Sept. 7, 1954 W. G. WINKLER ET AL 2,688,217

BOWLING ALLEY SANDING MACHINE

Filed July 6, 1951 4 Sheets-Sheet 1

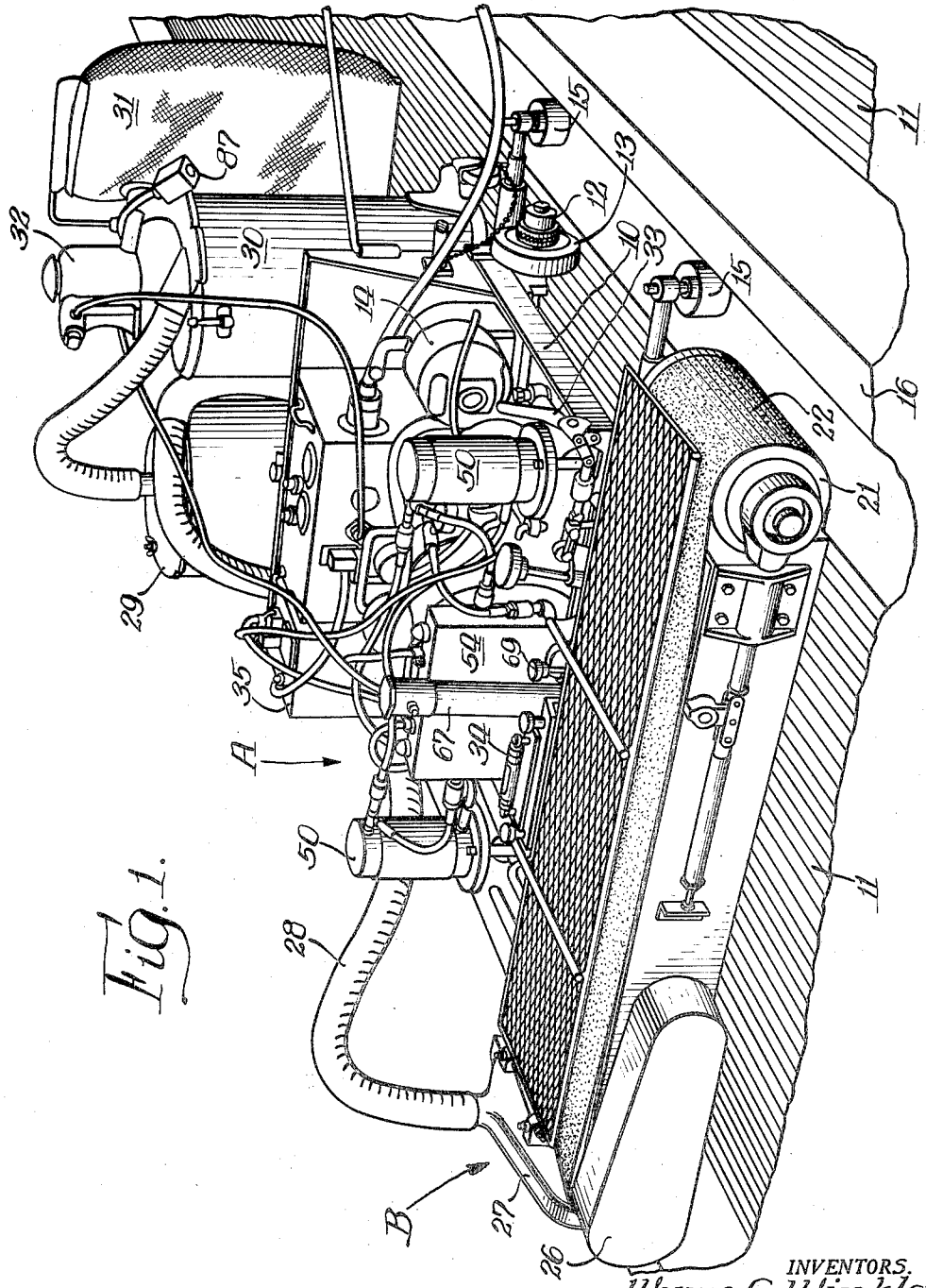


Fig. 1.

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Fig. 2.

