United States Patent [19]

Salberg

[11] **3,735,533**

[45] **May 29, 1973**

[54] **SHARPENING OF ICE SKATES**

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[73] Assignee: **Merco International Ltd.,** British Columbia, Calif.

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[21] Appl. No.: **137,789**

[30] **Foreign Application Priority Data**

Feb. 12, 1971 Canada 105211

[52] **U.S. Cl.** ....**51/34 E,** 51/228

[51] **Int. Cl.** **B24b 19/00**

[58] **Field of Search** ....51/34 F, 34 A, 34 C, 51/100, 228, 5, 34 E

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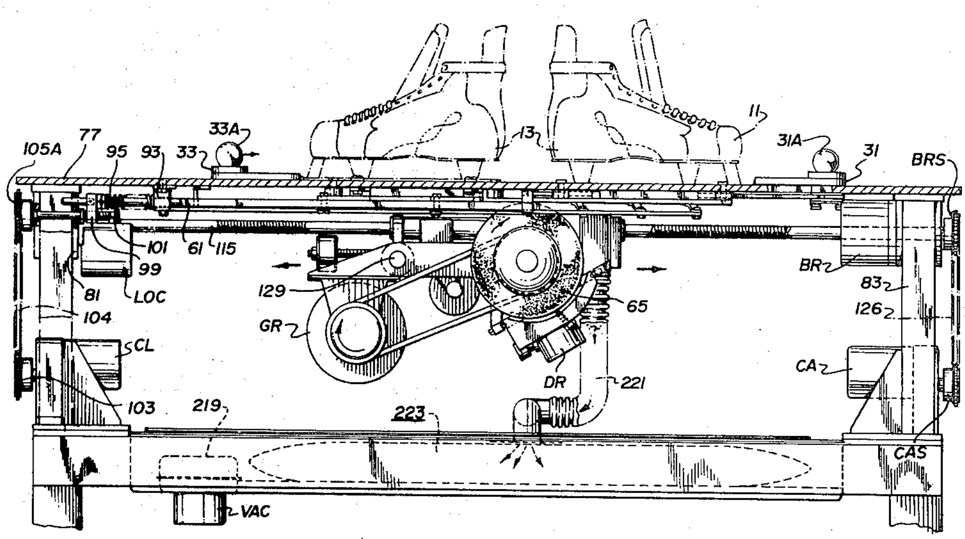
Primary Examiner—Milton S. Mehr
Attorney—Stevens, Davis, Miller & Mosher

[57] **ABSTRACT**

A coin-operated automatic ice skate sharpening machine is disclosed. The two skates are arranged heel-to-heel and the two aligned edges ground by a thin, flat grinding wheel having a convex wheel edge profile. The wheel lies in the same plane as the skate blades. The wheel moves along the skates, so grinding a concave edge profile. The machine can be set grind either "figure" skates or "hockey" skates as desired. The grinding wheel is automatically dressed. The number of passes by the grinding wheel is preset by the operator to take into account present condition of skates.

10 Claims, 20 Drawing Figures



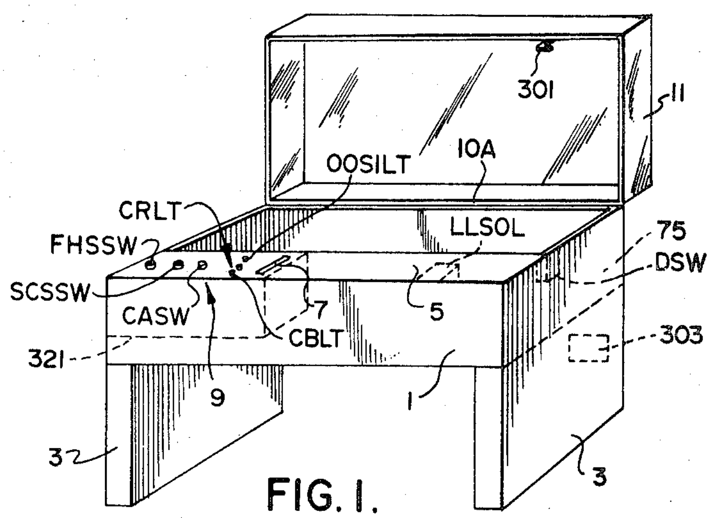
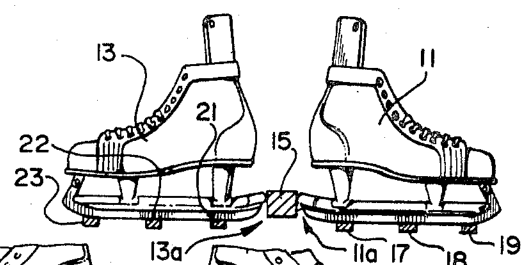


FIG. 1.

FIG. 2



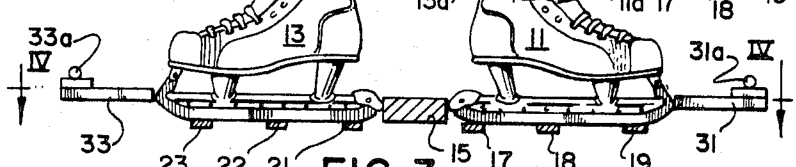


FIG. 3.

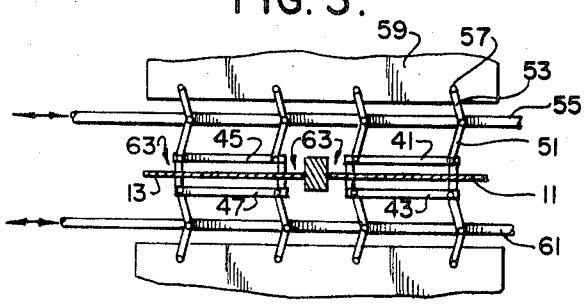


FIG. 4.

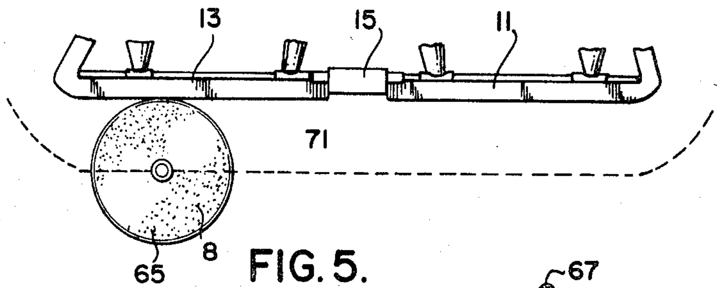
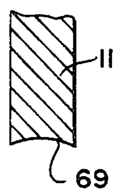


FIG. 5.

FIG. 7



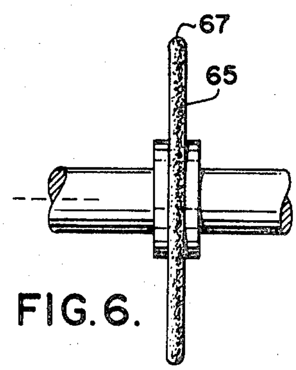
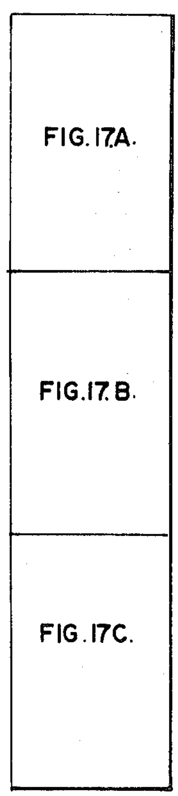


FIG. 6.

FIG. 17d.



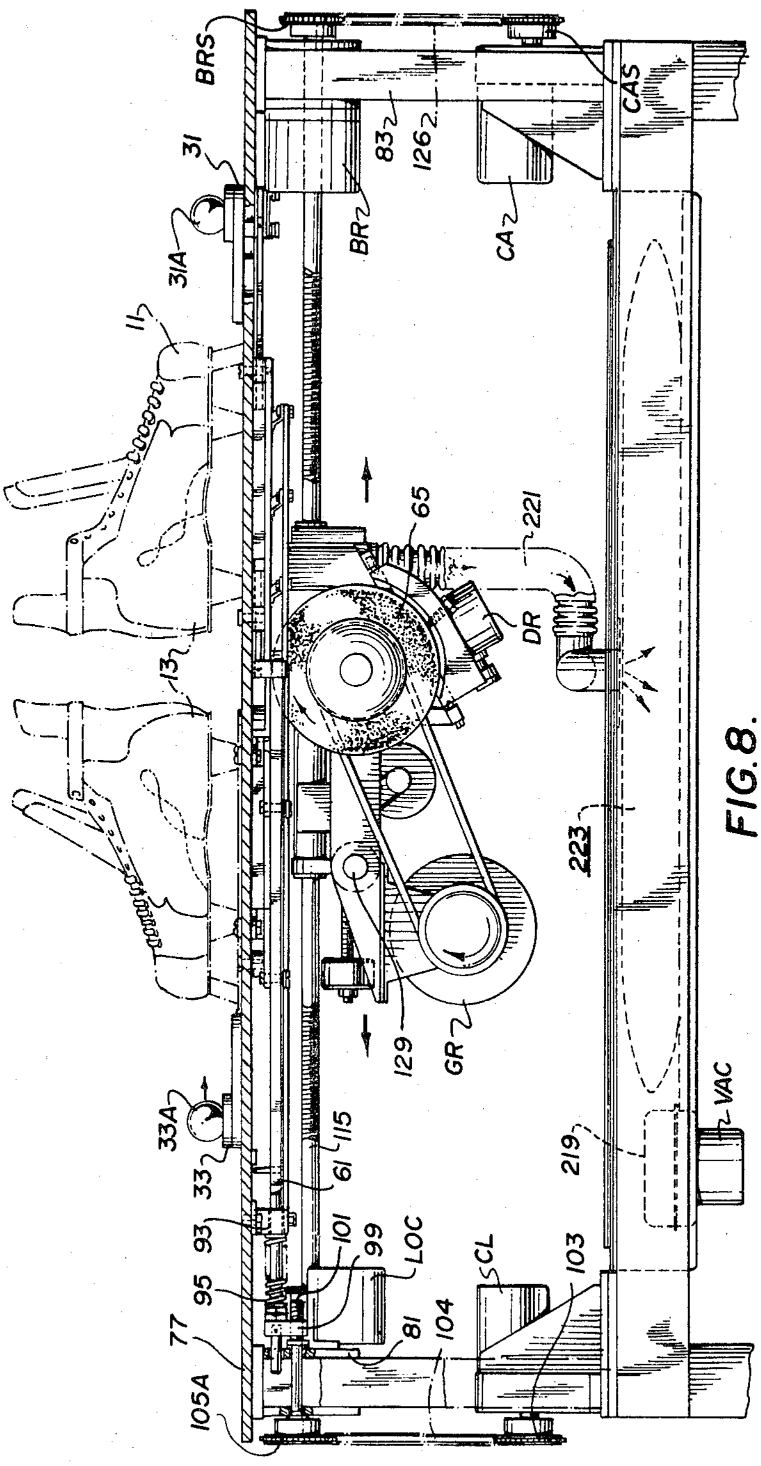

BRS
31
31A
11
13
83
126
BR
CA
CAS
65
221
DR
223
129
GR
33A
33
115
61
93
95
77
105A
101
99
LOC
CL
103
81
104
219
VAC

FIG. 8.

