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**Grant**

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## [54] LADLE SKIMMER


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[52] **U.S. Cl.** .....**266/37,** 266/1 R

[51] **Int. Cl.**.....**F27d 23/00**

[58] **Field of Search** .....159/42; 210/523, 525–527; 212/35, 55; 214/23, 29, 30, 32, 132; 266/1 R, 1 S, 34 R, 37



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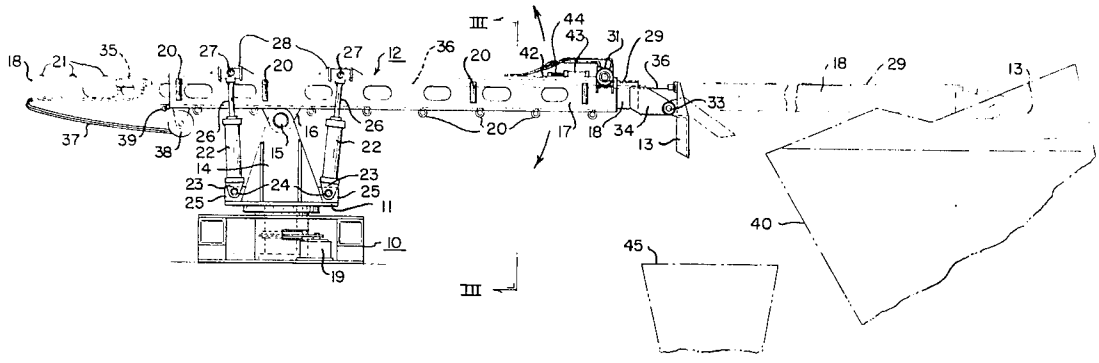
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[57] **ABSTRACT**

The specification discloses a skimmer mechanism comprising a supporting platform or structure, a turntable rotatably mounted on said supporting platform, a power operated means for imparting a rotary movement to the turntable, a boom assembly pivotally mounted on said turntable and including an extensible and retractable boom section on said boom assembly, a pivotable skimmer blade or paddle mounted at the outer end of said boom section, power operated means for pivotally moving said boom assembly relative to said turntable, power operated means for extending and retracting said boom section with respect to the boom assembly, and power operated means for pivotally actuating the skimmer blade.


**6 Claims, 3 Drawing Figures**



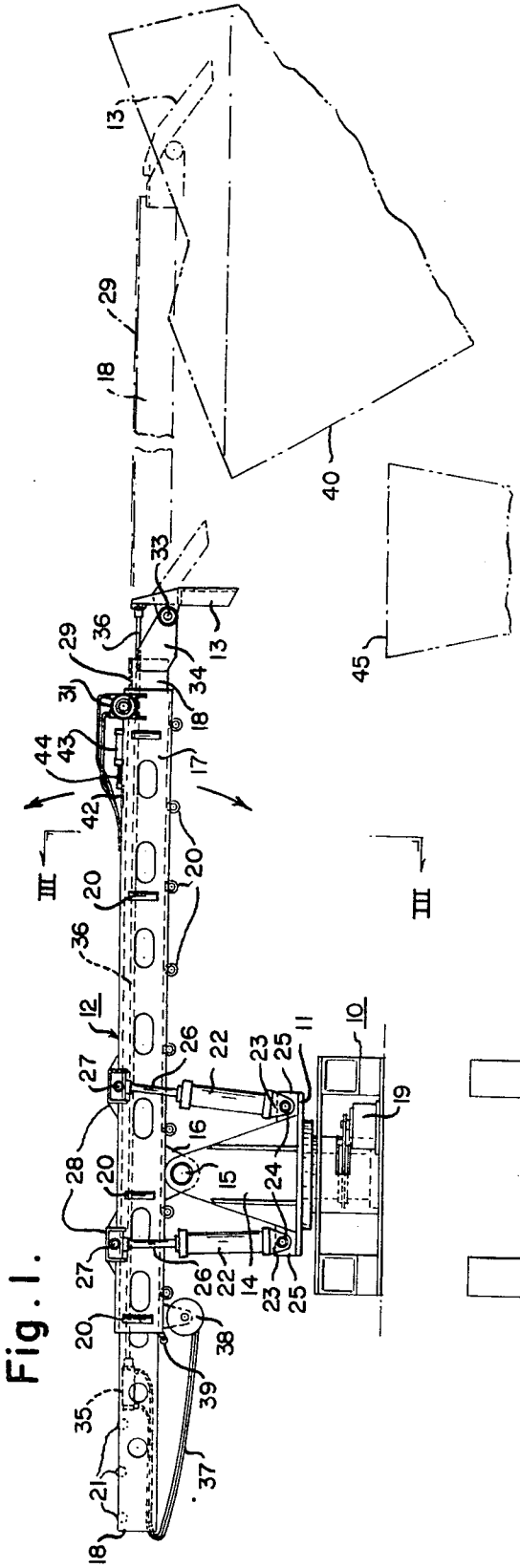


Fig. 1.

