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(54) Open-width washing machine.

(57) A machine (1) for washing continuous fabrics flat constituted by at least one washing unit (3) provided with a plurality of drums (4) through which a fabric (2) to be washed is passed; each of the drums (4) is defined by an input shaft (10) connected to a transmission (8), by an outer tubular body (17) extending outside and coaxially of the input shaft (10) and interacting with the fabric (2) to be washed, and by a clutch (19) interposed between the input shaft (10) and the outer tubular body (17) that permits the latter to rotate relative to the input shaft (10) if the tension on the fabric (2) varies as a result of dimensional variations in the fabric (2).

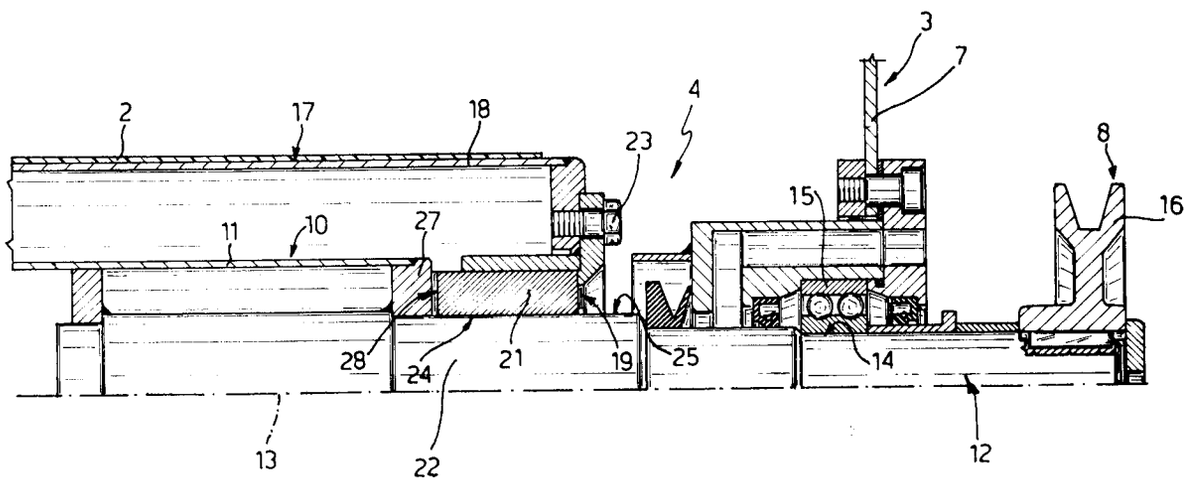

Fig. 2

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The present invention relates to a machine for washing continuous fabrics spread flat.

A known method of washing continuous fabrics is to use a machine including two or more washing units in series provided with synchronising devices interposed between the units themselves in order to regulate the flow of fabric in dependence on the operating conditions of the unit downstream.

Each of these washing units includes a plurality of substantially horizontal, parallel drums and the fabric passes over and around these drums.

In most applications, the drums are made to the same diameter and are linked by a transmission, usually a belt drive, which enables the drums to rotate at the same angular velocity and, in particular, because of what was said above, ensures that their outer sleeves, which interact with the fabric, rotate at the same peripheral speed.

Units of the type described above are universally used but have the disadvantage of poor functional reliability as they are substantially insensitive to variations in dimension (shrinkage or stretching) of the fabric during the various stages of the wash, particularly when the fabric is passing from one drum to the next. In fact, as is well known, during the wash, the fabric passed between the drums is entrained by the drums connected to the transmission and is gradually soaked with various cleaning fluids whose chemical characteristics and temperature are variable according to the requirements of the wash. The fabric is therefore subjected during its passage from one drum to the next to different temperatures, and therefore to a thermal gradient, which, if positive, will cause the portion of fabric involved to shrink and, as the peripheral speed of the drum is substantially constant, will vary the stress on the fabric, in this case by increasing the tensile stress, thereby causing an inevitable and unwanted alteration in the structural characteristics of the fabric.