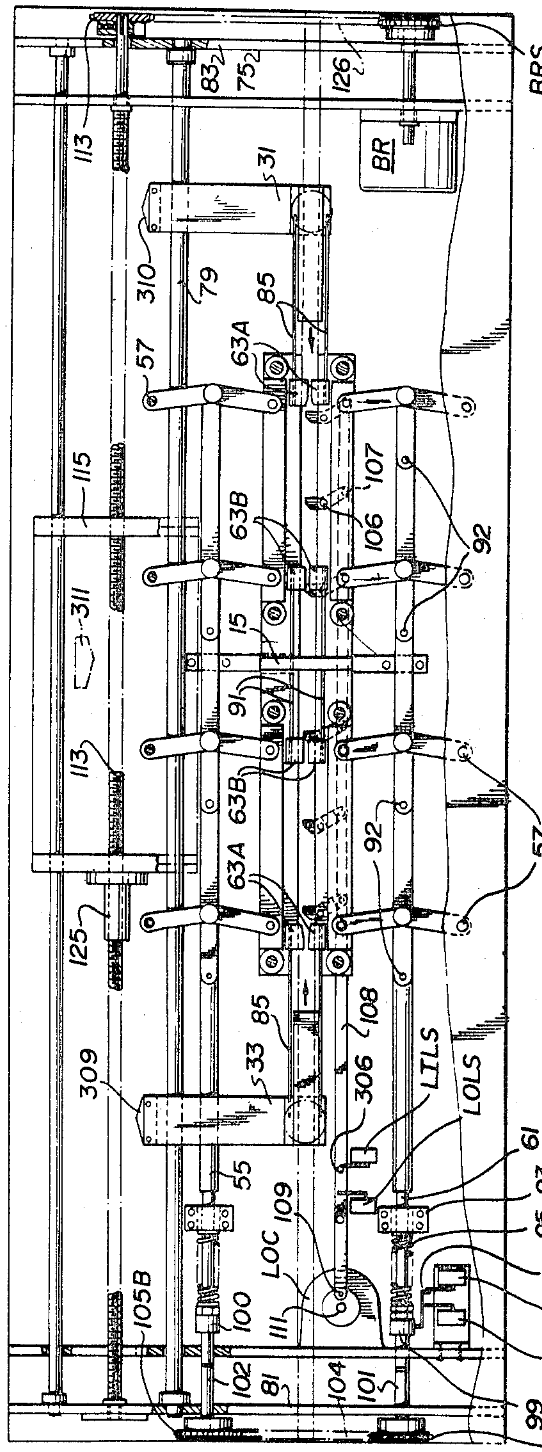


FIG. 9.

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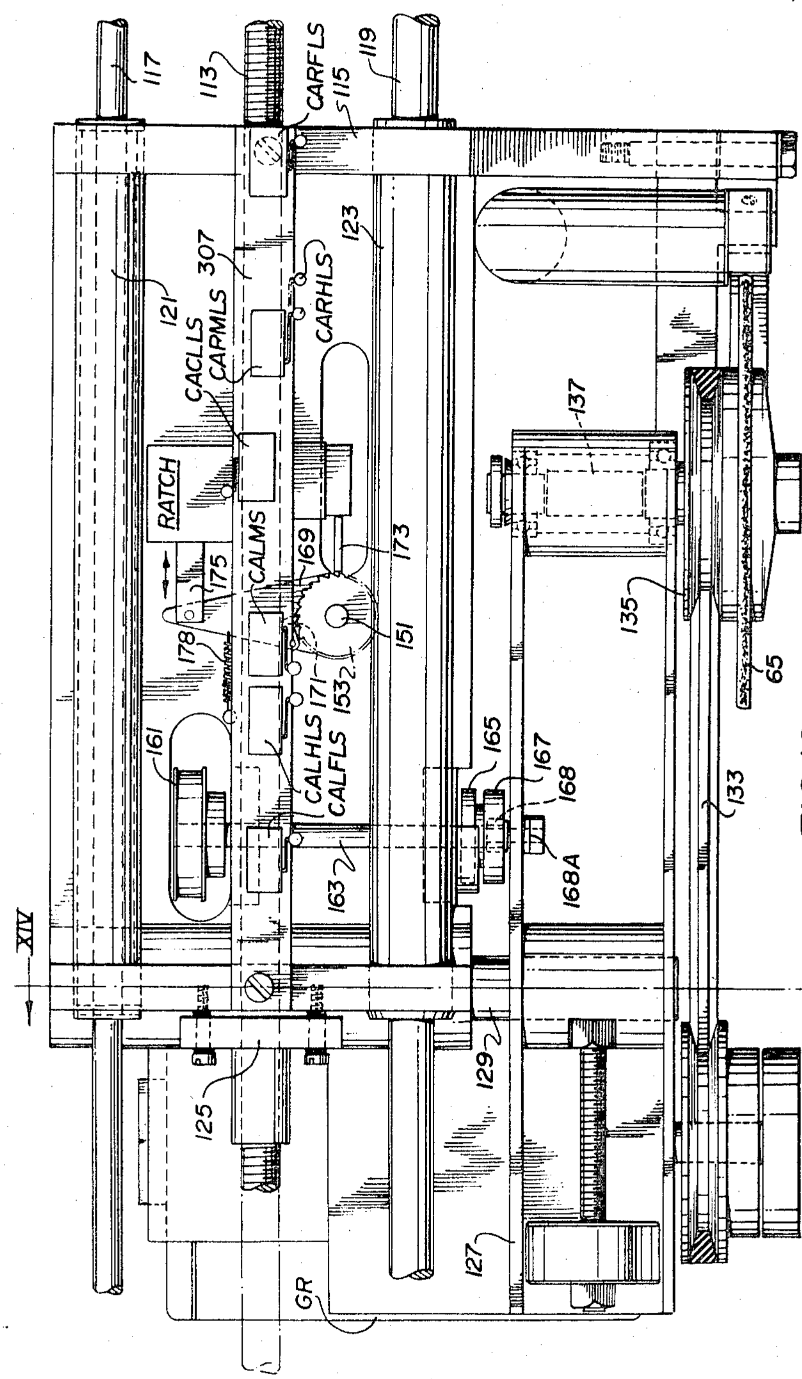

FIG. 10.

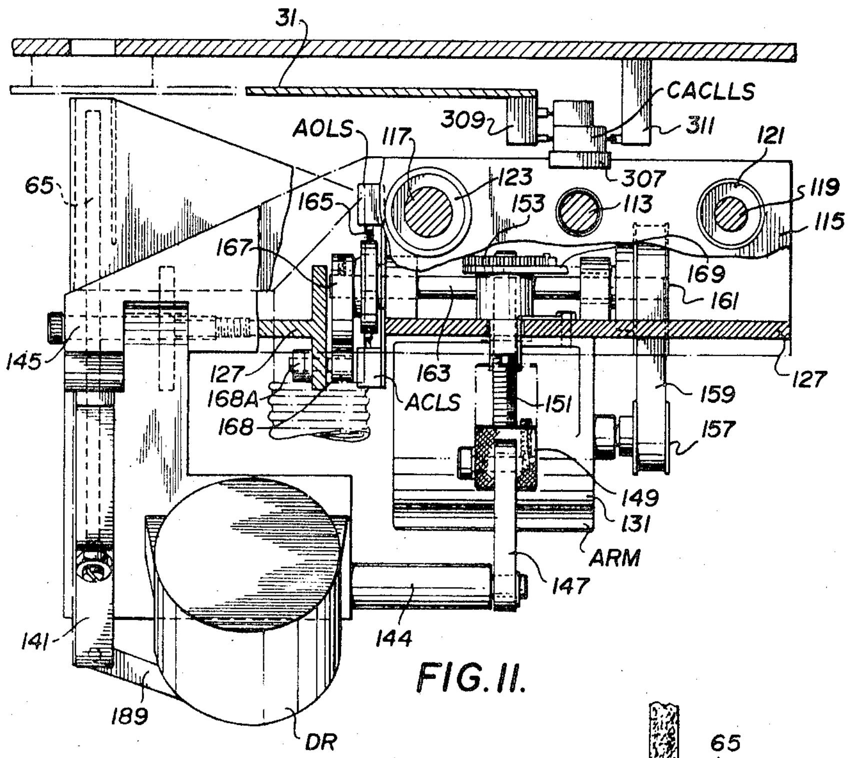
31
CACLLS
309
311
AOLS
117
121
307
123
119
65
165
153
113
115
167
169
161
145
127
163
127
168A
ACLS
151
159
168
157
149
131
ARM
147
144
141
189
DR

FIG. 11.

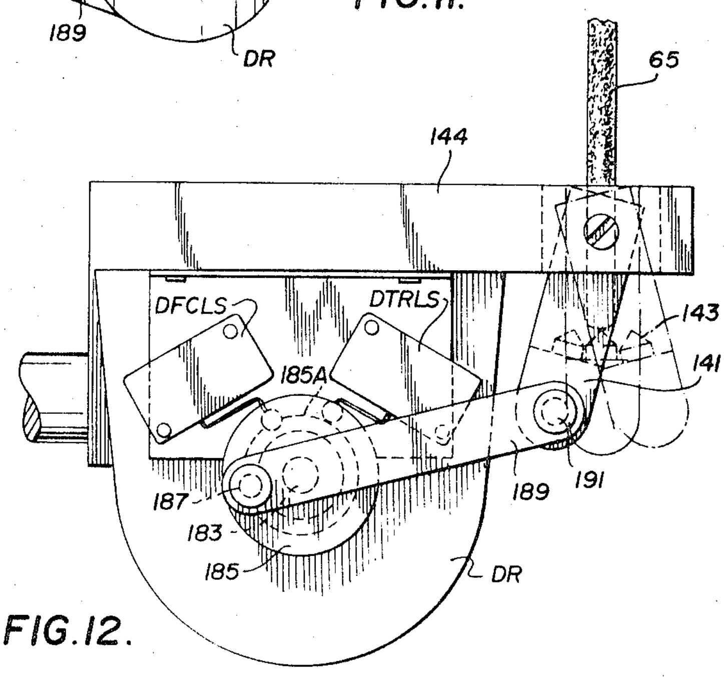
65
144
DFCLS
DTRLS
143
185A
141
187
189
191
183
185
DR

FIG. 12.