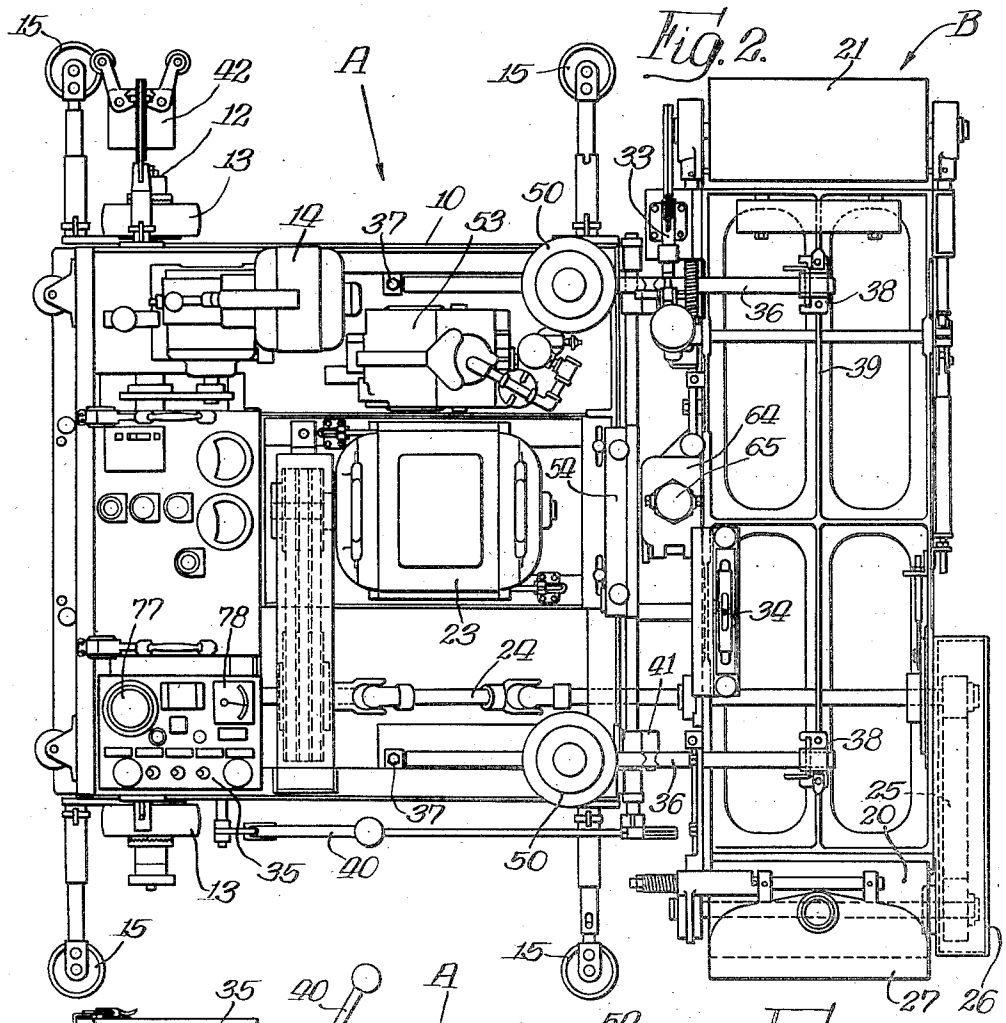
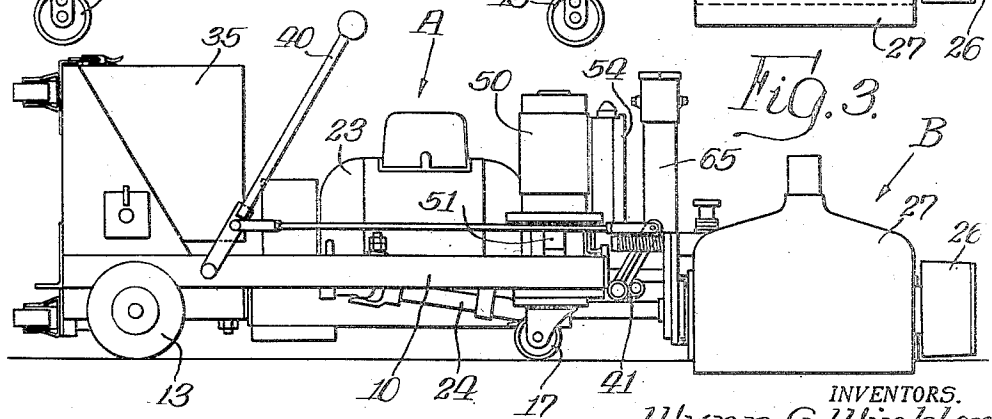


Fig. 3.



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BOWLING ALLEY SANDING MACHINE

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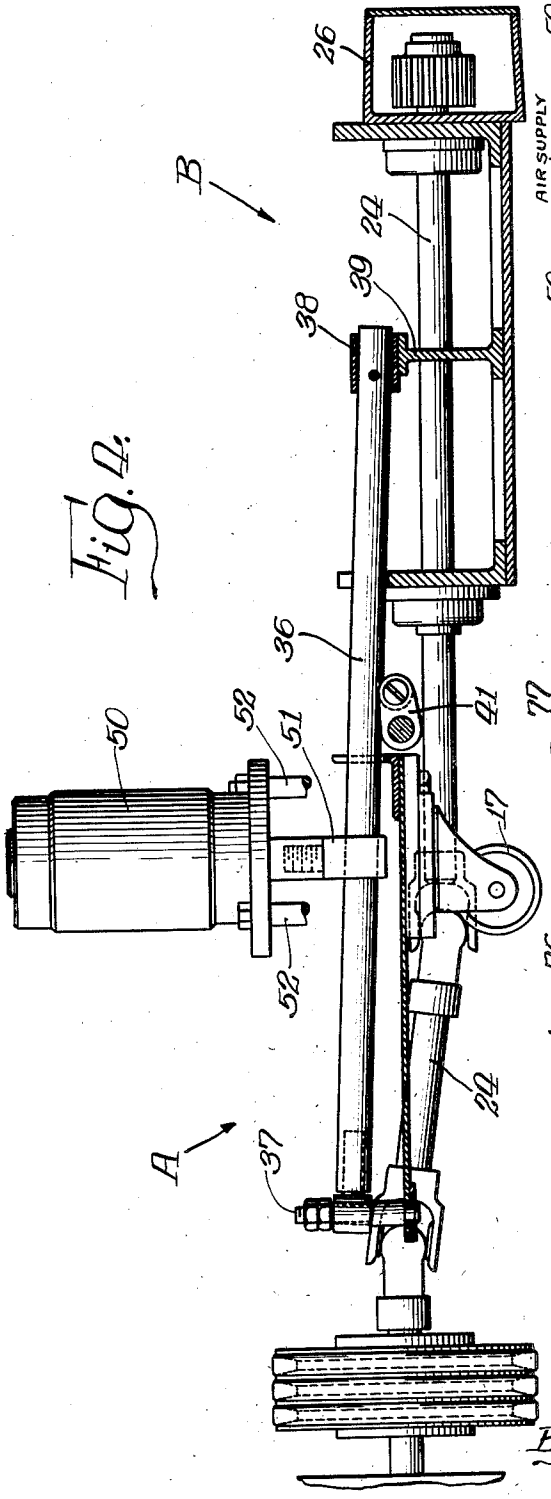