On the other hand, if a negative thermal gradient occurs during the passage from one drum to the next, the tension will first be seen to decrease between the latter with loops forming and gradually growing and, in the final stage of the wash when the liquid impregnating the fabric is removed, part of these loops will be laminated onto a corresponding portion of the fabric, damaging the homogeneity and quality of the fabric itself.

The object of the present invention is to provide a machine for washing fabrics spread flat which eliminates the disadvantages described above and, in particular, which has characteristics which make it sensitive to possible variations in the dimensions of a fabric being washed and which is simple and economical to make.

According to the present invention there is provided a machine for washing continuous fabrics flat, this machine including at least one washing unit, which in turn includes a plurality of substantially parallel drums between which a fabric to be washed is passed, and means for rotating the drums, characterised in that each of the said drums includes an input shaft connected to the transmission, a driven cylindrical body extending coaxially of the input shaft and interacting with the fabric to be washed, and friction clutch means interposed between the input shaft and the driven cylindrical body.

In a preferred embodiment, the friction clutch means include at least one friction bush arranged to support the driven tubular body coaxially of the input shaft and arranged to permit relative rotation of the driven cylindrical body and the input shaft.

The invention will now be described with reference to the appended drawings, which illustrate one embodiment as a non-limitative example, in which:

Figure 1 shows a schematic section of a significant portion of a machine for washing continuous fabric spread flat according to the present invention; and

Figure 2 is an enlarged partial cross-section, with parts removed for greater clarity, taken on the line II-II of Figure 1, of a preferred form of a detail of the machine of Figure 1.

Figure 1 shows an entire machine 1 for washing flat continuous fabric 2, illustrated schematically by a broken line. This machine 1 includes two or more washing units 3, of which one only is illustrated schematically in Figure 1, each of which is provided with a device generally indicated 4' for regulating the flow of fabric to the next unit 3 and includes a plurality of substantially identical, parallel drums 4 through which the fabric 2 to be washed is passed. In particlar, the drums 4 have substantially identical outer diameters, are rotatably coupled to a support structure 7 of the respective unit 3 and are linked by a transmission, preferably a belt drive, illustrated schematically in Figure 1 and generally indicated 8.

As illustrated in Figure 2, each of the drums 4 includes an input shaft 10 made up of an inner central tubular body 11 and two cylindrical end bodies 12, each of which extends outside the central tubular body 11 along the axis 13 of the tubular body 11 and has an inner end portion which extends into the tubular body 11 and is fixed to it. Furthermore, each of the cylindrical bodies 12 is provided with a seat 14 for housing a bearing 15 for coupling the respective drum 4 to the structure 7 of the respective unit 3. A pulley 16 constituting part of the transmission 8 is keyed to a section of the free end of one of the cylindrical bodies 12 and, in use, is arranged to rotate the input shafts 10 at the same angular velocity.

Still with reference to Figure 2, each drum 4 further includes an outer tubular body 17 which extends coaxially outside the central tubular body 11 and in turn includes two end portions 18 each extending axially beyond the corresponding end of the central tubular body 11, outside the respective cylindrical body 12.

The outer tubular body 17 is coupled to the input shaft 10 by a friction clutch 19 arranged to enable the outer tubular body 17 to rotate relative to the input shaft 10 when the respective drum 4 is subjected to particular load conditions, in particular when a tangential force acts on the outer tubular body 17 greater than the highest tension that the fabric 2 may be subjected to without dimensional variations in the structure of the said fabric 2.

Still with reference to Figure 2, the friction clutch 19 includes two bushes 21, only one of which is illustrated in Figure 2, each of which is made from graphitic carbon and is positioned between the respective end portion 18 of the outer tubular body 17 and an intermediate portion 22 of the respective cylindrical body 12 of the input shaft 10. In particular, each of the bushes 21 is releasably connected to the respective end portion 18 of the outer tubular body 17 by a plurality of screws 23 of which only one is illustrated in Figure 2, and has an inner cylindrical surface 24 which interacts with a corresponding outer cylindrical surface 25 of the respective intermediate portion 22. Furthermore, each bush 21 extends outside the inner tubular body 11 in a position facing a respective shoulder 27 formed on the input shaft 10 and which an inner axial surface 28 of the respective bushing 21 is arranged to abut to limit the axial movement of the outer tubular body 17 relative to the input shaft 10.