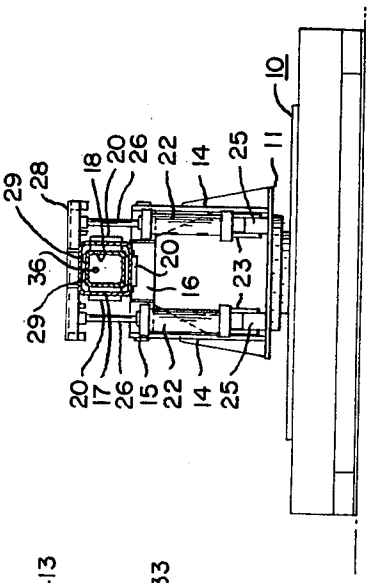


Fig. 3.

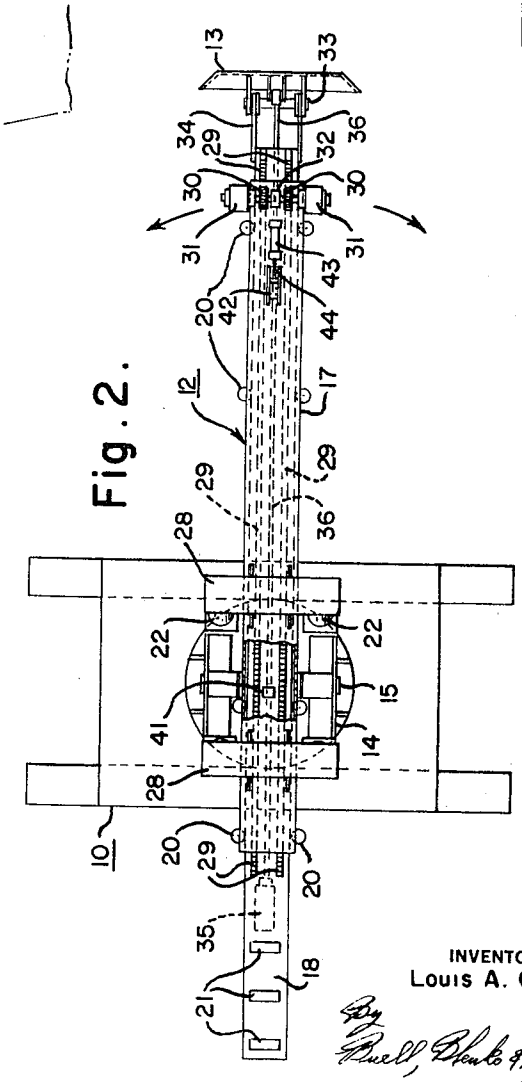


Fig. 2.

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# LADLE SKIMMER

The present invention relates to a skimmer mechanism for various types of liquids, and more particularly to a skimmer of the character described for removing an overlying molten slag kish layer or the like from liquid metal. My invention is primarily intended for, but not necessarily limited to, the removal of a molten slag layer from various types of ladles, furnaces, and other vessels employed in steel making operations. Although described primarily in conjunction with applications in the steel industry, my invention is obviously adapted for other or analogous uses wherein skimming functions are necessary.

In the manufacture of steel and related processes, it is frequently necessary to remove an overlying molten slag layer from a melt or batch of the liquid metal. Previous slag skimmers for the most part can only be utilized with smelting furnaces, converters, ladles and the like having a lateral pouring spout or opening. They cannot be used in induction type crucible furnaces or in those ladles where the opening is at the top of the furnace.

Examples of this type of skimmer mechanism are disclosed in the U.S. Pat. to McFeaters No. 2,554,836 and Sherwood No. 3,353,810. These skimming mechanisms, although admirably suited for their intended purpose, include complicated structures for insertion of a slag skimmer or divider into a lateral opening of converters, rotary furnaces, and the like. In effect, the Sherwood and McFeaters skimming mechanisms serve as dams or dividers to withold an overlying slag layer while the molten metal is poured from beneath the slag. There is no provision of means for removing or skimming an overlying slag layer before the vessel is poured or tapped.

A skimmer mechanism capable of operating through a vessel top opening is disclosed in the U.S. Pat. to Lister No. 2,349,972. The Lister arrangement, however, does not remove slag from the vessel; rather it continuously pushes an overlying slag layer aside in order to expose fresh metal for oxidation and purification. The Lister arrangement, more over, is supported upon the vessel itself, which of course, complicates the vessel removal operation.

This situation is alleviated to some extent by the skimming mechanism of the type disclosed in the U.S. Pat. to Hellmund No. 3,360,254, in which the skimming mechanism is supported, externally of the vessel for insertion into its top opening. The Hellmund arrangement necessitates complex structural configurations for raising and lowering, pivoting, and rotating its skimming mechanism. Moreover, the slag must be physically lifted out of the vessel by the skimmer, with attendant expenditure of operational time and labor. There are rather lengthy contact times with the extremely high temperature molten slag or kish, with resulting rapid deterioration in that portion of the skimming mechanism which contacts the slag. Difficulty is encountered in gauging the depth of penetration of the Hellmund skimming mechanism. It is also apparent that the rather large superstructure of the Hellmund skimming mechanism in certain applications would interfere with the movement of overhead cranes and other equipment, and would be difficult to swing aside in those applications where space is at a premium for removal of the vessel being skimmed.

