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Duca

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[54] **REAR SLAGGING FOR INDUCTION FURNACE**

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[52] **U.S. Cl.** **432/247,** 266/36, 432/157, 13/26

[51] **Int. Cl.** **F27b 14/02**

[58] **Field of Search** ..... 263/46, 33 A; 266/36, 39; 13/26; 432/247, 105, 107, 108, 156–167

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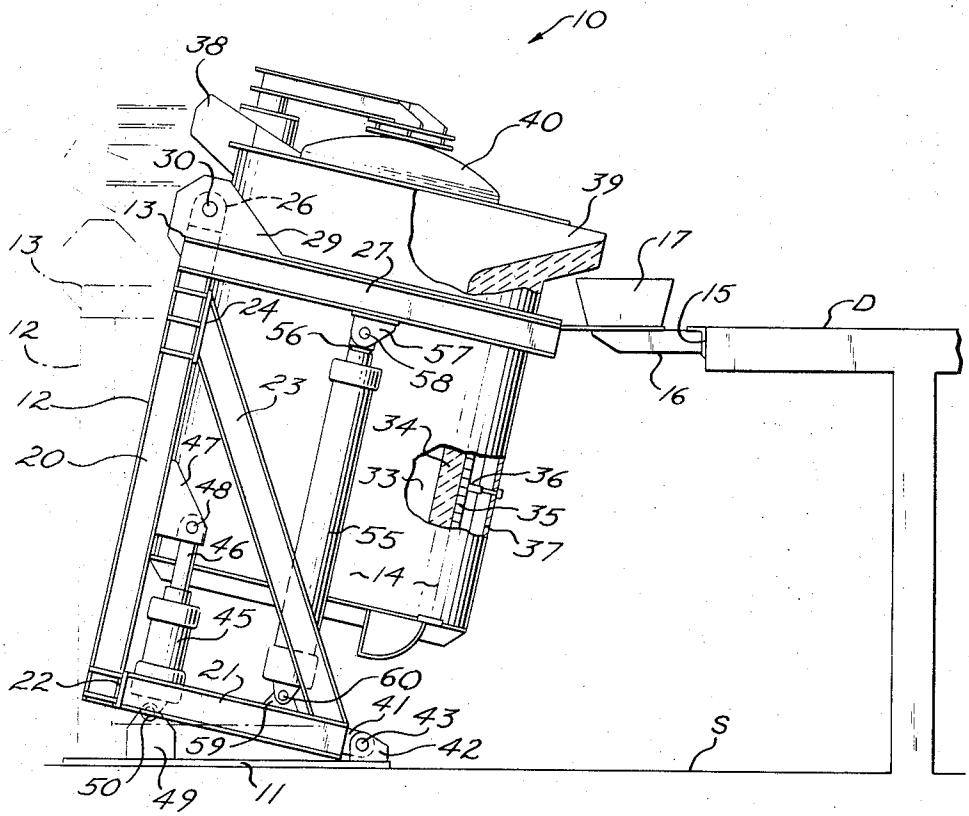
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[57] **ABSTRACT**

There is disclosed herein a coreless induction furnace disposed on a vertical axis during heating and having a front pouring spout and a rear slagging spout at the upper end thereof. The furnace is mounted in a forwardly pivotable cradle carried by a backwardly tiltable base frame, the base frame being pivoted at the bottom thereof rearwardly of the furnace axis.

