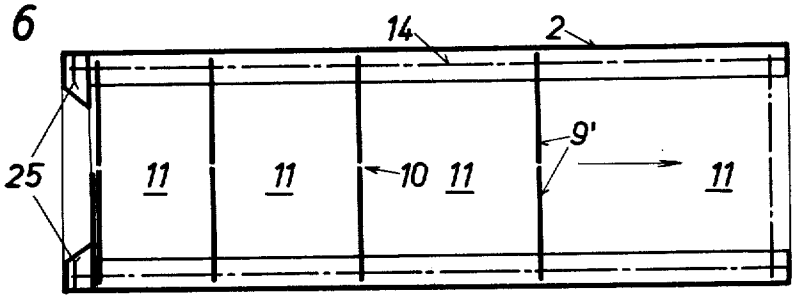


FIG. 7

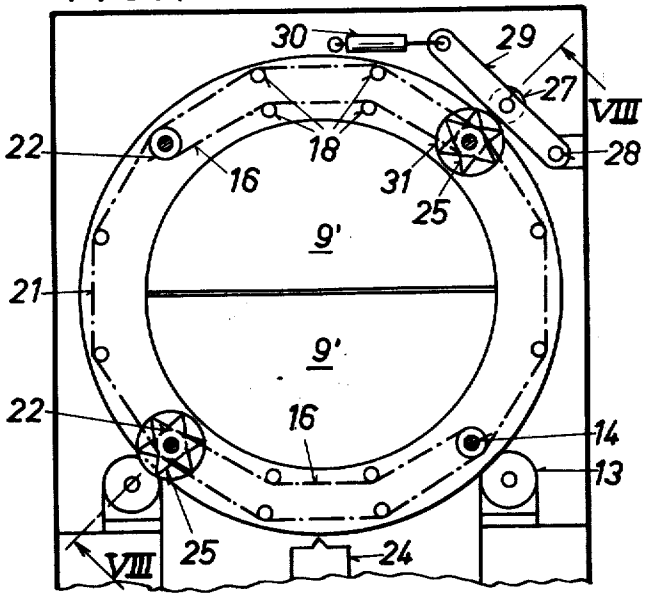
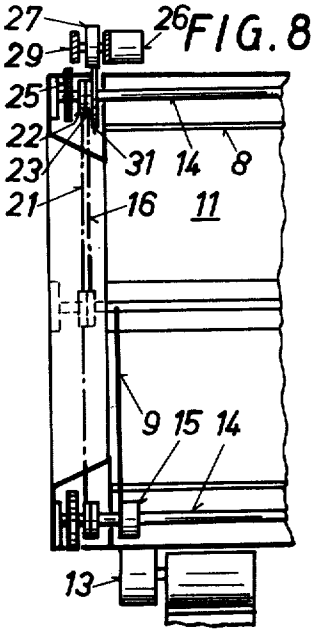


FIG. 8



DRUM-TYPE MACHINE FOR THE TREATMENT OF TEXTILE MATERIAL

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a drum-type machine operating in a continuous mode of operation for the batchwise treatment of textile material or similar goods, particularly for the drying of laundry, comprising a drivable drum mounted to be rotatable approximately horizontally in a stationary housing and provided with carrier or entrainment ribs. A treatment medium is present in the drum and radial, axially adjustable separating disks covering part of the drum cross section are disposed within the drum.

In applicant's German Utility Model 7,047,915, a drum-type machine has been disclosed wherein the radial separating disks provided in the drum are formed as half disks and are arranged at axial spacings, so that the material to be treated falls through the slot between the adjacent separating disks as it is conveyed through the rotating drum. In this way, the throughput is controlled by the slot size, i.e., depending on the size of the slot, a specific quantity of material to be treated moves axially through the drum and exits at the end from the drum. Thus, with the aid of appropriately arranged separating disks within the drum and at the end of the drum, a predetermined passage speed of the goods to be treated can be set, so that, depending on the type of material involved, the most favorable treatment time can be obtained. It has further been contemplated that the passage slot between the separating disks is made to be adjustable to accommodate changes in the passage speed. A separation of the batches is also possible with the aid of these separating disks. Furthermore, German Pat. No. 1,194,362 describes a drum-type machine wherein the drum consists of axially displaceable half disk parts. By displacing one of these half disk parts by the depth of one chamber, and by a respective rotation of the drum by half a revolution, the separate batches can each be moved forward in the conveying direction by respectively one chamber. It is a disadvantage, in this last-mentioned device, that the chambers all must be of equal size, since otherwise the separating disk parts cannot be synchronized. Thus, the size of the chambers cannot be made of different lengths to adapt same to the respective condition and treatment phase of the material. In this connection, a larger chamber volume is normally necessary or desired at the end of the treatment process. For example, the rinsing process at the end of the laundering procedure requires a larger relative portion of treatment bath than is required at the beginning. Similar considerations apply for dried textile material which, in the dried condition, occupies a considerably larger volume than in the wet state. For these reasons, an economical exploitation of the drum volume is impossible with the above-discussed previously known arrangement, since the maximum batch size is determined by the chamber volume which is only required in this size at the end of the treatment process. Also, the various treatment stages cannot be chronologically varied with respect to one another in the single drum. Furthermore, it is impossible or extremely difficult with this treatment process to discharge the material from the machine in the required fluffed-up and distributed condition.

