

[54] **LADLE SKIMMING MECHANISM**

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266/37, 308/33

[51] Int. Cl. **B66c 23/04, B66c 23/06**

[58] Field of Search 266/37; 187/19; 212/55;
52/118; 308/33; 214/145, 34, 32, 23

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UNITED STATES PATENTS

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[57] **ABSTRACT**

The specification discloses a skimming mechanism used in steel mills for removing slag from the surface of the molten metal in a ladle, the mechanism comprising an extensible boom assembly pivotally mounted on a turntable and power means arranged for rotating the turntable and for pivotally moving the boom assembly in a vertical plane relative to the turntable. The boom assembly comprises telescoping tubular sections, adjustable anti-friction means supporting the inner tubular section within the outer tubular section, a power-actuated driving mechanism comprising cooperating sprocket wheels and roller chains for extending and retracting the inner boom section with respect to the outer boom section, and a skimming paddle comprising a scoop portion separably attached to a mounting bracket portion that is mounted on the outer end of the inner boom section.

2 Claims, 11 Drawing Figures

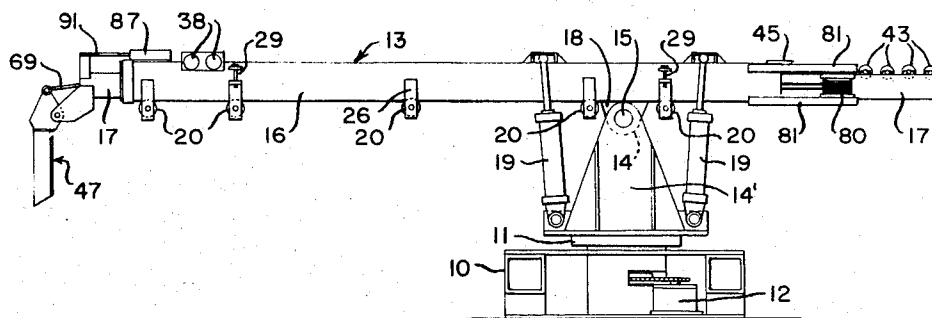


Fig. 1.

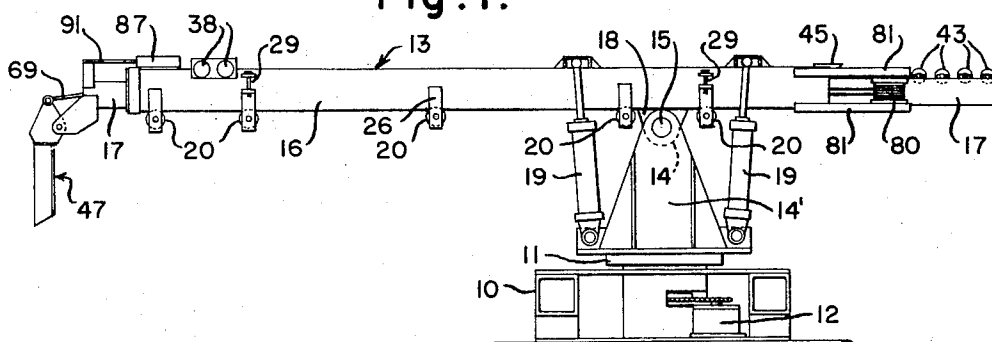


Fig. 7.

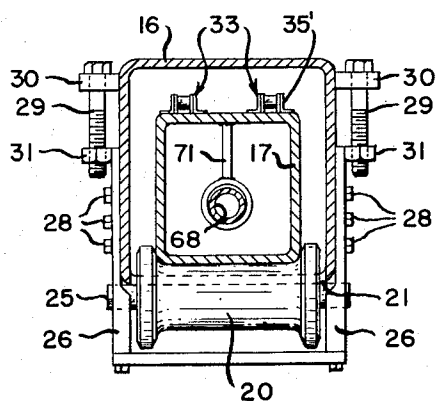


Fig. 9.

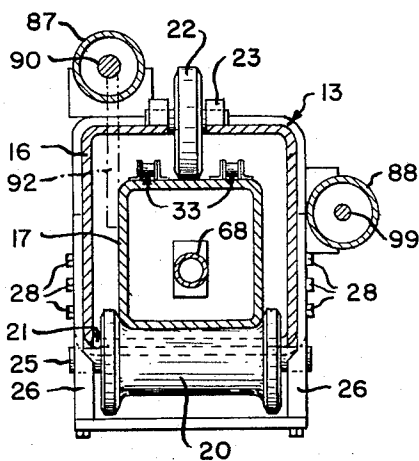


Fig. 8.

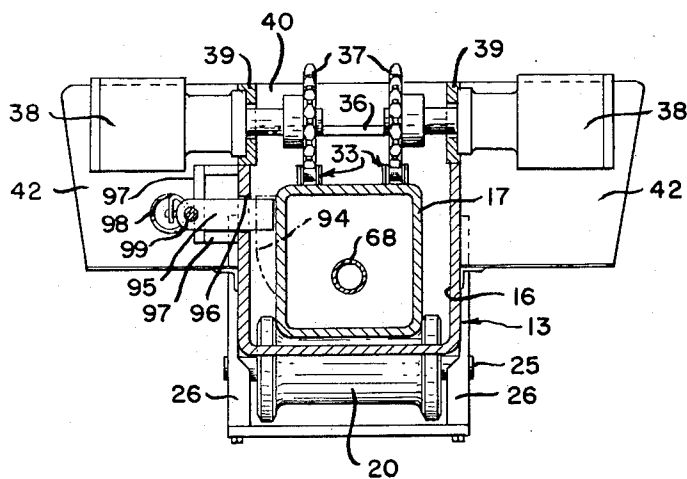
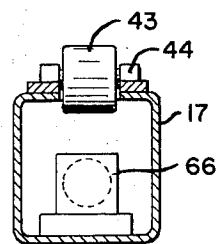


Fig. 10.