6 Claims, 3 Drawing Figures



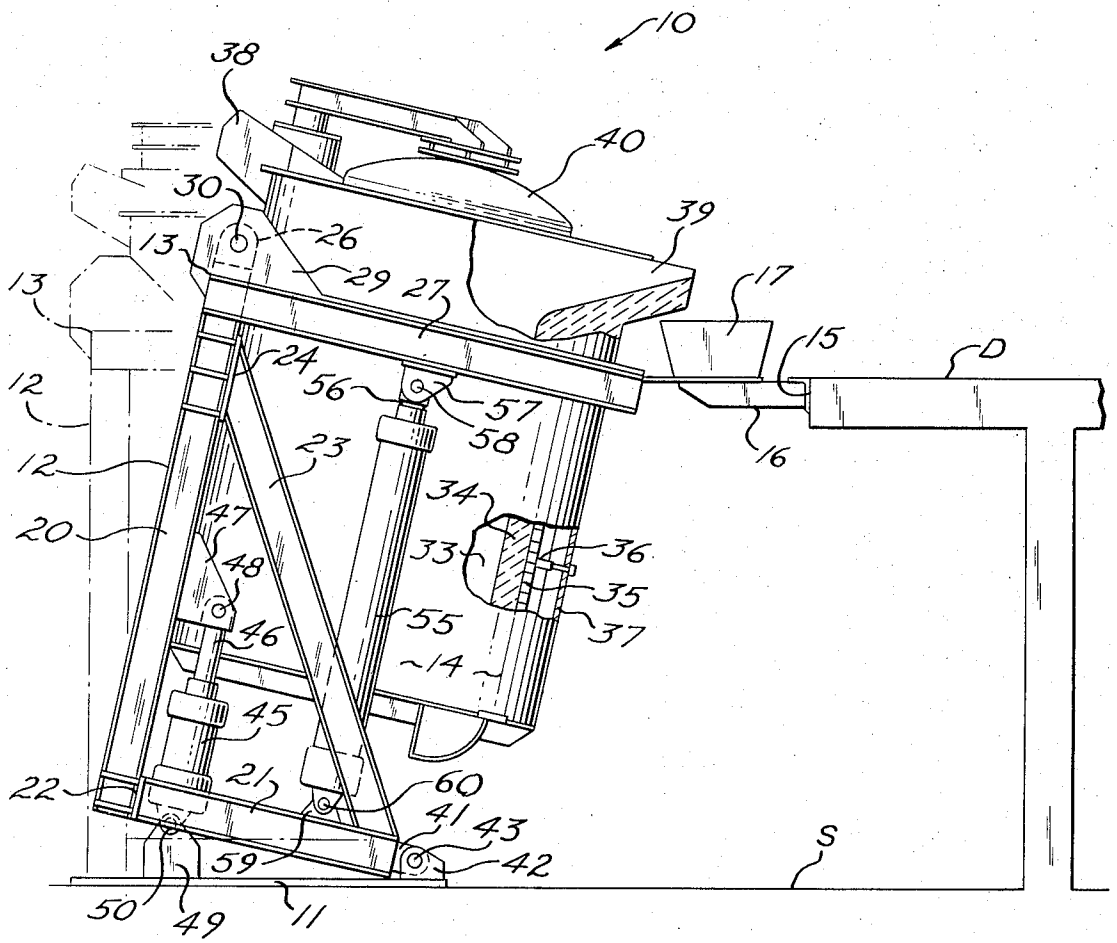


Fig. 1

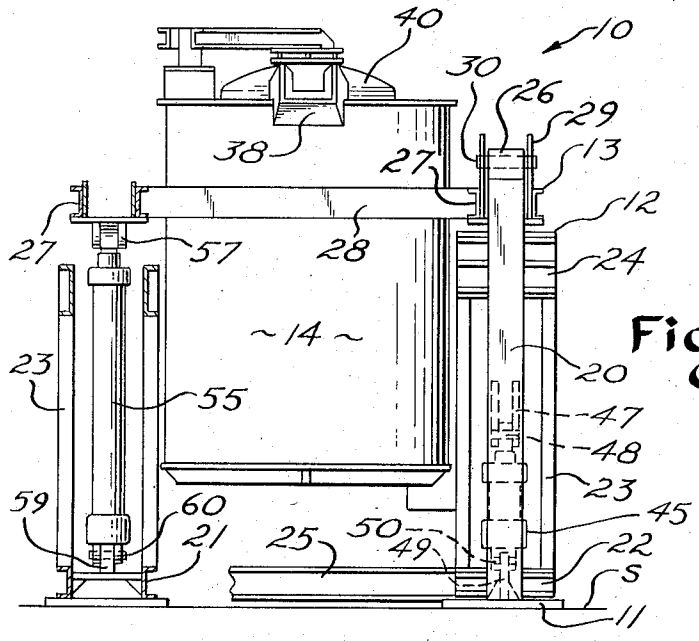


Fig. 2

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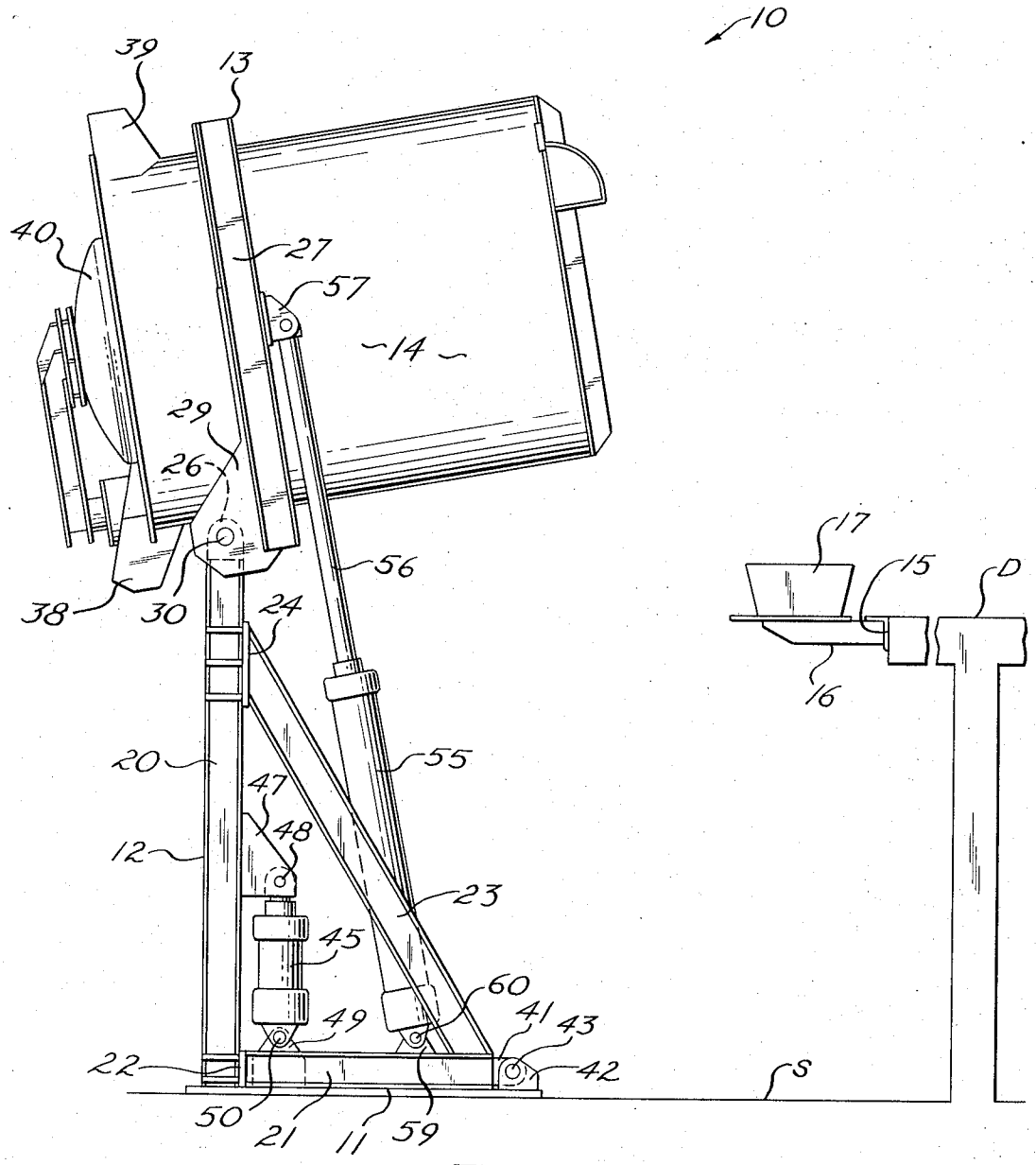


Fig. 3

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REAR SLAGGING FOR INDUCTION FURNACE

This invention relates to the induction heating and melting of metal and particularly to means for mounting a coreless induction furnace.