Therefore, it is contemplated by this invention to obtain, in addition to a batchwise, controllable passage of the material, a chronologically lengthened discharge of the material at the end of the drum, as well as an adaptation of the chamber volume to the respective condition of the material to be treated during the treatment process.

In accordance with a preferred embodiment of the invention, a plurality of separating disk parts together form a partition covering the drum cross section with at least one separating disk part of each partition being adjustable axially parallel to the drum axis of rotation by adjusting means driven by auxiliary power.

A particularly advantageous construction of the mounting and adjustability of the separating disk parts is obtained, according to the invention, by providing that the separating disk parts, preferably constructed as half disks, are mounted and axially guided in the carrier ribs at the drum.

In one preferred embodiment of the present invention, only one of the half disks for each partition is movable with alternate partitions being open and closed during operation of the drum to optimize conveyance of the material through the open partitions while limiting emptying or filling from treatment chambers adjacent respective opposite ends of the treatment chambers at opposite sides of the open partition.

In another preferred embodiment of the present invention, both half disks for each partition are movable such that the two half disks for a partition can be moved axially together in the conveying direction. The half disks are for each partition also separately axially movable to accommodate filling and emptying of the respective treatment chambers bounded thereby.

These and further objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawings which show, for purposes of illustration only, several embodiments in accordance with the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side schematic view of a drum-type machine constructed in accordance with the present invention with displaceable separating disk parts within the drum at one end position thereof;

FIG. **2** is a side schematic view of the drum of FIG. **1** showing the other end position of the separating disk parts;

FIG. **3** is a partial front schematic view of the drum of FIG. **1** showing adjusting mechanism for axially adjusting the movable disk parts;

FIG. **4** is a partial view along line IV—IV of FIG. **3**;

FIG. **5** is a side schematic view of a drum-type machine constructed in accordance with another preferred embodiment of the present invention with the separating disk parts at one end position thereof;

FIG. **6** is a side schematic view of the drum of FIG. **5** showing the other terminal position of the separating disks;

FIG. **7** is a partial front schematic view of the drum according to FIGS. **5** and **6** showing adjusting mechanism for axially adjusting the movable disk parts; and

FIG. **8** is a sectional view along line VIII—VIII of FIG. **7**.

DETAILED DESCRIPTION OF THE DRAWING

Referring to FIG. 1, the drum-type machine for the treatment of textile material or similar goods comprises a fixed housing 1 wherein a drum 2 is mounted to be rotatable and drivable in a conventional manner for rotation about a substantially horizontal drum axis. The drum 2 is open at both ends, a feeding hopper 3 serving for the introduction of the material to be treated at the inlet end. A stream of air, produced by a blower 4 and heatable by a heating unit 5, flows through the drum 2, at least part of this air stream being exhausted to the outside via an exhaust pipe 6. A purifier 7, for example in the form of a screen, filter cloth, filter bag, or the like, serves for cleaning the exhaust air exiting from the drum 2. In the drum 2, the material is partially entrained in the direction of rotation of the drum by carrier ribs 8, lifted upwardly, and opened up during the subsequent free fall, and is thereby brought into intensive contact with the treatment medium.

The interior of the drum 2 is subdivided in the axial direction by separating disk parts 9 and 9'. The disk parts are preferably constructed as semicircular half disks and form, in pairs, when they lie in one plane, closed partitions 10 dividing the drum 2 into closed treatment chambers 11. These treatment chambers 11 can all be of the same size or also differently large. For example, the treatment chambers can increase in volume in the conveying direction, as illustrated in the preferred embodiments.