In use, the fabric 2 passed through the drums 4 is entrained by the drums 4 themselves and is gradually soaked with various washing fluids whose chemical characteristics and temperature are variable according to the washing requirements. The fabric 2 is therefore subjected to various temperatures in the passage from one drum to the next and therefore to a thermal gradient which, if positive, causes the portion of the fabric 2 concerned to shrink. A variation in length, in particular a reduction in length, increases the opposing tangential tension on the drum 4 located downstream, in particular on the outer tubular body 17 of the drum 4. This increase in tangential tension on the drum 4 results in an increase in the opposing torque for a given drive torque and when the opposing torque reaches a limit, which is variable according to the type of fabric 2 and which can be set by adjustment of the characteristics of the friction clutch 19, the latter permits the outer tubular body 17 to rotate relative to the input shaft 10. In other words, increased tension in the fabric 2, caused by shrinkage of the fabric, causes relative sliding between the inner surfaces 24 of the bushes 21 mounted on the drum 4 concerned and the outer surfaces 25 of the intermediate portions 22 of the cylindrical end bodies 12 of the input shaft 10. In this way the peripheral speed of the rotating outer cylindrical body 17 is reduced, thereby substantially cancelling the increase in tension on that portion of the fabric 2 located upstream of the drum 4 considered.

From the above description it is clear that the structural characteristics of the described machine 1 make the machine 1 highly reliable in operation. In fact, as a result of the adoption of drums 4 with the friction clutches 19, the machine 1 is extremely sensitive to the variations in stress in the fabric 2 and, in particular, it can limit the tensile stress on individual portions of the fabric 2 running from one drum 4 to the next. Hence, the structural characteristics of the machine 1 permit the fabric 2 to be moved inside the machine 1 with a constant tractive force acting on each length of the fabric 2 passing through the drums 4, whatever the position of the portion considered inside the machine 1 and, in particlar, whatever the temperature of the fluid soaking the said portion. Finally, regulation of the peripheral speed of the drum 4 downstream of the portion considered, in dependence on the state of tension in the fabric 2, substantially eliminates looping (not illustrated) which developed during the wash when these portions of fabric were subjected to negative thermal gradients.

It is finally evident that modifications and variations can be made to the machine 1 described above without departing from the scope of the present invention. In particular, modifications can be made to the geometry of the drums 4 and the friction clutches 19 can be made differently with, for example, a different number of bushes 2 or with different shaped bushes made of a different material from that used. Furthermore, the friction clutches 19 can be replaced by a different type of friction clutch, for instance a disc clutch, without departing from the protective scope of the invention.

Claims

1. A machine (1) for washing continuous fabrics spread flat, the machine (1) including at least one washing unit (3) including, in turn, a plurality of substantially parallel drums (4) between which is passed a fabric (2) to be washed and means (8) for rotating the drums (4), characterised in that each of the drums (4) includes an input shaft (10) connected to the transmission (8), a driven cylindrical body (17) extend-

ing coaxially of the input shaft (10) and interacting with the fabric (2) to be washed, and friction clutch means (19) interposed between the input shaft (10) and the driven cylindrical body (17).

2. A machine according to Claim 1, characterised in that the friction clutch means (19) include at least one friction bush (21) arranged to support the driven cylindrical body (17) coaxially of the input shaft (10) and to permit the relative rotation of the driven cylindrical body (17) and the input shaft (10).