Fig. 2.

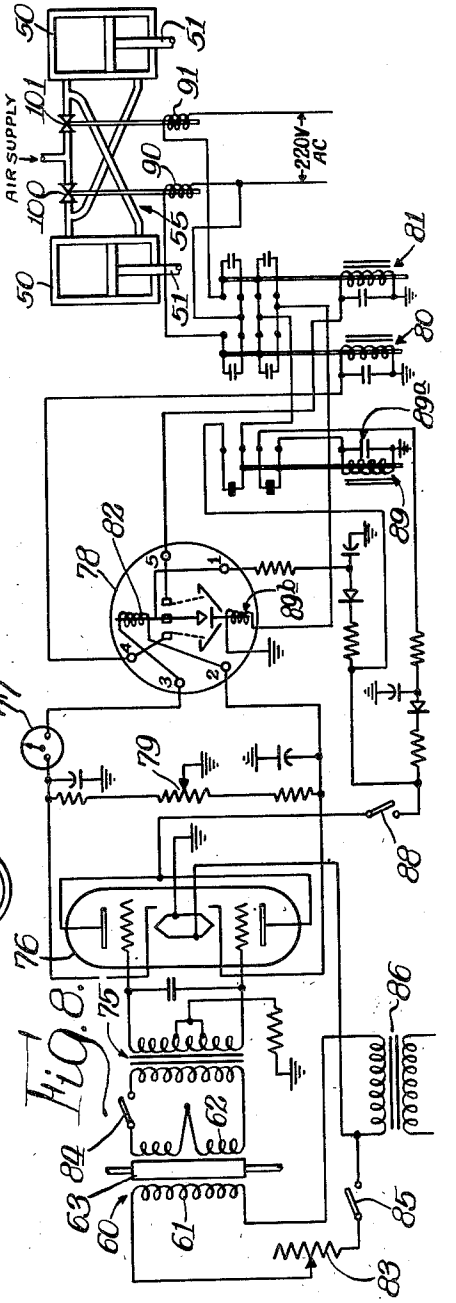


Fig. 8.

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BOWLING ALLEY SANDING MACHINE

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Fig. 5.

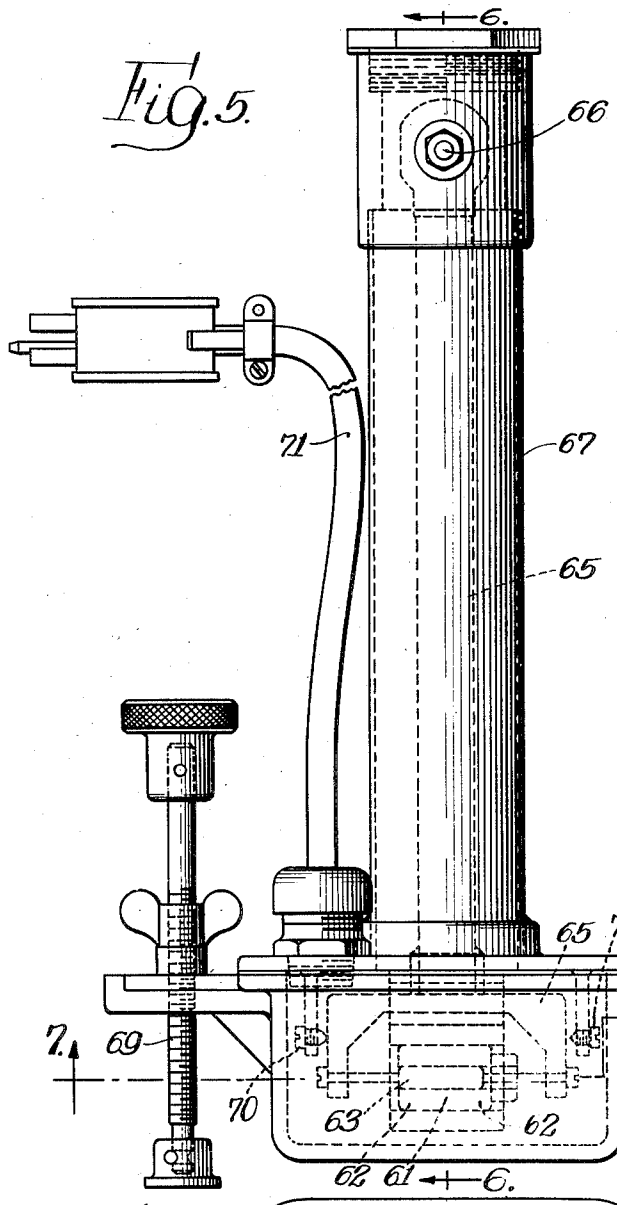


Fig. 6.