Various means have heretofore been provided for mounting coreless induction furnaces whereby the furnace can be pivoted in a forward direction for pouring the melt and tilted rearwardly for slagging. The upper end of the furnace is generally oriented witn respect to a fixed operationg deck for pouring operations with the remainder of the furnace normally disposed below said operating deck.

Prior mounting means known to the inventor pivot the furnace about a main pivot point whereby, when the furnace is tilted backwardly for slagging, the rear of the furnace drops below the normal operating deck. This means that the slag handling mechanism is below the normal floor-operating level of the deck which makes it difficult to handle. Additionally, some means must be provided to ensure that the furnace remains in its normal operating position and does not inadvertently fall to its slagging level during normal operation.

The present invention as herein illustrated comprises a base frame having a cradle which carries a coreless induction furnace. The cradle is pivoted to the frame on a horizontal axis disposed adjacent to the pouring spout of the furnace, and means are provided for rotating the cradle and furnace forwardly with respect to the frame for pouring. The base frame is pivoted at the bottom thereof rearwardly of the normal vertical axis of the furnace about an axis parallel with the cradle pivot. Means are provided for back-tilting the base frame for slagging the furnace through a rear slag spout. The base frame pivot is so positioned that the furnace moves both vertically upwardly and horizontally rearwardly whereby the slag spout moves over a slag box on the operating deck and slagging is conveniently done from said operating deck. The center of gravity of the base frame and furnace is such that the frame normally tends to set flat on a horizontal base surface with the furnace disposed on a vertical axis, and there is no possibility of the furnace inadvertently falling to slagging position.

In view of the foregoing, it is an object of this invention to provide a back-tilting coreless induction furnace assembly whereby rear slagging can be accomplished above the normal operating deck level.

Another object of the invention is to provide an induction furnace assembly of the above type which normally tends to set in an upright position and cannot inadvertently fall to slagging position.

Still another object of the invention is to provide an induction furnace assembly as set forth above wherein the furnace moves both vertically upwardly and horizontally rearwardly when back-tilted for slagging.

Yet another object of the invention is to provide an induction furnace assembly having the above features and characteristics wherein the furnace is pivotable forwardly for pouring with respect to a frame and wherein the frame is tiltable in the opposite direction for back-tilting the furnace.

Other objects of the invention and the invention itself will be understood from the following description of one embodiment thereof as shown in the accompanying drawings in which:

FIG. 1 is a side elevation of the furnace of this invention showing the furnace in back-tilted or slagging position;

FIG. 2 is a front elevation, on a slightly reduced scale, showing the furnace in its normal, level, operating position; and

FIG. 3 is a side elevation similar to FIG. 1 showing the furnace in the pouring position.

Referring now to the drawings in all of which like parts are designated by like reference numerals, an induction furnace assembly generally indicated at **10** comprises a pair of base plates **11**, a base frame **12** mounted upon said base plates, a forwardly pivotable cradle **13** mounted at the upper end of said base frame, and a coreless induction furnace unit **14** carried by the cradle **13**. The base plates **11** are mounted upon any suitable supporting surface "S" disposed substantially below the level of an operating deck "D." The operating deck "D" has an edge portion **15** spaced from the back of the furnace assembly **10** to which is mounted a rear tilt deck **16** supporting a slag box **17**.

The base frame **12** comprises a pair of laterally spaced, vertical columns **20**, each said column being connected at the lower end thereof to a pair of spaced, parallel, rearwardly directed horizontal members **21** secured at their forward ends to a common plate **22** which is, in turn, connected to the lower end of a vertical column **20**. Upwardly and forwardly angled diagonal braces **23** are respectively connected at their lower ends to the rearwardly directed end portions of the horizontal members **21** and at the upper ends thereof to upper plates **24** mounted adjacent to the upper ends of the vertical columns **20**. It will be understood that the columns, members, plates, braces, etc. comprising the base frame are preferably heavy structural steel members such as I-beams or channel-shaped beams which are welded, bolted, riveted or otherwise suitably secured together.