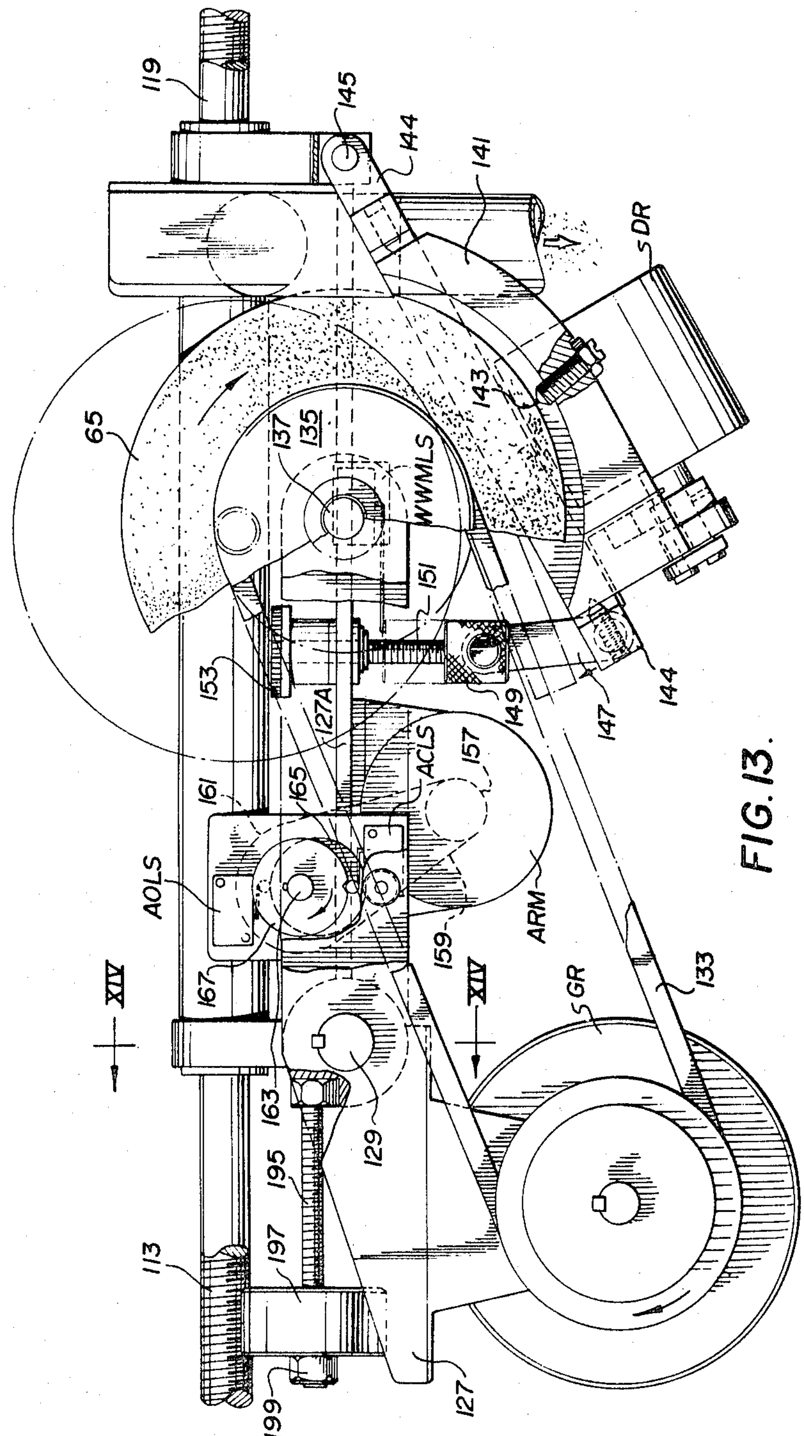
119
145
144
141
DR
65
137
135
143
WWMLS
151
153
127A
149
147
144
161
165
ACLS
157
AOLS
167
ARM
159
XIV
XIV
GR
133
163
129
195
113
197
127
199

FIG. 13.

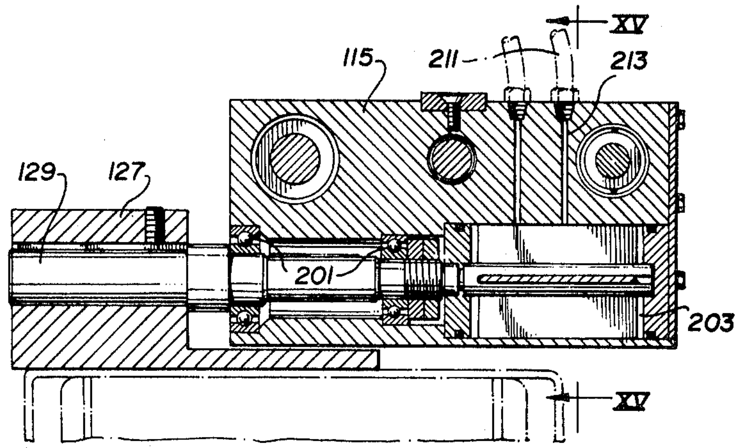

FIG.14.

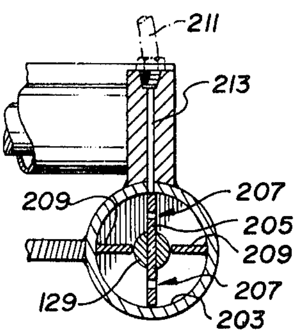

FIG.15.

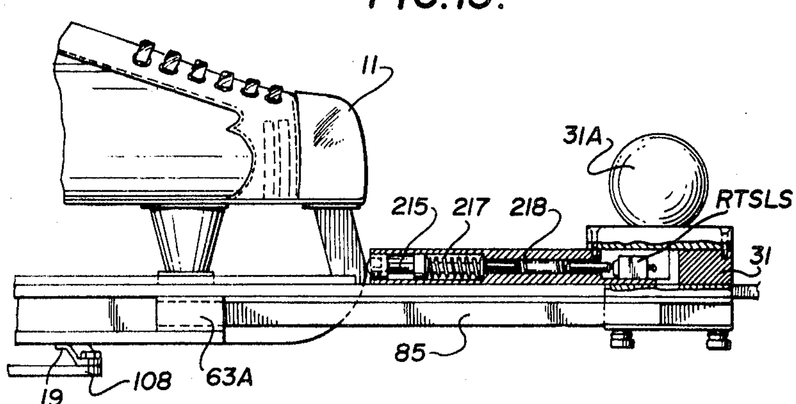

FIG.16.

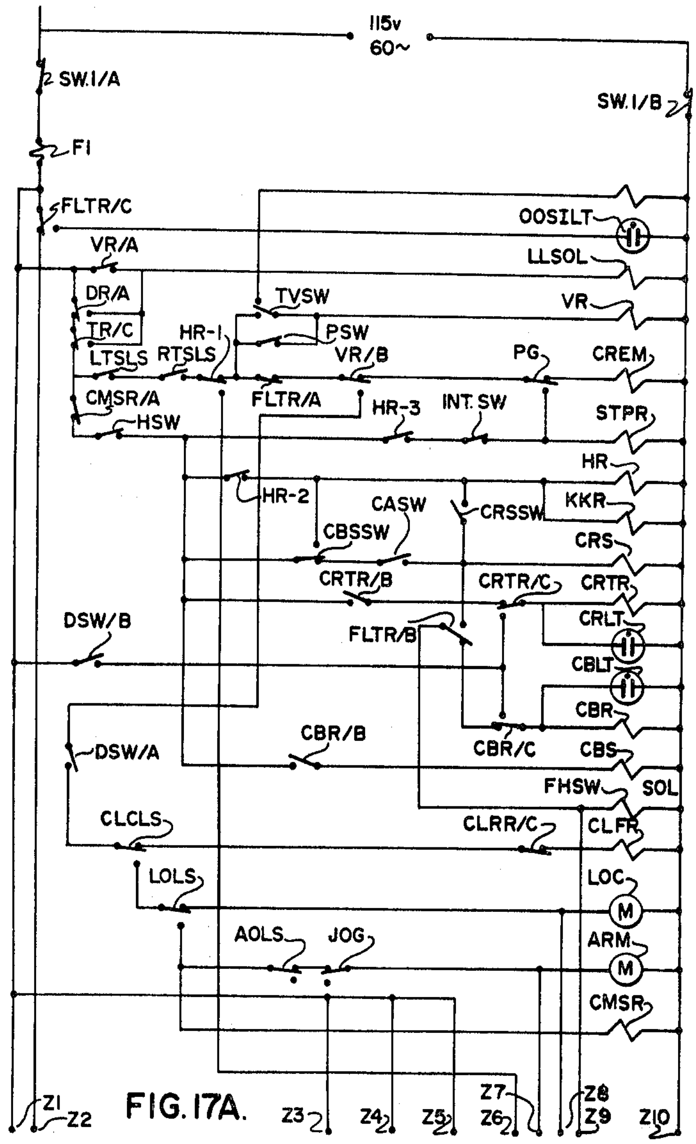
115v
60~
SW.1/A
SW.1/B
F1
FLTR/C
OOSILT
VR/A
LLSOL
DR/A
VR
TVSW
TR/C
HR-1
PSW
LTSLS
RTSLS
VR/B
PG
CREM
CMSR/A
FLTR/A
HR-3
INT. SW
STPR
HSW
HR
HR-2
CASW
CRSSW
KKR
CBSSW
CRS
CRTR/B
CRTR/C
CRTR
DSW/B
FLTR/B
CRLT
CBLT
CBR
CBR/B
DSW/A
CBR/C
CBS
FHSW
SOL
CLCLS
CLRR/C
CLFR
LOLS
LOC
M
AOLS
JOG
ARM
M
CMSR
Z7
Z8
Z1
Z2
Z3
Z4
Z5
Z6
Z9
Z10

FIG. 17A.