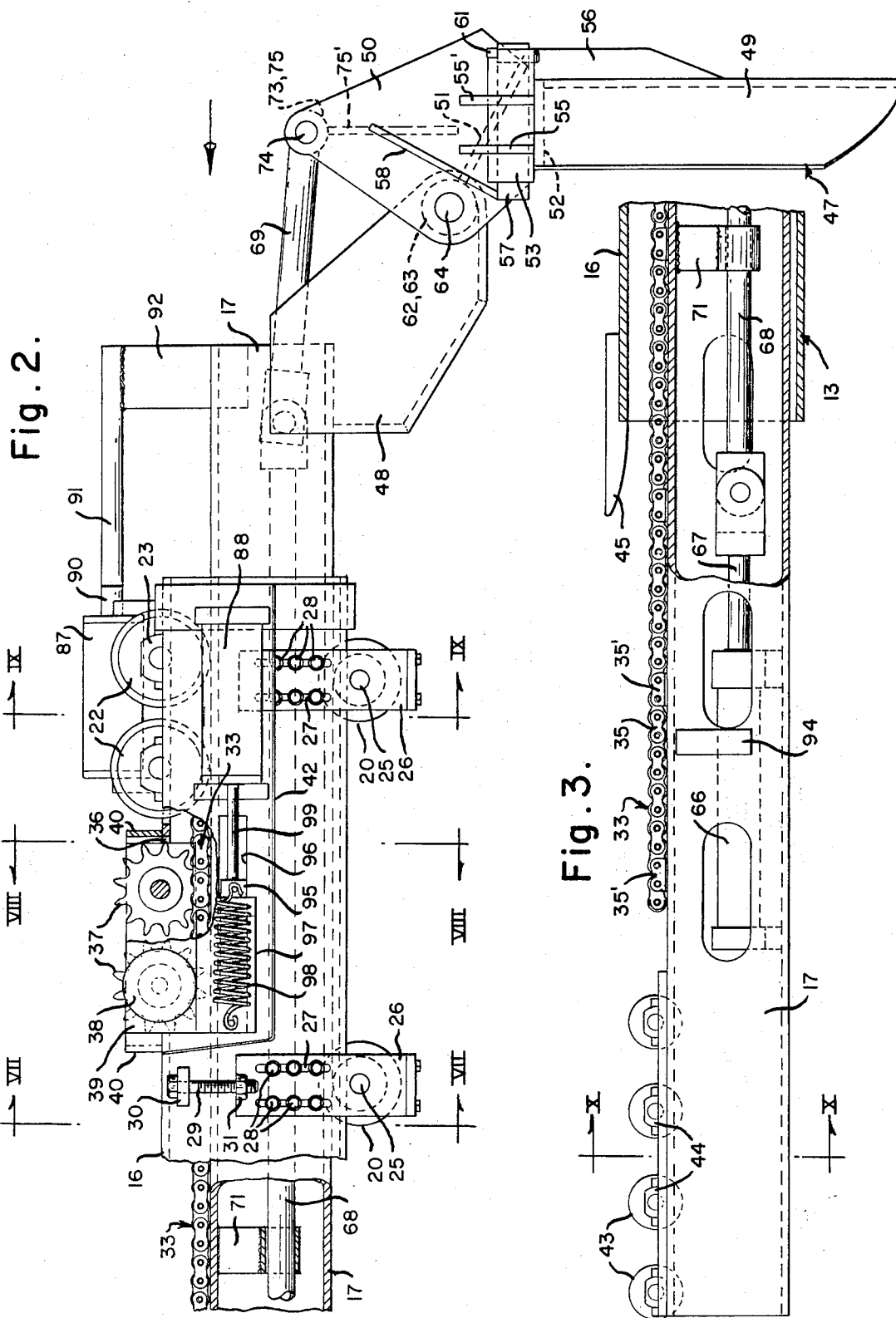
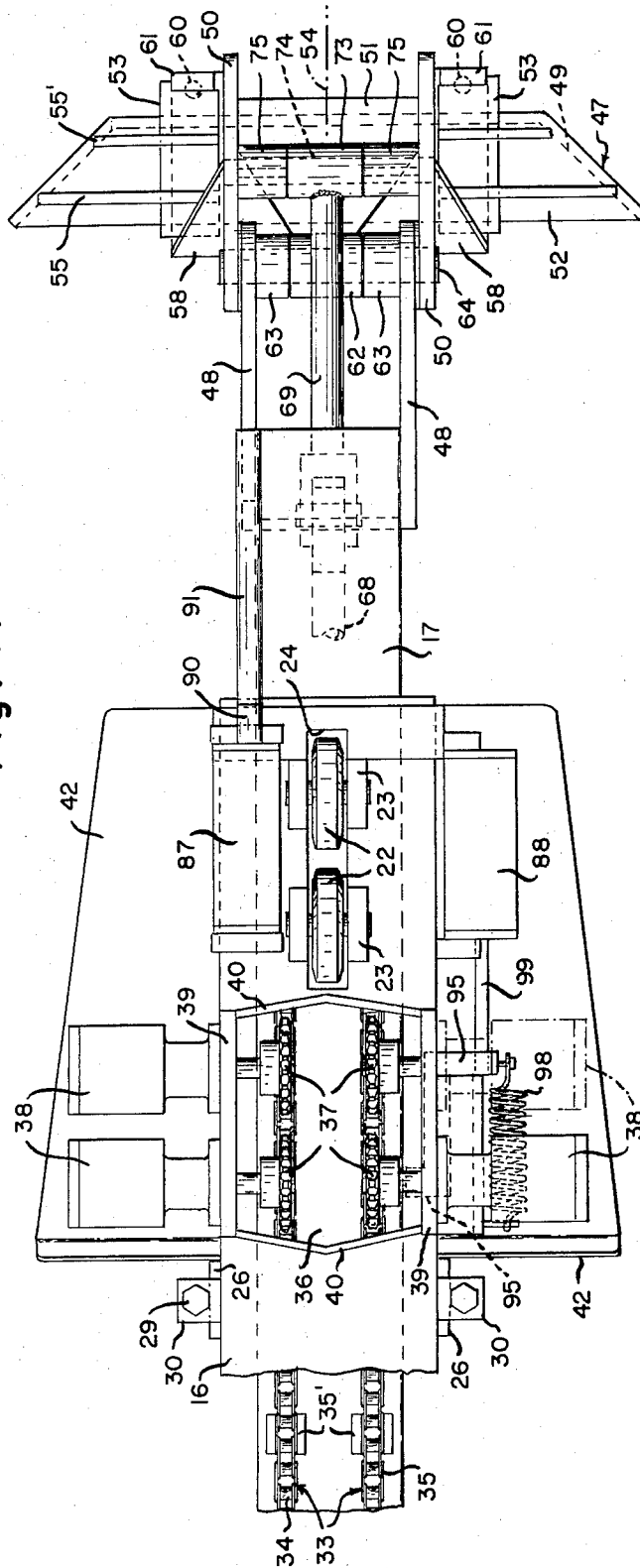


Fig. 4.