The lower ends of the pair of vertical columns **20** are rigidly secured together by means of a transverse beam **25** (FIG. 2). The upper ends of said vertical columns are provided with bearings **26** for pivotally mounting the forward end of the cradle **13**. The cradle **13** comprises pairs of side frame members **27** and end frame members **28** rigidly secured together and to the induction furnace unit **14** in any suitable manner. Each side of the cradle comprises a pair of parallel side frame members **27** spaced apart and each carrying an upwardly extending bearing plate **29** at its forward end. At each side of the induction furnace assembly **10**, the pair of bearing plates **29** overlap the sides of a bearing **26**, and a short heavy pivot shaft **30** projects through suitable openings in said bearing **26** and bearing plates **29** whereby the cradle **13** and induction furnace unit **14** are pivoted at the front of the base frame **12** just above the vertical columns **20**.

The induction furnace unit **14** comprises a crucible **33** formed by a suitable refractory lining **34** surrounded by a helical induction heating coil **35** retained by suitable securing means **36** within an outer shell **37**. The crucible **33** includes a front pouring spout **38** and a rear slag spout **39**. It is covered by a furnace lid **40**.

The base frame **12** is pivoted adjacent to the rearmost ends of the base plates **11** rearwardly of the axis of the induction furnace unit **14** by means of bearings **41** disposed between upstanding bearing brackets **42** of

said base plates, the bearings and bearing brackets being journalled to each other by means of pivot shafts **43.** The bearings **41** are welded or otherwise suitably secured to the rearwardly directed ends of the horizontal members **21** whereby the base frame **12** and the induction furnace unit **14** can be tilted backwardly from the broken line to the full line position shown in FIG. **1.**

Power means for back-tilting of the furnace is provided in the form of a pair of hydraulic cylinders **45** disposed adjacent to the front and at either side of the base frame **12.** Each cylinder **45** as herein illustrated, has an upwardly projecting piston rod **46** pivoted at its upper end to a heavy bracket means **47** welded or otherwise suitably secured to the rearwardly facing side of a vertical column **20** by means of a heavy pin **48.** The opposite end of each cylinder **45** is pivotally mounted to an upstanding bracket **49** projecting upwardly from the associated base plate **11** between the adjacent, spaced horizontal members **21** by means of a heavy pin **50.**

In the retracted position of the cylinders **45** (FIG. **2**), the base frame **12** is disposed with the horizontal members **21** flatwise against the base plates **11** and with the column **20** in the vertical position. This positions the induction furnace unit **14** on a vertical axis in which position it tends to stay due to natural pull of gravity. When the cylinders **45** are in the extended position (FIG. **1**), the base frame **12** and the furnace **14** are back-tilted whereby the rear slag spout moves upwardly and horizontally rearwardly to a position over the slag box **17.** Thus rear slagging can be effected easily above the level of the operating deck "D."

Pivoting of the furnace unit **14** for pouring is effected by a pair of hydraulic cylinders **55** which, in their retracted position are disposed substantially parallel with the axis of the furnace unit **14** substantially midway between the front and rear of said furnace. Each cylinder has an upwardly projecting piston rod **56** journalled at its upper end by a heavy pin **58** to suitable heavy bracket means **57** welded to the bottom surfaces of adjacent pairs of side frame members **27.** The lower end of each cylinder **55** is journalled by means of a pin **60** to a bearing member **59** secured to and projecting upwardly from the adjacent pair of horizontal members **21.**

When the cylinders **55** are retracted, they position and hold the furnace unit **14** and the crucible **33** parallel with the upright dimension of the base frame **12** whereby said base frame and furnace unit naturally tend to rest in the vertical position. When the cylinders **55** are in their extended position, as illustrated in FIG. **3,** the furnace unit **14** and cradle **13** are pivoted upwardly and forwardly to the curing position. The position shown in FIG. **3** is the extreme pouring position for completely emptying the crucible and the furnace may be tilted to any position of lesser tilt desired. From the foregoing it will be readily understood that when the crucible is tilted for either pouring or slagging, the center of gravity thereof remains rearwardly of the pivot shafts **30** and forwardly of the pivot shafts **43** whereby at all times, the natural tendency of the furnace is to return to the upright vertical position illustrated in broken line in FIG. **1** and in full line in FIG. **2.** It is never necessary to secure the furnace against falling into the slagging or pouring position during normal heating operations. Both pouring and slagging in this construction can be carried out above the normal level of the operating deck. Thus, it will be seen that the objects of the invention are fulfilled by the embodiment thereof herein disclosed.