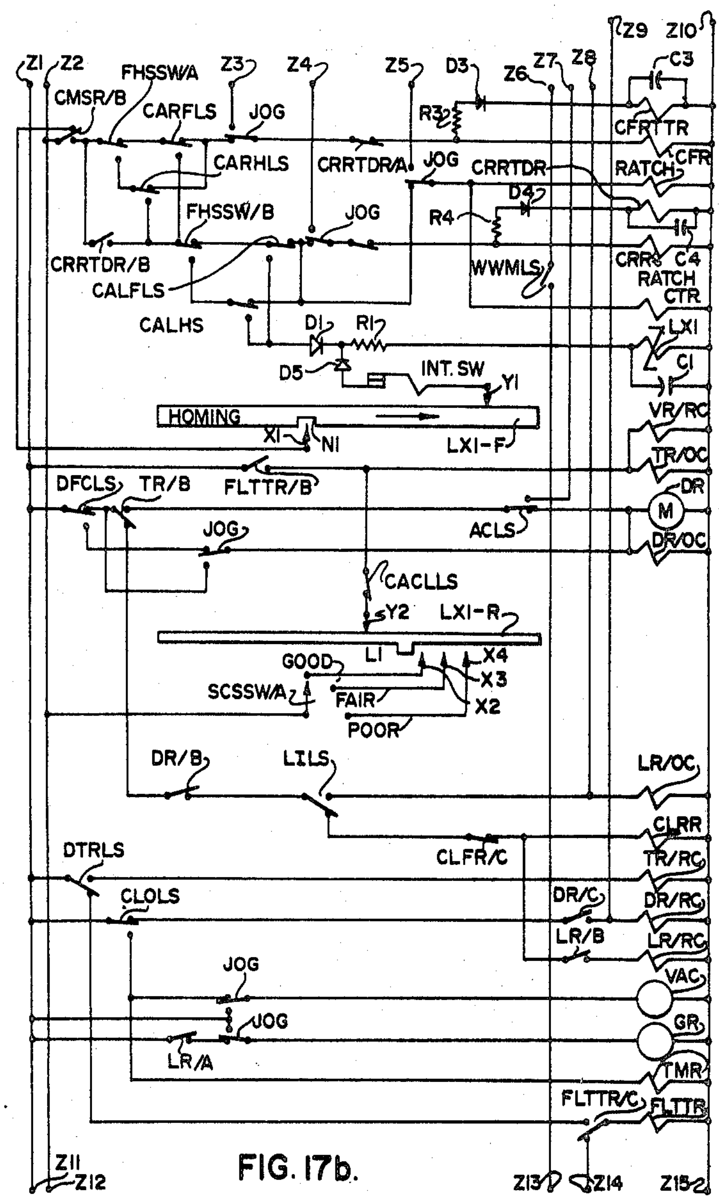
Z1
Z2
FHSSW/A
Z3
Z4
Z5
D3
Z6
Z7
Z8
Z9
Z10
C3
CMSR/B
CARFLS
JOG
R3
CFR
TTR
CFR
CARHLS
CRRTDR/A
JOG
CRRTDR
RATCH
D4
FHSSW/B
JOG
R4
C4
CRRTDR/B
CALFLS
WWMLS
CRR
RATCH
CTR
CALHS
D1
R1
LX1
C1
D5
INT. SW
Y1
HOMING
X1
N1
LX1-F
VR/RC
TR/OC
DFCLS
TR/B
FLTTR/B
DR
M
JOG
ACLS
DR/OC
CACLLS
Y2
LX1-R
L1
X4
GOOD
X3
SCSSW/A
FAIR
X2
POOR
DR/B
L1LS
LR/OC
CLRR
CLFR/C
DTRLS
TR/RC
CLOLS
DR/C
DR/RC
LR/B
LR/RC
JOG
VAC
JOG
GR
LR/A
TMR
FLTTR/C
FLTTR
Z11
Z12
Z13
Z14
Z15

FIG. 17b.

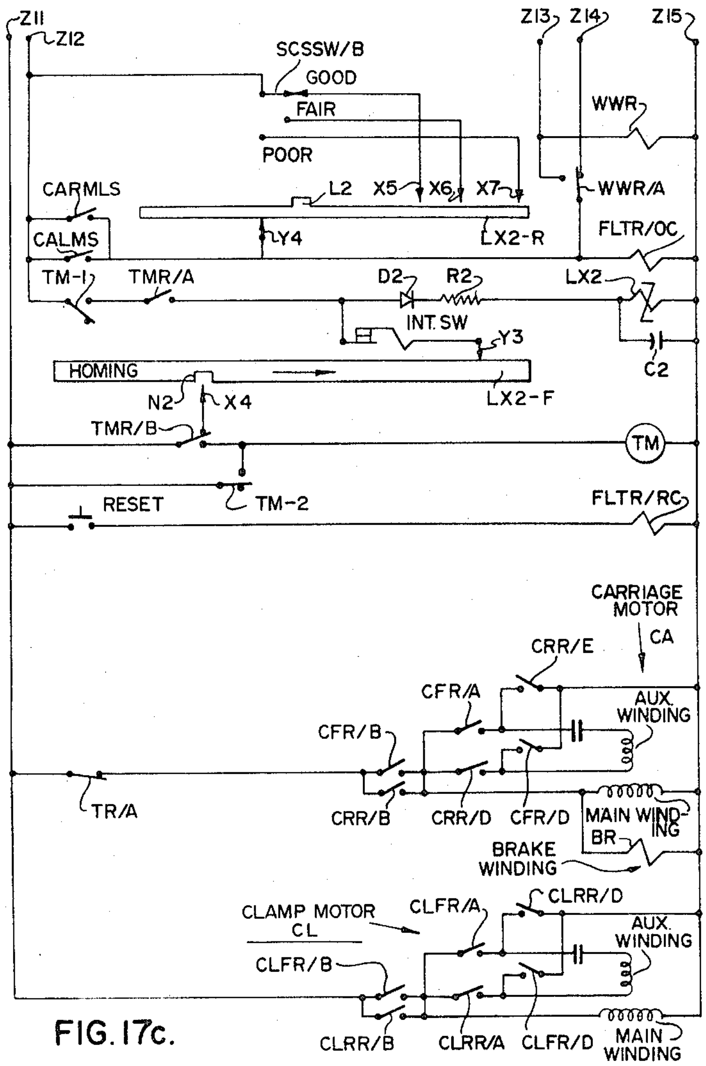
Z11
Z12
Z13
Z14
Z15
SCSSW/B
GOOD
FAIR
POOR
WWR
WWR/A
CARMLS
CALMS
L2
X5
X6
X7
Y4
LX2-R
FLTR/OC
TM-1
TMR/A
D2
R2
LX2
INT. SW
Y3
C2
HOMING
LX2-F
N2
X4
TMR/B
TM
RESET
TM-2
FLTR/RC
CARRIAGE MOTOR
CA
CRR/E
CFR/A
AUX. WINDING
CFR/B
TR/A
CRR/B
CRR/D
CFR/D
MAIN WINDING
BR
BRAKE WINDING
CLAMP MOTOR
CL
CLFR/A
CLRR/D
AUX. WINDING
CLFR/B
CLRR/B
CLRR/A
CLFR/D
MAIN WINDING

FIG. 17c.

SHARPENING OF ICE SKATES

This invention relates to a machine for the sharpening of ice skates, and finds special, although not exclusive, use as a coin-operated automatic machine capable of use by the general public and requiring no skill in its operation.

According to the invention, an ice skate sharpening machine includes clamp means arranged to clamp a skate blade in fixed position; a thin flat grinding wheel having its cross-sectional profile dressed to the desired cross-section of the skate blade edge; mounting means by which the grinding wheel is held with its plane in a plane containing the skate blade; driving means by which the grinding wheel can be driven at a suitable grinding speed; biasing means by which the driven grinding wheel can be brought towards the skate blade edge so as to engage and grind that edge to the said desired cross-section; traversing means by the grinding wheel is moved along the skate blade to grind all appropriate parts of the skate blade edge.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a schematic representation of a coin-operated automatic ice-skate sharpening machine;

FIG. 2 is a diagram showing how a pair of ice skates are inserted into the machine of FIG. 1;

FIG. 3 is a diagram showing how certain adjustments are made to the machine so that it may accommodate different sizes of skates.

FIG. 4 is a diagrammatic plan view of skate clamping means in the machine of FIG. 1, and is taken on the line IV—IV of FIG. 3;

FIG. 5 is a diagram showing the movement of a grinding wheel during sharpening of the two skates;

FIG. 6 is an edge view of the grinding wheel shown in FIG. 7;

FIG. 7 is a transverse section of a skate blade and shows the concave edge profile produced by the machine;

FIG. 8 is a sectional front view of an upper part only of the machine shown in FIG. 1;

FIG. 9 is a sectional plan view taken immediately below a top plate of the part of the machine shown in FIG. 8, parts of the machine remote from the section plane being omitted for purposes of clarity;

FIG. 10 is a plan view of a movable carriage shown in FIG. 8;

FIG. 11 is an end view of the carriage shown in FIG. 10, taken from the right-hand side of FIG. 10;

FIG. 12 is an end view of the lower left-hand side only of FIG. 11, this view being taken from the opposite direction, i.e. from the left-hand side of FIG. 10;

FIG. 13 is a front view of the carriage shown in FIG. 8, but is drawn to a larger scale than that Figure and also is partly broken away to show parts which are normally hidden;

FIG. 14 is a transverse section taken on the line XIV—XIV of FIG. 13 and as viewed in the direction indicated by the arrows;

FIG. 15 is a transverse section taken on the line XV—XV of FIG. 14 and as viewed in the direction indicated by the arrows;

FIG. 16 is a sectional front elevation of a skate toe locator device shown to a smaller scale in FIG. 8;

FIGS. 17A, 17B and 17C, when arranged one above the other in the manner indicated in FIG. 17D (which is located on the same sheet as FIG. 5), form the electrical circuit for a coin-operated automatic control system for the ice-skate sharpening machine of the previous Figures.

Referring first to FIG. 1, this is a diagrammatic representation of an automatic coin-operated ice skate sharpening machine. It will be seen the machine comprises a boxlike body 1 mounted on side legs or pedestal 3, and has its top for the most part open but with, at the front, a top plate 5 carrying the necessary coin-accepting and return mechanism 7 and several controls indicated at 9. A recessed-type lid 10 is pivoted to the top of the machine along one edge 10A and when lowered closes in the space behind the top plate 5.

The machine of FIG. 1 is complex, and before a detailed description of the machine is undertaken, the major mechanical features will be pointed out with reference to FIGS. 2 through 7.