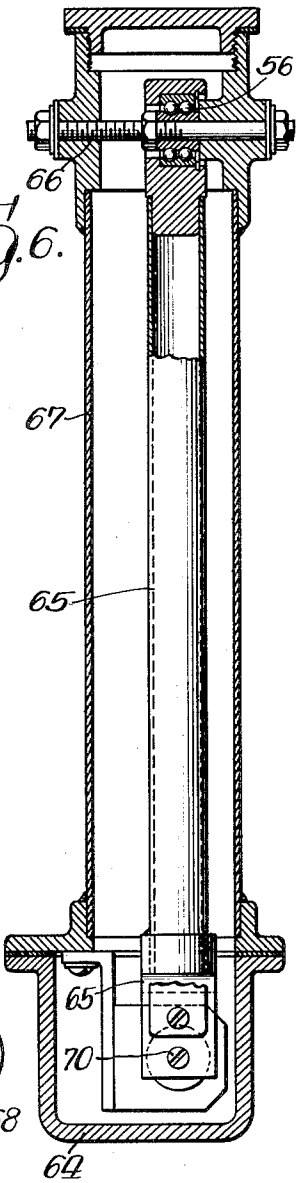
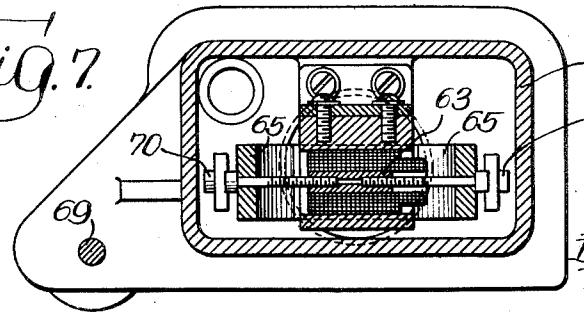


Fig. 7.



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UNITED STATES PATENT OFFICE

2,688,217

BOWLING ALLEY SANDING MACHINE

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Application July 6, 1951, Serial No. 235,498

15 Claims. (Cl. 51—174)

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This invention is concerned with a bowling alley sanding machine and more particularly to the particular means employed for obtaining an alley as nearly level as possible from side to side by sanding with the machine.

The primary object of this invention is to provide a bowling alley sanding machine of new and improved design.

Another object of this invention is to provide a bowling alley sanding machine having a chassis for rolling over the alley and a sanding platen which is maintained in a position to sand the alley transversely to nearly level or level within predetermined specifications.

Another object is the provision of a device of the character described in which novel and improved means are employed for the purpose of shifting weight between the chassis of the device and the sanding platen so that high areas in the alley are sanded more heavily and the low areas are sanded to a lesser degree.

Another object is the provision of a machine of the character described in which control means are provided for allowing the machine to sand the alley to a tolerance less than .040 of an inch out of level transversely of the alley.

Another object is the provision in a machine of the character described of a completely automatic control for sanding the alley substantially level transversely and a manual control substitutable for the automatic control.

Other features, advantages and objects of the invention will be apparent from the following description of a preferred embodiment of the invention illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of the machine sitting in operating condition on a bowling alley; Fig. 2 is a plan view of the machine with certain parts removed for purposes of clarity; Fig. 3 is a side elevational view of the machine as shown in Fig. 2; Fig. 4 is a fragmentary vertical sectional view taken through one of the rods or tongues connecting the carriage and sanding platen; Fig. 5 is a side elevational view of the pendulum included in the control; Fig. 6 is a sectional view of the pendulum taken along line 6—6 in Fig. 5; Fig. 7 is a sectional view taken substantially along line 7—7 in Fig. 5; and Fig. 8 is a diagrammatic line illustration of the control circuit and the operating devices.

While we have shown and shall hereinafter describe a preferred embodiment of this invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

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The alleys upon which the game of bowling is played are ordinarily made of wood about 42 inches wide and extending from the player's end to the opposite end upon which the bowling pins are placed in a particular pattern. The object of the game, of course, is to bowl over as many of the pins with one throw of the ball as is possible. The accuracy with which a ball may be rolled down the alley toward the pins may depend, in part at least, upon the condition of the alley surface. The American Bowling Congress has specified that alleys upon which its sponsored tournaments are held shall be not more than .040 of an inch out of level across the alley. Continued use of alleys, of course, results in wear of the surface and in time results to considerably more than the limit established by the American Bowling Congress. Rotary or drum type of machines are not able to provide such accurate sanding and are not automatic in operation. A cut and try method of sanding is not desirable as the end result is not uniform from alley to alley.