It will be understood that many changes in the details of the invention as herein described and illustrated may be made without, however, departing from the spirit thereof or the scope of the appended claims.

I claim:

1. A back-tilting induction melting furnace assembly having a center of gravity comprising an induction furnace unit normally disposed on a vertical axis for melting, said furnace unit having a forwardly directed pouring spout and a rearwardly directed slag spout; an upright unitary rigid frame having a front portion and a rearwardly extending portion; means pivotally mounting said furnace unit to said frame for pivoting about an axis disposed adjacent to the upper end of and at the front portion of said frame and forwardly of the center of gravity of said furnace unit and frame and adjacent to said pouring spout whereby said furnace unit is pivotable upwardly and forwardly with respect to said frame to pour melt therefrom; and means pivotally mounting the lower end of said frame on a fixed base means rearwardly of the center of gravity of said furnace unit and frame for tilting said frame and said furnace unit rearwardly and upwardly for slagging whereby the center of gravity of said frame and furnace unit is between said two pivotal mounting means.

2. A back-tilting induction melting furnace assembly as set forth in claim **1:** said means pivotally mounting said furnace unit comprising a cradle mounted adjacent to the upper end of said furnace unit; said cradle pivoted at its forward end to the upper end of said frame adjacent to the front portion of said frame on an axis transverse to the direction of pouring.

3. A back-tilting induction melting furnace assembly as set forth in claim **2:** power means acting between said frame and said cradle for pivoting said cradle and said furnace unit forwardly for pouring; and power means acting between said frame and said fixed base means for tilting said frame, cradle, and furnace unit rearwardly for slagging.

4. A back-tilting induction melting furnace assembly as set forth in claim **2:** said cradle having side members disposed at the sides of said furnace unit adjacent to the upper end thereof; said frame having horizontal members at the bottom side edges thereof; cylinders disposed on either side of said furnace unit and connected between said side members and said horizontal members substantially rearwardly of the vertical plane of said transverse axis for pivoting said cradle and furnace unit forwardly for pouring; the rearwardly directed ends of said horizontal members being pivoted on said fixed base means to provide the lower pivot for said frame; and cylinder means connected between the front of said frame and said fixed base means for tilting said frame, cradle, and furnace unit rearwardly for slagging.

5. A back-tilting induction melting furnace assembly as set forth in claim **1:** power means for pivoting said furnace unit forwardly and upwardly about the axis of said first mentioned pivotal mounting means; and power means for tilting said frame and furnace unit upwardly and rearwardly about the axis of said second mentioned pivotal mounting means.

6. A back-tilting induction melting furnace assembly having a center of gravity comprising an induction furnace unit normally disposed on a vertical axis for melting, said furnace unit having a forwardly directed pouring spout and an opposite, rearwardly directed slag spout disposed generally at the level of a normal operating deck; an upright unitary rigid frame having a front portion and a rearwardly extending portion; means pivotally mounting said furnace unit to said frame for pivoting about an axis disposed adjacent to the upper end of and at the front portion of said frame forwardly of the center of gravity of said furnace unit and frame and adjacent to said pouring spout whereby said furnace

unit is pivotable upwardly and forwardly with respect to said frame to pour melt therefrom above the level of the operating deck; and means pivotally mounting the lower end of said frame on a fixed base means rearwardly of the center of gravity of said furnace unit for tilting said frame and furnace unit rearwardly and upwardly in the opposite direction for slagging above the level of the operating deck, the center of gravity of said furnace being between said two pivotal mounting means whereby said furnace normally tends to return to an upright position.

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