Jan. 3, 1967 C. D. FISHER 3,295,774

ATTRITION MILL APPARATUS

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FIG. 1.

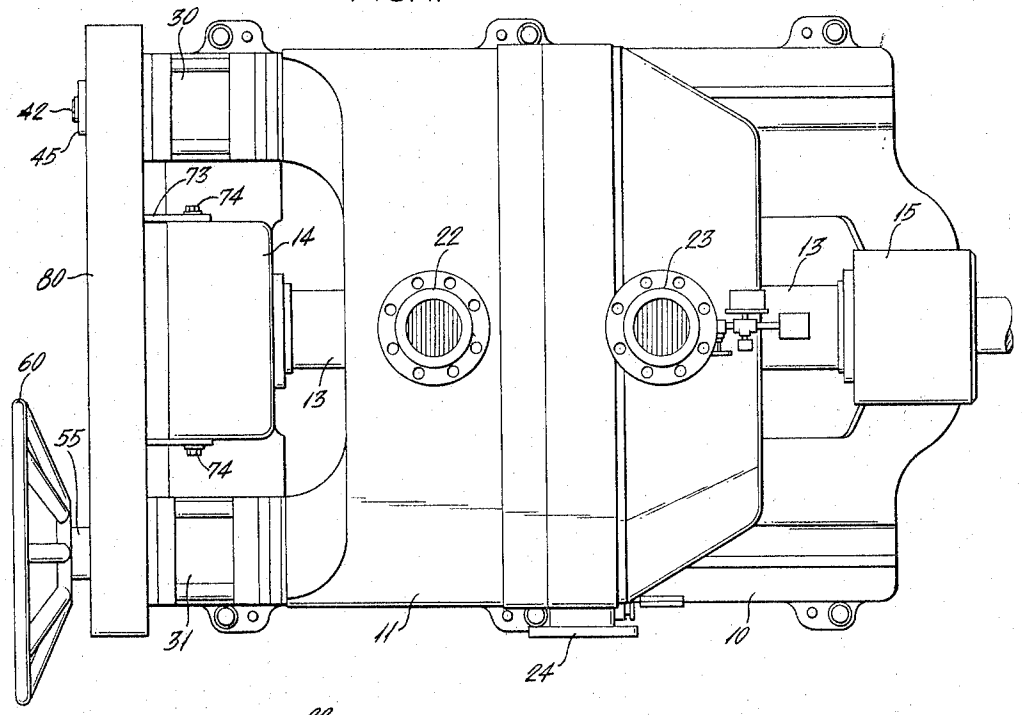


FIG. 2.

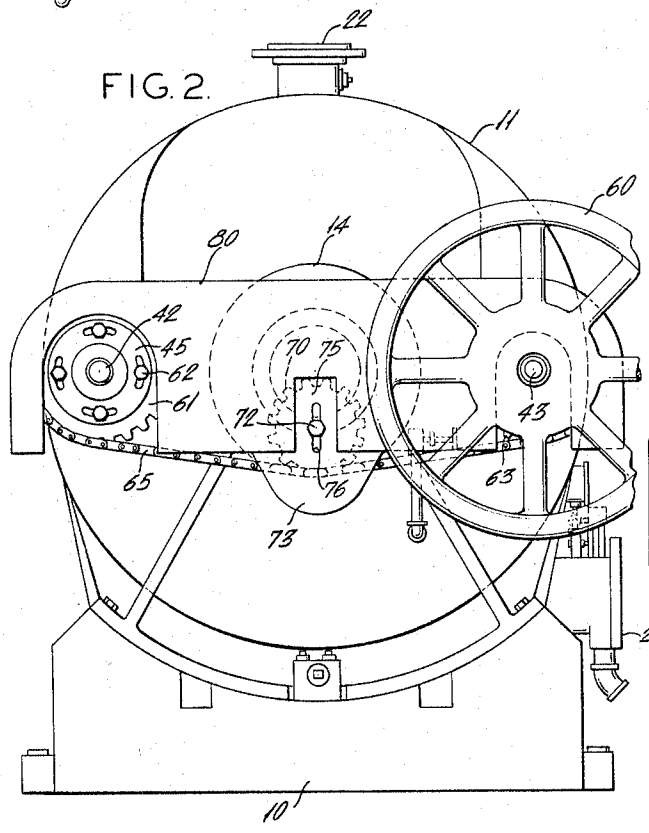
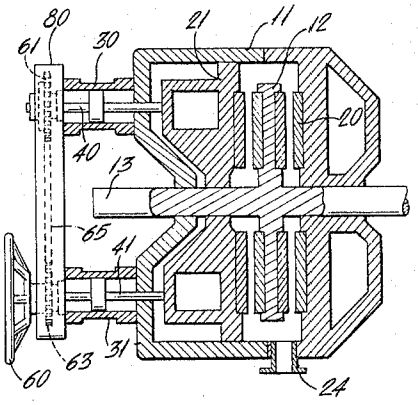


FIG. 5.



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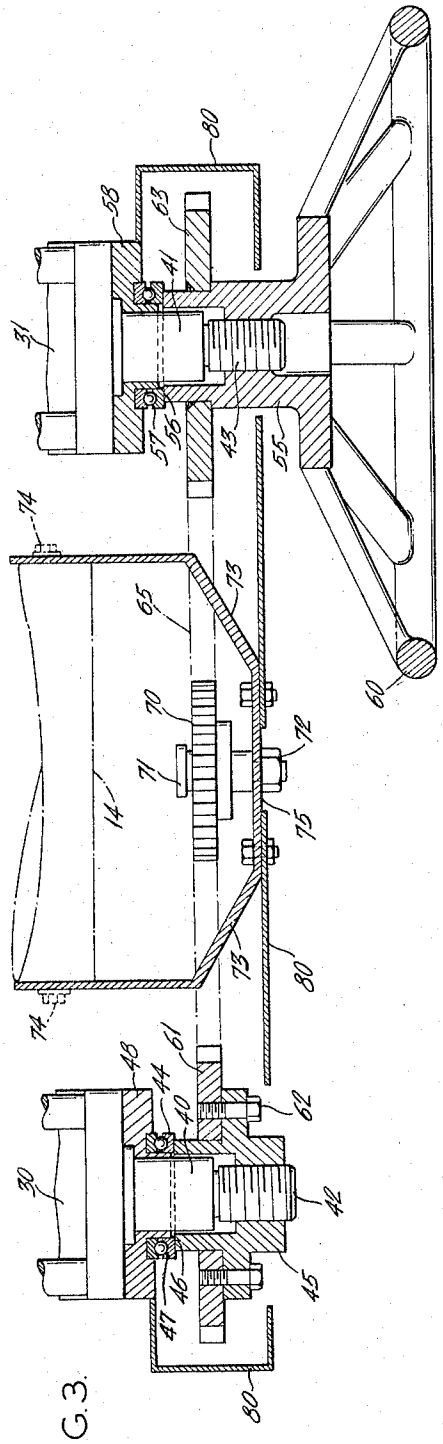


FIG. 3.

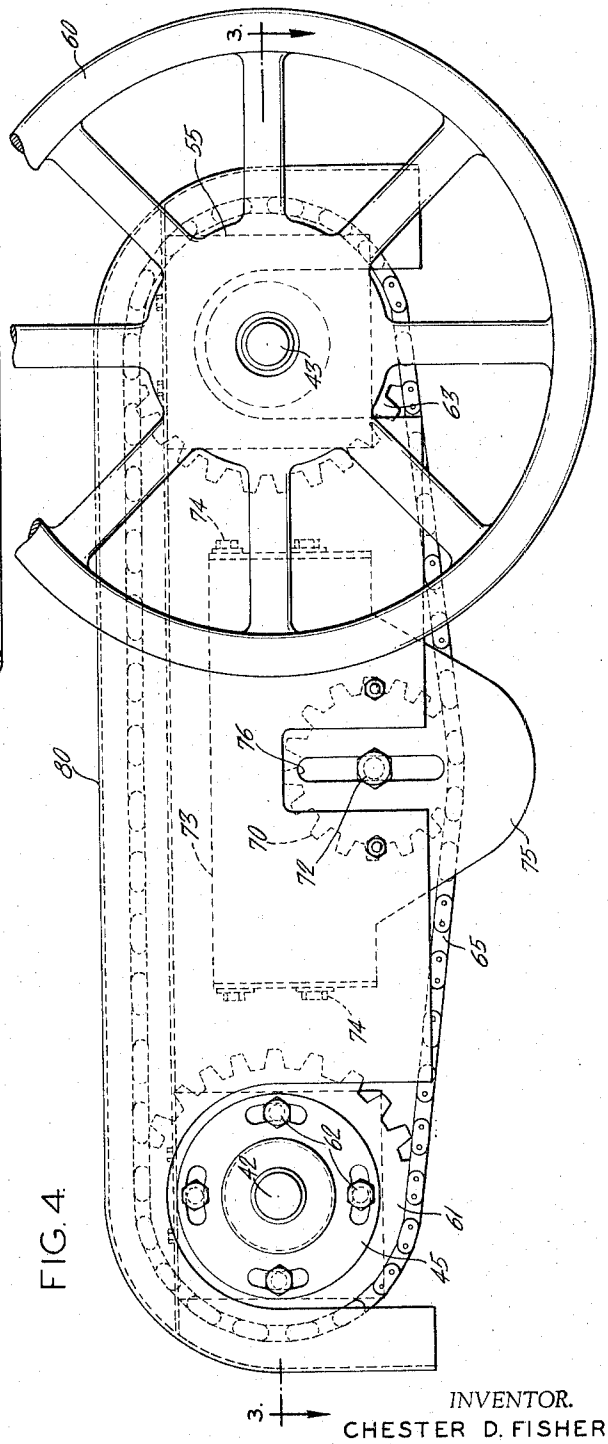


FIG. 4.

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ATTRITION MILL APPARATUS

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8 Claims. (Cl. 241—256)

This invention relates to attrition mill apparatus and, more particularly, to rotating disc attrition mills for refining paper pulp and like usage and in which the attrition or refining or grinding action is obtained by passing the material to be treated between the opposed faces of a rotating disc and a cooperating attrition surface, and, still more particularly, to mechanical means for pre-setting the clearance between the opposed mating attrition surfaces.

As will be understood, rotating disc attrition mills of the character generally to which this invention relates may be considered as including at least one rotating disc having attrition surfaces thereon and in cooperating or mating engagement with another attrition disc which may or may not be rotating. The grinding action on the material being treated in such apparatus occurs as the material is fed radially outwardly between the closely spaced attrition surfaces, and the extent or severity of such grinding action is determined, in large measure, by the close axial spacing maintained between the two working attrition surfaces.

Although the control and adjustment of such axial spacing between the working attrition surfaces (which spacing for many applications is desirably maintained within only a few thousandths of an inch of a predetermined setting) may conventionally be achieved by fluid pressure control (e.g., pneumatic or hydraulic cylinder-and-piston arrangements acting on one or both of the attrition surfaces for axial adjustment thereof), it may be desired in certain circumstances to vary the axial spacing between the attrition surfaces occasionally or intermittently, while yet being able automatically to return to a particular predetermined or pre-set spacing. For example, especially when such attrition mill devices are operated intermittently instead of continuously, it may be desired for a variety of reasons to separate the attrition surfaces after each run, and then to re-adjust the axial spacing between the surfaces to exactly the same setting as previously at the start of a new run and even under circumstances where the hydraulic or flow conditions are such that a different pressure situation obtains even though the axial spacing be the same.

As will be understood, conventional hydraulic controls on such apparatus permit approximating a preconceived setting with the hydraulic controls alone and/or by noting power consumption on the drive motor or other indicia of the axial spacing between the working surfaces in terms of the power consumed or work being done. Yet such a situation is not always exactly equivalent to re-establishing a predetermined spacing in terms of a few thousandths of an inch, and especially under circumstances where the control apparatus may be remote from the attrition mill device itself and/or where, as usual, the construction of the attrition mill apparatus is such as to preclude visual or other direct measurement or inspection.

According to this invention, however, there are provided arrangements and devices for pre-setting any of a variety of axial spacings between the working attrition surfaces so that, notwithstanding adjustment or movement of the attrition surfaces out of such pre-set axial spacing, the pre-set spacing is readily and automatically achieved as often as may be desired; and, as a further feature of this invention, means are particularly provided for achieving such goals even under circumstances where the adjusting or positioning apparatus for the attrition discs is

parallelly operated on opposite sides of the machine yet without transverse misalignment even when the pre-set position is to be accurate within a few thousandths of an inch.

With the foregoing and additional objects in view, this invention will be described in more detail, and other objects and advantages thereof will be apparent from the following description, the accompanying drawings, and the appended claims.

In the drawings:

FIG. 1 is a top plan view of one variety of attrition mill apparatus having applied thereto means embodying and for practicing this invention;

FIG. 2 is an end elevation of the apparatus of FIG. 1 from the left-hand end thereof;

FIG. 3 is a partial horizontal section through that portion of FIG. 1 including apparatus embodying and for practicing this invention;

FIG. 4 is an end elevation view of the apparatus of FIG. 3; and

FIG. 5 is a diagrammatic or schematic view indicating a horizontal section through the apparatus of FIG. 1 illustrating this invention in operation.

Referring to the drawings, in which like reference characters refer to like parts throughout the several views thereof, there is shown here, merely for purposes of illustrating one form of apparatus embodying and for practicing this invention, an attrition mill generally of the character disclosed in co-pending application Serial No. 175,862 filed January 15, 1962, and now abandoned. As noted in such co-pending application and as will be understood, such attrition mill apparatus includes a base 10 having a generally cylindrical casing 11 thereon, within which is a rotating disc 12 on a main shaft 13 mounted for rotation and free axial movement in bearings 14 and 15. Also within casing 11 is a stationary and non-rotating but axially movable disc 21 at the opposite side of rotating disc 12 (all as schematically and quite diagrammatically illustrated in FIG. 5).

The material to be treated is supplied into casing 11 through material inlets 22 and 23, and flows to both sides of rotating disc 12, which is driven for rotation by a conventional motor (not shown). Upon rotation of disc 12, in known manner, the material to be treated is forced radially outwardly of the discs and withdrawn through outlet 24 in casing 11. During such radial outward movement, the material to be treated passes between the opposed and mating working surfaces formed between stationary disc 20 and one side of disc 12 and, simultaneously, between the opposite side of disc 12 and non-rotating disc 21.

The axial spacing between the cooperating and mating attrition surfaces is maintained by moving non-rotating disc 21 axially within casing 11, thereby automatically adjusting the spacing between both side of the rotating disc and the corresponding non-rotating mating surfaces, since rotating disc 12 is axially freely floating in bearings 14 and 15 and thus assumes a median position axially between non-rotating discs 20 and 21 depending upon the axial position of disc 21.

Such axial control and spacing of the working surfaces in the type of apparatus illustrated, is provided, as disclosed in said co-pending application, by hydraulic cylinder-and-piston arrangements 30 and 31 acting together under hydraulic pressure fluid to move non-rotating disc 21 axially within casing 11 from a fully open position (in which there may be several inches between the attrition surfaces for purposes of changing the plates thereon) to a working position where the spacing between adjacent attrition surfaces is only a few thousandths of an inch. Naturally, as will be understood, hydraulic pressure

gauges and inspection of throughput of material and/or horsepower or power consumption indications from the drive motor may all be utilized as indicating or estimating the axial spacing of the discs in terms of the work being done thereby on the material passing therethrough, yet it may be desired to be able, after backing the discs off, to re-establish a previous spacing therebetween directly in terms of spacing and without regard to pressure or flow conditions between the attrition surfaces of the discs.

To this end, as particularly illustrated in FIGS. 3 and 4, there are provided rearwardly extending piston rod portions **40** and **41** in hydraulic cylinder devices **30** and **31**, respectively, connected to the pistons therein and extending rearwardly through the ends of the hydraulic cylinders. Piston rod extensions **40** and **41** carry at the extreme ends thereof a threaded portion **42** and **43**, respectively. On threaded extension **42** is carried a stop member or nut **45** having forward abutting surfaces **46** for movement into and out of engagement with a ballbearing arrangement **47** engaging a stop plate **48** affixed to the end of hydraulic cylinder **30**.

A similar arrangement obtains with respect to hydraulic cylinder **31** in which a stop member or nut **55** is threadably engaged with threaded portion **43** on piston rod extension **41**, and includes an annular abutting surface **56** engaging ballbearing means **57** against a plate **58** affixed to the end of cylinder **31**. In this instance, however, the axially outer end of stop member **55** is shown as being developed into hand wheel control **60**.

A sprocket wheel **61** is shown as affixed to stop member **45** as by bolts **62**, while a similar sprocket **63** is shown as being affixed to stop member **55** as by welding. A roller chain **65** interconnects sprockets **61** and **62** for positive driving rotation thereof. Also, in the embodiment shown, an idler tension-adjusting sprocket **70** is illustrated as preferred for adjusting the tension of chain **65**, and is mounted on a shaft **71** affixed, as by bolt **72**, to a bracket arrangement **73**, mounted on any conventional portion of the apparatus, and, in the illustrated embodiment, on bearing housing **14** as by bolts **74**. Preferably bracket **73** includes in an end portion **75** a vertically elongated slot **76** for accommodating bolt **72** on idler sprocket shaft **71** in a manner enabling vertical adjustment of idler sprocket **70** for adjustment of the tension of chain **65**, all as is particularly apparent from FIG. 4. There is also preferably included as a safety measure an outer covering or shield **80** for housing the chain and sprocket drive and affixed to bracket **73** or otherwise as may be desired.

As will be apparent from the foregoing, rotation of hand wheel **60** in either direction will cause rotation of sprocket **63** and simultaenous rotation of sprocket **61**, both to the same extent and direction, thus moving stop members **45** and **55** axially of piston rod extensions **40** and **41** as the stop members are rotated about the threaded engagement therewith. Thus, if the hydraulic cylinder-and-piston devices **30** and **31** are actuated to bring non-rotating plate **21** to any given axial position with respect to non-rotating plate **20**, and then hand wheel **60** is rotated in the proper direction to bring the contacting surfaces **46** and **56** of stop members **45** and **55** into abutting relation with ballbearing means **47** and **57** bearing against plates **48** and **58**, then the hydraulic cylinders may be actuated to back off non-rotating disc **21** (i.e., to the left in FIG. 1 or 5) for opening the clearances between the working surfaces.

If no further rotating adjustment is made of hand wheel **60**, and hydraulic cylinders **30** and **31** at any time thereafter are actuated to move non-rotating disc **21** to the right in the drawings (even by remote control from an operating station distant from the apparatus itself), then the non-rotating disc will return to precisely the same axial spacing as before because the closing motion thereof will be arrested as the contacting surfaces **46** and **56** on stop members **45** and **55** once again come into abutting relation with plates **48** and **58** and bearings **47** and **57**. By the same token, if the non-rotating disc **21** is backed off axially and it is desired to bring it hydraulically up to a new or different axial setting, it is merely necessary to rotate hand wheels **60** to move stop members **45** and **55** further outwardly along the threaded extensions **42** and **43** sufficiently so that there will be no contact between the stop members and plates **48** and **58** until after the new axial spacing has been achieved, at which point stop members **45** and **55** may be positioned by hand wheel **60** so that such new axial spacing can be accurately re-established at any time thereafter.

I claim:

1. In attrition mill apparatus characterized by a casing defining a chamber therein, a rotatable attrition disc in said chamber secured to a shaft rotatably mounted within said casing, a non-rotatable attrition disc mounted in said chamber for axial movement relative to said casing, and means on said casing for axially positioning said non-rotatable disc including a hydraulic cylinder-and-piston assembly, the improvement comprising selectively adjustable stop means for setting said non-rotatable attrition disc at a predetermined axial position, said means comprising a threaded piston rod extension extending outwardly from said cylinder-and-piston assembly, a stop member on said piston rod extension threadedly engaged therewith for selective positioning thereon, and means associated with said cylinder-and-piston assembly for engagement with said stop member to limit inward travel of said piston rod.

2. In attrition mill apparatus characterized by a casing defining a chamber therein, a rotatable attrition disc in said chamber secured to a shaft rotatably mounted within said casing, a non-rotatable attrition disc mounted in said chamber for axial movement relative to said casing, and means on said casing for axially positioning said non-rotatable disc including a pair of hydraulic cylinder-and-piston assemblies mounted in diametrically spaced relation from the rotational axis of said apparatus, the improvement comprising selectively adjustable stop means for setting said non-rotatable attrition disc at a predetermined axial position, said means comprising threaded piston rod extensions extending outwardly from each of said cylinder-and-piston assemblies, a stop member on each of said piston rod extensions threadedly engaged therewith, means associated with each said cylinder-and-piston assembly for engagement with said stop members to limit inward travel of said piston rods, and means for coordinately rotating both said stop members for selective positioning thereof on said piston rods to uniformly control the inward travel limit of said piston rods while permitting outward movement of said rods, thus allowing the reestablishment of a predetermined axial position of said non-rotatable attrition disc.

3. The invention as claimed in claim **2** wherein said means associated with each said cylinder-and-piston assembly for engagement with said stop members to limit inward travel of said piston rods comprises a stop plate affixed to each said cylinder-and-piston assembly, each said stop plate having bearing means secured thereto for engagement with one of said stop members.

4. The invention as claimed in claim **2** wherein said means for coordinately rotating both said stop members for selective positioning thereof on said piston rods comprises a sprocket wheel affixed to each said stop member, a chain interconnecting said sprocket wheels to coordinate rotation of said stop members, and a hand wheel extending from one of said stop members for actuating said chain and sprocket wheels.

5. In attrition mill apparatus characterized by a casing defining a generally cylindrical chamber therein a first non-rotatable attrition disc mounted coaxially within said casing, a second coaxial non-rotatable attrition disc movably mounted in said casing for axial movement relative

to said stationary disc, a shaft extending coaxially of the casing chamber and bearing means in said casing rotatably supporting said shaft therein, a rotatable attrition disc on said shaft disposed between the first and second non-rotatable discs for cooperation therewith, and means on said casing for axially positioning said second non-rotatable disc including a plurality of hydraulic cylinder-and-piston assemblies, the improvement comprising selectively adjustable stop means for setting said second non-rotatable attrition disc at a predetermined axial position, said means comprising threaded piston rod extensions extending outwardly from each of said cylinder-and-piston assemblies, a stop member on each of said piston rod extensions threadedly engaged therewith, means associated with each said cylinder-and-piston assembly for engagement with said stop members to limit inward travel of said piston rods, and means for coordinately rotating each said stop member for selectively positioning thereof on said piston rods to uniformly control the inward travel limit of said piston rods while permitting outward movement of said rods thus allowing the reestablishment of a predetermined axial position of said second non-rotatable attrition disc.

6. In attrition mill apparatus characterized by a casing defining a generally cylindrical chamber therein, a first non-rotatable attrition disc mounted coaxially within said casing, a second coaxial non-rotatable attrition disc movably mounted in said casing for axial movement relative to said stationary disc, a shaft extending coaxially of the casing chamber and bearing means in said casing rotatably supporting said shaft therein, a rotatable attrition disc on said shaft disposed between the first and second non-rotatable discs for cooperation therewith, and means on said casing for axially positioning said second non-rotatable disc including a pair of hydraulic cylinder-and-piston assemblies mounted in diametrically spaced relation from the rotational axis of said apparatus, the improvement comprising selectively adjustable stop means for setting said second non-rotatable attrition disc at a predetermined

axial position, said means comprising threaded piston rod extensions extending outwardly from each of said cylinder-and-piston assemblies, a stop member on each of said piston rod extensions threadedly engaged therewith, means associated with each said cylinder-and-piston assembly for engagement with said stop members to limit inward travel of said piston rods, and means for coordinately rotating both said stop members for selective positioning thereof on said piston rods to uniformly control the inward travel limit of said piston rods while permitting outward movement of said rods thus allowing the reestablishment of a predetermined axial position of said second non-rotatable attrition disc.

7. The invention as claimed in claim 6, wherein said means associated with each said cylinder-and-piston assembly for engagement with said stop members to limit inward travel of said piston rods comprises a stop plate affixed to each said cylinder-and-piston assembly, each said stop plate having bearing means secured thereto for engagement with one of said stop members.

8. The invention as claimed in claim 6, wherein said means for coordinately rotating both said stop members for selective positioning thereof on said piston rods comprises a sprocket wheel affixed to each said stop member, a chain interconnecting said sprocket wheels to coordinate rotation of said stop members, and a hand wheel extending from one of said stop members for actuating said chain and sprocket wheels.

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