In the preferred embodiment of FIGS. 1 through 4, one disk half 9 of each partition 10 is mounted fixedly to the drum 2, while the other disk half 9' is mounted to be axially displaceable so that, by an axial shifting of the disk halves 9', a passage 12 is produced through the partition (as best shown in FIG. 1 between the second and third chambers 11 from the left end of the drum). The material falls through this passage 12 during the rotation of the drum and passes into the following (third from left in FIG. 1) chamber 11. This axial movement of the material may be enhanced by a corresponding flow component of the air and/or by placing the drum into an inclined position. In order to prevent the immediate exit from the chamber (third from left in FIG. 1) 11 to be loaded, the partition 10 arranged (at the right side thereof) in the conveying direction is closed. Once the material to be treated has completely entered this (third from left in FIG. 1) chamber 11, the partition 10 at the input or left side is closed, and at the earliest at this instant, the partition at the outlet or right side is opened. Thus, respectively every second partition 10 is simultaneously opened, whereas the partitions disposed therebetween are closed, and vice versa. The conveying speed of the material to be treated through the drum 2 accordingly depends on the size of the passage 12 and on the instant at which the partitions 10 are opened; consequently, this speed is controllable.

As can be seen from FIGS. 3 and 4, the drum 2 is mounted on friction wheels 13 which can be set into rotation by drive motors. Although only one wheel 13 is shown to simplify this disclosure, it will be understood that an appropriate number of wheels and associated drive motors will be provided to support and rotate the drum 2. The movable disk halves 9' are connected with threaded bushings 15 attached threadedly to threaded spindles 14 disposed in the carrier ribs 8. One of the threaded spindles 14 is connected to a motor 32 and is set into rotation by the latter. Each of the movable disk halves 9' are mounted at respectively two threaded spindles 14 and are guided axially thereby. Both threaded spindles 14 for a given disk half 9' carry chain wheels 17 over which a rotating chain 16 is placed in order to obtain a planar-parallel displacement of the disk half 9'. Guide wheels 18 serve for guiding the chain 16. The motor 32 has a sliding contact 19 slidable along a contact path or plate 20 affixed to the housing deriving current from this plate 20. The motor 32, upon each rotation of the drum, obtains a current pulse from plate 20 which results in a rotation of the threaded spindles 14. By an automatic programming device, it is furthermore possible to limit the length as well as the number of these current pulses, so that a specific opening width in the partition 10 and thus a desired flow speed of the material to be treated through the drum 2 can be initially programmed. Since such a programming device could be constructed by one skilled in the art from known means, given the present disclosure, the details of such a programming device have not been included herein in order not to obscure the disclosure of the present invention.

The resetting of the disk halves 9' from the FIG. 2 to the FIG. 1 position takes place correspondingly by the programming device. Alternatively, separate means for controlling the spindles to return the disk halves to the FIG. 1 may be provided.

During the entire opening time of the partition 10 (second partition from left in FIG. 1), the batch of textile material present in the last (far right FIG. 1) chamber 11 exits therefrom and is distributed uniformly onto a subsequent non-illustrated conveying means, for example a conveyor belt. The length of the treatment chambers 11 increases in the conveying direction. Correspondingly, the respective passage 12 can differ by an appropriate selection of the pitch of the threaded spindles 14. Also, the contact path 20 can also be extended around the entire circumference of the drum or non-contacting control switches responsive to rotation of the drum are likewise contemplated by the present invention for control of motor 32.

In the embodiment of FIGS. 5 through 8, similar reference numerals as in FIGS. 1–4 are used for like structure. The partitions 10 each consist of two displaceably supported disk halves 9'. In accordance with FIG. 5, the drum 2, for loading purposes, is at a standstill with a horizontally disposed parting line between the disk halves 9', wherein the disk half 9' disposed at the top is advanced to the right by one chamber division with respect to the lower disk halves, so that a batch of laundry can be fed from the feeding hopper 3 into the first treatment chamber 11. Thereafter, the upper disk halves 9' are reset to the left to form the chamber division as illustrated in FIG. 6. The treatment of the material then commences with the now initiated rotation of the drum, during which the disk halves 9' forming the now closed partitions 10, are moved together in the conveying direction. The batches of laundry in the treatment chambers 11 are thus shifted in the conveying direction by one chamber division, whereby the finished batch of textile material is ejected from the last treatment chamber 11 which is now open toward the discharge side. After a predetermined period of time which is at least as long as the time required for adjusting the partitions 10, the drum 2 is arrested in a posi-

tion wherein the disk halves 9' are disposed one on top of the other, and the upper disk halves 9' are again displaced by one chamber size in the direction toward the feed opening. Thereafter, the drum 2 is turned by half a revolution into the position according to FIG. 5, whereupon a new charging step is initiated. The further processes take place as described above.