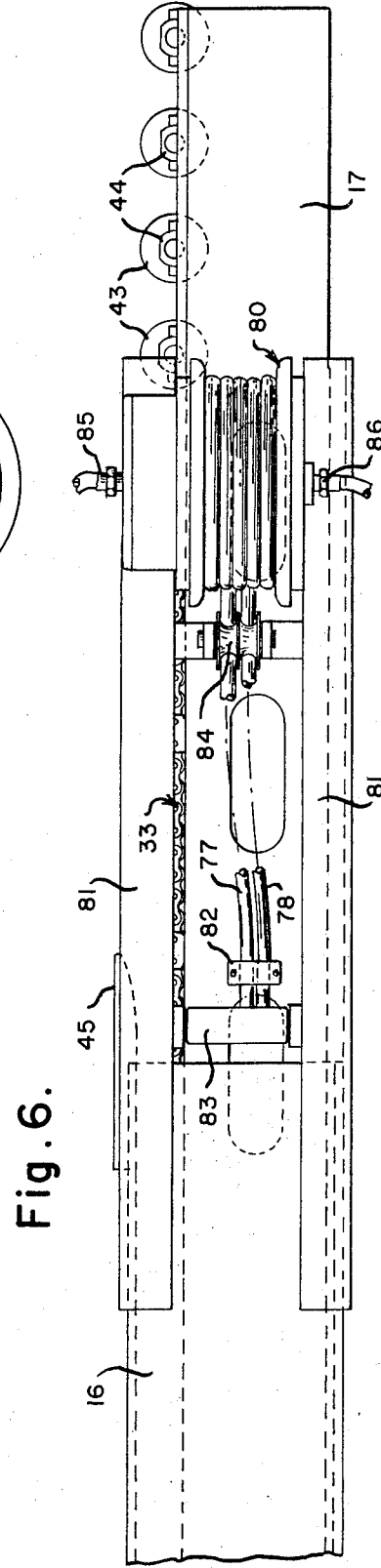
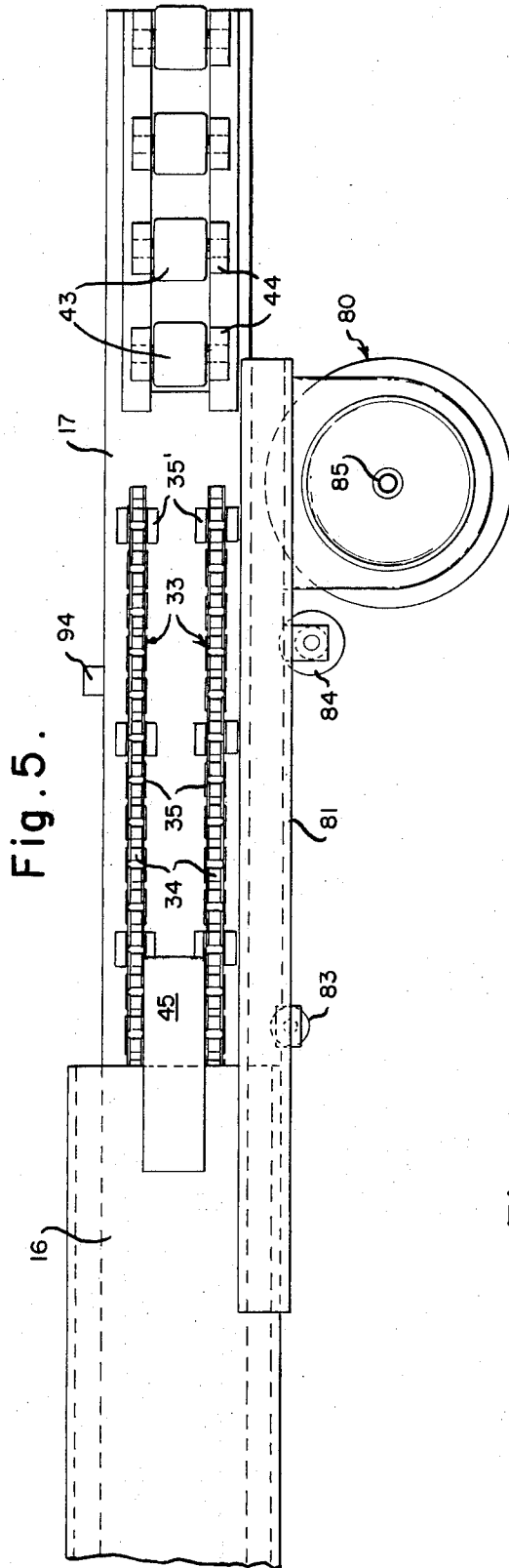
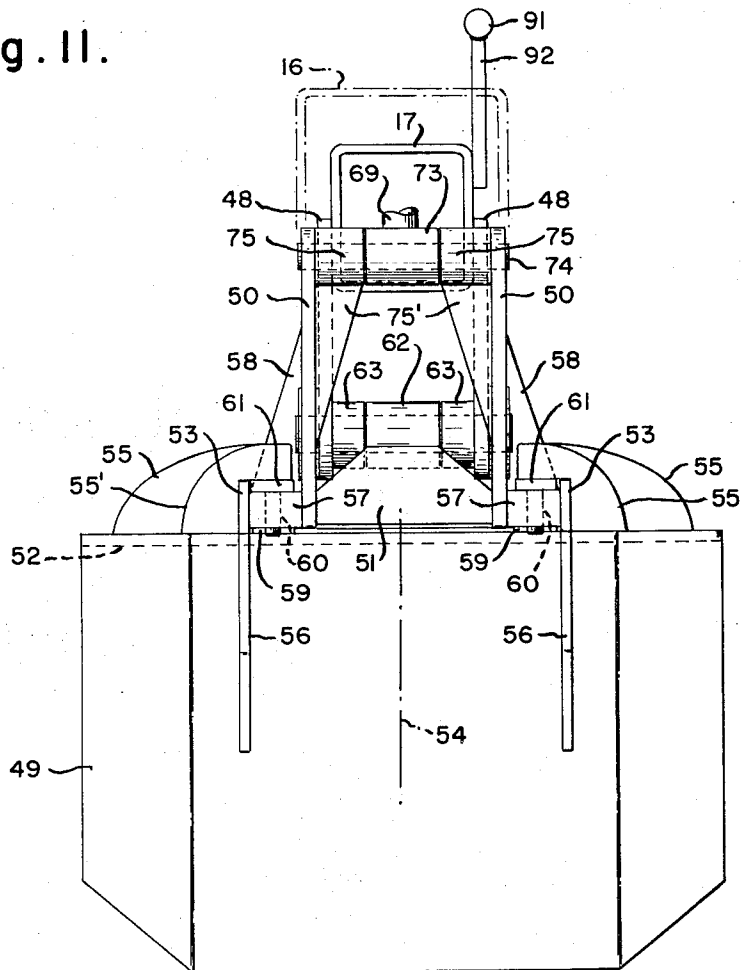