FIG. 2 shows how two skates 11 and 13 (forming a pair of skates) are inserted by the operator into the machine of FIG. 1, the skates being inserted heel-to-heel in an upright position with the heel ends 11A and 13A of the two skates abutting against opposite sides of a center bar 15. Skate 11 rests on three spaced bottom locators 17,18 and 19, and skate 13 rests on three bottom locators 21,22 and 23.

FIG. 3 shows how two toe-locator assemblies 31 and 33 are then brought into contact respectively with the toe ends of skates 11 and 13, the operator effecting this movement using knob-like handles 31A and 33A respectively on the two assemblies.

FIG. 4 is a sectional plan view on the line IV—IV of FIG. 3 and shows how (when the preferred coin is accepted by the machine and certain necessary controls are set) two pairs of spring-loaded clamp bars 41, 41,43,45 and 47 lying parallel to the skate blades and with bars 41 and 43 respectively on opposite sides of blade 11 and bars 45 and 47 respectively on opposite sides of blade 13, are caused to move inwardly to clamp the two blades and hold them in position. This Figure shows how the bars 41 through 47 are carried by toggle links. Thus, associated with bar 41 is a pair of toggle links 51 and 53 both pivotally carried at one end by an axially movable rod 55 with link 51 pivotally connected at its other end to bar 41 and with link 53 pivotally connected at its other end by a pivot pin 57 to a main structural part 59 of the machine. Thus endwise movement of the rod 55 and its companion rod 61 on the other side of the skates, to the left in FIG. 4, causes the skates to be clamped between the bars 41 through 47, while subsequent movement of rods 55 and 61 to the right in FIG. 4 releases the two skates. It will be seen that the bars 41 through 47 act on the skate blades through small, generally rectangular blocks 63, and it will be shown in detail later that whereas the blocks nearer the center bar 15 are located against movement along the length of the skate blades, the outer blocks are moved lengthwise of the blades by the adjustment of the locator assemblies 31 and 33 to ensure that they will be positioned near the toe of the skate blade, despite the insertion of skates of different lengths.

FIG. 5 illustrates actual grinding operation on the skates. After the bottom locations 17 through 23 have been moved aside, a grinding wheel 65 having the profile shown in FIG. 6 is brought upwardly into contact with the heel end of skate 11, and then moved to the right in FIG. 5 while grinding a concave profile on the skate edge. The mounting of the grinding wheel and its driving motor is such that the grinding wheel is pressed upwardly against the skate with a substantially contact force. Since the grinding wheel 65 is repeated dressed to a convex curve 67 (see FIG. 6) with a radius of three-fourths inch, a concave transverse profile 69 (see FIG. 7) of this radius is formed on all parts of the skate blades which the grinding wheel touches during its movements between limiting left-hand and right-hand positions in FIG. 5. The approximate locus of the center of the driving wheel during a complete grinding operation is shown by the dashed line 71.

Now that the general form of the machine has been described, the more detailed showing of the practical machine is the subsequent figures will be described. It will be appreciated that much of the cabinet shown in FIG. 1 is provided merely to present the part accessible to the member of the public who is the operator, at a convenient height. Thus the opening through which the operator inserts the skates for sharpening has its lower edge at about 36 inches above the floor level, and this should be borne in mind in considering FIG. 8, which shows as a sectional front elevation of only the part of the machine which lies immediately below the level of plate 5.

In FIG. 8 one can readily identify the skates 11 and 13 to be sharpened, the toe locator assemblies 31 and 33, and the grinding wheel 65. These, and the other parts, are mounted and supported by a generally rectangular framework 75 which, as indicated in FIG. 1 is covered with suitable decorative panels which enclose the moving parts of the machine. Considering FIG. 8 in conjunction with FIG. 9, which is a plan view taken immediately below a top plate 77 shown in FIG. 8, it will be seen that the two assemblies 31 and 33 are slidably mounted on a shaft 79 which extends across the machine from left to right in FIG. 9 and is mounted at its ends respectively in two side parts 81 and 83 of the framework 75. These two assemblies carry flat blade or leaf springs 85 which carry blocks 63A described above as being used to clamp the toe ends of the skate blades. Blocks 63B used to clamp the heel ends of the skate blades are carried by flat blade or leaf springs 91 which are mounted on center bar 15. Also shown in FIG. 9 is the manner in which each of the two rods 55 and 61 is formed of a number of segments connected together by pivot pins 92, and in which an end part of each rod (to the left in FIG. 9) extends through a bracket 93 and beyond that bracket is screwthreaded and carries a compression spring 95 acting between locknuts and the bracket, and biasing the rod to the left in this figure. This left-wards movement renders the clamping of the skate blades effective. Aligned with the left-hand end of each rod 55 and 61 is a slidably mounted actuator 99 or 100, which on movement to the right releases the skate clamp. As shown in FIG. 8, each actuator is formed with a screwthreaded hole which contains a complementory shaft 101 or 102. Rotation of the screwthreaded shafts will displace the rods 55 and 61 lengthwise. A reversible clamp motor CL mounted on part 81 drived a chain sprocket 103 which through a chain 104 and sprockets 105A and 105B drives the two shafts 101 and 102. Rods 55 and 61 are supported at about their mid-lengths by extending through suitable bearings in lateral extensions of the centerbar 15.

The six bottom locators 17 through 23 (see FIG. 8) are mounted by pivot pins such as the pivot pin 106 on the plate 77, and are in the form of simple levers with their outer ends coupled by pivot pins such as pin 107 to an actuating rod 108. At one end (to the left in FIG. 9), rod 108 is connected to a crank pin 109 on a crank disc mounted on a vertical shaft 111. This is the output shaft or a locator motor LOC.

Also extending between the two side plates 81 and 83 is a screwthreaded lead screw 113, held against lengthwise movement by suitable locknuts. This lead screw serves to move a carriage 115 which carries the grinding wheel 65 and associated parts. As most readily seen in plan view FIG. 10, carriage 115 is slidably supported on two smooth rods 117 and 119 which extend between the side parts 81 and 83 and are carried thereby. The carriage has suitable low-friction slider bearings 121 and 123 engaging the two rods, and the carriage also carries a nut member 125 which engages the lead screw 113 so that rotation of the lead screw causes movement of the carriage in the appropriate direction. A carriage motor CA is mounted on side plate 83, and drives a chain sprocket CAS connected by a chain 126 to a sprocket 1135 on lead screw 113 and to a sprocket BRS on a brake BR. Brake BR is a spring loaded brake which is released by the application of an electric current, as indicated in FIG. 17C.

Carriage 115 carries a sub-chassis 127 (see FIG. 14) mounted on a pivot shaft 129 extending transversely of the direction of movement of the grinding wheel 65. To the left of this shaft 129, the sub-chassis carries a driving motor GR coupled by a V-belt 133 to a driving pulley 135 positioned to the right of the shaft 129, and mounted on a shaft 137 which carries the grinding wheel 65. Also mounted on the sub-chassis are means by which the grinding wheel 65 can be turned up during use of the machine. Thus, in FIG. 12, is shown a pivoted arm 141 which carries a diamond wheel facing tool 143 and, as the arm oscillates, dresses the wheel profile.

FIG. 13 illustrates the manner in which a bracket 144 which carries 141 is pivotally mounted on the sub-chassis 127 by pivot pin 145 toward the righthand side of the carriage 115, and at its opposite end is connected by a swinging link 147 to a nut member 149 fitted on a vertical screwed rod 151 (see FIG. 11), so that appropriate rotation of rod 151 will raise the rear end of the arm 141 and so advance the diamond dressing tool 143 towards the axis of rotation of the grinding wheel 65. The rod 151 carries at its upper end a ratchet wheel 153 (see FIG. 10) which bears on the top of a plate-like part 127A of the sub-chassis 127. Mounted on the underside of the plate-like part 127A is an electric motor ARM having a driving pulley 157 coupled by a v-belt 159 to a larger driven pulley 161 mounted on a shaft 163 extending across the top of plate-like part 127A. At the further end, shaft 163 carries a first cam 165 and a second cam 167, which can be seen clearly in FIGS. 10 and 11. Cam 167 engages a roller 168 carried by a pin 168A on the sub-chassis 127. Since pin 168A is to the right of shaft 129, Cam 167 in one limiting position holds the right-hand end of sub-chassis 127 down, and in its other limiting position permits the right-hand end (and thus the grinding wheel 65) to rise.

Referring now to FIG. 10, it will be seen that an approximately triangular plate 169 is fitted under the ratchet wheel 153 and can oscillate on the same axis as that wheel. Plate **169** carries a pawl **171** spring loaded into contact with the ratchet wheel, while a detent rod **173** is spring biased into contact with the ratchet wheel and prevents reverse (i.e. anticlockwise) the outward end of plate **169** is pivotally connected to a plunger **175** of a solenoid ratch. A tension spring **178** biases plate **169** to the left. Each time the solenoid **177** is energized, the plate **169** rocks clockwise through a small angle and the pawl **171** advances the ratchet wheel **153** through an angular distance of one tooth. This raises the nut member **149** through a small distance and by swinging the bracket **144** advances the diamond dressing tool through a predetermined distance towards the central axis of the grinding wheel **65**.

Referring now to FIG. **12**, mounted on the bracket **144** is a further electric motor DR of the type including an integral speed reducing gear train, and output shaft **183** of this motor is caused to rotate at a relatively slow speed. A crank disc **185** mounted on this shaft carries a crank pin **187** connected by a link **189** to a pivot pin **191** mounted on the arm **141**, and as the motor drives the crank disc continuously in one direction, the diamond dressing tool **143** swings through a short arc which includes the profile of the grinding wheel **65**.

As is clear from FIG. **13**, the sub-chassis **127** carries a threaded shaft **195** extending towards the left of that figure, and a counterweight **197** is screwthreaded on the shaft and can be locked in adjusted position by a locknut **199**. Thus the force with which the grinding wheel **65** presses upwardly on the bottom of a skate to be sharpened can be adjusted by adjustment of counterweight **197**. Referring to FIGS. **14** and **15** it will be seen that pivot shaft **129** is locked against rotation in the sub-chassis **127**, and is rotatably mounted in two spaced ball bearings **201** carried by the carriage **115**. Beyond these ball bearings, the shaft is continued into a cylindrical damper chamber **203**. The part of the shaft within the chamber carries a cross vane **205** extending very nearly to the walls of the chamber and provided with small bleed holes **207**. Extending across the chamber towards and into close proximity to the shaft **129** are two fixed vanes **209**. The chamber is otherwise filled with hydraulic fluid through a hose **211** and a bore **213**. As a result, oscillatory movement of the sub-chassis **127** relative to the carriage **115** is severely damped, so preventing the build up of "chatter" as the grinding wheel works on the skates.