Also in this embodiment of FIG. 5, the adjusting means for the partitions 10 can be a threaded spindle 14 similar to spindles 14 for the FIG. 1 embodiment. These spindles 14 have different thread pitches in order to be able to adjust the partitions 10 by respectively one chamber division for a given rotation of the drum and for different length chambers along the length of the drum axis, preferably with the longest chamber at the outlet end as illustrated.

The rotation of the threaded spindles 14 can be achieved in a manner already described above for the embodiment of FIG. 1 by means of electric motors 32 driven in one or the other direction of rotation by a programming circuit. The common movement of the disk halves 9' can also be accomplished by a stop 24 provided fixedly at the housing, which stop engages, upon each rotation of the drum 2, the teeth of a gear wheel 25 and rotates the latter by one graduation. This gear wheel 25 is disposed on one of the threaded spindles 14 associated with a formation of disk halves 9'. After the final position of the disk halves 9' has been attained (with the right most closed partition approaching the outlet end of the drum), overload safety clutches provide that the drum 2 can continue its rotation unimpeded. For this purpose, the stop 24 can also be constructed to be switchable into an engagement position and into an idling position. The two spindles 14 for each of the upper and lower sets of disk halves are synchronously coupled by chain 16 in a manner as described above for FIG. 3.

At the end of the treatment period, the drum 2 comes to a standstill in a position with a horizontal parting line between the two disk halves 9' (FIG. 7). The resetting of the disk halves 9' respectively disposed at the top, which now becomes necessary, is effected by a wheel 27 connected with a motor 26. This wheel 27 is mounted at a lever 29 pivotable about a shaft 28 fixedly mounted to the housing. The lever 29 is selectively pressed against a wheel 31 attached to one of the threaded spindles 14, by means of a compressed-air or hydraulic cylinder 30 serving as the adjusting means; at the same time, the motor 26 is turned on. After the disk halves (then disposed at the top) 9' have been reset, the wheel 27 is disengaged from the wheel 31 by cylinder 30, the drum 2 is rotated by half a revolution, and after the charging or filling step, the disk halves 9' which are now disposed at the top are also turned back into the initial position in the same way as described above utilizing the wheel associated with one of the threaded spindles for this other set of disk halves and the wheel 27.

The common adjustment (moving of disk halves forming solid partitions together) of the disk halves 9' can also be accomplished by means of a chain 21 associated with all threaded spindles 14 together, this chain extends about the entire periphery of the drum and imparts to all threaded spindles 14 a synchronous rotary movement. For this purpose, chain (sprocket) wheels 22 are additionally fixedly provided on the threaded spindles 14, while the chain wheels 23 of the chains 16 can be connected with the respective threaded spindle 14 by means of an override clutch effective in a direction in opposition to the rotation.

The disk halves can furthermore be adjusted according to another suggestion of the invention by adjusting means fixedly mounted to the housing. The disk halves 9', in this case, are disposed to be axially displaceable in the carrier ribs 8. A stop connected to the separating disk 9' extends toward the outside through a longitudinal slot in the drum 2. During the rotation of the drum, this stop passes through the adjusting means which can be shifted at the housing 1 in parallel to the drum 2, and upon each run-through, the adjusting means adjusts the stop and thus the separating disk 9', connected thereto so that it is advanced by a fraction of the length in the conveying direction. The adjusting means itself can be moved by a drivable worm spindle or also by pressure medium cylinders. The resetting step is effected by arresting the drum 2 with the stop being arranged in the adjusting means, and then resetting the latter.

The treatment of textiles or similar goods, such as, for example, hides, furs, or flat or shaped goods consisting entirely or partially of synthetic resins, is not limited to the above-described drying operation, but also covers, with the appropriate technical modifications, treatments with any desired gaseous, liquid, pulverulent, and similar treatment media. Finally, the adjustment of the disk parts 9' can be accomplished by correspondingly arranged adjusting means 14 also chronologically independently, in order to obtain a differently long treatment in the individual treatment chambers 11.