Fig. II.



LADLE SKIMMING MECHANISM

The present invention relates to a skimming mechanism for liquids, and more particularly to a skimming mechanism of the type for removing an overlying layer of slag or kish from molten metal. Our invention is primarily intended for, but not necessarily limited to, the removal of a molten slag layer from molten metal in various types of ladles, furnaces and other vessels employed in steel making operations.

In the prior copending U.S. Pat. application, Ser. No. 107,676, filed Jan. 19, 1971, of Louis A. Grant, which application is assigned to the assignee of the present application, there is disclosed and claimed a skimming mechanism for skimming the surface layer of slag or kish from the molten metal in ladles, furnaces and the like. The aforesaid skimming mechanism comprises an extensible boom, pivotally mounted on a turntable and having on its outer end a pivoted skimming blade or paddle which is power-actuated to flip the accumulated slag or kish over the lip of the ladle into a receiving vessel.

The extensible boom of the said application comprises outer and inner telescoping tubular boom sections, the inner boom section being guidably supported within the outer boom section by anti-friction rollers carried on the bottom and side walls of the outer boom section.

The extension and retraction of the inner boom section relative to the outer boom section is effected by a drive mechanism comprising a rack and pinion arrangement in which a plurality of parallel longitudinally extending rack members fixed on the upper face of the inner boom section are individually engaged by corresponding hydraulic-motor-driven pinion gears carried on the outer boom section.

The boom assembly is supported in a desired pivotal position on the turntable, or rocked up and down as desired, by a plurality of hydraulic cylinders on opposite sides of the pivotal connection of the outer boom section to the turntable.

A double-acting cylinder is located within the inner boom section remotely from the skimming blade and has a piston rod which extends through the inner boom section to a pivotal connection with the skimming blade displaced from the fulcrum thereof for pivotally actuating the blade. Hydraulic pressure connections to the double-acting cylinder are established via a pair of flexible hoses carried on a reel mounted adjacent the rear end of the outer boom section. The hoses extend through the rear end of the inner boom section and the reel automatically allows the hoses to lengthen and shorten as necessary to follow the extension and retraction of the inner boom section.

The skimming mechanism of the aforesaid application has functioned satisfactorily under service conditions but is open to certain disadvantages from the standpoint of maintenance and service life. For example, the manner in which the inner boom section is guidably mounted within the outer boom section on rollers is not flexible enough in view of the warping of the inner boom section due to exposure to heat. Unless the inner boom section remains straight, some binding occurs on the guiding rollers and this increases the friction to the point where the load on the driving motors for the pinions of the rack and pinion drive becomes excessive. Also the rack and pinion drive employed

makes no provision for dirt elimination. Consequently, the collection of dirt in the grooves between the teeth on the racks ultimately packs hard and this prevents proper mating of the pinion gear and rack. In some instances, stresses have occurred due to the packing of the dirt in the rack which have resulted in fracture of the rack, or pinion, or both. Repair of the rack is difficult and time-consuming, with resulting loss of operating time of the skimming mechanism. Also, the method and manner of connection of the pressure hose from the rear to the double-acting cylinder actuating the pivotal skimming blade, results in wear and abrasion of the hose due to rubbing on the exposed rear edge of the outer boom section when the inner boom section is extended. In addition, the skimming blade collects deposits of slag which harden and interfere with effective skimming performance, as well as pivotal action of the blade. Replacement of the entire blade is thus necessitated which is costly.

In order to overcome and avoid the aforesaid disadvantages of the skimming mechanism of the aforesaid application, we have devised an improved design of skimming mechanism.

More specifically we have provided a boom assembly of the type having outer and inner tubular boom sections, the inner boom section being guidably supported on its bottom surface which rests on flanged rollers, in turn suspended by brackets adjustably attached to the outer boom section. The rollers extend through holes in the bottom wall of the outer boom section and the inner boom section is centrally guided within the outer boom section between the end flanges on the rollers.

We have also provided an improved driving mechanism for extending and retracting the inner boom section, which comprises a plurality of lengths of roller chains the links of which are secured at intervals along the length of the chains as by welding certain links to the upper wall of the inner boom section, in longitudinally extending parallel relation, and a plurality of individually motor-driven sprocket wheels mounted on the outer boom section and extending through the wall thereof into engagement with the chains on the inner boom section. The adjustable guiding rollers supporting the inner boom section concurrently serve to adjust to the appropriate meshing or driving relation between the sprocket wheels and the roller chains.

