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(54) Compression spring grinding machine

(57) The present invention relates to a compression spring grinding machine (1), of high use flexibility. The machine comprises: a supporting table (2) which can rotate about an axis (2a) thereof; first driving means (4) for driving the supporting table (2) with either a continuous or intermittent motion about the axis (2a) thereof; at least two mandrels (5,6) having axes (5a,6a) parallel to the axis (2a) of the supporting table (2), rotatably associated, about the respective axes (5a,6a), with the supporting table (2) and projecting from a loading face thereof. The apparatus further comprises a main loading disc (7), which can be coaxially mounted on the loading face of the supporting table (2), and at least two minor loading discs (13,14), which can be mounted on the loading face of the supporting table (2), coaxially with the mandrels (5,6), alternately to the major or main loading disc (7). The machine further comprises a grinding station, including a pair of grinding wheels (18,19), opposite to the supporting table plane and operating on pieces to be ground, supported by loading discs (13,14) at the grinding station. Second driving means are moreover provided for driving the minor loading discs (13,14) about the axis of the related mandrel (5a,6a), at least at the grinding station.

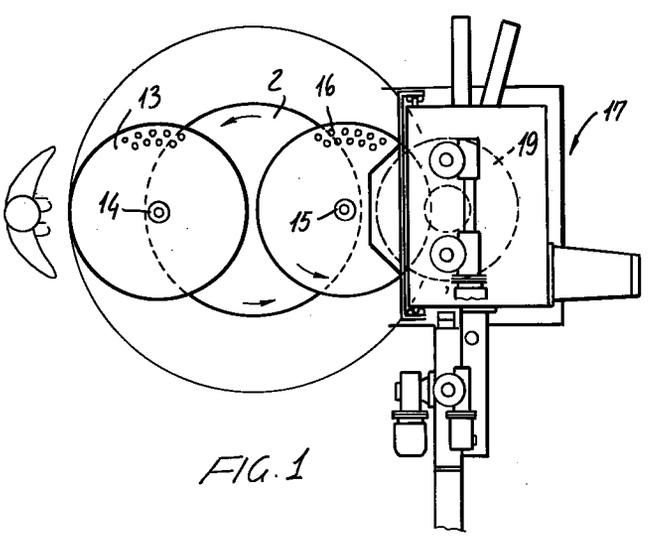

FIG. 1

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Description

BACKGROUND OF THE INVENTION

The present invention relates to a compression spring grinding machine, of high operation or use flexibility.

As known, the springs and, in particular, the springs provided for operating under compression, are usually subjected, during the production thereof, to a grinding operation, for grinding the axial end portions of the spring so as to bring these axial end portions to lay on planes which are substantially perpendicular to the axis of the spring.

This grinding operation is conventionally performed by suitable grinding machines which comprises a grinding station, in which are arranged two opposite grinding wheels.

The springs to be ground are loaded into suitable seats provided in a loading disc, having an axis parallel to the axis of the grinding wheels, which is rotatably driven about the axis thereof, so as to progressively bring the springs between the grinding wheels, in order to be ground.

The grinding of the spring can be performed by a single passage between the grinding wheels, which are held at a set spacing from one another, or by successive passage of the springs between said grinding wheels, the latter being progressively displaced to one another.

The single-pass grinding operation, which is preferred for springs made of a comparatively small diameter wire, is conventionally performed on grinding machines including a loading disc of large diameter, which is rotatively driven about the axis thereof with a suitably low speed.

The diameter of the grinding wheels is so selected that a given thickness of the wire and a given size of the spring can be ground by a single passage between the grinding wheels.

These machines are also adapted to perform the several-pass grinding operation; however, they have a comparatively small yield, because of their small operating speed.

In order to perform a subsequent-pass grinding operation, it is conventionally used another type of grinding machine, which is provided with a supporting table, of disc-like configuration, provided on the top of a pair of vertical-axis mandrels, provided for receiving each a loading disc of small diameter.

These mandrels are rotatively driven about respective axes thereof, so as to cause the related loaded disc to turn, whereas to the supporting table is applied an intermittent rotary movement so as to bring, in turn, a loading disc to the grinding station and then to bring, by turning the related loading disc, the springs under the action of the grinding wheels, which are progressively displaced towards one another, during the several operating passages.

Such a machine, of the two loading disc type, can not be used for performing a single-pass grinding operation, since the space for loading the loading disc to the grinding position thereof, is not sufficient.

