Jan. 16, 1968 J. R. JARVIS 3,363,772

EXTRACTOR

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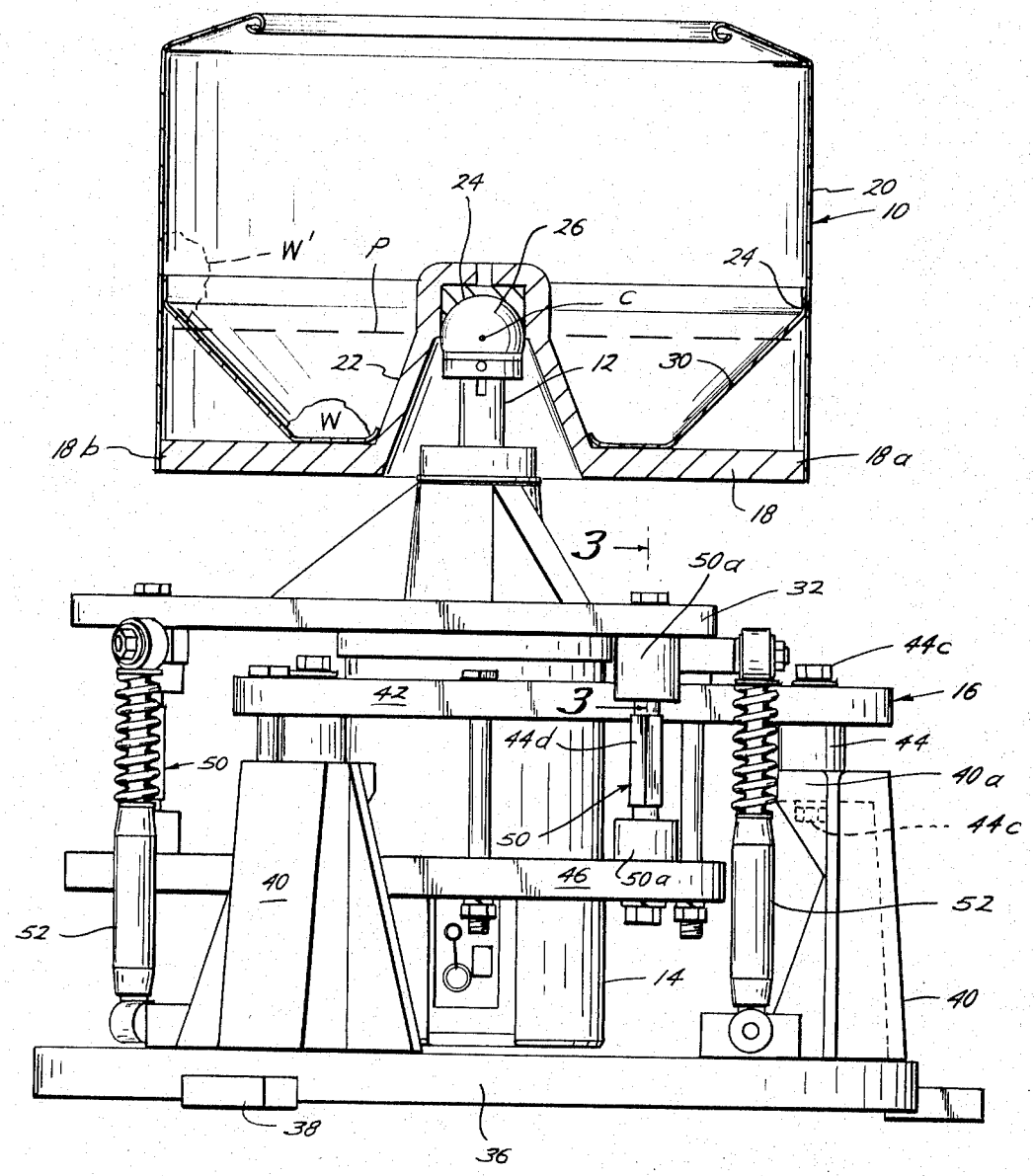