We have also provided an improved arrangement for feeding the pressure hose from the hose reel to the blade-actuating cylinder within the inner boom section. This arrangement comprises mounting the hose reel on a rear end extension and feeding the hose through an opening in the side wall of the inner section to the cylinder. The provision of greater clearance space between the walls of the outer and inner boom sections accommodates the hose therebetween as the inner boom section reciprocates between retracted and extended positions relative to the outer boom section.

We have further provided a new design of skimming paddle comprising separable scoop and mounting bracket portions, thus making it possible to replace the scoop portion without replacement of the mounting bracket portion.

The above features, as well as other features and structural details of the presently preferred embodiment of the invention will be elaborated upon in the forthcoming description, in connection with the accompanying drawings, wherein:

FIG. 1 is a general elevational side view of the skimming mechanism comprising the presently preferred embodiment of the invention,

FIG. 2 is a fragmentary elevational side view of the skimming mechanism on enlarged scale, showing front end details of the pivotal blade, the driving mechanism and the adjustable guide rollers,

FIG. 3 is a fragmentary elevational side view of the skimming mechanism on the same scale as FIG. 2, showing rear end details,

FIG. 4 is a fragmental plan view of the front end of the skimming mechanism,

FIG. 5 and 6 are, respectively, plan and side elevational views of the rear end of the skimming mechanism showing mounting details of the hose reel and the hose connections to the inner boom section,

FIGS. 7, 8, 9, and 10 are cross-sectional views, taken on lines VII—VII, VIII—VIII and IX—IX of FIG. 2 and X—X of FIG. 3, respectively, and

FIG. 11 is a front end view, looking in the direction of the arrow in FIG. 2, showing additional details of the skimming paddle and the manner in which it is mounted.

Referring to FIG. 1 of the drawings, the embodiment of skimming mechanism shown is generally similar to that shown and described in the copending U.S. Pat. application Ser. No. 107,676 of Louis A. Grant, insofar as the mounting platform, turntable and power cylinders for holding and moving the boom assembly are concerned. Since reference may be had to the said copending application for a description of these details, they will be identified briefly herein without a detailed description.

As shown in FIG. 1, the skimming mechanism comprises a support structure or platform 10 fabricated of hollow-square girders which may be extensible for accommodating the platform for mounting in a building structure or for otherwise anchoring this platform in position. A horizontal turntable 11 is rotatably mounted on the platform 10 and is rotated by motor 12 through a suitable drive mechanism, such as a chain drive. U.S. Pat. Nos. 3,471,888 and 3,458,396 to Grant et al. and to Grant issued Oct. 14, 1969, and July 29, 1969, show arrangements suitable for mounting and rotating the turntable 11.

An extensible boom assembly 13, is pivotally mounted on the turntable 11 for pivotal movement in a vertical plane in a manner generally similar to that described for the boom assembly in copending U.S. Pat. application, Ser. No. 107,676. Briefly, a pair of bearing members 14 formed at the upper ends of spaced brackets 14' attached to the turntable serve to support opposite ends of a shaft 15 constituting a fulcrum for the boom assembly 13.

As evident from FIG. 1, and particularly shown in FIGS. 7, 8, and 9, the boom assembly 13 comprises two telescoping tubular members, illustratively shown as of square or rectangular cross-section, hereinafter referred to as the outer boom section 16 and the inner boom section 17. The boom assembly 13 is fulcrummed on the shaft 15 by a pair of spaced bearing brackets 18 attached as by welding to the bottom wall of the outer boom section.

In a manner similar to that described in copending U.S. Pat. application Ser. No. 107,676 a plurality of power cylinders 19 of the double-acting type are disposed symmetrically on opposite sides of the shaft 15

for supporting the boom assembly 13 in a desired position in a vertical plane and for effecting pivotal movement thereof to a desired position. It will be seen that the lower ends of the cylinders 19 are pivotally attached to the turntable 11 and the distal ends of the piston rods are pivotally attached by brackets to the wall of the outer boom section 16.

One of the salient improved features of the present invention is provided by an improved mounting arrangement for the inner boom section 17. This arrangement is shown generally in FIG. 1 and comprises a plurality, illustratively shown as five in number, of flanged rollers 20, disposed in spaced relation along the outer boom section 16 as presently more fully described, and extending through openings 21 in the bottom wall of the outer boom section. As evident in FIGS. 7, 8, and 9, the width of the inner boom section 17 conforms closely to the distance between the flanges at the ends of the rollers 20, thereby being guided for reciprocative movement relative to the outer boom section, without the necessity for roller guides in the opposite side walls of the outer boom section 16. In order to prevent the inner boom section 17 from rising up and separating from the rollers 20, a pair of longitudinally aligned rollers 22 (FIGS. 4 and 9) are mounted in bearing brackets 23 attached to the outer surface of the front end of outer boom section and extend through a centrally located longitudinal slot 24 (FIG. 4) in the upper wall of the outer boom section into rolling contact with the upper smooth surface of the inner boom section.

Each roller 20 is rotationally mounted, as by antifriction bearings at opposite ends, on a shaft 25 which is in turn supported and secured at its opposite ends in circular holes provided in a pair of brackets 26. Brackets 26 are adjustably attached to the opposite side walls of the outer boom section 16, as shown in FIG. 2. For this purpose the brackets have a pair of vertically extending parallel slots 27 (FIG. 2) through which a plurality of screws 28, illustratively shown as three in number, extend to screw into corresponding tapped holes in the wall of the outer boom section.

Certain remotely spaced brackets 26, as shown in FIG. 1, are arranged for vertical adjustment by as screw 29 for a purpose presently to be explained. As seen in FIG. 2, a laterally extending lug 30 is provided on the wall of the outer boom section for each screw 29. The lug has a hole through which the screw extends with the head of the screw resting on the top of the lug. A nut 31 is welded to the upper end of the bracket 26, in line for screw-threaded engagement by the lower end of the screw.