Thus, the shops performing grinding operations on compression springs are compelled to buy both type of machines, with a comparatively high capital expense.

SUMMARY OF THE INVENTION

Accordingly, the aim of the present invention is to solve the above disclosed problems by providing a grinding machine which is specifically designed to both perform the grinding of compression springs in a single pass and in several subsequent passages, and which, moreover, can use both large diameter loading discs and small diameter loading discs, so as to meet different use requirements, while providing a very high production yield.

Within the scope of the above mentioned aim, a main object of the present invention is to provide such a compression spring grinding machine, which is very safe and flexible in operation and which, moreover, is very competitive from a mere economic standpoint.

According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a highly flexible compression spring grinding machine, characterized in that said machine comprises: a supporting table, rotatable about an axis thereof; first driving means for driving said supporting table with either a continuous or intermittent motion about the axis thereof; at least two mandrels, having axes parallel to the axis of the supporting table, rotatably supported, about their respective axes, to said supporting table, projecting from a loading face thereof and angularly spaced from one another about the axis of the supporting table; a major loading disc, which can be coaxially mounted on the loading face of the supporting table; at least two minor loading discs, having a diameter less than the diameter of said major loading disc, which can be mounted on said loading face of said supporting table coaxially of said mandrels, alternately to the major loading disc; a grinding station, including a pair of grinding wheels, opposite to the laying plane of said supporting table and adapted to operate on pieces to be ground, carried by said loading discs to a grinding station; and second driving means for driving said minor loading discs about the axis of the related mandrel, at least at said grinding station.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the grinding machine according to the present invention will become more apparent hereinafter from the following detailed disclosure of a preferred, though not exclusive, embodiment of the subject compression spring grinding machine, which is illustrated, by way of an indicative, but

not limitative, example, in the accompanying drawings, where:

Figure 1 is a schematic top plan view illustrating the compression spring grinding machine according to the present invention during a several-pass grinding operation;

Figure 2 is a side elevation and partially cross-sectioned view of the subject compression spring grinding machine, performing a several subsequent pass grinding operation;

Figure 3 is a top plan view of the subject grinding machine performing a single pass grinding operation;

and

Figure 4 is a further side elevation and partially cross-sectioned view illustrating the grinding machine according to the present invention performing a single-pass grinding operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the number references of the above mentioned figures, the grinding machine according to the present invention, which has been generally indicated by the reference number 1, comprises a supporting table 2, having a substantially disc-like configuration, and having a vertical axis 2a.

The supporting table 2, in particular, is rotatably supported so as to turn about the axis 2a thereof, by a base 3, on which are arranged first driving means for driving said supporting table 2 with a rotary movement about the axis thereof, either continuous or intermittent, depending on requirements, as it will become more apparent hereinafter.

The first driving means comprises a motor-reducing unit 4, arranged on the supporting base 3 of the machine and coupled, by the output shaft thereof, to a main shaft 4, having an axis coinciding with the axis 2a, and its top end portion rigidly restrained to the supporting table 2.

With the supporting table 2 are associated at least two mandrels 5 and 6 which have vertical axes 5a and 6a and project from the two opposite surfaces or faces of the supporting table 2.

In the embodiment shown in the drawings, are provided two mandrels, which are angularly offset from one another about the axis 2a of an angle of 180°; if necessary, it is possible to provide several mandrels, angularly spaced from one another about the axis 2a.

The machine further comprises a major loading disc 7, which can be arranged on the loading face of the supporting table 2, or on the top face thereof, and which is provided with two holes 8 and 9, to allow those portions of the mandrels 5 and 6 projecting on the top from the loading face of the supporting table 2 to pass therethrough; on the major loading disc 7, moreover, is provided a plurality of seats 10 in which can be arranged the compression springs to be ground.

The subject grinding machine further comprises at least two minor loading discs, indicated by 12 and 13, which have a diameter less than the diameter of the major loading disc 7, and are arranged on the loading face of the supporting table 2.

The minor loading discs 12 and 13 are provided with respective central holes 14, 15, by means of which a respective minor loading disc is engaged, in a rotatively rigid manner, with the related mandrel 5 or 6.

The minor loading discs 12 and 13 are also provided with a plurality of seats or recesses 16, in which can be arranged the compression springs to be ground.