3. A machine according to Claim 2, characterised in that each bush (21) is made of graphitic carbon.

4. A machine according to Claim 2 or Claim 3, characterised in that the drums (4) have the same outer diameter and each includes an outer tubular body (17) defining the driven cylindrical body and extending outsie the input shaft (10) and a pair of bushes (21) releasably connected to opposite end portions (18) of the outer tubular body (17) and coupled to respective intermediate portions (22) of the input shaft (10), these bushes (21) being adapted to interact with respective shoulders (27) carried by the input shaft (10) to limit the axial movement of the outer tubular body (17) relative to the input shaft (10); the means (16) for rotating of the drums (4) being arranged to rotate the input shafts (10) of the drums (4) at the same angular velocity.

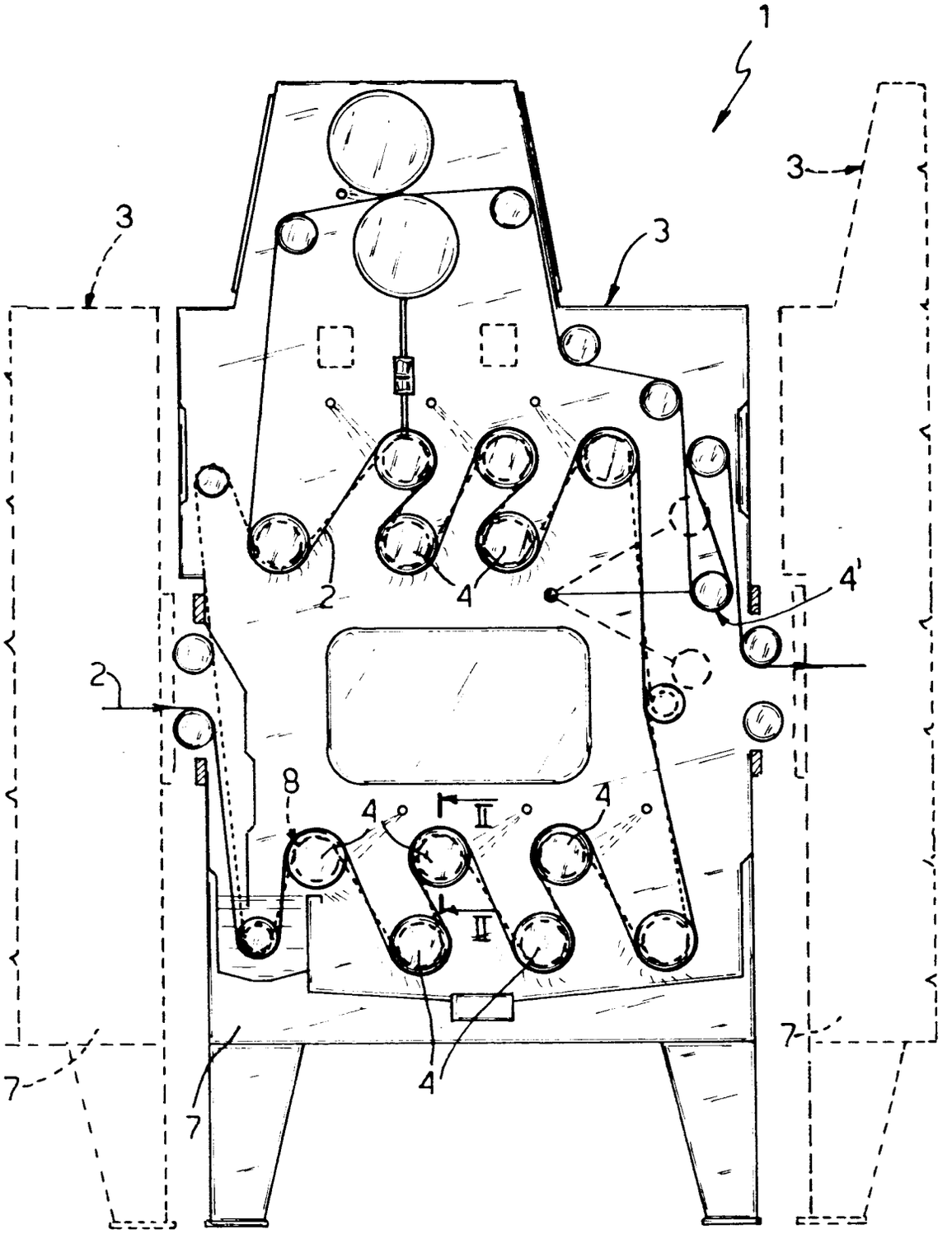

Fig. 1

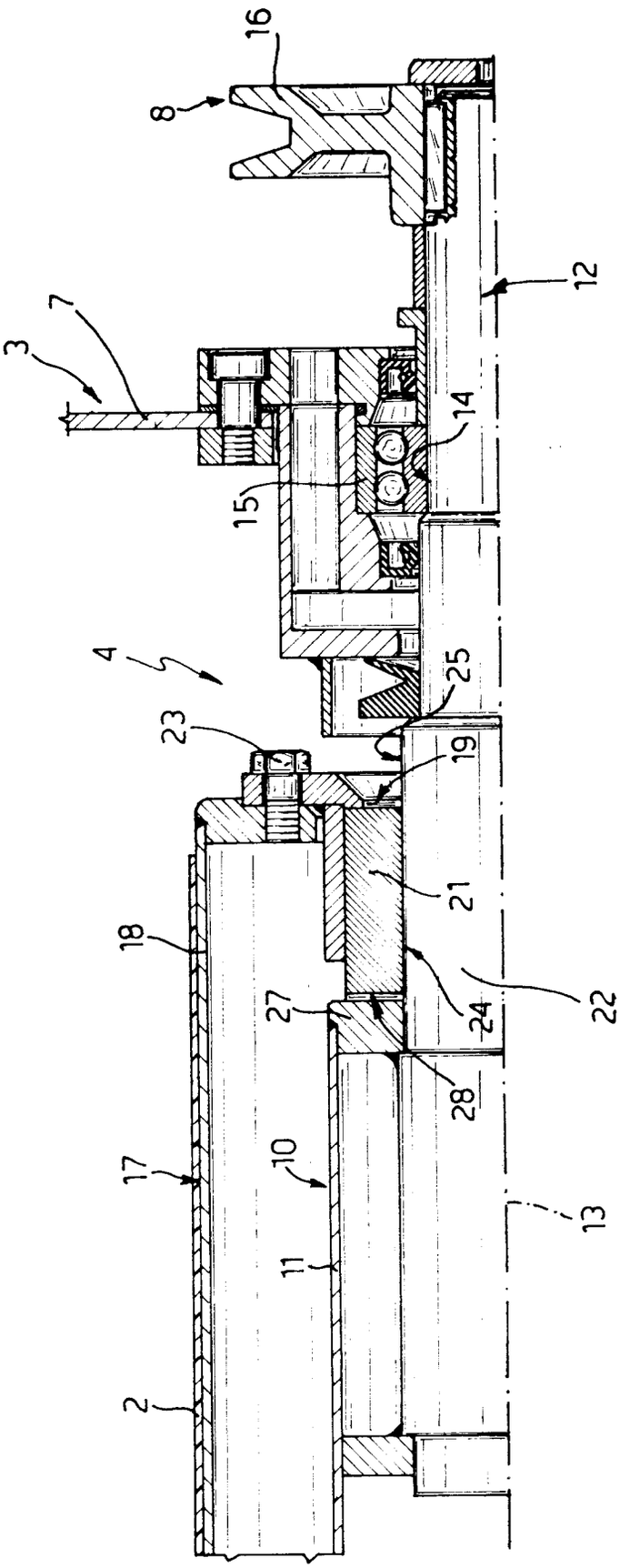

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 11 0402

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-1 290 394 (BEMBERG) * the whole document * ---	1	D06B3/36
A	DE-B-1 217 168 (ARTOS) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 SEPTEMBER 1992	PETIT J.P.

CATEGORY OF CITED DOCUMENTS

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