In general, none of the prior skimming mechanisms of which I am aware are capable of operation through a top vessel opening with minimal movement by a non-complex, compact mechanism. Insofar as I am aware no prior skimmer mechanism is capable of operating both through top and side or lateral vessel openings. This is a considerable disadvantage in many steel-making procedures and other operations involving liquid metals, as vessels of both top and side pouring spouts are occasionally encountered in the same plant.

I overcome these disadvantages of the prior art by providing a novel skimming mechanism wherein a skimmer blade or paddle is mounted on the outer end of an extensible boom section or member carried by a boom assembly for convenient insertion into either a top or lateral opening type of vessel. My



skimming mechanism is, therefore, capable of being utilized in a wide variety of applications involving various types of ladles, converters, rotary furnaces, and the like. The boom assembly structure is pivotally mounted on the upper side of a supporting turntable rotated by power operated means through a substantial angle to either side of a neutral position. In consequence the boom assembly may be quickly swung horizontally, the boom section extended, and the skimmer blade thereon inserted into the vessel opening for appropriate positioning with respect to the surface of the liquid metal in the vessel. Conversely, the boom assembly may be pivotally raised and swung laterally while retracting the boom section to a position for enabling the removal of the vessel.

In accordance with my invention, the skimmer blade is pivotally mounted on the outer end of the extensible and retractable boom section of the boom assembly structure, and pivotal movement of the blade accomplished through power operated means suitably controlled for effecting a flicking motion of the blade. The skimming mechanism is, therefore, utilized to push or drag the blade in a straight or curved line across or through the overlying slag layer, and at the end of the stroke the blade is operated to flick the slag out of the vessel opening.

There is further provided a boom assembly wherein an outer pivotally mounted boom member carries therewithin an inner boom section or member which is guidably supported, as by anti-friction means, for extension and retraction telescopically with respect to the outer boom member. To accomplish the movement of the inner boom member with respect to the outer boom member the inner boom member is provided along its upper face with a pair of longitudinally extending rack members in spaced parallel relation to each other, the rack members being substantially co-extensive with the length of the inner boom member. Pinion gears rotatably mounted on the outer boom member and cooperatively engaging corresponding rack members on the inner boom member are effective when rotatably driven by motor means, also carried on the outer boom member, to effect relative movement of the inner boom member telescopically with respect to the outer boom member. To limit the extension of the inner boom member relative to the outer boom member, cushioned stop means comprising cooperating elements on the inner and outer boom members become effective at the desired limit of the outward travel of the inner boom member.

There is also provided an arrangement whereby the skimmer blade is pivotally actuated. For this purpose and in order to avoid continual and close-range exposure to the high temperatures in the vessel, a power cylinder is provided within the inner boom member adjacent the end remote from the skimmer blade and the piston rod for the piston of the power cylinder is longitudinally supported along its length within the inner boom member and coupled at its distal end to the skimmer blade. Flexible hose connections to the power cylinder for supplying operating fluid pressure are maintained notwithstanding extension and retraction of the inner boom member, by means of a reel mechanism which acts to automatically let out hose or take up slack in the hose as needed to correspond to the movement or travel of the inner boom member in the outer boom member.

There is also provided a power operated mechanism whereby the boom assembly is supported in a horizontal position and actuated pivotally up or down out of the horizontal position as required. For this purpose the boom assembly is pivotally mounted over and above the turntable by cooperating clevises in which a common shaft is journaled. A plurality of pairs of power cylinders are arranged on each side of the pivotal connection between the turntable and the boom assembly. The pairs of cylinders are utilized to provide concurrently acting and unidirectional moments of force on the boom assembly to support it in a given position or to pivotally shift the boom assembly up or down as required.

During the foregoing discussion, various objects, features and advantages of the invention have been set forth. These

and other objects, features and advantages of the invention together with structural details thereof will be elaborated upon during the forthcoming description of a presently preferred embodiment of the invention and a presently preferred method of practicing the same.

A presently preferred embodiment of the invention is shown in the accompanying drawings, wherein:

FIG. 1 is an elevational view, showing the essential structure of the skimmer mechanism and the manner in which it may be employed to skim the accumulated molten slag layer and by flicking action of the skimmer blade cause it to be deposited in a separate vessel for convenient removal;

FIG. 2 is a plan view, showing further details of the skimmer mechanism; and

FIG. 3 is a sectional view, taken on the line III—III of FIG. 1, showing additional details of the skimmer mechanism.

Referring to the drawings, it will be seen that the skimmer mechanism comprises a support structure or platform **10**, a turntable **11** rotatably mounted on the platform **10**, a boom assembly **12** pivotally carried on the turntable, and a skimmer blade **13** mounted on the outer end of the boom assembly.