Laterally of the supporting table 2, is provided a grinding station 17, in which are provided two grinding wheels 18 and 19, having vertical axes, and arranged coaxially of one another; the two grinding wheels 18 and 19 are arranged oppositely facing the laying plane of the supporting table 2 and are driven, in a known manner, with a rotary movement about their axes 20, by a motor-reducing driving unit.

Moreover, at least one of the grinding wheels 18 and 19 can be controllably displaced along the related axis 20, so as to change the mutual spacing of the grinding wheel depending on the grinding requirements.

The mandrels 5 and 6 are rotatable supported, about their respective axes 5a and 6a, by the supporting table 2; moreover, second driving means are provided, for rotatively driving the mandrels 5 and 6, at least as the respective minor loading disc 12 or 13, is arranged at the grinding station 17.

As shown, the second driving means comprise a motor-reducing unit or assembly 21, which is arranged under the supporting disc 2 and is provided with an output shaft, which can be either connected to, or disconnected from, one of the mandrels, 5 or 6, as the latter is arranged near the grinding station 17.

More specifically, on the output shaft 21a of the motor reducing unit 21, is coupled a half clutch 22, for example a toothed half-clutch, which can be coupled to a further half-clutch 23, in turn connected to the bottom end portions of the mandrels 5 and 6.

The grinding machine according to the present invention operates as follows.

In order to perform a single-pass grinding operation on the compression spring, between the grinding wheels 18 and 19, on the supporting table 2 is mounted the major or larger loading disc 2, thereon are arranged the compression spring to be ground; the grinding wheels 18 and 19 are set at a proper spacing from one another, so as to perform the grinding operation by a single-passage.

The motor reducing unit 4 is so operated as to cause the supporting table 2 and, accordingly, the loading disc 7, to be turned with a small speed, to bring progressively the compression springs arranged on the loading disc 7 under the action of the grinding wheels 18 and 19 which will grind, by a single passage, both the

end portions of the compression springs, projecting from the two faces of the loading disc 7.

In order to grind the compression springs in several passages between the grinding wheels 18 and 19, on the supporting table 2 are mounted the two minor or smaller loading discs 12 and 13, and on these loading discs 12 and 13 are arranged the compression springs to be ground.

The motor-reducing unit 4 is so operated as to cause the supporting table 2 to be reciprocately turned, or intermittently turned, through 180°, so as to respectively locate a smaller or minor loading disc, 12 or 13, at the grinding station 17.

As one of the loading discs, 12 or 13, is properly located at the grinding station 17, the half-clutch 23 of one of the mandrels, 5 or 6, will be arranged at the half-clutch 22, mounted on the output shaft 21a of the motor-reducing unit 21.

Then, the two half-clutches 22 and 23 will be connected to one another, and the motor-reducing unit 21 will be operated so as to progressively bring the compression springs provided on the smaller loading disc 12 or 13, arranged at the grinding station 17, between the grinding wheels 18 and 19.

The grinding of the springs arranged on the loading discs 12 and 13 is performed through several passages or operations, by suitably changing the distance of the grinding wheels 18 and 19, for each subsequent working operation, to the end of the grinding processing of the springs.

From the above disclosure and from an observation of the accompanying drawings, it should be apparent that the invention fully achieves the intended aim and objects.

In particular, the fact is to be pointed out that a high yield grinding machine has been provided, which is specifically designed for grinding compression springs, either by a single path, or by several subsequent passes, by varying the mutual spacing of the grinding wheels, while using a single larger diameter loading disc, or a plurality of smaller diameter smaller discs.

The invention, as disclosed, is susceptible to several variations and modifications, all of which will come within the inventive idea scope.

Moreover, all of the details can be replaced by other technically equivalent elements.

In practicing the invention, the used materials, as well as the contingent size and shapes, can be any, depending on requirements.

Claims

1. A highly flexible compression spring grinding machine, characterized in that said grinding machine comprises: a supporting table, rotatable about an axis thereof; first driving means for rotatively driving said supporting table either with a continuous or an intermittent motion about the axis thereof; at least two mandrels, having axes parallel to the axis of the supporting table, rotatably supported, about their respective axes, to said supporting table, projecting from the loading face thereof and angularly spaced from one another about the axis of said supporting table; a major loading disc, which is coaxially mounted on the loading face of the supporting table; at least two minor loading discs, having a diameter less than the diameter of said major loading disc, which can be mounted on said loading face of said supporting table coaxially of said mandrels, alternately to said major loading disc; a grinding station, including a pair of grinding wheels, opposite to the laying plane of said supporting table and provided for operating on pieces to be ground, carried by said loading discs to a grinding station; second driving means for rotatively driving said minor loading discs about the axis of the related mandrel, at least at said grinding station.