Referring now to FIG. **16**, this illustrates a preventative device mounted in the toe locator assembly **31**, a similar device being provided in assembly **33**. A plunger **215** positioned in a bore in the assembly is biased by a compression spring **217** to extend a short distance beyond the remainder of the assembly. The travel of this plunger is limited by a suitable stop, and typically is about one-sixteenth of an inch. When the operator slides the assembly **33** up against the toe of a skate, the plunger is moved only as the skate tip is firmly engaged by the assembly. The other end of the plunger is coupled through a very stiff spring **218** to the operating plunger of a microswitch RTSLS, so that the microswitch is operated only when the toe locator assembly is properly in position relative to the skate.

A vacuum dust collecting system is provided (see FIG. **8**) below the plate **77**, and comprises an electric motor VAC driving a fan **219** which draws dust laden air through ducts **221** having inlets positioned near the grinding wheel **65**. A filter unit **223**, similar to that used in a domestic vacuum cleaner, extracts the dust from the air before it reaches fan **219**.

As mentioned earlier, the apparatus is intended to operate substantially automatically, once the operator has taken certain initial steps, and to permit this automatic operation a number of limit switches are incorporated in the apparatus. Thus switch RTSLS in assembly **33** has been mentioned, and a corresponding switch LTSLS is provided in toe locator assembly **33**. FIGS. **17A**, **17B** and **17C**, when arranged one above the other as shown in FIG. **17D**, show the complete electrical circuit for the apparatus. It will be noted that the various limit, switches, motors and relays are given references which include letters that indicate the names allotted to the circuit components. These various items are set out in the following lists, which also indicate the figures on which they will be found:

Reference	See Figures	Name of component
Coin Mechanism	(FIG. 1)	
PSW	17A	Price switch
PG	17A	Pulse Generator
CREM	17A	Coin Return Electromagnet
STPR	17A	Stepper
INT.SW.	17A 17B 17C	Interrupter Switch
HR	17A	Homing relay with three poles designated HR-1, HR-2 and HR-3.
KKR	17A	Kicker
CRS	17A	Coin return solenoid (escrow unit)
CRSSW	17A	Coin return solenoid switch
CBS	17A	Cash box solenoid (escrow unit)
CBSSW	17A	Cash box solenoid switch
HSW	17A	Homing switch
CASW	17A	Cancel (coin return) switch

MISCELLANEOUS

F1	17A	Fuse
SW.1	17A, 1	on-off switch, 2 pole single throw. Poles SW.1/A and SW.1/B
LLSOL	17A, 1	Lid Lock solenoid
TVSW	17A	Test Vend Switch
DWS	17A and 1	Door switch (lid) 2 pole single throw. Poles DSW/A and DSW/B
FH SW SOL	17A	Figure/Hockey switch return solenoid
FH S SW	17B	Figure/Hockey selector switch with poles FHSSW/A and FHSSW/B
SCSSW	17B	Skate condition selector switch with poles SCSSW/A and SCSSW/B
JOG	17A 17B	Push button switch of the momentary make type
RESET	17C	Push button switch of the momentary make type
TM-1	17C	Cam operated switch on timer.
TM-2	17C	Cam operated switch on timer.
D1, D3, D4 D5	17B	Diodes
D2	17C	Diode
R1, R3, R4	17B	Resistors
R2	17C	Resistor
C1, C3, C4	17B	Capacitors
C2	17C	Capacitor
RATCH	10 and 17B	Ratchet solenoid
RATCH CTR	17B	Ratchet counter relay
BR	8 and 17C	Magnetic disc brake
LX1	17B	24 position stepping switch
LX2	17C	24 position stepping switch

Indicator lights (all glow discharge lamps)

OOSILT	17A	"out of Service" indicator light.
CRLT	17A	Coin return light labelled "Money Refunded"
CBLT	17A	Cash box light labelled "Operation Complete"

Relays

Certain of these relays are self-latching, and therefore have an operating coil (—/OC) and a release coil (—/RC). Such relays are marked *

*VR	17B	Vend relay. 2 poles. Latch-in. Operating coil VR/OC and release coil VR/RC
*TR	17B	Trip Relay. 3 poles. Latch-in. Coils TR/OC and TR/RC.
*DR	17B	Dresser relay. 3 poles. Latch-in. Coils DR/OC and DR/RC
*LR	17B	Locator relay. 2 poles. Latch-in. Coils LR/OC and LR/RC
*FLTR	17C	Fault relay. 3 poles. Latch-in.
CRTR	17A	Coin return relay. 2 poles.
CBR	17A	Cash box relay 2 poles. Contacts CBR/C are make-before-break.
CLFR	17A	Clamp (motor) forward relay. 4 poles.
CLRR	17B	Clamp (motor) reverse relay. 4 poles
CMSR	17A	Carriage motor start relay. 2 poles
CFR	17B	Carriage forward relay. 4 poles
CRR	17B	Carriage reverse relay. 5 poles
TMR	17B	Timer relay. 2 poles.
FLTTR	17B	Fault trip relay. 2 poles
WWR	17C	Wheel wear relay. 1 pole.

RELAY CONTACT

The relay poles or contacts are indicated by the reference used for the relay, as set out above, with the addition of /A, /B, /C, /D and /E to indicate the various poles.

Motors		
LOC	8 and 17A	Locator motor. 20 rpm. 1/70 hp.
ARM	11 and 17A	Arm motor. 20 rpm. 1/70 hp.
DR	12 and 17B	Dresser motor. 20 rpm. 1/70 hp.
CL	8 and 17C	Clamp motor. 60 rpm. 1/15 hp.
CA	8 and 17C	Carriage motor. 350 rpm. 1/15 hp.
TM	17C	Timer motor. 1 rpm. With three lobe cam.
VAC	8 and 17B	Vacuum motor
GR	8 and 17B	Grinder motor. 3,450 rpm. ⅛ hp.

Limit Switches		
CLCLS	9 and 17A	clamps closed.
CLOLS	9 and 17B	clamps open.
LOLS	9 17A	Locator out.
LILS	9 17B	Locator in.
AOLS	9 13 17A	Arm open (grind)
ACLS	9 13 17B	Arm closed (dress)
CACLLS	10 17B	Carriage centerline position.
CARFLS	10 17B	Carriage right side figure.
CARHLS	10 17B	Carriage right side hockey.
CARMLS	17C	Carriage right side maximum
CALFLS	10 17B	Carriage left side Figure
CALHLS	10 17B	Carriage left side Hockey
CALMLS	10 17C	Carriage left side Maximum
DFCLS	12 17B	Dresser full cycle
DTRLS	12 17B	Dresser trip switch (30° lag)
WWMLS	13 17B	Wheel wear maximum, i.e. shut down required.
RTSLS	16 and 17A	Skate toe sensing switch right.
LTSLS	17A	Skate tow sensing switch left.

The machine is intended for use by unskilled members of the public, who will be able to make use of the machine upon paying a predetermined sum. An orthodox coin-freed mechanism is used for exacting payment, and does not really form part of the present invention. However, the most important features of that coin freed mechanism will be shown and described in order to facilitate a full understanding of the various electrical circuits.

The coin-freed mechanism includes a coin-accepting slot which will accept nickels, dimes and quarters, and this slot leads to a mechanical sorter which routes the different coins through different passages. As each coin passes, it operates pulse generator switch PG, and the number of times it operates that switch will depend upon the route being followed by the coin, i.e., by its value. Thus a nickel causes one pulse, a dime two pulses, and a quarter five pulses, each pulse being caused by a movement of the switch PG between its pair of contacts. These pulses energize the operating coil STPR of a stepping switch, so that the setting of this switch indicates what value of coins has passed through the coin slot. Associated with the stepping switch is a price switch PSW, which can be adjusted by the serviceman so that it closes when the said stepping switch reaches a position indicating that coins to the value of the desired service have passed through the coin slot. Thus, typically the charge will be a quarter, and when coins to a total value of a quarter have been entered and accepted, price switch PSW will close. The coin mechanism is of the type known as "escrow", and coins fed into it are held until the operation to be paid for is properly completed, whereupon they are released to a cash box. Otherwise, the coins are returned to the operator. Coin return solenoid CRS and coin return solenoid switch CRSSW, and cash box solenoid CBS and cash box solenoid switch CBSSW are associated with this mechanism. Should the device be out of order, then a set of mechanical fingers associated with the coin slot prevents the insertion of further coins. These are retracted when solenoid CREM is energized. Such a coin-freed mechanism is very well known in the art and is used in many different types of automatic vending machine.

Referring back to FIG. **1**, associated with the lid **10** is a mechanical operator for the door switch DSW, this being preferably concealed so that a user would not be able to identify the switch and operate it while keeping the door open. For example a magnet operating a reed switch can be used. The lid **10** also carries a claw **301** which can be engaged by a complementary member moved by the lid lock solenoid LLSOL. The controls **9** include: the figure/hockey selector switch FHSSW which is of a type which automatically resets to "FIGURE"; the skate condition selector switch SCSSW: the CANCEL (coin return) switch CASW.

On a back panel **303** of the machine is provided the on-off switch SW.1. Under a normally locked panel in plate **5** are: price switch PSW; test vend switch TVSW; kicker switch KKR; a set of push buttons controlling individually the switches marked JOG; a reset switch RESET. These are controls for use by an attendant should the machine require attention.

Referring now to FIG. **9**, the two limit switches CLCLS and CLOLS are shown, these switches being operated by a metal strip **305** carried by the rod **61** so that switch CLOLS is automatically closed when the rod **61** is displaced to the right, so that the skate clamps are released, and so that switch SLCLS is closed when rod **61** is fully displaced to the left, indicating that the skate clamps are closed.

It also shows limit switches LILS and LOLS which are operated by a pin **306** mounted on the rod **108** and are actuated to indicate whether the locators **19** through **23** are "in" or "out" (as shown).

Referring now to FIG. **10**, mounted on the top of the carriage **115** is a longitudinally extending bar **307** which carries the limit switches CALFLS CALMLS; CALHLS; CACLLS; CARHLS and CARFLS. In FIGS. **9** and **11** are shown cam bars **309**, **310** and **311** disposed above the carriage **115** and arranged to operate the limit switches referred to above.

Also shown in FIG. **11** are the two limit switches DFCLS and DTRLS associated with cam disc **165** mounted on shaft **163**. In FIG. **12** are shown limit switches DTRLS and DFCLS associated with cam **185A** driven by dresser motor DR.