The present invention provides a sanding machine which may automatically run back and forth on an alley and, by successive sanding cuts, level the alley transversely thereof to tolerance much less than that required by the American Bowling Congress. The machine of the present invention accomplishes this result by automatically sanding heavier on the high spots in the alley until all areas are substantially level with all other areas. An important feature of the invention contributing to this result is the accurate control of the machine that is afforded by this invention.

A general understanding of the mechanical parts of the machine is necessary to an understanding of the control utilized. The machine is comprised of two general parts, a carriage A and a sanding platen B. The carriage is formed of a base frame 10 adapted to track on the alley 11 by rolling on a fixed axle 12, having wheels 13 thereon, through which the machine is driven by means of a motor 14. A clutch mechanism is provided so that the motor 14 may be disconnected from the wheels 13 to permit manual moving of the machine from one place to another. The front end of the carriage is supported on swivel casters 17 at each front corner. The carriage is also provided with guide wheels 15 at its four corners which are so arranged to engage the rails 16 be-

tween alleys 11 to keep the machine in a straight path along the alley.

The sanding platen is a rather heavy structure having a carefully machined bottom with a driving roller 20 at one end and an idler roller 21 at the other end, over which a continuous sanding belt 22 may be passed. The sanding belt is driven by means of a drive motor 23 carried on the carriage and connected by means of a universal-joined drive shaft 24 extending in front of the carriage to the platen and driving the sanding belt by means of a chain drive 25 connected with the driving roller 20. Ordinarily a protective housing 26 covers the driving chain 25 to prevent injury to workmen. All dirt, grit and sawdust picked up by the sanding belt will be conveyed to the left-hand side of the sanding platen, as viewed in Fig. 1, and picked up by a suction nozzle 27 which conveys, by means of flexible tube 28, all such material to a water bath tank 29, dust tank 30 and dust collector bag 31 towed at the rear of the carriage. The dust collector apparatus is driven by an electrical motor 32 mounted on the top of the dust tank.

The sanding platen idler roller 21 is mounted for movement longitudinally of the platen by a belt-tensioning device 33 so that the belt may be changed when desired. Ordinarily the sanding platen rests directly on the alley bed and provision is made for lifting the sanding platen so as to carry its weight on the carriage when it is desired to change the sanding belt.

The carriage and platen are secured together, as best seen in Fig. 4, by a pair of rods or tongues 36 each of which is loosely pivoted on an upstanding stud 37 secured to the carriage at one end and at the other end is pinned in a sleeve 38 secured to the center rib 39 of the sanding platen. These connections are both loose and ordinarily serve to carry the platen along with the carriage as it tracks over the alley. Both rods or tongues 36 are mounted adjacent the longitudinal edges of the carriage frame. The lifting device previously referred to includes a hand lever 40 pivoted to the frame 10 for actuating cams 41 resting directly under the tongues 36 at the front of the carriage. By pulling the hand rod 40 rearwardly of the machine the cams 41 raise the tongues 36, thus elevating the sanding platen off the alley.

The machine is automatic for the purpose of traversing the alley from one end to the other. The drive motor 14 is a single phase reversible motor and is connected with a limit switch 42 arranged at one side of the carriage for contact with fixed members attached to the alley. Upon contact of the limit switch with a fixed member at either end of the alley, the drive motor 14 is reversed and the machine then travels in the opposite direction until it reaches the other end of the alley when the direction of movement is again reversed. The reversing movement is accomplished without disturbing the sanding operation of the platen since the sanding belt drive motor 23 is independent of the motor 14 used to move the machine.

Since the sanding platen rests directly on the alley bed and the connections between the platen and the carriage are fairly loose, the platen follows the contour of the alley as the machine traverses from one end to the other, giving a result of sanding the alley in its original contour. Such is not the desired result and therefore the machine of this invention is provided with a control designed to sand the alley by a plurality of cuts to a final level condition. In general, the control operates on the connecting tongues between the carriage and platen to lift weight of the platen on the low side thereof and to press downwardly on the platen on the high side thereof to effect heavier sanding on the high areas of the alley and sanding to a much lesser degree on the low areas. This operation continues throughout the sanding passes of the machine until the alley bed is sanded substantially level within certain tolerances. In effect, the control apparatus transfers weight of the platen to the carriage whenever a low area is reached and also transfers carriage weight to the platen over high areas of the alley.

The physical structure by which such weight shift is accomplished includes a pair of pneumatic cylinders 50 each having a reciprocal double acting piston therein connected by means of a downwardly extending eye 51 with the adjacent rod or tongue 36. These leveling cylinders are supported on a pair of posts 52 secured to the front of the carriage generally above the front casters 17. A small air compressor 53 is supported on the carriage and connected into an air-control box 54 on the front of the carriage. Solenoid-operated valves within the box 54 control the admission of compressed air to the control cylinders 50. The cylinders are so cross-connected that the admission of air to the top side of one also admits air to the bottom side of the other so that they operate concurrently in opposite directions and in opposition to the tilt of the platen in response to an unlevel portion of the alley. This connection is shown diagrammatically at 55 in Fig. 8. The air compressor may be regulated to provide compressed air at any desired pressure up to about 25 p. s. i. but is ordinarily operated at about 16–18 p. s. i. The sanding platen itself weighs approximately 220 to 240 pounds and the lifting force applied by the cylinders 50 is sufficient to reduce the weight of the platen over the lower side by about 80 pounds and to add a similar amount of weight to the platen over the high side.