Fig. 1

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Fig. 2

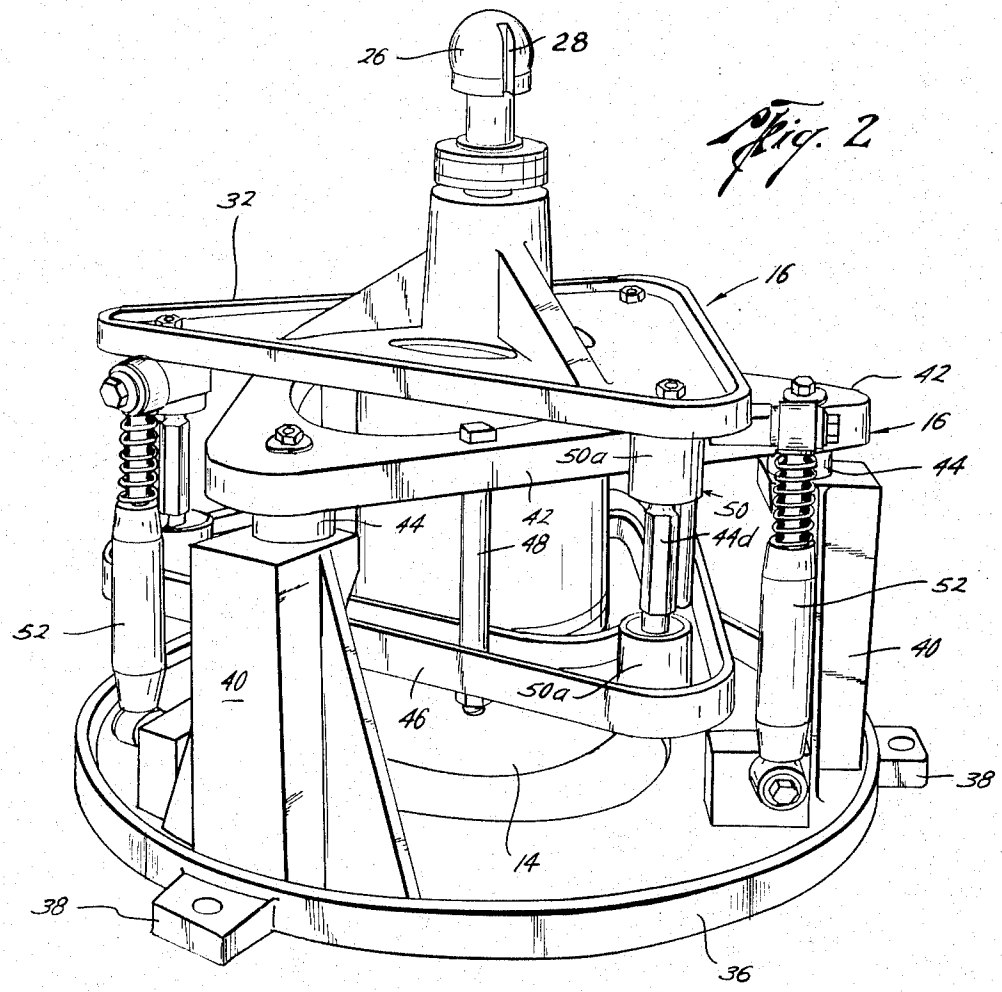
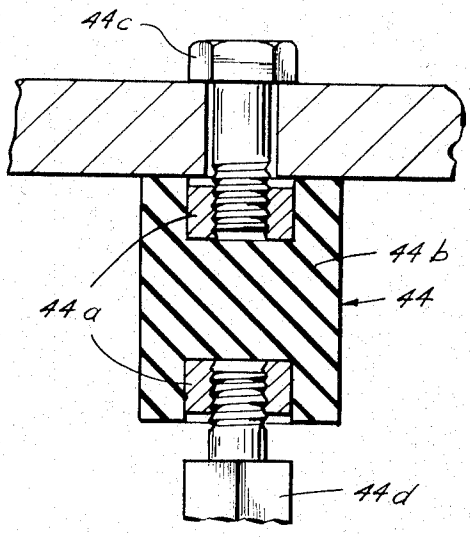