The various relays and other devices which have not been shown in the Figures showing the mechanical details of the device, are mounted in a box **321** mounted under the cabinet panel. Thus the two stepping switches LX1 and LX2 are rotary switches each having twelve operating positions and arranged to be moved in a step-like manner by an internal mechanism from position to position. The switch LX1 is used to count the number of grinding passes carried out by the grinding wheel over a pair of skates, and is moved by pulses applied from the left hand switch CALHLS. The switch includes a front strip contact LX1-F which is contacted continuously by a contact Y1, and by a contact X1 except when that contact is opposite a notch N1. The switch includes a rear strip contact LX1-R which is contacted continuously by a contact Y2, and contacted only at certain times by contacts X2, X3 and X4 when they encounter a lug L1.

The switch LX2 is used as an overall timer to detect any hang-up in the operation of the machine, and to abort a skate grinding operation should an excessive time elapse between initiation of a skate grinding operation and the completion of the operation. It has twelve steps or positions and its stepping coil LX2 is energize periodically under the control of contacts TMR/A of the timer TM. The switch LX2 includes a front contact strip contact LX2-F continuously contacted by a contact Y3, and by a contact X4 except when that contact is opposite a notch N2. The switch includes a rear strip contact LX2-R which is contacted continuously by a contact Y4, and contacted only at certain times by contacts X5, X6 and X7 when they encounter a lug L2. These contacts X5, X6 and X7 are connected to the skate condition selection switch so that the time allowed for completion of a skate sharpening operation is adjusted to suit the number of passes to be carried out on the skates. This timer sounds an alarm if the operation is not completed in the permitted time.

The detailed operation of the machine will now be described. The machine is intended for use at ice rinks, and is intended to be used by members of the public who require their ice skates to be sharpened. By operator is meant the person operating the machine, and it may be assumed that the operator is an unskilled person following a list of printed instructions provided in a prominent position on the front of the machine.

The on-off switch SW.1 is put "on" by a member of ice rink staff, and in this connection in most areas it is not permitted for the on-off switch to be enclosed in any manner, so it is merely positioned at the back of the machine where it is not too accessible to misguided operators. It can if desired be omitted and the power lead plug used as an "on/off" device. The lid **10** is suitably biased to the open position shown by a small spring (not shown), in order to make the method of use of the machine more clear to potential users. As a result, the door switch DSW is open and both its contacts DSW/A and DSW/B (see FIG. 17A) are open. Since DSW/A is open, neither locator motor LOC or arm motor ARM can be energized, so that the locators **19** through **23** must remain in their effective positions while the grinding wheel **65** cannot rise to an effective grinding position.

The operator now places his two skates into the position shown schematically in FIG. **2** and in more detail in FIG. **8.** He then brings the two toe locator assemblies **31** and **33** inwardly, which ensures that the two skates are backed up against the center bar **15.** When this action is completed, the two toe locator sensing switches RTSLS and LTSLS are both closed. Up to this point, the coin mechanism cannot accept coins, since the solenoid CREM is not energized and therefore the mechanical fingers block the coin slot.

The operator now sets certain controls **9** (see FIG. **1**) and inserts his coin, typically a quarter. The controls involved include section switch FHSSW which must be set according to whether the skates to be sharpened are figure skates or hockey skates. It will be appreciated that hockey skates are ground along the full length of the blade, but figure skates include a set of teeth at the toe end which must not be included in the grinding operation. In view of the importance of this control, this control is arranged automatically to reset itself to "Figure" after each grinding operation is completed, since then no permanent damage can then be caused if the control is improperly set. This switch has the contacts or poles FHSSW/A and FHSSW/B, and through these the length of the blade which is ground is limited if a Figure skate is being sharpened.

A second control is the skate condition selector switch SCSSW which has three settings marked respectively "good", "fair" and "poor". This refers to the present condition of the skates, and ensures that a good pair of skates shall not be excessively ground, and that fair and poor pairs of skates will receive an appropriate amount of additional grinding.

Like most coin-fed mechanisms, the controls **9** includes a "cancel" coin return switch CASW, and a set of lamps namely lamp OOSILT, with the legend "OUT OF SERVICE", lamp CRLT with the legend "MONEY REFUNDED" and lamp CBLT with the legend "OPERATION COMPLETE".

After setting controls FHSSW and SCSSW and inserting his quarter, the operator closes the lid and from then onwards the operation is automatic. To prevent the automatic operation of the machine from being interfered with as a result of interference with the controls once an operating sequence has begun, the lid **10** is arranged when closed to cover substantially all the controls. However, the manually operable Cancel Switch CASW and the three indicator lights OOSILT, CRLT and CBLT are all exposed so that they are available to the operator at all times.

The coin mechanism may reject the coin offered to it and this is carried out by a purely mechanical part of the mechanism, which passes the coin to a coin return slot without actuating any of the switches shown and described above. Assuming the coin mechanism receives and accepts the appropriate coins, then switch PSW will close and the normal sharpening procedure will commence when the lid **10** is closed if certain basic conditions are satisfied: the main switch is closed (contacts SW.1/A and SW.1/B both closed;) the fault relay not energized (contacts FLTR/A, FLTR/B and FLTR/C in positions shown);

the lid is shut (door contacts DSW/A and DSW/B both closed);

the dresser relay DR not energized (contacts DR/A in position shown);

the trip relay not energized (contacts TR/C in the position shown);

both toe locator assemblies **31** and **33** properly engaged with toes of skates (limit switches LTSLS and RTSLS both closed);

the carriage in a central position, i.e. with the grinding wheel **65** below the center bar **15** (limit switch CACLLS CLOSED);

dresser in rest position shown (contact DFCLS closed).

When switch PSW closes, it energizes the vend relay VR and this through its contacts VR/A energizes the lid lock solenoid LLSOL. This lid lock is of the type which enables the lid to be closed when the solenoid is energized, but not to be opened once the solenoid is energized. Thus the energization of the lid lock solenoid before the lid is actually shut does not prevent closure of the lid, but of course until the lid is shut the lid switches DR/A and DR/B remain open and so prevent initiation of a grinding operation.

Usually the last condition to be satisfied will be the closure of the lid and thus closure of both switch contacts DSW/A and DSW/B. Thereupon power is applied (FIG. **17**A) through door switch DSW/A and normally closed contacts CLCLS and CLRR/C to the clamp motor forward relay CLFR. The contacts of that relay assume their "energized" positions so that clamp motor CL is energized for forward operation (see FIG. **17**C contacts CLFR/B, CLFR/A, CLFR/D) and shafts **101** and **102** are rotated to move the actuators **99** and **100** to the left in FIG. **9**, so permitting compressing springs **95** to move the two rods **55** and **61** to the left in FIG. **9**. The springs **95** thus force the four clamps bars **41** through **47** inwardly and, through the blocks **63** these clamp the two skate blades firmly in position. As movement of the actuators **99** and **100** is completed, the strip **305** moves to the left so that limit switch CLOLS opens and limit switch CLCLS closes. With the operation of limit switch CLOLS, the vacuum cleaning motor VAC is energized, so that extraction and filtering of dust laden air from near the grinding wheel commences. The timer relay TMR also is energized, and through its contacts TMR/B energizes the timer motor TM so that the stepping switch LX2 (used as a supervisory time control) is rendered operative.

Referring to FIG. **17**A, changeover of contacts CLCLS de-energizes the clamp forward relay CLFR, so that the clamp motor CL stops, and through contacts LOLS energizes the locator motor LOC. As will be clear from FIG. **9**, rotation of the shaft **111** of this motor moves the rod **108** to the left, and this causes the locators **17** through **23** to swing from the inserted position shown in FIG. **9** to a retracted position where they do not lie below the skate blades. As this movement is completed, pin **306** moves to the left to operate the contacts of limit switch LILS and LOLS.

The operation of contacts LILS (see FIG. **17**B) energizes the operating coil LR.OC of the locator relay LR, and the closure of contacts LR/A of this relay energizes the grinder motor GR. Thus grinding wheel **65** is started up.

The operation of contacts LOLS (see FIG. **17**A) de-energizes the motor LC, and energizes the motor ARM through contacts AOLS and JOG. Motor ARM drives the shaft **163** and thus the two cams **165** and **167**. Cam **167**, as mentioned above, acts on a roller **168**. Initially, the cam is in such a position that it holds the roller **168** down to stop the grinding wheel **65** from rising to an operative position. As the motor ARM drives the cam, this restraint is removed and the sub-chassis **127** rocks on shaft **129** so that the grinding wheel **65** rises to contact the superjacent skate blade. The second cam **165** operates the limit switch AOLS when the cam **167** has reached its limiting position, and as will be seen in FIG. **17**A this breaks the circuit to the motor ARM so stopping that motor.

The operation of contacts LOLS mentioned above, in addition to energizing the sub-chassis motor ARM, also energizes the carriage motor start relay CMSR (FIG. **17**A), and operates its contacts. Thus contacts CMSR/B (at the top of FIG. **17**B) close, to energize the carriage forward relay CFR. The operation of the contacts of this relay, contacts CFR/A, CFR/B and CFR/D (near the bottom of FIG. **17**C) energize the carriage motor CA to run in the forward direction, i.e. the carriage moves to the right in the drawings. The application of power to the brake winding releases the brake. The motor CA drives the lead screw **113** which, through the nut member **125** moves the carriage **115**.

Depending upon the setting of the Figure/Hockey selector switch FHSSW, either limit switch CARFLS or FARHLS will be effective when operated to break the power supply to carriage forward relay CFR, so restoring its contacts to the state shown in FIG. **17**C. The removal of power from the brake winding permits the brake spring to reapply the brake, bringing the carriage to an abrupt stop. Since the brake is applied only when no power is applied to the carriage motor CA, the time delay relay CFRTDR is provided to ensure that the brake will be able to bring the carriage to a complete halt before power is applied to move the carriage in the opposite direction. This relay is in shunt with relay CFR, but by the provision of R3, C3 and D3 does not release as quickly as relay CFR. By the action of time delay relay CRFTR, a short pause takes place, after the limit switch operates and after relay CFR applies the brake BR before the carriage reverse relay is energized.

Once relay CRR is energized, it is held its by it holding circuit contact CRRTDR/B, and the carriage motor CA is energized and drives the carriage to the left in FIG. **8**, the skate grinding operation being continued until the carriage reaches a left hand position determined by whether hockey or figure skates are being ground. The appropriate limit switch CALFLS or CALHLS is then operated, and the operation of the selected limit switch effects several operations:

a signal is provided to the stepper coil of the stepping switch LX**1**, the pass counter;

a signal is passed to the wheel dresser ratchet coil RATCH, (FIGS. **10** and **17**B) and advances the dresser towards the wheel axis by a set amount

the carriage motor CA is stopped;

the brake BR is applied;

the time delay relay CRRTDR remains energized for a short time and delays operation of the motor forward relay CFR:

relay CFR is later energized, starting the carriage motor CA running in the forward direction and releasing the brake BR;

the carriage moves to the right in FIG. **8**.