Adjustment of the rollers 20 to provide proper positioning of the inner boom section 17 in the outer boom section 16 is effected by first adjusting the rollers 20, which can be adjusted by the screws 29, so as to properly align and level the inner boom section within the outer boom section. The brackets 26 for the adjusted rollers 20 are locked in position by tightening screws 28. The remaining rollers 20 are subsequently adjusted into contact with the bottom surface of the inner boom section and locked in position by tightening screws 28.

This method of adjustment of the position of rollers 20 is particularly important for reasons which will be explained presently in connection with the driving mechanism for reciprocating the inner boom section in the outer boom section.

The driving mechanism for effecting reciprocation of the inner boom section is a particularly important feature of the invention and will now be described by particular reference to FIGS. 2, 4, and 8. As shown, a pair of lengths of roller chain 33 are fixed in parallel longitudinally extending relation to the top surface of the inner boom section 17 for substantially the entire length thereof. Chains 33 comprise rollers 34 and connecting links 35. The attachment of the chain 33 to the inner boom section is preferably effected by providing angle links 35' (FIG. 3) at spaced intervals along the chain 33 to facilitate welding thereof to the inner boom section. This allows a certain flexible movement to the rollers 34 of the chain which is desirable.

Adjacent the front end of the outer boom section is a transverse slot 36 (FIG. 2) to provide access to the chains by a plurality of sprocket wheels 37, each individually driven by a suitable hydraulic motor 38. The mounting arrangement for the sprocket wheels 37 and motors 38 comprises two side bracket plates 39 of greater thickness than the wall of the outer boom section inset into the wall slot 36 and welded to the wall. Transverse struts 40 of shallow V-shape are welded at opposite ends to the side plates 39 to provide reinforced support thereto and an enclosure for the sprocket wheels.

Two motors 38 are attached as by screws to each of the opposite side plates 39 in longitudinal spaced relation, so that they are in substantial transverse alignment. The sprocket wheels 37 which are removably attached to the shafts of the motors 38 are positioned transversely so as to mesh appropriately with a corresponding chain 33.

The functional importance of the adjustable brackets 26 for rollers 20 should now be apparent in relation to establishing the appropriate relative positions of the sprocket wheels 37 and the chains 33 for proper transmission of driving forces from sprocket wheels to chains.

It will be understood that the motors 38 at opposite sides of the boom assembly are necessarily actuated concurrently in opposite directions in order to provide a unidirectional thrust force on the inner boom section, either for extension or for retraction with respect to the outer boom section. Moreover, by providing a plurality of individually power-driven sprocket wheels, there is assurance that operation of the inner boom section may be effected notwithstanding possible failure of one or more of the motors.

In view of the exposure to very high temperatures radiant from the molten metal in a steel mill environment and also for safety purposes, a so-called heat shield 42 is provided on each side of the outer boom section in surrounding relation to the motors 38. As will be seen in FIGS. 2, 4, and 8 each of the shields 42 extends longitudinally outside and underneath the motors 38 and is attached as by angle brackets to the wall of the outer boom section 16.

In order to provide additional support while the inner boom section 17 is in extended position, a plurality of supporting rollers 43 are mounted in suitable bearing brackets 44 attached to the rear end of the inner boom section as shown especially in FIGS. 3 and 5. A cam plate 45 is attached as by welding to the top wall of the outer boom section at its rear end for engagement by the rollers 43 to insure entrance into the rear opening of the outer boom section 16.

A skimming blade or paddle 47 is mounted on a U-shaped bracket 48 attached as by welding to the outer or forward end of the inner boom section 17, as particularly shown in FIGS. 1, 2, and 11. The paddle 47 is fabricated of sheet steel plates and comprises a separable and replaceable lower three-sided scoop section 49 and an upper mounting bracket section comprising two spaced mounting plates 50 joined by an intervening angularly disposed generally triangular plate member 51. The scoop section 49 is closed at the top edge by a transverse plate member 52, integrally attached as by welding. To the top surface of the plate member 52, a pair of angle brackets 53 are attached in parallel spaced relation symmetrically on opposite sides of the longitudinal center line 54 (See FIG. 4) of the scoop section, thereby providing longitudinal slots. A pair of spaced gusset plates 55 and 55' are welded to the top plate member 52 and to each of the angle brackets 53 to support them in position. A pair of gusset plates 56 are also attached to the front face of the scoop section and to the overhanging end of the angle brackets 53 to further support the angle brackets in position.

A bar 57 is attached as by welding to the outside surface of each mounting plate 50 along the bottom portion thereof. A triangular gusset plate 58 is attached between the inner end of each bar 57 and the mounting plate 50 for reinforcement. The scoop section 49 is attached to the mounting section by sliding the scoop section inwardly so that the bars 57 telescope inside the corresponding groove or slot formed between each angle bracket 53 and the top plate 52 of the scoop section. A wear plate or strip 59 (FIG. 11) is preferably attached to the surface of the top plate 52 to provide appropriate clearances without lost motion between each bar 57 and the corresponding angle bracket.

In order to lock the scoop section to the mounting bracket section, each bar 57 is provided with a hole 60 therethrough adjacent the front end, and after the scoop section is mounted on the bar, a T-bolt 61 is inserted in the hole. The cross bar of the T-bolt is offset from the center line of the bolt, thus providing an exposed portion of the upper end of the bolt. Under operating conditions, the angle brackets 53 shift back into position covering the exposed portions of the end of the T-bolt as shown in FIG. 4, thus locking the bolt in position against accidental removal or dislodgement.

The paddle 47 may be attached to the bracket 48 in a fixed position, if desired. However, in the preferred form thereof the paddle is pivotally mounted on the bracket 48. To provide the pivotal mounting, a sleeve bearing 62 is attached, as by welding, to the inner edge of the triangular plate member 51 midway between the mounting plates 50. Attached to the inside of each of the side walls of the U-shaped bracket 48 is a sleeve bearing 63, the two bearings 63 being in transverse alignment. A pin 64 extending through the bearings 62 and 63 and secured in position by end washers or pins, forms the fulcrum or pivot for the paddle 47.