2. A grinding machine according to Claim 1, characterized in that said supporting table has a substantially disc-like configuration and having a vertical axis.

3. A grinding machine according to Claims 1 and 2, characterized in that said first driving means comprise a first motor-reducing unit, arranged on a base of said machine rotatably supporting said supporting table; said first motor-reducing unit having an output shaft connected to a vertical shaft in turn coaxially connected to said supporting table.

4. A grinding machine according to one or more of the preceding claims, characterized in that said second driving means comprise a second motor reducing unit, arranged on the bottom of said supporting table, near said grinding station; said second motor reducing unit comprising engagement means, which can be controllably actuated and deactuated in order to rotatively drive about a rotary axis thereof one of said mandrels, arranged at said grinding station.

5. A grinding machine according to one or more of the preceding claims, characterized in that said engagement means comprise a half-clutch, mounted on the output shaft of said second motor-reducing unit and provided for engaging with or disengaging from the bottom end portions of the mandrels, projecting at the bottom from said supporting table and bearing a corresponding half-clutch, as one of said mandrels is associated with the output shaft of the second motor-reducing unit.

6. A grinding machine according to one or more of the preceding claims, characterized in that said grinding wheels are arranged coaxially along a vertical axis, further driving means being provided for caus-

ing said grinding wheels to be moved toward one another or away from one another.

7. A grinding machine according to one or more of the preceding claims, characterized in that said loading discs are provided with a plurality of recesses for housing said compression springs to be ground.

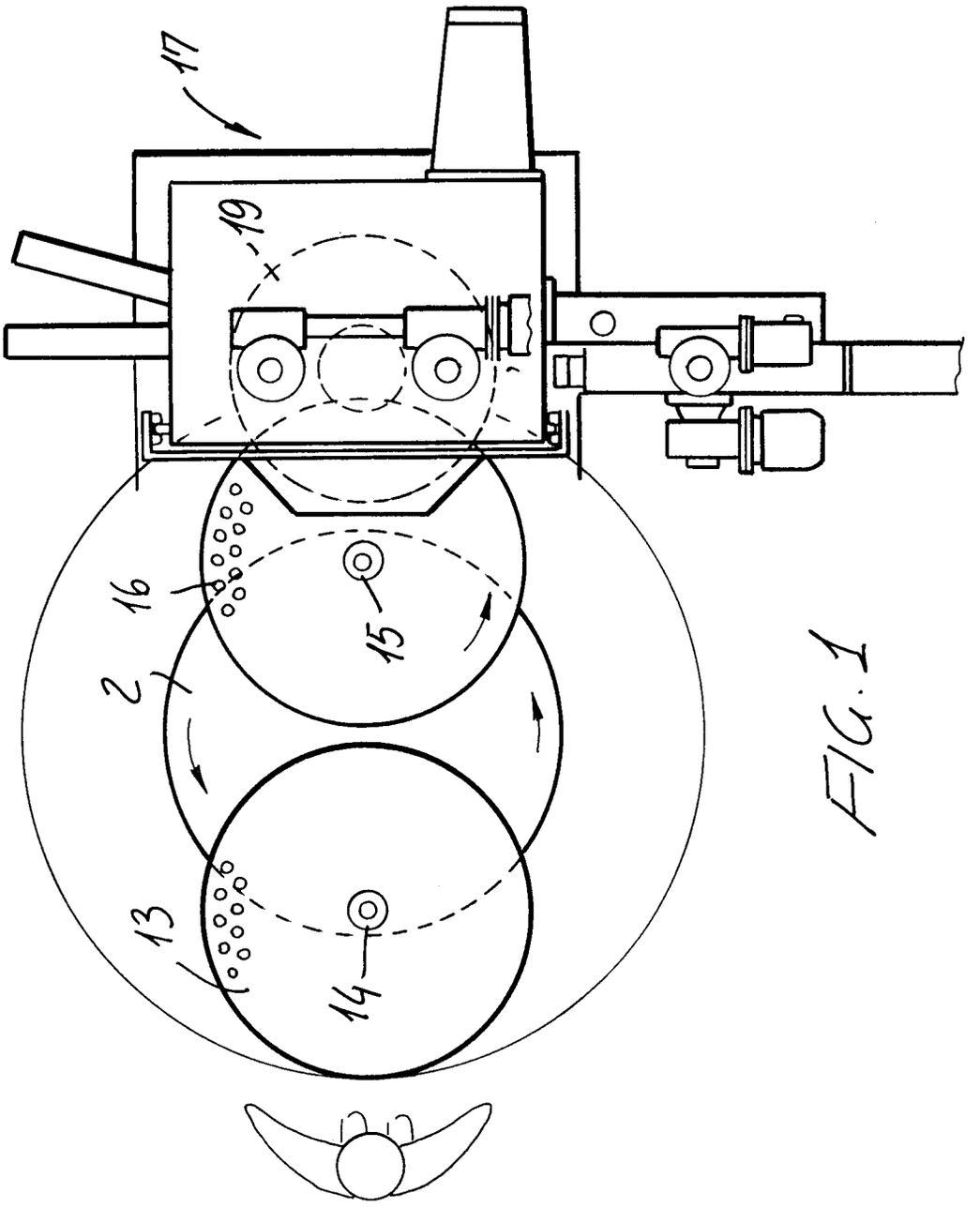

FIG. 1

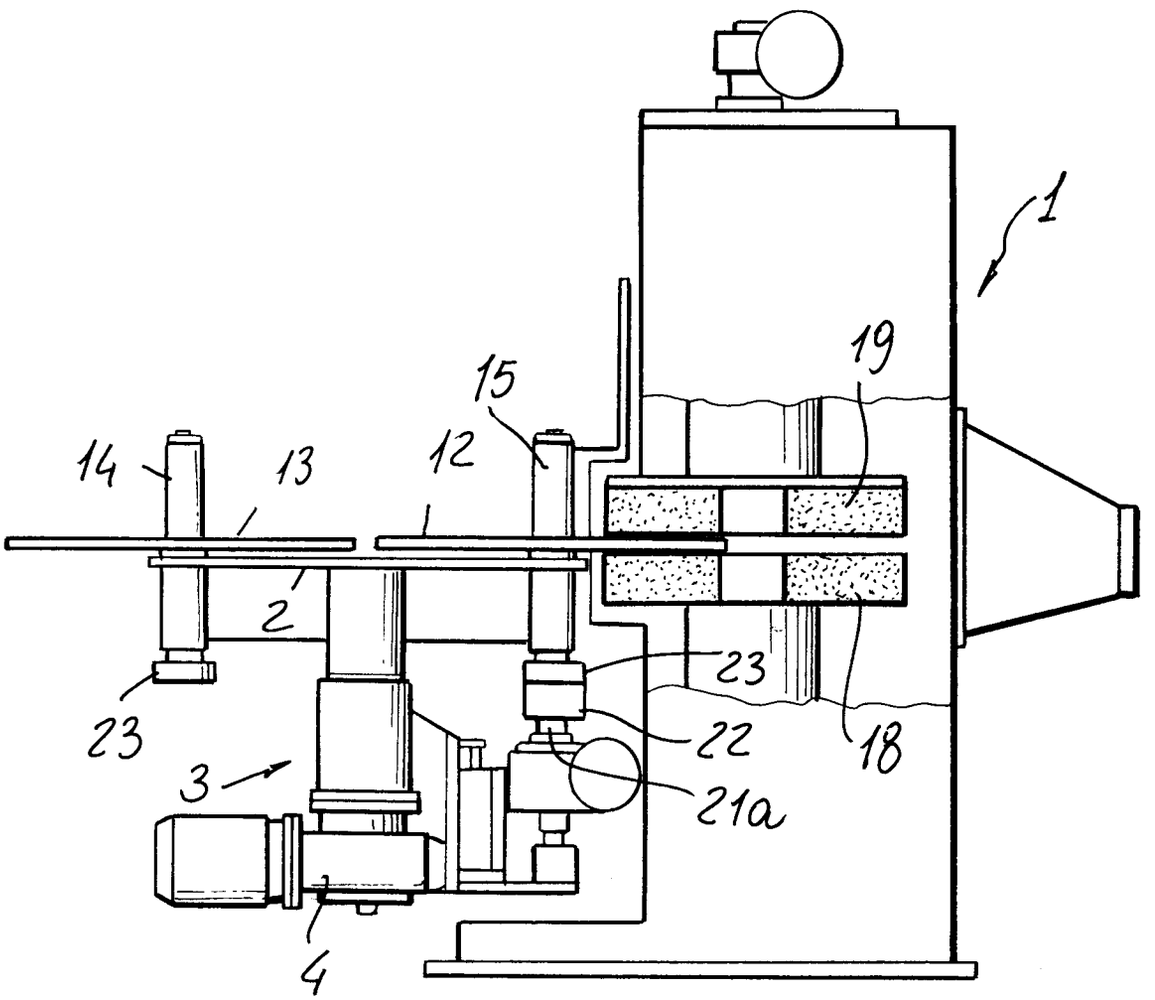

FIG.2

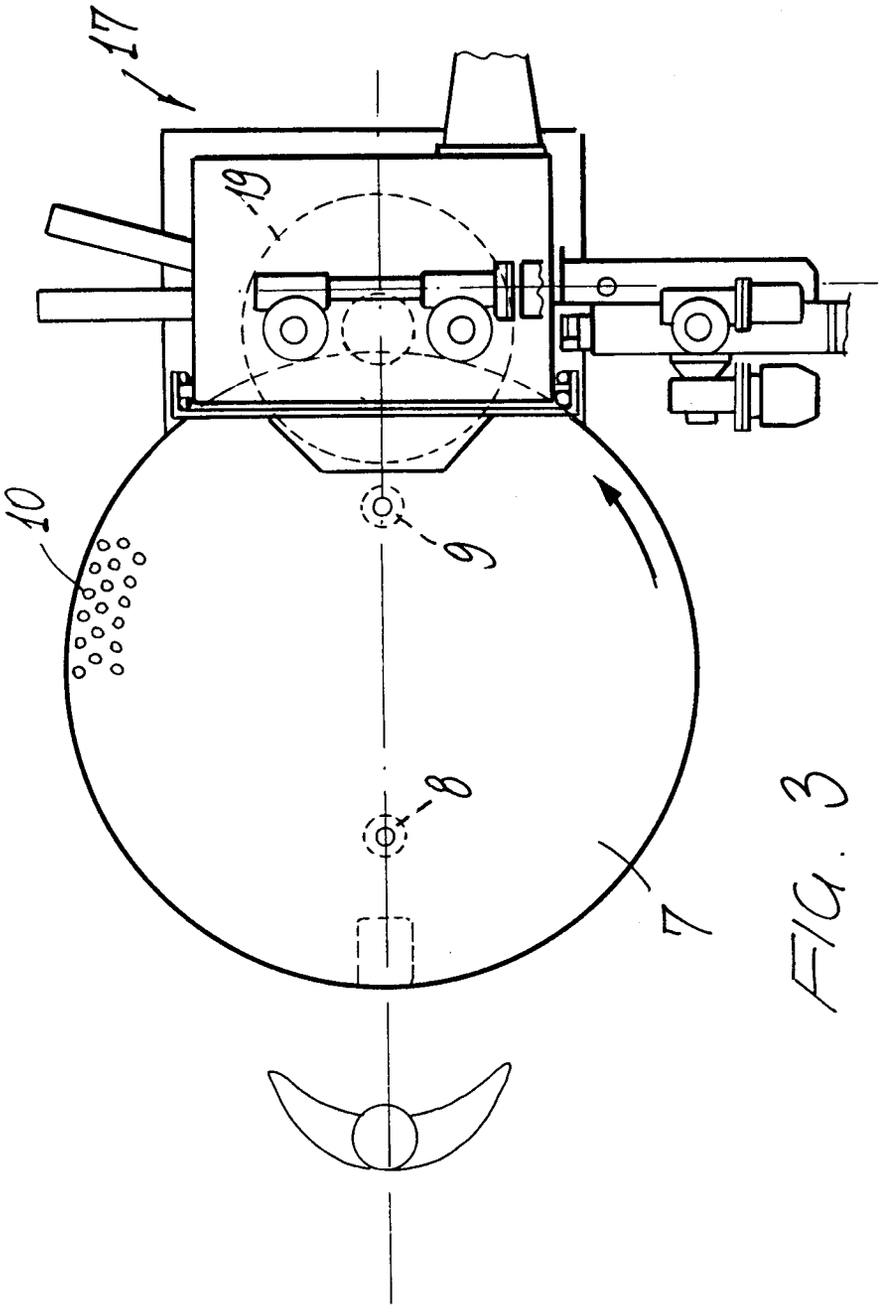

FIG. 3

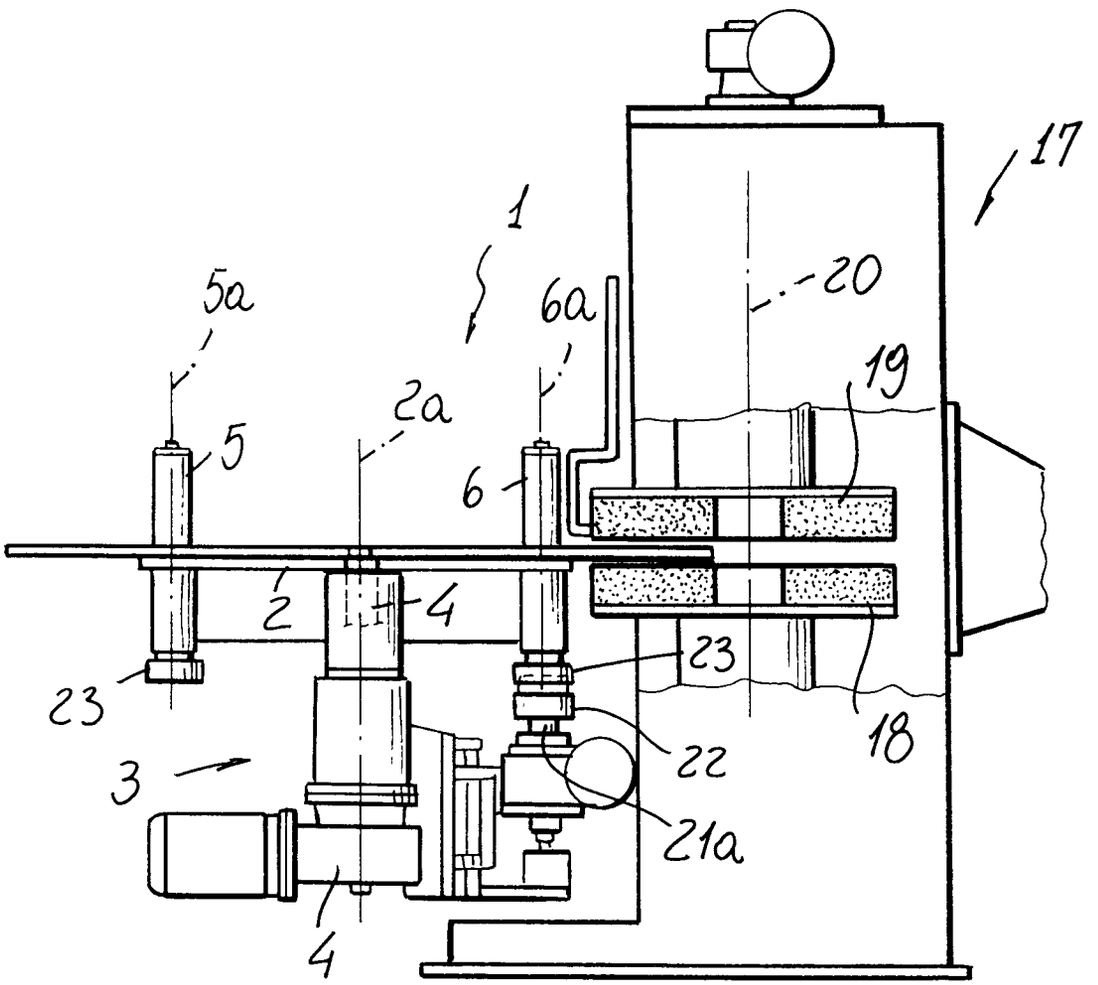

FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 83 0546

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.6)
Y	DE-A-15 02 470 (KUNZ-BECK) 23 October 1969 * the whole document *	1,2,6,7	B24B7/16 B24B41/00
Y	FR-A-1 599 254 (HACK) 15 July 1970 * page 3, line 31 - page 4, line 32; figures *	1,2,6,7	
A	FR-A-1 353 975 (KUNZ-BECK) * page 2, line 24 - line 28; figures *	3	
A	GB-A-1 207 757 (HACK) 7 October 1970 * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 April 1996	Garella, M

CATEGORY OF CITED DOCUMENTS

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