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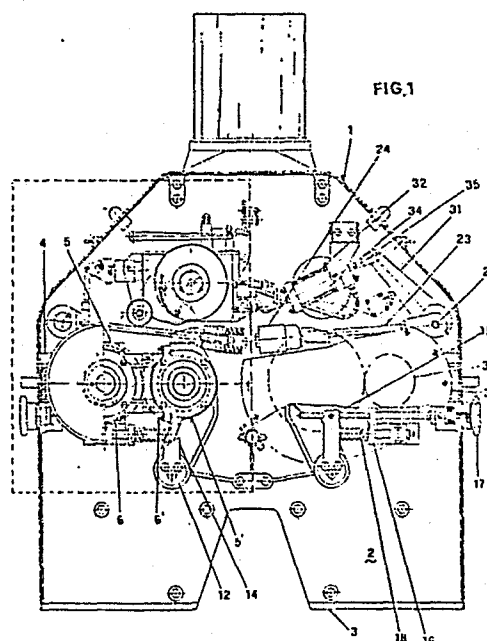
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(54) Roller mill of the horizontal roll type for cereals.

(57) The cereal roller mill comprises at least one pair of horizontal rolls (6,6'), of which one (6) is fixed and is supported by supports (5) applied to the machine shoulders (2) and one (6') is mobile and mounted on supports (5') which are hinged to said shoulders (2) and operated by lever and cam systems during the attack and withdrawal movements, and further comprises adjustment members operable from the outside for horizontally moving the two supports (5') for the mobile roll (6') independently of each other. Each support (5') for the mobile roll (6') is hinged at one end to a cylindrical member (12) eccentrically mounted on a pin (13) for connection to the corresponding shoulder (2) and rigid with an adjustment member (14, 15, 16, 17) operable from the outside, and is connected at its other end to a member (23) for controlling the attack and withdrawal movements, by way of a member (24, 25) which is elastically yieldable in the withdrawal direction. Further elastic members (18) are provided having one end connected to the shoulder (2) at points separated from the supports (5) for the fixed roll (6), and having their other end connected to the mobile supports (5') and acting in the withdrawal direction.



This invention relates to a roller mill of the horizontal roll type for cereals.

Roller mills of the horizontal roll type for cereals are known. They generally comprise two vertically
5 separated sections which can either operate "in parallel" in the sense that the same feed cereal is fed simultaneously to their inlets and subjected to the same treatment (rupture, grinding or finishing) or can operate independently of each other by subjecting the material to different treatments.

10 Independently of said treatments, and of the particular type of grinding roll which they carry, in known roller mills of the horizontal roll type for cereals these rolls are driven continuously with different rotational speeds in opposite directions, and are also kept spaced
15 apart from each other when no cereal is being fed. Entry of the cereal to be ground causes one of these rolls, namely the mobile roll, to approach the other fixed roll before the cereal falls into the grinding zone, and this operation constitutes the so-called "attack" of the mobile roll. When
20 the cereal feed ceases, the mobile roll still remains close to the fixed roll for a short time in known roller mills in order to ensure that all the cereal which has accumulated in the grinding zone becomes ground, after which it is moved

away. This operation is commonly known as the "withdrawal" of the mobile roll.

In known roller mills, besides these attack and withdrawal stages it is also required to set the minimum
5 distance between the grinding rolls, both in order to ensure that the roll generating lines are perfectly parallel on setting-up the machine, and to adjust the "fineness" and uniformity of grinding over the entire machine operating face.

10 Both the attack and withdrawal movements and the setting operations are effected by cam and lever systems which on the one hand ensure the necessary accuracy even to the extent of small movements, and on the other hand enable considerable masses subjected to high stresses to be moved
15 by the application of a small force.

This equipment for moving and setting the grinding rolls in known cereal roller mills considerably extends the construction of the machine itself, but more importantly it considerably complicates roll removal and replacement, which
20 is required both for processing changes and for the necessary periodic overhaul and maintenance of the rolls.

In this respect, in such an event it is not only necessary to remove the relative supports with the two

rolls, the motion transmission members and part of the machine frame, but it is also necessary to completely remove the members which effect the attack and withdrawal operations and set the relative position of the grinding
5 rolls, and the members which are conventionally present for taking-up any slack between the various moving parts and for preventing the damaging and disturbing vibration which would otherwise accompany the operation of the machine.

The object of the invention is to obviate these
10 drawbacks by providing a cereal roller mill of the horizontal roll type, in which the rolls can be removed and remounted without having to substantially remove the members involved in the attack and withdrawal, setting and slack take-up of said rolls.