When the carriage is at the central position shown in FIG. **8**, the carriage center limit switch CACLLS is operated, and what happens then depends upon how the skate condition selector switch SCSSW has been set. If it was set to the "good" setting, so that only one grinding pass is required, then the stepping switch contact strip LX1-R will be at such a position that contact X2 will be connected to contact Y2 through the strip contact, and the trip relay operating coil TR/OC will be energized to operate that relay. By the operation of the contacts of that relay, several things happen:

the carriage motor CA is stopped, so that its brake is applied and the carriage brought to rest in its central position;

the vend relay trip coil is energized;

release of this relay through its various contacts releases the lid lock solenoid and the coin release solenoid CREM;

through trip relay contacts TR/B and switch ACLS the arm motor ARM is energized and this motor brings down the sub-chassis **127** carrying the grinding wheel **65** to a non-operative position;

when the sub-chassis reaches its lowest position, the switch ACLS changes its state and the motor arm is deenergized and the dresser motor DR is energized.

The grinding wheel **65** is still being driven, and the dresser motor swings the dressing tool **143** over the profile of the rotating wheel to dress it. The amount of material removed is determined by the amount the dressing tool has been advanced by the dresser ratchet RATCH.

At this point is is convenient to consider what would have happened if the skate condition selector switch had been set to "fair" or to "poor". In either of those cases, the trip relay would not have operated when the carriage reached its center position, and the grinding wheel **65** would have carried out a second grinding operation first on the right-hand skate, and then on the left-hand skate. Eventually the carriage would have come back to the central position for the second time, but this time the pulse received from the left-hand limit switch would have moved the stepping switch LX1 so that the contact X3 would have been engaged by the lug L1. If the selector switch was set to "fair", this would have initiated the operation of the trip relay already described above. However, this time, the dresser ratchet would have received a second pulse (from the left-hand limit switch) so that a larger amount of dressing of the grinding wheel would take place. If the selector switch was set to "poor", again the trip relay would not have been operated, and a third skate grinding operation would have taken place, to be terminated when contact X4 engaged lug L1. In that case, the dresser ratchet RATCH would have received three impulses from the left-hand limit switch, giving a still larger amount of dressing to the grinding wheel **65**.

During the dressing operation, after the first few degrees of rotation of the crank disc **185** from the full cycle position of FIG. **12**, the limit switch DTRLS is operated, and this operates the trip relay release coil TR/RC. The dresser motor is then operating under control of the full cycle limit switch DFCLS. After the dresser tool **143** has swung across the profile of the grinding wheel and returned to its original position, the limit switch DFCLS will operate. This stops the dresser motor DR, and at the same time energizes the locator motor LOC which operates to move the locators **19** through **23** back into place below the blades of the skates. When this action is completed, the limit switch LILS operates to de-energize the locator motor LOC and to energize the clamp release relay CLRR which, through its contacts shown in FIG. 17C energizes the clamp motor CL so that it operates to release the clamps which hold the skates in place. This operation of the clamp motor ceases as the clamp-open limit switch CLOLS is operated, and stops both the timer TMR and the vacuum cleaner motor VAC. This action of switch CLOLS also energizes the release coils DR/RC and LR/RC of the dresser and locator relays. Operation of the dresser relay through contacts DR/A releases the lid lock solenoid LLSOL. Following operation of the limit switch CLOLS, a pulse is applied to the solenoid FHSW.SOL, which operates mechanically on the selection switch FHSSW to return it automatically to the "figure" setting. A pulse is applied to the cash box solenoid to release money to the cash box, and the "operation complete" light CBLT is energized. A holding circuit through contacts DSW/B keeps this light on until the lid 11 is raised.

The skates have now been ground; the grinding wheel has been dressed; the skates have been freed; the lid lock is released; the coins stored in the escrow unit have been transferred to the cash box; and the operator can open the lid and remove the sharpened skates.

It will be appreciated that, in order to facilitate servicing of the machine, a number of electrical controls are provided which are not involved in normal operation of the apparatus. Thus the various JOG switches and the kicker relay are provided for the assistance of a serviceman in moving the various parts during maintenance and repair. Since the present is a description of the manner of operation, rather than of maintenance and repair, no detailed discussion of the use of these other items appears necessary. However, for completeness it is mentioned that if, for example, the carriage should overrun so that one of the "maximum" limit switches CALMLS and CARMLS is operated, then this establishes a circuit which energizes the fault trip relay FLTTR, which in turn through its contacts energizes the trip relay TR which, as described above in connection with the termination of a skate grinding operation, bring the grinding wheel down out of contact with the skates and closes down the operation, releasing the skates and permitting the lid **11** to open. It also through its contacts FLTR/B releases the money in "escrow" to the money return slot, and causes the "money refunded" light CRLT to be energized.

When the grinding operation is terminated because of a fault condition, the fault relay is mechanically latched in, and can be released only by operation of a reset switch RESET shown in FIG. 17C and effective to energize the release coil FLTR/RC of this relay.

The two stepping switches LX1 and LX2 automatically step-on to a "home" position when the automatic cycle is completed, and the timer TM also is reset to zero.

The limit switch WWMLS and the dresser counter RATCH CTR monitor the amount of dressing which has been carried out on the grinding wheel. As a result of repeated dressing, the diameter of the wheel 65 decreases, and the counter RATCH CTR is available to a maintenance engineer and can be read to see how many dressing steps have been carried out on the wheel. He can then see whether the dressing wheel is due for replacement. Should for any reason the dressing wheel not be replaced, and tend to become too small in diameter, in due course the limit switch WWMLS will become operates. When this happens, initially nothing unusual happens, and the skate sharpening operation during which the switch trips is carried on to completion. However, during the closing down stages of the skate grinding operation, relay FLTR is energized but not relay FLTTR. As a result, the next time money is inserted into the machine and accepted, a circuit is established through contacts HR-1 (in FIG. 17A) lead Z6, limit switch WWMLS (FIG. 17B), and lead Z13 to wheel wear relay WWR (FIG. 17C), closing its contact WWR/A to energize the fault relay FLTR/OC. This sets up the normal fault close down operation, the money being returned to the operator, the skates being released, and the out-of-service OOSILT becoming illuminated.

It will be seen that the skate sharpening machine which has been described above can be operated by unskilled persons, and subject to the following of simple if not foolproof operating instructions, will automatically sharpen a pair of skates to a suitable degree. Further, it will continue to do this for a considerable period of time, because of its built-in ability to redress the grinding wheel automatically in accordance with the amount of work done by the grinding wheel during a sharpening operation. The machine can accept and sharpen satisfactorily both Figure and Hockey skates, and skates of all normally encountered sizes. The unskilled operator is fully protected against injury during the operating cycle, and should any fault develop the money in escrow is returned and the skates in the machine are released and made available to the operator.

The sharpening is a proper concave sharpening of the blade, and in the case of blades having (as viewed from the side) a curved edge, the grinding operation faithfully follows the existing curve.

I claim:

1. An ice skate sharpening machine including:
   a. clamp means arranged to clamp a skate blade in fixed position;
   b. a thin flat grinding wheel having its traverse cross-sectional profile dressed to the desired concave cross-section of the skate blade bottom edge;
   c. mounting means by which the grinding wheel is held with its plane in a plane containing the skate blade;
   d. driving means by which the grinding wheel can be driven at a suitable grinding speed;
   e. biasing means by which the driven grinding wheel can be brought towards the skate blade edge so as to engage and grind that edge to the said desired cross-section;
   f. traversing means by which the grinding wheel is moved along the skate blade to grind all appropriate parts of the skate blade edge.

2. A skate sharpening machine according to claim 1, and in which:
   a. the clamp means are arranged to clamp both skates of a pair of skates with their blades in alignment; and
   b. the said traversing means is adapted to move the grinding wheel along both skate blades in turn to grind all appropriate parts of both skate blade edges.

3. A skate sharpening machine according to claim 2, and in which:
   a. the two skates are arranged in heel-to-heel arrangement;
   b. limit switches are arranged to be operated as the said grinding wheel reaches an appropriate point near the toe end of each skate;
   c. the limit switches are arranged to stop forward movement of the grinding wheel by the traversing means when the grinding wheel reaches the said appropriate point.

4. A skate sharpening machine according to claim 2, and in which:
   a. a first limit switch is arranged near the toe end of the or each skate blade;
   b. a second limit switch is arranged nearer the toe end of the or each skate blade than is the said first limit switch;
   c. the first limit switch is arranged to terminate forward movement of the grinding wheel at a first appropriate point when a "figure" skate is being ground;
   d. the second limit switch is arranged to permit forward movement of the grinding wheel beyond the said first appropriate point as far as a second appropriate point when a "hockey" skate is being ground.

5. A skate sharpening machine according to claim 1, and in which:
   a. an abutment is provided against which the heel end of each skate blade is placed;
   b. a movable toe locator is movable along the direction containing the said skate blade to engage the toe end of the skate blade;
   c. switch operating means movable with the said toe locator are arranged to operate a limit switch when the said grinding wheel reaches a predetermined point near the toe end of the skate;

   whereby different sizes of skates can be sharpened in the machine and excessive forward movement of the grinding wheel is prevented despite the insertion of different size of skates.

6. A skate sharpening machine according to claim 1, and in which

   grinding wheel dressing means are provided by which the profile of the grinding wheel can be dressed.

7. A skate sharpening machine according to claim 6, and in which:
   a. an automatic system provides operation of the wheel dressing means;
   b. a presettable control determines the degree of dressing to be given to the grinding wheel in a single operation.

8. A skate sharpening machine according to claim 1, and in which;
   a. an automatic control system is provided;
   b. the automatic control system determines the actual grinding of the (or each) skate blade;
   c. the automatic control system automatically effects any necessary redressing of the grinding wheel.

9. A skate sharpening machine according to claim 1 and in which:
   a. an automatic control system is provided;
   b. the automatic control system determines the number of times the skate blade will be ground, in accordance with the setting by an operator of a variable control.

10. A skate sharpening machine according to claim 1, and in which:
   a. an automatic control system is provided;
   b. the automatic control system determines the actual grinding of the skate blade.
   c. a coin-operated mechanism controls the automatic control system, whereby a grinding operation takes place only if an acceptable coin is first fed to the coin-operated mechanism.

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