Fig. 3



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United States Patent Office 3,363,772
Patented Jan. 16, 1968

3,363,772

EXTRACTOR

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Filed Jan. 19, 1967, Ser. No. 610,438
6 Claims. (Cl. 210—363)

ABSTRACT OF THE DISCLOSURE

A centrifugal extractor having a cylindrical basket assembly with an open-top and heavy bottom, mounted on a rotating vertical shaft by a ball and socket connection. The basket assembly has a baffle extending angularly upward from its bottom to its side wall whereby upon rotation of the basket, substantially all of the clothes in the basket will be driven by centrifugal action to a level above the ball and socket connection to substantially dynamically balance the basket and its load so that it can rotate relatively vibrationless even in a canted position. The motor driving the vertical shaft is mounted in a vibration damping system having double acting movement limiters to prevent excessive vibrational movement during certain critical periods of basket speed.

This invention relates to a centrifugal extractor, and more particularly to a top-loading centrifugal extractor for extracting liquid from clothes and the like contained in a basket rotating at high speed about a vertical axis.

In commercial laundries, it has been found expedient to take clothes from a washing machine in a very wet condition and put them in a machine specifically designed for the centrifugal extraction of the water. These machines are known as centrifugal extractors and operate at high speeds in order to rapidly and thoroughly extract the water contained in the clothes. Although an effort is usually made to manually distribute the clothes properly around the inside of the basket so that no unbalance is created, as a rule some unbalance occurs. If the unbalance is significant, considerable vibration will result.

Commercial centrifugal clothes extractors usually have an open top perforated clothes basket which is mounted upon a motor driven vertical shaft for spinning about a vertical axis. The connection between the shaft and basket is normally of the ball and socket type with the ball on the upper end of the shaft and the socket in a central pocket extending upwardly substantially into the tub. Thus, the basket can tilt in any direction about the shaft. Even though the operator makes a conscious effort to evenly distribute the clothes load in the basket, it is not uncommon to have an unbalanced load. This causes the basket to be initially tilted with respect to the shaft to a position approaching static gravitational balance. Then as the motor starts turning the basket, the resulting centrifugal force begins to overcome the gravitational force acting to keep the basket tilted and when great enough, the centrifugal force will cause the basket to move toward a level position. As it does so, the load unbalance increases its vibrational effect and at the same time, it pulls the basket socket against one side of the ball on the shaft resulting in increased frictional engagement between the two. As a result, the friction will prevent the basket from becoming entirely level and it will be revolved in a canted position. As its speed increases, the unbalanced load increases the magnitude of the vibration until the usual vibration limit switch is operated to shut off the motor. The operator must then manually adjust the clothes load to bring it more nearly in balance.

In some cases, the unbalance may be very substantial

and results in such excessive vibration that the switch cannot effectively shut the extractor down before damage occurs. For example, an extractor normally is bolted to a floor and the vibration has been known to tear the extractor loose.

Various attempts have been made to solve this serious problem but none have been entirely satisfactory. For example, heavy duty vibration absorption systems have been proposed as have strengthening the supporting framework for the motor and basket. However, these have not resulted in reducing the vibration tendencies of the basket but only in reducing its effect on the support for the extractor. The vibration forces resulting from the unbalanced load still exert their effect.

It is therefore an object of this invention to provide a centrifugal extractor in which clothes or the like, even though initially unevenly deposited in the basket, will be moved by centrifugal force to a position such that the mass unbalance of the clothes will result in reducing the centrifugal unbalance of the basket and clothes whereby even though the mass unbalance of the clothes is quite substantial, it does not result in excessive vibration.

In commercial clothes extractors, it is desirable to rotate the basket at a speed of 1700 or 1800 r.p.m. to thoroughly extract water from the clothes. It has been found that in going through a critical intermediate speed range, e.g. the range of 400 to 600 r.p.m. the mass unbalance exerts a maximum vibratory effect which then decreases as the speed is further increased. In cases of severe mass unbalance, the clothes repositioning mentioned above may not limit vibration to a desired level in the critical speed range. Analysis of the movement of the basket and motor while operating within this range has shown that there are two prime components of movement. First there is horizontal movement through a horizontal plane. Second there is a vertical rocking or wobbling movement with respect to such horizontal plane. It has been found that by limiting such vertical movement, the vibrational forces generated by the basket can be reduced. It is therefore another object to provide a support system for the motor and basket to reduce the vibrational effect of relatively large unbalanced loads while the basket speed is being passed through a critical intermediate speed range.

Other objects, advantages and features of this invention will be apparent to one skilled in the art upon consideration of the detailed description, the appended claims and the attached drawings, wherein:

FIG. 1 is a front elevational view partly broken away and partly in cross-section to show the details of a preferred embodiment of the centrifugal extractor of the present invention;

FIG. 2 is an isometric view of the basket supporting and driving mechanism of the extractor shown in FIG. 1; and

FIG. 3 is a view taken on the line 3—3 of FIG. 1.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will hereinafter be described in detail a preferred embodiment of the invention with the understanding that the present detailed disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the exact embodiment illustrated.

Referring now to FIG. 1, it can be seen that the top-loading centrifugal-type extractor is formed of an open-top basket assembly **10** operatively connected to a vertical shaft **12** which is accelerated and decelerated by a motor **14** mounted in a support system **16**. A cabinet (not shown) encloses the operating mechanism specified above, and will contain provisions for catching and draining the extracted fluid.

The open-top basket assembly 10 is formed of a heavy circular bottom plate 18 and a perforated cylindrical sheet metal side wall 20, the top end of the latter having a central opening with an inwardly curved lip. The weight of the bottom plate 18 is preferably substantially greater than the weight of the clothes which will be placed in the basket assembly 10 for reasons explained later. For example, in a centrifugal extractor which is designed to extract the liquid from a load of clothes weighing 25 pounds, the circular bottom plate 18 weighs approximately 90 pounds. About the central vertical axis of the bottom plate 18 is a pocket 22, which extends upward substantially into the interior of the basket assembly 10. In the form shown in the drawing, the pocket 22 is provided with a socket-like interior 24 and the vertical shaft 12 is provided at its upper extremity with a ball-like member 26. The shaft 12 extends into the pocket 22 and the ball-like member 26 is engaged in the socket 24. The ball-like member 26 is provided with a keyway slot 28. A key carried by socket 24 is engaged therewith to operatively connect the basket assembly 10 to the shaft 12; whereby rotation of the shaft 12 causes the basket assembly 10 to rotate. However, it will be noted that the basket assembly is free to tilt about the vertical axis. It will thus be seen that means are supplied for providing a universal connection between the basket assembly and the motor driven shaft which prevents relative rotation therebetween while at the same time permitting tilting of the basket assembly in any direction about the shaft and, more specifically, about a point C at the center of the ball-like member and lying on the axis of the shaft.

In order to reduce the vibration resulting from an unbalanced load, basket assembly 10 is provided with a baffle 30 which extends angularly upward from a locus about the interior portion of bottom plate 22 to the side wall 24 adjacent and preferably above a transverse plane P through the tilt center at point C. The baffle may have straight walls and be generally frusto conical as shown or may have curved walls and be part of a hemisphere. By the time the centrifugal extractor reaches its maximum operating speed substantially all of the clothes in the basket assembly 10 will, as a result of centrifugal force, have traveled up the baffle 30 and be located above the level established by plane P. For example, in one 25 pound extractor, it was found that initially about twenty percent of the clothes rested below plane P. By the time the basket assembly had reached about 1100 r.p.m., only about five percent were below the plane and at about 1700 r.p.m., less than two percent were below.

With this construction, when the clothes are initially placed in the basket assembly, any unbalanced load will cause the basket assembly to tilt or cant until the basket assembly and clothes reach a static gravitational balance. To facilitate discussion of the operation of the extractor illustrated, let it be assumed that a weight W represents the unbalanced mass. The basket assembly will therefore tilt counter-clockwise. As it does so, portion 18*a* of plate 18 moves in an arc upwardly about ball 26 and portion 18*b* moves downwardly. As a result, the effective movement arms of these portions respectively become longer and shorter. Thus, the basket assembly moves to a position of static gravitational balance.

By making plate 18 substantially heavier than the expected weight of the unbalanced mass, the relative effect of the latter in tilting the basket assembly will be reduced. Thus, if mass W is small compared to the weight of the plate, the latter will move a lesser distance to static balance than it would have to move when the mass W is larger.

As the basket assembly begins to spin, the mass W will be moved up along the baffle 30 to a position which will be called mass W'. Plate 18 will tend to move the basket assembly toward a level position as the vertical component of the centrifugal force generated by its revolution becomes large enough to overcome the gravitational force

acting on the plate and unbalanced mass. However, the mass W', being above the plane P, will generate a downward vertical component of centrifugal force. As the speed increases and the basket assembly's tilt decreases, a position of dynamic balance will be reached due to these vertical components becoming substantially equal and the basket assembly will then continue rotating in a canted position. In this position the horizontal components of centrifugal force are substantially equal and opposite at diametrically opposed positions around the centerline of rotation of shaft 12 so to minimize unbalanced centrifugal forces causing vibration.

It has been found that the basket assembly 10 in one size (25 pound) of extractor can rotate practically vibration-free with an unbalance approximating a nine pound concentrated weight such as mass W', whereas in prior constructions in the same size extractor, an unbalance of over two pounds resulted in excessive vibration.

Even though such construction permits a centrifugal extractor to be rotated with reduced vibration, there will still be some vibrational movement of the basket assembly even though it may be minimal. In order to dampen such movement and reduce the portion of it transmitted by the overall extractor to the floor on which it sits, the shaft 12 and the motor 14, which are in direct drive relations, are mounted on a basket assembly and motor support system 16, as by connecting the motor to a horizontal plate 32 which forms a part of such system. A base plate 36, which is adapted to be positioned on a floor, forms the base of the centrifugal extractor apparatus. Bolt-down ears 38 are provided on the base plate 36 in case it is desired to bolt the centrifugal extractor apparatus to the floor. The base plate 36 has three, equally circumferentially spaced, upstanding vertical members 40. A first or intermediate triangular horizontal plate 42 having a central opening through which the motor 14 extends is attached to the vertical members 40 of the base plate 36 by resilient mounts 44, one being located at each corner of plate 42. The mounts 44 each have a threaded nut 44*a* (FIG. 3) bonded to a main rubber body 44*b* so as to receive studs 44*c* or spacer bars 44*d*. Studs 44*c* extend through apertures in the three corners of plate 42 and ears 40*a* at the top of vertical members 40. Thus the mounts 44 are secured to horizontal plate 42 and vertical members 40.

A second or lower triangular horizontal plate 46 having a central opening through which motor 14 extends is positioned between base plate 36 and the intermediate horizontal plate 42. The lower horizontal plate 46 is angularly shifted approximately 60° relative to the intermediate horizontal plate 42. The horizontal plates 42 and 46 are tied together by rigid members 48 located approximately at the midpoint of the sides of the two plates, see FIG. 2. The upper mounting plate 32 on which motor 14 is mounted and the shaft 12 is journalled is also triangular in shape and is angularly aligned with the lower horizontal plate 46. The mounting plate 32 is attached to the lower horizontal plate 46 by resilient means 50 extending between the two plates at their three corners. The resilient means is shown as including two resilient mounts 50*a* constructed like mount 44 in FIG. 3 and spaced apart by a spacer bar 44*d*.

With such construction, any vibrational movement of the rotating basket assembly 10 will also be transmitted directly to mounting plate 32. Such vibrational movements are transmitted from mounting plate 32 to the resilient means 50 where the movements are partially dampened out. The remaining vibrational movements are transmitted to lower plate 46 and then directly to the first horizontal plate 42. Any movement of the latter is partially absorbed by mounts 44 so that only a portion of the vibrational movement of the basket assembly is finally transmitted to base plate 36. Any such remaining vibrational movement is transmitted through the base plate 36 to the floor.

As indicated above, it has been found that limiting or

restraining vertical movement of the basket assembly while it is passing through its critical speed range reduces the vibrational forces generated by the basket assembly. As shown in FIGS. 1 and 2, resilient means are provided limiting vertical movement of the basket assembly and are illustrated as three hydraulic shock absorbers **52** each being connected between upper plate **32** and the base plate **36**. It will be noted that the absorbers **52** are pivotally connected at each of their ends to the corresponding plates so that plate **32** is substantially free to move in a horizontal plane without restraint by the absorbers. However, plate **32** is restrained in its movement in a vertical plane. In this connection, it is preferred that the absorbers be of the lost motion type in that they can be extended and retracted a limited distance (e.g., ¼ inch) without exerting a restraining force but will exert such a force when the extent of movement exceeds this distance.

With this construction, the basket assembly, during its initial acceleration, will gyrate with both vertical and horizontal components of movement. The horizontal movement will be restrained only by the mounts **44** and resilient means **50**. The vertical movement, once it is large enough to tend to exceed the lost motion limitations of absorbers **52**, will be limited. As a result, the basket assembly never vibrates excessively as it is accelerated through its critical speed range. After its speed passes above such range, the vibrational movement decreases to a minimum.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A top loading centrifugal clothes extractor comprising in combination; a support system; a drive motor mounted on said system; a vertical shaft driven by said motor; an open top basket assembly adapted to receive the clothes from which liquid is to be extracted and including a heavy bottom portion of substantially greater weight that that of clothes intended to be deposited in the assembly and also including cylindrical side walls; the basket assembly being formed with a pocket coaxial with the assembly and extending upward thereinto a substantial distance, the shaft extending upwardly into said pocket; universal means operatively connecting the upper end of the shaft to the basket assembly so as to prevent relative rotation therebetween while permitting the basket assembly to tilt in any direction about a point on the centerline of the shaft, said universal means being constructed such that said point is located within said pocket a substantial distance above said bottom portion; and an annular baffle in the basket assembly extending angularly upwardly from a locus in the interior portion of the bottom portion to the side walls adjacent a plane transverse of the basket assembly and passing through said point whereby upon rotation of the basket assembly, substantially all of the clothes in the basket assembly will be positioned, as a result of centrifugal action, above said plane at the inner periphery of the side walls.

2. The apparatus of claim **1** wherein said universal connecting means includes a socket carried by the basket assembly in said pocket and a ball engaging the socket and carried by the upper end of said shaft.

3. The apparatus of claim **1** wherein said baffle extends to the side walls at a location above said plane.

4. The apparatus of claim **1** wherein said support system includes a base, a first member mounting said motor and shaft, a second member, resilient motion limiting means connecting said base to said second member and the latter to said first member, and shock absorbing means connected between said base and first member so as to limit vertical movement of the first member relative to the base.

5. The apparatus of claim **4** wherein the shock absorbing means is constructed to permit the first member to move vertically without substantial restraint through a limited distance and then applying resilient restraint to limit movement of the first member beyond said distance.

6. A top loading centrifugal clothes extractor comprising in combination: a support system; a drive motor mounted on said system; a vertical shaft driven by said motor; an open top basket assembly adapted to receive the clothes from which liquid is to be extracted and including a heavy bottom plate of substantially greater weight than that of clothes intended to be deposited in the assembly and also including cylindrical side walls; the basket assembly being formed with a pocket coaxial with the assembly and extending upward thereinto a substantial distance, the shaft extending upwardly into said pocket; a ball and socket connection between the upper end of the shaft and the basket assembly and arranged so as to prevent relative rotation therebetween while permitting the basket assembly to tilt in any direction about a point on the centerline of the shaft, said ball and socket connection being constructed such that said point is located within said pocket a substantial distance above said bottom portion; and a conical baffle in the basket assembly extending angularly upwardly from the bottom plate to the side walls above a plane transverse of the basket assembly and passing through said point whereby upon rotation of the basket assembly, substantially all of the clothes in the basket assembly will be positioned, as a result of centrifugal action, above said plane at the inner periphery of the side walls.

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