The advantages attained by the present invention reside particularly in that, by a planar-parallel displacement of the separating disks, it is possible to obtain a chronologically controllable and batchwise passage of the material through the drum. Furthermore, the treatment chambers can have differing sizes in order to attain a maximum adaptation to the condition of the textile material during the course of the treatment. Also, the discharge of the material at the end of the drum takes place in an extended manner with respect to time; it is conducted during the time of an entire cycle. Therefore, the treated goods are passed with good distribution to the subsequent conveying means. Consequently, the present invention makes it possible to attain a batchwise treatment of textile material or similar goods which is adapted to the particular material and can be carried out at a relatiely low technical expense and with different treatment media, in order to be able to conduct treatment processes, such as washing, conditioning, dyeing, drying, and similar operations.

In the preferred embodiment of FIG. 7, a single stop 24 may be arranged such that both gear wheels 25 engage the stop 24 on each revolution to advance the separation disk-halves 9' twice per revolution.

While I have shown and described several embodiments in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to those skilled in the art and I therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

I claim:

1. Apparatus for the batchwise treatment of textile material and the like comprising:

a housing,

a material accommodating drum mounted in said housing for rotation about a drum axis,

and at least one partition means for subdividing the interior of said drum into a plurality of separate treatment chambers spaced axially from one another in the direction of said drum axis,

each of said partition means including a plurality of part disk members which extend substantially perpendicular to said drum axis and which together substantially fill the cross-section of the interior of said drum, at least one of the part disk members forming a respective partition means being axially movable relative to said drum and in a direction parallel to said drum axis between a closed partition position with said respective part disk members at the same axial position along said drum axis to form a substantially closed partition wall which prevents axial movement of the material being treated to the next adjacent treatment chamber and an open partition position with said at least one axially movable part disk member axially spaced from other of said respective part disk members to permit passage of the material being treated to the next adjacent treatment chamber.

2. Apparatus according to claim **1**, wherein said drum includes at least one carrier rib extending substantially parallel to said drum axis for imparting lifting forces to material being treated in said drum upon rotation of said drum.

3. Apparatus according to claim **2**, wherein said drum axis extends substantially horizontally, and wherein said housing is fixed in position.

4. Apparatus according to claim **3**, further comprising adjusting means for moving movable ones of said part disk means between said respective closed partition and open partition positions in response to rotational movement of said drum about said drum axis.

5. Apparatus according to claim **2**, wherein said part disk members are constructed as half disks with two half disks for each partition means.

6. Apparatus according to claim **5**, wherein movable ones of said half disks are mounted and axially guided in respective ones of said carrier ribs.

7. Apparatus according to claim **5**, wherein for each partition means, one of said half disks is fixed in an axial position along said drum axis, the other of said half disks being axially movable.

8. Apparatus according to claim **7**, wherein a plurality of said partition means are provided, and wherein all of said axially movable half disks are connected to a common adjusting means which includes means for simultaneously moving all of said movable half disks.

9. Apparatus according to claim **8**, wherein at least three of said partition means are provided, and wherein said movable half disks are maintained axially spaced from one another in such a manner that when a first of said movable half disks is in a closed partition position, a second movable half disk immediately adjacent said first movable half disk is in an open partition position, and a third movable half disk which is spaced from said first movable half disk by said second movable half disk is in a closed position, whereby material being treated can be axially passed through the partition means having said second movable half disk while said partition means having said first and third movable half disks prevent passage of material being treated to and from the treatment chambers at opposite sides of said partition with said second movable half disk.

10. Apparatus according to claim **9**, wherein more than three of said partition means are provided, and wherein alternative ones of said movable half disks as seen in the direction of the drum axis are in said open partition position when the remaining ones of said movable half disks are in said closed partition positions.

11. Apparatus according to claim **10**, further comprising adjusting means for moving movable ones of said part disk means between said respective closed partition and open partition positions in response to rotational movement of said drum about said drum axis, wherein said drum axis extends sustantially horizontally, and wherein said housing is fixed in position.

12. Apparatus according to claim **10**, wherein said movable half disks of adjacent partition means extend radially opposite one another with respect to said drum axis.

13. Apparatus according to claim **12**, wherein said common adjusting means includes threaded spindle means extending parallel to said drum axis, said threaded spindle means having portions with different thread pitches to accommodate different treatment chamber lengths.

14. Apparatus according to claim **8**, wherein said common adjusting means includes threaded spindle means extending parallel to said drum axis, said threaded spindle means having portions with different thread pitches to accommodate different treatment chamber lengths.

15. An apparatus according to claim **14**, wherein said common adjusting means includes periodically switchable electric motors for rotating said threaded spindle means.

16. An apparatus according to claim **15**, wherein said electric motors are controlled in response to rotation of said drum.

17. An apparatus according to claim **8**, wherein said common adjustment means includes axially displaceable adjusting members arranged in said housing outside of said drum and stop members associated with said movable half disks which extend radially outside said drum to engage said axially displaceable adjusting members.

18. Apparatus according to claim **7**, wherein said movable half disks of adjacent partition means extend radially opposite one another with respect to said drum axis.

19. Apparatus according to claim **5**, wherein, for each partition means, both of said half disks are axially movable.

20. Apparatus according to claim **19**, wherein first adjusting means are provided for moving the half disks of each of the respective partition means together in a conveying direction with each partition means forming a substantially closed movable partition wall.

21. Apparatus according to claim **20**, wherein second adjusting means are provided for moving one of the half disks of each of the respective partition means separately from the other in a direction opposite said conveying direction so that each partition means is opened to permit passage of material being treated.

22. Apparatus according to claim **21**, wherein said first adjustment means is responsive to rotation of the drum to continuously move said closed partition walls

in the conveying direction with closed treatment chambers between adjacent partition means.

23. Apparatus according to claim **22**, wherein said second adjusting means includes means for moving said one of the respective half disks to open partition positions when said drum is at a standstill.

24. Apparatus according to claim **21**, wherein said second adjusting means includes means for moving said one of the respective half disks to open partition positions when said drum is at a standstill.

25. An apparatus according to claim **21**, wherein said second adjusting means includes stop means fixed to the housing and engageable with gear wheels drivingly connected to the first adjusting means for imparting movement of said half disks to respective open partition positions.

26. An apparatus according to claim **25**, wherein said stop means are movable between engagement and idling positions with respect to said gear wheels.

27. Apparatus according to claim **20**, wherein said first adjusting means is responsive to rotation of the drum to continuously move said closed partition walls in the conveying direction with closed treatment chambers between adjacent partition means.

28. Apparatus according to claim **1**, further comprising adjusting means for moving movable ones of said part disk means between said respective closed partition and open partition positions in response to rotational movement of said drum about said drum axis.

29. Apparatus according to claim **28**, wherein said adjusting means includes threaded spindle means extending parallel to said drum axis, said threaded spindle means including portions with different thread pitches to accommodate effectively different treatment chamber lengths.

30. An apparatus according to claim **29**, wherein said threaded spindle means extend through carrier ribs which protrude into said drum to apply lifting forces to the material being treated during rotation of the drum.

31. Apparatus according to claim **28**, wherein said adjusting means include periodically switchable electric motors for applying moving forces to said movable part disk members.

32. An apparatus according to claim **31**, wherein said electric motors are controlled in response to rotation of said drum.

33. An apparatus according to claim **28**, further comprising stop means fixed to the housing and engageable with gear wheels correlated to the adjusting means for resetting the adjusting means to predeterminedly position the respective movable part disk members.

34. An apparatus according to claim **33**, wherein said stop means are movable between engagement and idling positions with respect to said gear wheels.

35. An apparatus according to claim **1**, further comprising adjustment means including axially displaceable adjusting members arranged in said housing outside said drum and stop members associated with movable ones of said part disk members, wherein said stop members extend radially outwardly from said movable part disk members to outside of said drum to engage said axially displaceable adjusting members such that said movable part disk members move with said axially displaceable adjusting members.

36. An apparatus according to claim **1**, wherein a plurality of separate adjustment means are provided for separately and independently controlling the movement of the respective movable part disk members.

37. An apparatus according to claim **1**, wherein said drum is a drying drum for textile materials which has a feeder hopper at one end and an outlet at the opposite end, said partition means being axially spaced from one another between said feeder hopper and outlet to form said treatment chambers, wherein said drum axis extends substantially horizontally such that said textile material is conveyed in a direction from said feeder hopper toward said outlet in response to rotation of said drum and the movement of a drying medium therethrough.

38. An apparatus according to claim **37**, wherein the effective length of the treatment chambers formed by said partition means at said outlet end is greater than the effective length of the treatment chambers at said feeder hopper end.

39. An apparatus according to claim **1**, wherein said drum is a horizontally disposed textile material treatment drum having means for applying a treatment medium means to said textile material in said treatment chambers.

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