The cylinders 50 are automatically controlled during travel of the machine over the alley by an electronic circuit so connected to operate the air valves 100, 101, which admit compressed air to the cylinders. The heart of this control circuit is a push-pull phase detector circuit obtaining its input from a transformer mounted on the sanding platen. In Fig. 8 this transformer 60 is shown as having a primary winding 61 energized with approximately 6.3 volts A. C. The secondary 62 is in two parts, series connected. The transformer has a sintered iron core 63 which is movable in either direction out of the windings. When the core is centered within the windings, no voltage is registered at the output of the transformer. Upon movement of the core in one direction, a voltage in phase with the supply voltage is present at the output; and when moved in the other direction, a voltage out of phase with the input voltage is present.

This transformer is mounted on the rear of the platen substantially in the center thereof in a housing 64 adapted to be secured to the platen (Figs. 5–7). The windings are held in secure position within the housing 64 in an oil bath, and the sintered iron core 63 is supported on a pendulum 65 pivotally mounted with ball bearings 56 on a shaft 66 in a housing 67 extending above the transformer housing 64. The pendulum housing is provided with one fixed support

68 and one vertically adjustable support 69 with which it may be secured to the rear of the sanding platen. A very fine adjustment is provided whereby the pendulum may be aligned accurately at right angles to the lower surface of the sanding platen. The length of the pendulum 65 is approximately 12 inches and since the alley bed is approximately 42 inches wide, a ratio is provided whereby .009 of an inch out of level on the alley will result in a movement of the core of approximately .0025 of an inch. Stops 70 are provided within the housing to limit the movement of the pendulum and thus the core 63 within the windings 61 and 62 of the transformer. An electrical lead 71 supplies the current to the primary and also the leads from the secondary of the transformer. It will be understood that upon movement of the sanding platen out of level once the pendulum has been properly positioned, will result in a movement of the core toward the low side of the platen, thus causing an output either in phase or out of phase with a supply voltage to the transformer.

The control circuit is intended to utilize the output of the transformer 60 to eventually operate the valves which control the admission of air to the cylinders 50 which level the sanding platen. The output of the transformer 60 is supplied to an impedance-matching transformer 75. The output of the transformer 60 will be proportional to the amount of motion of its core 63, and depending upon whether the output is in phase or out of phase with the supply voltage, a corresponding voltage will be supplied to the impedance-matching transformer, and thus to the grids of the two sections of the dual triode tube 76. The plates of the two triodes are connected together and to the main line voltage, thus having alternating voltages of equal magnitudes and in phase applied to them. The grids of the dual triode tube 76 may be impressed with a voltage in one case in phase with the plate voltage and in the other, out of phase with the plate voltage. Thus, in the section of the tube in which the grid and plate voltages are in phase, the average current through the tube will be increased over the quiescent state in which the grid voltage is zero and in the other section the average plate current will be decreased over the quiescent current. The cathode circuit of the tube is connected with a microammeter 77 and a second microammeter 78 in series. In the quiescent condition, depending upon whether the potentiometer 79 is properly adjusted to compensate for slight differences in the conductances of the two triode sections, no flow will occur and none will be registered on either of the microammeters. However, upon movement of the core in the transformer 60, the situation in the dual triode tube has changed to provide an increased current in one section and a decreased current in the other section so that the increased current will be registered on the microammeters 77 and 78. By a reversal of the movement direction of the core 63 of transformer 60, the increased current is provided in the other section of the tube and this current will cause the microammeters to register in the opposite direction.

The microammeters in the circuit are provided for two purposes. The scale of the microammeter 77 registers 125–0–125 and is for purposes of giving a visual indication of the position of the transformer 60 and thus the tipping of the platen and the condition of the alley immediately under the platen. The microammeter 78 is manufactured by Schaevitz Engineering Company and is designated a "Sensitrol." A flow of 25 microamperes will swing the needle of the "Sensitrol" into contact with one of the magnetic contact points 78–4 or 78–5. A separate timing circuit operates to release the needle from the contact point about every four seconds. The microammeter 78 has an operating coil 82 which is in circuit with microammeter 77.

The microammeter 78 registers 25–0–25 microamperes and provides the means for energizing relays 80 and 81 which close the circuits to solenoids 90 and 91 which in turn open either valves 100 or 101. Since the output current of the transformer 60 is proportional to movement of the core, the amount of tipping of the platen will be registered on the microammeters. So long as the output is at least 25 microamperes, the needle of the "Sensitrol" 78 may make contact with either point 78–4 or 78–5, thus energizing one or the other of the relays 80 or 81 which close the circuits to the solenoids. A gain control in the form of a potentiometer 83 is provided in the circuit to the primary winding of the transformer 60 which is mounted on the platen for the purpose of varying the sensitivity of the circuit. Under conditions of greatest sensitivity, a tipping of the sanding platen as much as .009 of an inch out of level will result in an output from the transformer sufficient to give 25 microamperes current to close the circuit to one or the other relays 80 or 81.

Various controls are provided within the circuit for convenience of checking, such as a manual relay switch 88 which may be used to cut out the relays 80 and 81 whereby the vertical position of the pendulum holding the core 63 of transformer 60 may be checked with a bubble tube 34 mounted on the sanding platen and accurately positioned with relation to the bottom sanding surface thereof. A manual switch 85 may be thrown to cut off the supply current from transformer 86 to the primary transformer 60. A manual switch 84 may be thrown to open the line between the secondary winding 62 and the transformer 75.

The circuit utilized for disengaging the needle of the microammeter 78 from one or the other of the contact points 78–4 or 78–5 includes a relay 89 and a condenser 89*a* connected in the circuit in such a way that when either of the contact points are closed with the needle of microammeter 78, this circuit to the releasing coil 89*b* is activated. This is accomplished by connecting this part of the control circuit so as to introduce current into it whenever one or the other of the operating relays 80 or 81 is energized.

Ordinarily an alley to be refinished is first gone over with a very rough sandpaper to remove the old surface finish. The alley may then be given several passes with a rough cut paper such as 30 or 50 grit under automatic control of the electronic circuit. The machine may be passed over the alley a sufficient number of times to level the alley within the tolerances permitted by the control circuit. To finish the alley preparatory to applying a new finishing surface, a very fine paper such as 100 grit is placed on the sanding platen and the machine is passed over the alley to take out all sanding cuts and scratches. Ordinarily this is done without the leveling control. A manual control is provided for inser-

tion in the circuit between the relays 80, 81 and the solenoids 90, 91. This manual control comprises a single pole, double throw switch by which the machine may be passed over the alley with the platen biased high on one side or the other or with the platen level. If desired, the manual control of the leveling cylinders 50 may also be used during other stages of the sanding procedure or in the event that the control circuit fails to operate properly.

For convenience of the operator, the visual controls of the electronic circuit are included in a control box 35 mounted on the rear of the carriage 10 and include the microammeter 77 and the "Sensitrol" 78. The manual control switch 87 is shown in Fig. 1 and may be held by the operator while walking behind the machine. The accuracy of the control may be checked at any time desirable by shimming the sanding platen to a level condition as indicated by the bubble tube 34 and opening the relay switch 88 whereby the vertical condition of the pendulum 65 may be checked on the microammeter 77.

By the provision of the machine of this invention and the control herein provided, all bowling alleys may be sanded to a tolerance much more stringent than that provided at present by the American Bowling Congress, and thus all alleys so treated will be uniformly level transversely thereof.

We claim:

1. A bowling alley sanding machine comprising, a carriage for tracking on the alley, a sanding platen in front of the carriage extending across the alley, a pair of rods at the sides of the carriage loosely connecting the platen and carriage for movement together lengthwise of the alley, a pneumatic cylinder secured to the front of the carriage over each rod with a double acting piston in each cylinder connected to the adjacent rod, a source of compressed air connected with the cylinders and means for admitting air concurrently to the top side of one piston and the bottom side of the other piston to lift one rod and push downwardly on the other whereby platen weight is transferred to the carriage on one side thereof and carriage weight is transferred to the platen on the other side thereof.

2. A bowling alley sanding machine comprising, a carriage for tracking on the alley, a sanding platen in front of the carriage extending across the alley, a pair of rods at the sides of the carriage loosely connecting the platen and carriage for movement together lengthwise of the alley, a pneumatic cylinder secured to the front of the carriage over each rod with a double acting piston in each cylinder connected to the adjacent rod, a pneumatic line connecting the lower side of each cylinder to the upper side of the other cylinder, a source of compressed air, and an automatic control responsive to tipping of the platen out of level to admit compressed air to one connected side of said cylinders to lift on the rod at the low side of the platen and to push downwardly on the rod on the high side of the platen.

3. A bowling alley sanding machine having a carriage adapted to track on the alley and a sanding platen in front of the carriage extending across the alley, means for transferring weight of the platen to the carriage whereby the alley may be sanded level across comprising, a rod at each side of the carriage loosely connecting the platen and carriage, and pressure applying means mounted on the carriage over said rods for lifting one of the rods whereby upward pressure applied to said rod may transfer weight of the platen to the carriage through the rod.

4. A bowling alley sanding machine having a carriage adapted to track on the alley and a sanding platen in front of the carriage extending across the alley, means for transferring weight of one end of the platen to the carriage and for transferring weight from the carriage to the opposite end of the platen to cause heavier sanding on said opposite end comprising, a pair of spaced rods loosely connecting the platen and carriage, a lifting device mounted over each rod between said connections and a control for selectively operating the lifting devices.

5. A bowling alley sanding machine having a carriage adapted to track on the alley and a sanding platen resting on and extending across the alley, lifting means mounted on the carriage and connected with the platen, and a control means for operating the lifting means in response to tipping of the platen out of level, said control means operating said lifting means to decrease the weight of the platen on the alley only on the low side of the alley when the platen tips out of level.

6. A bowling alley sanding machine adapted to sand an alley bed substantially level transversely thereof comprising, a carriage adapted to track on the alley, a sanding platen in front of the carriage extending across the alley, connecting means between the carriage and platen to secure them for movement together over the alley, lifting means mounted on the carriage adjacent the platen adapted to lift at least a portion of the weight of the platen by upward pressure applied to the connecting means, and control means for actuating the lifting means in response to tipping of the platen out of level.

7. A bowling alley sanding machine adapted to sand an alley bed substantially level transversely thereof comprising, a carriage adapted to track on the alley, a sanding platen in front of the carriage extending across the alley, a pair of tongues connecting the platen and carriage, a power unit mounted on the carriage adjacent each tongue and having means connecting the unit with the tongue, and a control means automatically operable in response to tipping of said platen out of level for actuating at least one of said power units to lift on the tongue adjacent the low side of the platen.

8. A bowling alley sanding machine adapted to sand an alley bed substantially level transversely thereof comprising, a carriage adapted to track on the alley, a sanding platen in front of the carriage extending across the alley, a pair of spaced tongues connecting the carriage and platen, said tongues being connected to the ends of the platen disposed adjacent the edges of the alley bed, a pressure applying unit mounted on the carriage adjacent each tongue, said units each being joined to the adjacent tongue intermediate its ends for applying pressure thereon to raise or lower the tongue, means interconnecting the pressure applying units for concurrent oppositely directed pressure applications thereof to transfer weight between the carriage and the platen, and control means adapted to actuate the pressure applying means upon tilting of the platen out of level to transfer part of the weight of the platen over the lower side of the alley to the carriage and to increase the effective weight of the platen over the higher side of the alley.

9. A bowling alley sanding machine compris-

ing, a carriage adapted to track on the alley, a sanding platen in front of the carriage extending across the alley, a pair of tongues loosely connecting the carriage and platen, a pair of reciprocal pneumatic units mounted on the carriage each connected to one tongue for raising and lowering the tongue, a source of compressed air connected with said units, valve means controlling admission of air to said units, and control means for automatically opening and closing said valve means in response to tipping of the sanding platen, said control being arranged to admit air to the pneumatic units so as to raise the tongue on the low side of the platen and press downwardly on the tongue on the high side of the platen.

10. A bowling alley sanding machine as specified in claim 9 in which the valve means are solenoid operated and the control includes means for energizing said solenoids upon tipping of the platen out of level.

11. A bowling alley sanding machine as specified in claim 10 in which said solenoids are energized by the control means upon tipping of one end of the sanding platen substantially less than .040 of an inch lower than the other end.

12. A bowling alley sanding machine as specified in claim 9 in which the control includes a transformer mounted on the platen and having a core suspended on a pendulum arranged at right angles to the platen, solenoids arranged to operate said valve means, and a circuit between said transformer and said solenoids whereby movement of the core sets up current in said circuit controlling energization of said solenoids.

13. A bowling alley sanding machine comprising, a carriage for tracking on the alley, a sanding platen resting on the alley in front of the carriage, means securing the platen to the carriage for movement over the alley therewith, pneumatic means for shifting a part of the weight of the platen to the carriage at either side of the platen whereby heavier sanding may occur on one side of the alley, and an automatic control circuit for operating said pneumatic means in response to tipping of the platen out of level including a transformer mounted on the platen with a movable core therein, said core being suspended on the lower end of a pendulum for movement with said tipping of the platen, said transformer having an output in phase with the supply voltage upon movement of said core in one direction and out of phase therewith upon movement of the core in the other direction, a detector circuit connected with the transformer and control relays operated from the detector circuit, said relays providing selective control of said pneumatic means for raising the platen on the low side thereof to provide heavier sanding on the higher side of the platen.

14. A sanding machine comprising a carriage adapted to track along a substantially straight path on the work to be sanded, a sanding platen in front of the carriage resting on the work transversely of said path, a pair of spaced tongues joining the platen to the carriage, a fluid pressure unit mounted on the carriage over each tongue for raising and lowering the respective tongues to cause said work to be sanded level and an automatic control for operating said fluid pressure units including an electrical circuit having a transformer therein mounted on the platen, said transformer having a movable core centered therein when the platen is level and movable toward the low side of the platen when the platen is tipped out of level, said transformer having an output voltage in phase with the supply voltage upon movement of said core in one direction and out of phase therewith upon movement of the core in the other direction, a detector circuit connected with the transformer and control relays operated from the detector circuit, said relays providing selective control of said fluid pressure units to raise the platen on the low side thereof and to press downwardly on the platen on the high side thereof whereby the work may automatically be sanded level.

15. A bowling alley sanding machine having a wheel-supported carriage adapted to track on the alley, a generally rectangular sanding platen disposed in front of the carriage extending across the alley and having its ends overhanging the edges of the alley, a substantially horizontal rod on each side of the carriage extending forwardly of the carriage and pivotally mounted to the carriage and the platen adjacent an end thereof, a pair of vertically disposed fluid cylinders mounted on the carriage above said rods, each of said cylinders having a reciprocal double action piston operatively connected to the rod disposed therebeneath, and means responsive to the out-of-level condition of the alley for simultaneously shifting said pistons in opposite directions to exert upward pressure on one of said rods and downward pressure on the other of said rods, the arrangement being such that part of the weight of the platen disposed over the low side of the alley is transferred to the carriage and the downward pressure of the platen over the high side of the alley is increased.

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