15 This object is attained according to the invention by a cereal roller mill comprising at least one pair of horizontal rolls, of which one is fixed and is supported by supports applied to the machine shoulders and one is mobile and mounted on supports which are hinged to said shoulders
20 and operated by lever and cam systems during the attack and withdrawal movements, and further comprising adjustment members operable from the outside for horizontally moving the two mobile roll supports independently of each other,

characterised in that each mobile roll support is hinged at one end to a cylindrical member eccentrically mounted on a pin for connection to the corresponding shoulder and rigid with an adjustment member operable from the outside, and is
5 connected at its other end to a member for controlling the attack and withdrawal movements, by way of a member which is elastically yieldable in the withdrawal direction, further elastic members being provided having one end connected to the shoulders at points separated from the fixed roll
10 supports, and having their other end connected to the mobile supports and acting in the withdrawal direction.

Advantageously, each mobile roll support can comprise a central cylindrical cavity for housing the roll bearing, an appendix which extends vertically from said
15 cavity portion and is hinged at its end to the cylindrical member, and a second appendix which extends from the opposite side and is hinged to the member which controls the attack and withdrawal movements.

Again according to the invention, the roller mill
20 can comprise for each support a precompressed spring interposed between a ledge rigid with the shoulder and a lever rigid with the cylindrical member, said lever being connected to a threaded rod which can be rotated by an

external handwheel.

The spring can advantageously be of adjustable type.

A preferred embodiment of the present invention is 5 described hereinafter by way of non-limiting example with reference to the accompanying drawings, in which:

Figure 1 is a partial diagrammatic side view of a two-section roller mill according to the invention; and

10 Figure 2 is a detailed view to an enlarged scale of the rectangle shown by dashed lines in Figure 1.

As can be seen from the figures, the roller mill according to the invention comprises a stand 1 formed from two shoulders 2 which are rigidly connected together by a 15 base 3 and cross-members. The machine is divided vertically in the longitudinal direction into two constructionally equal sections which are joined together at their rear. Consequently, the lateral end of one section of the roller mill is identical to the opposite lateral end of the other 20 section, and an overall side view of the machine (see Figure 1) thus substantially represents both the ends of each section. Because of this, the description given hereinafter, which relates to one of the two sections, is also valid in

its entirety for the other section.

A horizontal slot 4 open at one end is formed in each shoulder 2, and between the two facing slots of the two shoulders 2 are mounted the supports 5,5' for the two grinding rolls, namely the fixed 6 and mobile 6' respectively. More particularly, the supports 5' for the mobile grinding roll 6' are disposed in such a manner that the relative roll is housed in the inner position in the slots 4, whereas the supports 5 for the fixed roll 6, which are of flanged type, are fitted externally to the shoulders 2 in that position of the slots 4 which is closest to their opening. In addition, the free portion of each slot 4 between the support for the fixed roll 6 and the support for the mobile roll 6' is occupied by a central removable side portion, while the free portion of each slot 4 between the support 5 for the fixed roll 6 and the open end is occupied by a removable outer side portion 8. Whereas the fixed roll 6 is unable to undergo any horizontal movement, the roll 6' can undergo small horizontal movements along the slots 4, both during the attack and withdrawal operations and during the operations involved in setting the distance between the two rolls, as will be apparent hereinafter. For this purpose, the two supports 5' for the mobile roll 6' are of

substantially elongated configuration, in the sense that in addition to comprising the necessary cylindrical cavity 9 which houses a bearing for the mobile roll 6', they extend in the form of a lower appendix 10 and an upper appendix 11.

5 The lower appendix 10 is provided at its end with a smaller cylindrical cavity housing a complementary cylindrical member 12 eccentrically mounted on a pin 13 rigid with the corresponding shoulder 2.

The cylindrical member 12 is rigid with a lever 14, 10 at the end of which there is provided a threaded bush 15 engaged by a threaded rod 16 which can be rotatably driven by an external handwheel 17. In the central portion of the lower appendix 10 there rests a coil spring 18, the other end of which rests on a ledge 19 rigid with the shoulder 2 15 at a point separated from the point 5. The spring 18, which can be adjusted in terms of its degree of precompression, acts in the sense of urging the mobile roll 6' to withdraw from the fixed roll 6.

The cylindrical cavity 9 of each support 5' is 20 substantially formed from two disks 20 removably connected to a tubular portion 21. This latter is formed from two parts, of which one part 22 facing the fixed roll 6 can be removed in order to enable the mobile roll 6' to be removed,

as described hereinafter.