Pivotal movement of the paddle 47 is effected by a cylinder 66 of the double-acting type (See FIG. 3) located inside the inner boom section 17 near the rear end thereof. Cylinder 66 is suitably attached to the bottom wall of the inner boom section. Cylinder 66 has a piston rod 67 the distal end of which is hingedly connected by a clevis and pin type of joint to a long rod 68 which extends longitudinally through the inner boom section to a point adjacent the outer end of the inner

boom section where it is, in turn, hingedly connected by a clevis and pin type of joint to a relatively short link rod 69. The rod 68 is supported at intervals through the length of the inner boom section by sleeve type bearing brackets 71, shown in FIGS. 2 and 3, which are dependently attached to the upper wall of the inner boom section. Link rod 69 has a sleeve bearing 73 at its outer end by means of which a pivotal connection to the mounting plates is provided. For this purpose a pin 74 (FIGS. 2 and 11) is supported at opposite ends in aligned sleeve bosses 75 attached to the inside of the mounting plates 50 and extends through sleeve bearing 73 which is disposed between the bosses 75. Triangular gusset plates 75' provide reinforced support to the bosses 75.

Hydraulic pressure is supplied selectively to the pressure chambers on opposite sides of the double acting piston of cylinder 66, for effecting reciprocative movement of the piston rod 67, through a pair of hoses 77 and 78 (FIG. 6). Reciprocative movement of the piston rod 67 effects corresponding pivotal action of the paddle 47, through the intervening rod 68 and link 69.

Hoses 77 and 78 are wound on a reel 80 carried on two angle brackets 81 forming an extension support at the rear end of the outer boom section 16. As shown in FIGS. 5 and 6, the hoses enter the interior of the inner boom section 17 through an opening in the side wall thereof, the hoses being firmly secured to the outer surface of the side wall by a clamp 82 prior to entry into the interior of the inner boom section. Inside the inner boom section hoses 77 and 78 are connected to fittings on the cylinder 66 via which communication is effected to the pressure chambers on opposite sides of the piston in the cylinder.

It will thus be seen that since opposite ends of the hoses are fixed relative to the inner boom section 17, no abrasion or wear on the hoses due to reciprocation of the inner boom section can occur. Of course, the portion of the length of the hoses between the clamp 82 and the reel 80 is under tension as the inner boom section is extended, that is, moves to the left as viewed in FIG. 6. Reel 80 is a conventional type in which the hoses are under constant tension and which allows the hoses to unwind to extend in length and automatically re-wind on the reel as the inner boom section 17 is retracted, that is, moves to the right as viewed in FIG. 6.

As is evident in the cross-sectional views, FIGS. 7, 8 and 9, there is adequate clearance space between the side walls of the inner and outer boom sections to accommodate the hoses 77 and 78 therebetween as the inner boom section 17 is extended outwardly. However, a roller 83 (FIG. 6) is mounted in a vertical position on the angle brackets 81 to insure that the hoses do not rub on the rear end of the outer boom section. Also a double-grooved pulley 84 is mounted on the angle brackets 81 to guide the hoses on the reel 80.

Hydraulic pressure is supplied to the reel 80 from pressure sources mounted in the platform 10 through external hose connections 85 and 86.

It will be apparent that if the paddle 47 is attached in a fixed position to the bracket 48, there is no need for the actuating cylinder 66 and the accessory hoses and hose reel and they may, in that circumstance, be omitted.

In order to prevent overtravel of the inner boom section 17 relative to a predetermined ambit in outer

boom section 16, and thereby prevent disengagement of the sprocket wheels 37 from the chains as well as damage to the skimming paddle 47 and other parts of the mechanism, cushioning limit stops comprising cushioning cylinders 87 and 88 are provided. As seen in FIGS. 2, 4 and 9, cushioning cylinder 87 is mounted by a suitable bracket on the top wall of the outer boom section 16 adjacent the front end thereof. Cylinder 87 has a piston rod 90 which projects forwardly in longitudinal alignment with a rod 91 that is attached by a bracket 92 to the front end of the inner boom section 17.

When the inner boom section is retracted to its inner limit of travel, the rod 91 engages the piston rod 90 and further travel of the inner boom section 17 is limited by the amount of cushioning travel of the piston cylinder 87. When the inner boom section is extended again, biasing means in the cylinder acts to restore the piston and piston rod 90 to the normal position in which it is shown in the drawings.

Cylinder 88 is similar to cylinder 87 and is mounted by a suitable bracket on the side wall of the outer boom section 16 adjacent the front end thereof. As shown particularly in FIGS. 3 and 8, a lug 94 attached on the side wall of the inner boom section 17 near the rear end thereof is arranged to engage a Z-bar 95 (FIG. 4) slidably mounted in a slot 96 in the side wall of the outer boom section 16, as the inner boom section approaches the limit of its outward extension. Z-bar 95 is supported externally of the slot 96 by a channel member 97 attached in a horizontal position to the outside surface of the side wall of the outer boom section 16. The outwardly projecting end of Z-bar 95 is biased to the left, as seen in FIG. 2, by a coil spring 98 into contact with the end of the channel member 97.

Piston rod 99 of cushioning cylinder 88 extends longitudinally back toward and contacts the projecting end of the Z-bar 95. Thus, as the inner boom section approaches its limit of outward extension, lug 94 engages the inner end of the Z-bar 95, which in turn exerts a compressing force on the piston rod 99 of cushioning cylinder 88. Upon retraction of the inner boom section, coil spring 98 restores Z-bar 95 to its normal position and the piston rod 99 of cylinder is restored concurrently therewith by biasing means embodied in the cylinder.

For simplicity, the control system by which operation of the turntable motor 12, the cylinders 19 for pivotally moving and holding the boom assembly, the hydraulic motors 38 for extending and retracting the inner boom section 17, and cylinder 66 for pivoting the paddle 47 is coordinated is not shown. However, it should be understood that a small hand-held control device of the push-button type may be employed for convenient centralized and rapid coordinated remote control of the various operations of the skimming mechanism.