The platform **10** may be fabricated of suitably heavy steel plates in the form of an elongated box having longitudinally extending arms preferably of hollow-square cross-section and variably extensible with respect to the platform to accomodate the platform for mounting in a building structure, or for otherwise anchoring the platform in position.

While not necessary for an understanding of the present invention, it will be understood that the platform **10** not only provides the appropriate bearing structure for mounting the turntable **11** therein but also provides a housing for the power means for rotating the turntable and the necessary control therefor as well as for other controls later referred to. Any suitable bearing structure for the turntable **10** may be provided. However, a suitable arrangement for this purpose is disclosed in U.S. Pat. Nos. 3,471,888 and 3,458,396 to Grant, et al. and to Grant respectively, entitled Soaking Pit Chipper and Demolition Machine issued Oct. 14, 1969 and July 29, 1969, respectively.

Essentially, the turntable **11** is attached to the upper end of a cylindrical support member which in turn is rotatably mounted within a cylindrical sleeve member anchored within the platform **10**. A power means such as a hydraulic motor **19** drives the cylindrical support member, via a chain or gear type of drive.

Turntable **11**, which rotates in a horizontal plane, carries the boom assembly **12** thereon, by an arrangement which provides for pivotal movement of the assembly in a vertical plane. For this purpose, a pair of spaced bearing members **14**, in the form of a clevis, support opposite ends of shaft **15**. A corresponding pair of spaced bearing members **16**, in the form of a clevis, attached to the boom assembly in the manner hereafter more fully described, are rotatably mounted on the shaft **15** between the outer bearing members **14**.

Boom assembly **12** comprises an outer tubular member **17**, illustratively shown as of a four-sided polygonal cross-section, and an inner tubular member **18** of corresponding cross-sectional configuration of lesser area. The inner tubular member **18** is substantially longer than the outer tubular member for reasons which will later appear. Moreover, it is supported for reciprocative telescopic movement within the outer tubular member by a series of longitudinally spaced anti-frictional rollers **20** attached to the respective faces of the outer tubular member and projecting through suitable openings in the outer tubular member, whereby the inner tubular member is guidably supported in spaced relation to the outer tubular member. In the illustrated embodiment the anti-friction rollers are provided on three faces of the outer tubular member, that is on the two side surfaces and on the bottom surface. In addition to the anti-friction rollers **20**, a series of anti-friction rollers **21**, illustratively shown as three in number, are mounted on the upper surface of the inner tubular member. Rollers **21** are adapted to contact the smooth inner surface at the upper side of the outer tubular member, as the inner tubular member is shifted outwardly from the position in which it is shown in solid lines to the outwardly extended position in which it is shown in broken lines, for providing additional frictionless support for the inner tubular member, particularly in the extended position thereof.

It will now be understood that the clevis comprising spaced bearing members **16** is in fact fixed on the outer tubular member **17**, which thus has a fixed pivotal mounting on the turntable **11**, whereas the inner tubular member may shift telescopically in either direction within the outer tubular member relative to the pivotal mounting arrangement on the turntable.

Boom assembly **12** is supported in a desired pivotal position on the turntable and tilted in a vertical plane on the support shaft **15**, as desired, in either direction from the position shown in FIG. **1** as indicated by the arrows, by means of a plurality of power cylinders **22** illustratively shown as four in number. Two of the cylinders **22** are disposed on one side of the pivotal connection of the boom assembly to the turntable and two cylinders **22** on the opposite side, as shown in FIGS. **1** and **2**. Moreover, each pair of cylinders is disposed in laterally spaced substantially vertical position so as to straddle the boom assembly, as shown in FIGS. **2** and **3**.

The casing of each of the cylinders **22** is pivotally connected, as by a clevis **23** and pin **24** at its lower end, to a vertical arm of a bracket **25** attached to the turntable **11**. The distal end of the piston rod **26** of each cylinder has an eye piece thereon by which the rod **26** is pivotally attached to a rod **27** supported horizontally at the top surface of the outer tubular member by suitable brackets **28**.

While not shown in the drawings, it will be understood that cylinders **22** are so-called double-acting cylinders in which fluid under pressure may be supplied alternatively to opposite sides of the piston in the cylinder to effect application of force to the outer tubular member of the boom assembly in opposite directions. Moreover, the hose connections (not shown) by which fluid pressure, such as hydraulic pressure, is supplied to the cylinders are such that the force moments exerted on the boom assembly are in the same direction. Thus, cylinders **22** are controlled so that the cylinders **22** on one side of pivot shaft **15** exert a pulling force while the cylinders **22** on opposite side of shaft **15** exert a pushing force. So long as the fluid pressure in the cylinders **22** on opposite sides of pivot shaft **15** is equal and static the boom assembly remains balanced in a corresponding pivotal position. Pivotal movement of the boom assembly is effected by changing the fluid pressure supplied to corresponding sides of the pistons in the cylinders or by reversing the application of fluid pressure to the cylinder pistons.

Telescopic movement of the inner tubular member **18** within the outer tubular member **17** of the boom assembly is effected by a rack and pinion drive mechanism now to be described. Secured, as by welding, to the upper face of the inner tubular member are a pair of parallel longitudinally extending and laterally spaced rack members **29**. Except for the section of the upper face of inner tubular member **18** occupied by thrust rollers **21**, the rack members extend substantially the entire length of the inner tubular member. Cooperatively engaging each of the rack members through suitable holes in the upper wall of the outer tubular member are corresponding pinion gears **30**. Each pinion gear **30** is fixed on the shaft of a corresponding motor means, such as a hydraulic motor **31**, and both gears are driven thereby so as to exert corresponding forces on the two rack members in the same direction to effect telescopic shifting of the inner tubular member within the outer tubular member.

Each motor means **31** is fixedly supported on the outer tubular member as by a suitable bracket member welded to the outer tubular member. The outboard end of the shaft of each motor **31** is supported in a common bearing member **32** attached to the wall of the outer tubular member. A separate motor drive for each rack member **29** is provided to insure

ability to move the inner tubular member should either one of the motor drives fail to operate.

The skimmer blade **13** is essentially a rectangular paddle fabricated and reinforced to withstand the heat and stresses to which it is subject at the surface of molten metal in a vessel. In order to best perform the slag gathering incidental to the skimming operation, hereinafter described, the side edges of the blade are canted or slanted, as seen in FIGS. **1** and **2**, so as to form a three-sided or trapezoidal-shaped frontal area. Moreover, as seen in FIGS. **1** and **2**, skimmer blade **13** has a clevis attached to its front face, which clevis is attached by a pin **33** to a pair of correspondingly spaced bracket arms **34** attached to the outer end of the inner tubular member. Skimmer blade **13** thus can be moved pivotally on the pin **33**. Pivotal movement of the skimmer blade is effected by a power cylinder, such as a hydraulic cylinder **35**, which is suitably mounted within the inner tubular member **18** by attachment to the interior of the wall thereof at the end remote from the skimmer blade. Cylinder **35** is of the double-acting piston type and has a piston rod **36** which extends longitudinally through the hollow interior of the inner tubular member and has a pivotal connection, at its outer end, with a clevis bracket attached to the front face of skimmer blade **13** above the pivot pin **33**. Piston rod **36** is preferably supported along its length within the inner tubular member by bearing brackets (not shown) attached to the wall of the inner tubular member, in view of the length of the piston rod which may be as much as 20 feet. It will be seen that by thus mounting the cylinder **35** at the end of the inner tubular member remote from the skimmer blade **13**, the cylinder is not subject to the intense heat of molten metal in a vessel being skimmed. Operating difficulties with the cylinder are thus obviated and the service life of the cylinder is lengthened.

Fluid under pressure, such as hydraulic pressure, is supplied selectively to opposite sides of the piston of cylinder **35** by way of two flexible hoses **37**. An automatic reel mechanism **38** attached by a bracket to the adjacent end of the outer tubular member, carries the flexible hoses **37** and, as the inner tubular member shifts telescopically within the outer tubular member, automatically feeds hose out of the reel or retracts it thereinto, thereby preventing the hoses from becoming entangled and damaged. A guide roller **39** is preferably provided at the lower edge of the adjacent end of the outer tubular member to protect the flexible hoses **37** against abrasion.

As viewed in FIG. **1**, supply of hydraulic pressure to one side of the piston of cylinder **35** causes the skimmer blade **13** to move pivotally in one direction, such as a clockwise direction, to a near vertical position shown in solid lines. Reversal of the supply of hydraulic pressure to the cylinder, that is the supply of hydraulic pressure to the opposite side of the piston of the cylinder, causes a reverse pivotal movement of the skimmer blade to a canted or inclined position as represented by broken lines. As will be explained more fully hereinafter, the inclined position of the skimmer blade is the usual position of the blade for skimming the top surface of molten metal in a ladle or vessel, represented in FIG. **1** by broken lines and identified by the reference numeral **40**. Moreover, the platform **10** is located such distance from the vessel **40** that the inner tubular member is shifted outwardly to an almost fully extended position, represented by the broken lines, during the skimming operation.

In order to prevent the undesired extension of the inner tubular member **18** with respect to the outer tubular member **17** beyond a certain limit of travel, a stop means is provided. The stop means comprises a lug **41** (FIG. **2**) fixed on the top surface of the inner tubular member between the rack members **29** and a slide member **42** retained between two parallel, longitudinal angle brackets fixed on the top surface of the outer tubular member **17**. Slide member **42** has a depending finger that extends inwardly through a longitudinal slot in the wall of the outer tubular member into the path of travel of the lug **41**. Lug **41** is so located longitudinally on the inner tubular member that it engages the depending finger on the slide member **42** as the inner tubular member approaches the limit of outward extension thereof. Movement of the slide member **42** is yieldingly resisted by a cushioning cylinder **43** through the piston rod **44** of the cylinder. Piston rod **44** is normally in an outwardly extended position to which it is biased, as by a spring acting on the piston within cylinder **43**, and the head on the distal end of the piston rod engages the slide member to correspondingly position the slide member. Thus, when lug **41** on the inner tubular member contacts the finger on the slide member, further movement of the inner tubular member is resisted by the cushioning medium, such as air, within the cylinder.

While omitted from the drawings for simplicity, it should be understood that appropriate connections are made to the pivot cylinders **22** and the hydraulic motors **31**, as by pipes or flexible hose, to effect operation thereof. Moreover, a centralized control box or panel may be employed for convenient and ready control by an operator, of the communications to the cylinders **22**, the motors **19** and **31** and to the cylinder **35** to enable operation of the skimmer mechanism in the manner now to be illustratively described.

Let it be assumed that a ladle **40** substantially filled with molten metal is moved to the appropriate position, represented in broken lines in FIG. **1**, for the skimming operation, that is tilted so as to cause the top surface of the slag on the molten metal to substantially reach the near edge of the ladle. Let it be also assumed that the skimmer mechanism is positioned as shown in solid lines in FIG. **1**, with the inner tubular member retracted and the skimmer blade **13** in vertical position. The operator then operates the controls so as to simultaneously extend the inner tubular member and pivotally rock the skimmer blade back to its canted position shown in broken lines. The operator gauges the amount of extension of the inner tubular member such that the lower edge of the skimmer blade dips into the surface of the slag on the molten metal in the ladle for the beginning of a skimming operation, approximately half way back toward the far edge of the ladle and then rocks the boom assembly toward the ladle to submerge the lower edge of the skimmer blade in the depth of slag on the molten metal sufficiently to skim off the layer of slag or kish on the surface. In order to skim the layer of slag or kish, the operator now causes retraction of the inner tubular member **18** across the ladle and, as the skimmer blade approaches the near edge of the ladle, simultaneously raises the boom assembly slightly while rocking the skimmer blade **13** quickly toward its vertical position. Thus the slag accumulated in front of the skimmer blade is tossed or flicked over the edge of the ladle and falls into a collection container **45** represented in broken lines. The operator may extend and retract the inner tubular member **18** several times and correspondingly control the rocking of the boom assembly and of the skimmer blade **13** as necessary to skim the front portion of the surface of the molten metal in the ladle, approximately half the total surface area. Obviously, some lateral shifting of the boom assembly is required in order to skim the areas of molten metal in the ladle to either side of a diametral line concurrently with retraction of the inner tubular member.

In order to complete the skimming operation for the remaining surface of the molten metal in the ladle to best advantage, without unnecessarily and repeatedly extending and retracting the inner tubular member **18**, the skilled operator now causes the skimmer blade to be moved back to its canted position while at the same time extending the inner tubular member so as to cause the skimmer blade to dip into the surface of the slag adjacent the far edge of the ladle. He then causes the boom assembly to be shifted alternately in opposite directions laterally across the face of the molten metal within the ladle while simultaneously causing the inner tubular member **18** to be gradually retracted toward the near edge of the ladle, thus gathering the layer of slag substantially into one accumulated mass within the trapezoidal front face of the skimmer blade. The skimming operation is completed by the operator, when the skimmer blade approaches the near edge

of the ladle, by a final concluding operational step, which comprises simultaneously raising the outer end of the boom assembly slightly while rocking the skimmer blade **13** quickly toward its near vertical position. The slag accumulated or gathered in front of the skimmer blade is thus tossed or flicked over the near edge of the ladle and falls into a collection container **45** represented in broken lines. It may be necessary to repeat the foregoing final part of the skimming operation to effectively remove all or substantially all of the slag on the surface of the molten metal.

It will be apparent that to a large extent the skill of the operator determines the manner in which to utilize the skimmer mechanism to best advantage and with a minimum of lost motion, and that no limitations are intended upon the manner in which the skimmer mechanism may be used, the above described method of operation being merely illustrative.

Upon completion of the skimming operation for a particular ladle **40**, the operator may raise the boom assembly, fully retract the inner tubular member, and if desired, swing the boom assembly laterally out of a central position, thus providing for removal of the ladle **40** or pot **45** and replacement with another ladle **40** or pot **45** by appropriate overhead crane or other conveying equipment. It will be apparent that the skimmer mechanism embodying the invention thus provides a minimum of interference with existing conveying equipment.

While a preferred embodiment of the invention and the manner of its use have been described, it will be apparent that variations in the embodiment and manner of its use are possible within the spirit and scope of the invention.

I claim:

1. A skimmer mechanism comprising a supporting structure, a turntable rotatably mounted on said supporting structure, motor means for rotatively moving said turntable, a boom assembly, means pivotally mounting said boom assembly on said turntable, power means for effecting pivotal movement of said boom assembly relative to said turntable and for holding it in a selected position, said boom assembly comprising an outer tubular member and an inner tubular member conforming to but of smaller cross-sectional area than said outer tubular member, anti-friction means guidably supporting said inner tubular member in spaced relation to the outer tubular member whereby said inner tubular member is telescopically extensible and retractible relative to the outer tubular member, interengaging mechanical drive members partly on the outer tubular member and partly on the inner tubular member, motor means for actuating said drive members to extend and retract said inner tubular member with respect to said outer tubular member, a skimmer blade pivotally mounted at the outer end of said inner tubular member, and a power cylinder mounted on the interior of said inner tubular member remotely from the said outer end thereof for actuating said skimmer blade, said power cylinder having a piston therein the piston rod of which extends longitudinally through the interior of said inner tubular member for substantially the entire length thereof and pivotally connects to said skimmer blade, said interengaging mechanical drive members comprising a plurality of parallel longitudinally extending rack members on the outer surface of said inner tubular member, a plurality of pinion gears rotatably mounted in openings in the outer tubular member and extending inwardly into meshing engagement with corresponding said rack members, and said motor means comprising a plurality of separate motor means for individually driving a corresponding one of said pinion gears so as to exert forces unidirectionally on the inner tubular member to shift it in one direction or the opposite direction relative to the outer tubular member.

2. A skimmer mechanism comprising a supporting structure, a turntable rotatably mounted on said supporting structure, motor means for rotatively moving said turntable, a boom assembly, means pivotally mounting said boom assembly on said turntable, power means for effecting pivotal movement of said boom assembly relative to said turntable and for holding it in a selected position, said boom assembly comprising an outer tubular member and an inner tubular member conforming to but of smaller cross-sectional area than said outer tubular member, anti-friction means guidably supporting said inner tubular member in spaced relation to the outer tubular member whereby said inner tubular member is telescopically extensible and retractible relative to the outer tubular member, interengaging mechanical drive members partly on the outer tubular member and partly on the inner tubular member, motor means for actuating said drive members to extend and retract said inner tubular member with respect to said outer tubular member, a skimmer blade pivotally mounted at the outer end of said inner tubular member, and a power cylinder mounted on the interior of said inner tubular member remotely from the said outer end thereof for actuating said skimmer blade, said power cylinder having a piston therein the piston rod of which extends longitudinally through the interior of said inner tubular member for substantially the entire length thereof and pivotally connects to said skimmer blade, said outer tubular member being of polygonal cross-section having corresponding longitudinally extending faces and said inner tubular member being of corresponding polygonal cross-section and longitudinally extending faces, each of a plurality of the faces of said outer tubular member having a series of longitudinally spaced openings therein, and the said anti-friction means comprising a plurality of anti-friction rollers mounted in bearing members attached to the faces of said outer tubular member in such a manner that said rollers project inwardly through said openings so as to engage the corresponding outer faces of the inner tubular member in guiding and supporting contact, the inner tubular member having a plurality of openings in one face thereof adjacent to the inner end thereof, and said anti-friction means further comprising a plurality of anti-friction rollers mounted in bearing members attached to said one face of the inner tubular member in such a manner that said rollers project outwardly through said openings so as to engage the corresponding inner face of the outer tubular member to sustain the thrust of the inner tubular member on the outer tubular member only as the inner tubular member approaches an extended position outwardly with respect to the outer tubular member.

3. A skimmer mechanism comprising a supporting structure, a turntable rotatably mounted on said supporting structure, motor means for rotatively moving said turntable, a boom assembly, means pivotally mounting said boom assembly on said turntable, power means for effecting pivotal movement of said boom assembly relative to said turntable and for holding it in a selected position, said boom assembly comprising an outer tubular member and an inner tubular member conforming to but of smaller cross-sectional area than said outer tubular member, anti-friction means guidably supporting said inner tubular member in spaced relation to the outer tubular member whereby said inner tubular member is telescopically extensible and retractible relative to the outer tubular member, interengaging mechanical drive members partly on the outer tubular member and partly on the inner tubular member, motor means for actuating said drive members to extend and retract said inner tubular member with respect to said outer tubular member, a skimmer blade pivotally mounted at the outer end of said inner tubular member, and a power cylinder mounted on the interior of said inner tubular member remotely from the said outer end thereof for actuating said skimmer blade, said power cylinder having a piston therein the piston rod of which extends longitudinally through the interior of said inner tubular member for substantially the entire length thereof and pivotally connects to said skimmer blade; said means pivotally supporting the said boom assembly on said turntable comprising a pair of spaced bearing members on said turntable, a pair of spaced bearing members fixed to said outer tubular member and disposed within the said bearing members on said turntable, and a common shaft journaled in said bearing members; and said power means for effecting pivotal movement of said boom assembly relative to

said turntable and for holding it in a selected position comprising a plurality of double-acting power cylinder means on opposite sides respectively of said common shaft and connectingly interposed between said turntable and said outer tubular member of said boom assembly, the said power cylinder means on one side of said shaft being pressurized oppositely to that on the other side for applying unidirectional force moments on said boom assembly to balance said boom assembly in a selected position and to pivotally shift said boom assembly to different positions.

4. A skimmer mechanism comprising a supporting structure, a turntable rotatably mounted on said supporting structure, motor means for rotatively moving said turntable, a boom assembly, means pivotally mounting said boom assembly on said turntable, power means for effecting pivotal movement of said boom assembly relative to said turntable and for holding it in a selected position, said boom assembly comprising an outer tubular member and an inner tubular member conforming to but of smaller cross-sectional area than said outer tubular member, anti-friction means guidably supporting said inner tubular member in spaced relation to the outer tubular member whereby said inner tubular member is telescopically extensible and retractible relative to the outer tubular member, interengaging mechanical drive members partly on the outer tubular member and partly on the inner tubular member, motor means for actuating said drive members to extend and retract said inner tubular member with respect to said outer tubular member, a skimmer blade pivotally mounted at the outer end of said inner tubular member, and a power cylinder mounted on the interior of said inner tubular member remotely from the said outer end thereof for actuating said skimmer blade, said power cylinder having a piston therein the piston rod of which extends longitudinally through the interior of said inner tubular member for substantially the entire length thereof and pivotally connects to said skimmer blade; said means pivotally supporting the said boom assembly on said turntable comprising a pair of spaced bearing members on said turntable, a pair of spaced bearing members fixed to said outer tubular member and disposed within the said bearing members on said turntable, and a common shaft journaled in said bearing members; and said power means for effecting pivotal movement of said boom assembly relative to said turntable and for holding it in a selected position comprising a pair of double-acting power cylinders on each side of said shaft, each pair in straddling relation to the outer tubular member of said boom assembly and connectingly interposed between said turntable and said outer tubular member of said boom assembly, one pair of power cylinders being oppositely pressurized with respect to the other pair for applying unidirectional force moments on said boom assembly to balance said boom assembly in a selected position and to pivotally shift said boom assembly to different positions.

5. A skimmer mechanism comprising a supporting structure, a turntable rotatably mounted on said supporting structure, motor means for rotatively moving said turntable, a boom assembly, means pivotally mounting said boom assembly on said turntable, power means for effecting pivotal movement of said boom assembly relative to said turntable and for holding it in a selected position, said boom assembly comprising an outer tubular member and an inner tubular member conforming to but of smaller cross-sectional area than said outer tubular member, anti-friction means guidably supporting said inner tubular member in spaced relation to the outer tubular member whereby said inner tubular member is telescopically extensible and retractible relative to the outer tubular member, interengaging mechanical drive members partly on the outer tubular member and partly on the inner tubular member, motor means for actuating said drive members to extend and retract said inner tubular member with respect to said outer tubular member, a skimmer blade pivotally mounted at the outer end of said inner tubular member, a power cylinder mounted on the interior of said inner tubular member remotely from the said outer end thereof for actuating said skimmer blade, said power cylinder having a double-acting piston therein the piston rod of which extends longitudinally through the interior of said inner tubular member for substantially the entire length thereof and pivotally connects to said skimmer blade, a pair of flexible hose means for communicating pressure fluid to opposite sides of the piston respectively, a reel mechanism carried by said outer tubular member adjacent the end remote from said skimmer blade which automatically feeds out said hose means or takes up slack therein as necessary to accommodate extension and retraction of said inner tubular member relative to the said outer tubular member, said hose means extending solely into the interior of said inner tubular member when said inner tubular member is retracted and into the interiors of both the inner tubular member and of the outer tubular member when the inner tubular member is in its extended position.

6. A skimmer mechanism comprising a supporting structure, a turntable rotatably mounted on said supporting structure, motor means for rotatively moving said turntable, a boom assembly, means pivotally mounting said boom assembly on said turntable, power means for effecting pivotal movement of said boom assembly relative to said turntable and for holding it in a selected position, said boom assembly comprising an outer tubular member and an inner tubular member conforming to but of smaller cross-sectional area than said outer tubular member, anti-friction means guidably supporting said inner tubular member in spaced relation to the outer tubular member whereby said inner tubular member is telescopically extensible and retractible relative to the outer tubular member, interengaging mechanical drive members partly on the outer tubular member and partly on the inner tubular member, motor means for actuating said drive members to extend and retract said inner tubular member with respect to said outer tubular member, a skimmer blade pivotally mounted at the outer end of said inner tubular member, a power cylinder mounted on the interior of said inner tubular member remotely from the said outer end thereof for actuating said skimmer blade, said power cylinder having a piston therein the piston rod of which extends longitudinally through the interior of said inner tubular member for substantially the entire length thereof and pivotally connects to said skimmer blade, and stop means for limiting the outward extension of said inner tubular member with respect to said outer tubular member, said stop means comprising an element fixed on the outer surface of said inner tubular member and projecting therefrom, a member slidably mounted on said outer tubular member and projecting through a slot therein toward said inner tubular member, said slidably mounted member being adapted to be engaged by the said element on the inner tubular member as said inner tubular member approaches the intended limit of outward extension relative to the outer tubular member, and cushioning cylinder means fixed on said outer tubular member and cooperating with said slidably mounted member for yieldingly resisting movement thereof incidental to outward extension of said inner tubular member.

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