The upper appendix 11 of each support 5' comprises a cavity for the passage of a tie rod 23 which controls the attack movement. At that end of the tie rod 23 which is more distant from the fixed roll 6 there are fitted two half casings 24,24' which are inserted telescopically into each other to enclose a plurality of cup springs 25 which can be preloaded by means of a setting screw 26. The half casing 24', which is not in contact with the setting screw 26, externally comprises at its end a pair of pointed projections 27 engaging in corresponding notches 28 provided in the appendix 11. The opposite end of the tie rod 23 is hinged to a pin 29 mounted eccentrically on a shaft 30 which passes through the machine and thus operates the tie rod 23 provided at the other side thereof, as will be seen hereinafter. For its rotation, the shaft 30 is provided at one end with a lever 31 connected to a single-acting hydraulic cylinder-piston unit 32.

On one side of the machine, external to the shoulder 2, there is fitted a gear unit 33 for transmission between the two rolls 6 and 6', the hydraulic cylinder-piston unit 32 also being provided on this side, whereas the other side of the machine comprises the

connection between the feed pulley (not shown) and the fixed roll 6.

The roller mill according to the invention operates as described hereinafter, but no description is given of the section for feeding and distributing the cereal to the two grinding rolls 6,6', or of the members which are not concerned with the operations involved in the attack and withdrawal, the setting, the take-up of slack and the mounting of the rolls and their removal for overhaul, and which are of known type and do not constitute the subject matter of the present invention.

In order to effect the attack operation, ie to cause the mobile roll 6', assumed spaced apart from the fixed roll 6, to approach this latter, both rolls being in a state of rotation, the cylinder-piston unit 32 is charged. This causes its rod 34 to retract into the cylinder 35, thus rotating the shaft 30 about its axis by way of the lever 31. This rotation causes the two eccentric pins 25 provided at both its ends to move and thus exert traction on the two tie rods 23. As the elastic reaction of the cup springs 25 prevails over the elastic reaction of the springs 18, the traction exerted on the tie rods 23 causes a corresponding rotation of the two supports 5' about the axis of the

corresponding cylindrical member 12, thus causing the mobile roll 6' to approach the fixed roll 6. Obviously during the design of the machine, the various parts are sized so that the maximum excursion of the rod 34 of the cylinder-piston unit 32 corresponds to the required horizontal translatory stroke of travel of the mobile roll 6', although any required adjustments and setting corrections can in any case be carried out by adjusting the preloading screws 26 for the cup springs 25.

10 The roller mill is now able to correctly perform its functions. If during its regular operation any foreign body such as a piece of iron should accidentally fall together with the cereal to be ground, any damage to the rolls is prevented by the elastic yielding of the cup
15 springs 25, which allow instantaneous withdrawal of the mobile roll 6' from the fixed roll 6 for the passage of said foreign body.

 During operation, each coil spring 18 elastically urges the relative support 5' in the withdrawal direction.
20 In this manner, by way of the mobile supports 5', the tie rods 23 are kept in a state of tension, which takes-up any slack between them and the supports 5', between them and the shaft 30, between the shaft 30 and the lever 31, and between

the lever 31 and the cylinder-piston unit 32. At the same time, because of the eccentricity of the pin 13 relative to the cylindrical member 12, said springs 18 also take-up the inevitable slack between the supports 5' and the cylindrical members 12, and between the cylindrical members 12 and the pins 13. Thus, the two springs 18 take-up all slack due to the attack, withdrawal and adjustment system, so eliminating any vibration and making the machine operation very silent.

If during prolonged operation of the roller mill any adjustments should become necessary either to compensate for the inevitable wear of the rolls or for restoring parallelism between the grinding surfaces thereof, or again to vary the characteristics of the ground product or to restore them to the required value, the miller, by operating the handwheel or wheels 17, moves the end of the corresponding lever 14 to cause the cylindrical member 12 to rotate about the axis of rotation of the eccentric pin 13 on which it is mounted. By virtue of this eccentricity, rotating the cylindrical member 12 also results in its translatory movement, and thus a translatory movement of the lower end of the support 5'. Thus by suitably operating the two handwheels 17 it is possible to effect the required adjustment in an extremely fine and precise manner.

When it is required to remove the rolls 6,6', for example for overhauling purposes, this can be done by the following succession of operations:

- removing the side covers which externally cover the
5 shoulders 2, and removing the front machine door 36,
- removing the front side pieces 8 which close the
horizontal slots 4,
- removing the drive pulley connected to the drive motor
from one side of the machine,
- 10 - removing the cover 37 and the transmission gears between
the two rolls 6,6' from the other side of the machine,
- opening the covers for the supports 5 of the fixed roll
6, slackening the ring nuts of the tension bushes for the
bearings housed therein, and removing the screwed
15 connections which connect each fixed support 5 to the
relative shoulder 2,
- removing the fixed roll 6,
- removing the central side pieces 7 from the slots 4,
- removing the studs in the outer disk 20 which covers the
20 mobile supports 5 but without completely removing said
disk,
- removing the front part 22 of both hollow cylindrical
portions 9,

- horizontally withdrawing along the slots 4 the mobile roll 6 with its bearings and disks 20 disposed to the side of each bearing.

Obviously, after overhauling or simply changing the 5 rolls 6,6', they are re-mounted by performing the described operations in the reverse sequence.

From the foregoing, it is apparent that the roller mill according to the invention has numerous advantages over known roller mills with horizontal rolls, and in particular:

- 10 - it enables the rolls 6,6' to be removed and re-mounted much more rapidly; this simplifies both the construction and the overhauling of the machine, while at the same time reducing the periods of forced inactivity and thus increasing the productivity of the system;
- 15 - it enables the rolls 6,6' to be removed and re-mounted without in any way having to upset the coarse adjustment (made by the screws 26) or the fine adjustment (made by the handwheels 17), and thus without having to re-make these adjustments on each re-mounting, these adjustments
20 amongst other things requiring highly specialised personnel;
- it enables a fine adjustment to be made with maximum precision by virtue of the reduction gearing system for

the rotation of each handwheel 17;

- it allows rapid heat dispersal from the rolls, even where actual cooling is not provided, by virtue of the direct connection between the supports 5 and shoulders 2, which
5 thus also involves the shoulders themselves in this heat dispersal.

C L A I M S

1. A cereal roller mill comprising at least one pair of horizontal rolls (6,6'), of which one (6) is fixed and is supported by supports (5) applied to the machine shoulders (2) and one (6') is mobile and mounted on supports (5') 5 which are hinged to said shoulders (2) and operated by lever and cam systems during the attack and withdrawal movements, and further comprising adjustment members operable from the outside for horizontally moving the two supports (5') for the mobile roll (6') independently of each other, 10 characterised in that each support (5') for the mobile roll (6') is hinged at one end to a cylindrical member (12) eccentrically mounted on a pin (13) for connection to the corresponding shoulder (2) and rigid with an adjustment member (14, 15, 16, 17) operable from the outside, and is 15 connected at its other end to a member (23) for controlling the attack and withdrawal movements, by way of a member (24, 25) which is elastically yieldable in the withdrawal direction, further elastic members (18) being provided having one end connected to the shoulder (2) at points 20 separated from the supports (5) for the fixed roll (6), and having their other end connected to the mobile supports (5')

and acting in the withdrawal direction.

2. A roller mill as claimed in claim 1, characterised in that each support (5') for the mobile roll (6') comprises a central cylindrical cavity (9) for housing the roll bearing, an appendix (10) which extends vertically from said cavity portion (9) and is hinged at its end to the cylindrical member (12), and a second appendix (11) which extends from the opposite side and is hinged to the member (23) which controls the attack and withdrawal movements.

10 3. A roller mill as claimed in claims 1 and 2, characterised by comprising for each support (5') a precompressed spring (18) interposed between a ledge (19) rigid with the shoulder (2) and a lever (14) rigid with the cylindrical member (12), said lever being connected to a threaded rod (16) which can be rotated by an external handwheel (17).

4. A roller mill as claimed in claims 1 to 3, characterised in that the spring (18) is of adjustable type.

5. A roller mill as claimed in claims 1 and 2, 20 characterised in that the cylindrical cavity (9) of each support (5') for the mobile roll (6') is bounded by two disks (20) connected to a tubular portion (21) which is itself divided into two parts, of which at least that part

(22) facing the support (5) for the fixed roll (6) is removable in order to allow removal of the bearing for the mobile roll (6') housed in said cylindrical cavity (9).

6. A roller mill as claimed in claims 1 and 2, characterised in that each member (23) for controlling the attack and withdrawal operations is constituted by a tie rod hinged to a single crankshaft (29, 30) disposed transversely to the machine and rotated by a hydraulic cylinder-piston unit (32).

10 7. A roller mill as claimed in one or more of claims 1 to 6, characterised in that between each tie rod (23) and the corresponding appendix (11) of the support (5') for the mobile roll (6') there is disposed an elastic member (24, 24', 25, 26) having an elastic constant which is
15 greater than that of the spring (18).

8. A roller mill as claimed in claims 1 and 7, characterised in that the elastic member interposed between each tie rod (23) and the corresponding appendix (11) of the support (5') for the mobile roll (6') is constituted by two
20 half casings (24, 24') which can telescopically retract one into the other and enclose a plurality of cup springs (25) maintained in a precompressed state by a locking and adjustment screw (26).

9. A roller mill as claimed in one or more of claims 1 to 8, characterised in that each shoulder (2) is provided with a horizontal slot (4) open at one end and housing, from the inner end to the outer end, the pivot of the mobile roll
5 (6'), a removable central side portion (7), the pivot of the fixed roll (6) and a removable outer side portion (8), in that order.

FIG.1