In general, the operation of the skimming mechanism for removing slag or kish from the top surface of the molten metal in a ladle is similar to that described in the aforementioned copending U.S. Pat. application Ser. No. 107,676.

It will be understood, therefore, that the ladle containing the molten metal is tilted from the vertical until the level of the molten metal is such as to almost run out over the lip of the ladle. In such position, the operator extends the inner boom section 17 over the top of the ladle and causes the paddle 47 to assume a position

inclined forwardly from the vertical so as to parallel the slope of the back wall of the ladle. Thus it is possible for the operator to dip the tip of the paddle 47 into the molten metal at the rear of the ladle and by retracting the inner boom section draw an accumulation of slag back toward the lip of the ladle. Repeated extension and retraction of the inner boom section, as well as turning of the turntable so as to reach the entire surface area of the molten metal in the ladle, enables the operator to quickly clear the slag from the surface of the metal back over the lip of the ladle into a collecting vessel or bucket.

The pivotally mounted paddle 47 is advantageous in several respects. Firstly, if it is desired to employ the paddle in a fixed position, the cylinder 66 may be employed to change the position of the paddle over a wide angle from a vertical position to any forwardly inclined position suitable to the slope of the back wall of the ladle, which will change during the skimming operation with a change in the inclined position of the ladle. Secondly, the cylinder 66 may be employed to quickly change the inclination of the paddle back toward the vertical as the inner boom section is retracted toward the lip of the ladle to flip or toss an accumulation of slag over the lip of the ladle into a collecting vessel.

The particular design of paddle and manner of mounting also has certain advantages over heretofore known constructions. Firstly, because the scoop section is designed to be separable from the mounting section, replacement only of the scoop section of the paddle will be effected while retaining the mounting section. Because of the accumulation of molten slag, which over an extended period of skimming operation, adheres to the scoop section of the paddle, the effective skimming ability of the paddle is impaired. In such cases, it has heretofore been necessary to replace the entire paddle including the mounting bracket portion thereof. By eliminating the necessity for replacing the mounting bracket portion of the paddle, an appreciable reduction in operating cost is effected. Moreover, the design of the mounting section of the paddle guards against the accumulation of slag deposits around the area of pivotal support of the paddle which would, in the course of time, interfere with the pivotal operation of the paddle. It will be noted that the closed bottom of the U-shaped bracket 48 and the slanting plate member 51 between the side members 50 prevents the deposit and accumulation of slag around the fulcrum pin 64 and sleeve bearings 62 and 63, thus increasing the service life of the mounting bracket section and making it possible to retain the mounting section when the scoop section of the paddle is replaced.

A particular advantage of the invention resides in the sprocket wheel-roller chain type of drive for extension and retraction of the inner boom section. This type of drive is self-cleaning, thereby eliminating the accumulation of dirt in the parts, in contrast to the previous rack and pinion type of drive. Moreover, repair or replacement of individual links or rollers of the chain reduces the maintenance expense as well as the time required to effect repair in the event of the breakage of parts compared to the rack and pinion type of drive.

Furthermore, the manner and means for adjustably mounting the rollers 20 is advantageous in that it con-

currently makes possible the relative adjustment of sprocket wheels 37 and the roller chains for appropriate driving effectiveness without additional means for this purpose.

It should be observed also that the manner of mounting the hose reel 80 and the connection of the hoses 77 and 78 to the paddle-operating cylinder 66 eliminates difficulties and breakdown due to wear and breakage of hoses in prior designs of skimming mechanism.

In summary, it will be seen that the skimming mechanism which we have provided has numerous advantages over prior designs, all of which contribute to a more effective skimming operation, as well as to longer intervals between shutdowns for overhaul or maintenance operations of the apparatus. Moreover, the cost of operation and maintenance is reduced over prior designs of skimming mechanism.

While the presently preferred embodiment of the invention has been described and disclosed herein, it will be apparent that variations in the embodiment and in the manner of its use are possible, within the terms of the appended claims.

We claim:

1. In a skimming mechanism having a supporting structure, a boom assembly movably mounted on said structure, said boom assembly having an outer boom section, an inner boom section supported telescopically for reciprocative movement within said outer boom section, and a skimming paddle carried on the forward end of said inner boom section, the improvement comprising drive means for effecting reciprocative movement of the inner boom section within the outer boom section, which drive means comprises at least one length of roller chain stretched longitudinally in a straight line on one of said boom sections, said chain comprising rollers connected by links, means attaching the opposite ends of the chain to the boom section, means attaching certain links of the chain at intervals between the ends thereof to the said one boom section, at least one power-driven sprocket wheel carried on the other of said boom sections and drivingly engaging said chain, a series of horizontally disposed longitudinally spaced rollers carried on the outer boom section and having end flanges for guidably supporting said inner boom section against lateral deviation from a uniform reciprocative path relative to the outer boom section, means adjustably fixing the elevation of certain of said horizontal rollers in the series relative to said outer boom section to establish appropriate leveling of the inner boom section for proper driving relationship between a roller chain and its cooperating sprocket wheel, and means for adjusting the elevation of the remaining said horizontal rollers into supporting relation to the inner boom after the level of said inner boom is set by said certain rollers.

2. A skimming mechanism according to claim 1, wherein said drive means comprises a plurality of lengths of roller chains fixed in parallel relation longitudinally on said inner boom section, and a plurality of power-driven sprocket wheels are carried on said outer boom section, at least two of which drivingly engage each of said roller chains.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,800,965

Dated April 2, 1974

Inventor(s) George E. Barron and Harry Pavone

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The name of the Firm should read:
Buell, Blenko & Ziesenheim

Column 3, line 13, "FIG." should read --FIGS.--.

Column 4, line 43, "as" should read --a--.

Column 6, line 2, "be" should read --by--.

Column 8, line 44, after "cylinder" insert the numeral --88--.

Column 8, line 58, "f" should read --of--.

Signed and sealed this 10th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,800,965 Dated April 2, 1974

Inventor(s) George E. Barron and Harry Pavone

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The name of the Assignee should read:

"LOUIS A. GRANT, INC."

Signed and sealed this 3rd day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents