F. G. LYNDE.

MOTOR VALVE CONSTRUCTION.

APPLICATION FILED SEPT. 28, 1917.

1,311,660. Patented July 29, 1919.

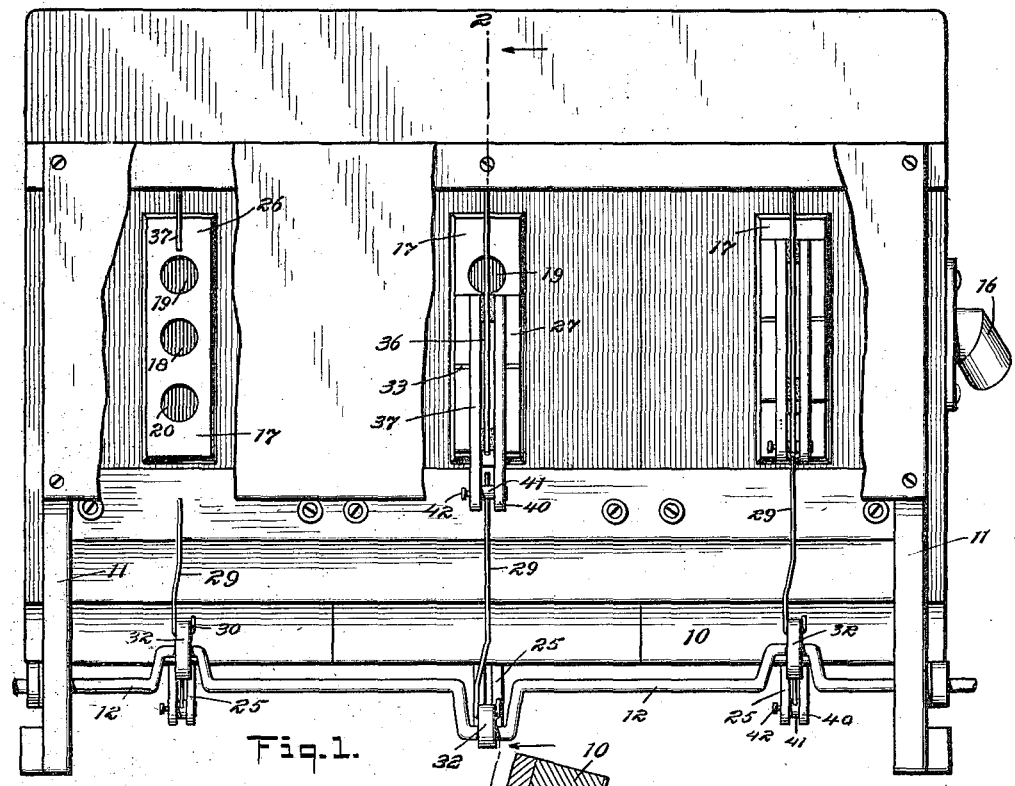


Fig. 1.

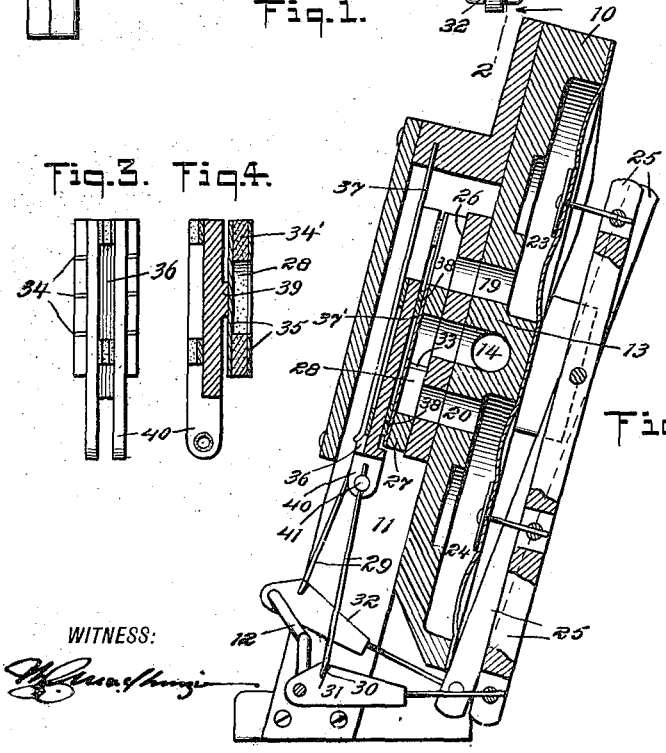
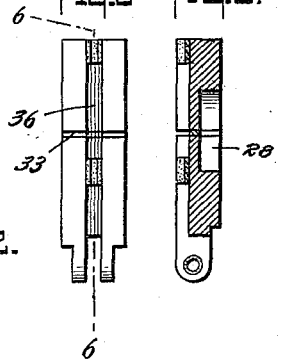


Fig. 2.

Fig. 3. Fig. 4.

Fig. 5 Fig. 6.



WITNESS:

INVENTOR

Frank G. Lynde

BY W. S. Orton.

ATTORNEY

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRANK G. LYNDE, OF NEWARK, NEW JERSEY, ASSIGNOR TO LAUTER COMPANY, OF NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MOTOR-VALVE CONSTRUCTION.

1,311,660. Specification of Letters Patent. Patented July 29, 1919.

Application filed September 28, 1917. Serial No. 193,650.

To all whom it may concern:

Be it known that I, FRANK G. LYNDE, a citizen of the United States, residing in the city of Newark, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Motor-Valve Construction, of which the following is a specification.

My invention relates in general to a pneumatically actuated motor of the type particularly designed for driving the take-up spool actuating mechanism in player pianos and particularly relates to improvements in the slide valves in such motors.

The efficiency of these motors obviously depends, among other features, upon the elimination, as far as possible, of leakage of the pneumatic power in its passage through the motor. In the slide valve control type of such motors it has been discovered that a large percentage of this wasteful leakage occurs between the slide block and its coacting guide plate. The engaging faces of the slide block and the guide plates are usually flat surfaces and theoretically should not leak. With careful workmanship the motors leave the factories with little, if any leakage at this place but after the device has been in use for a while some leakage develops presumably due to a slight warping of the engaging surfaces. These surfaces are preferably formed of wood but in order to eliminate this leakage attempts have been made to form the surface of different metals but this did not eliminate the leakage.

Accordingly one of the objects of this invention is to provide a simple form of slide valve in which the leakage is minimized.

I attain this object in general by forming one of the surfaces in its conventional flat form and to design the other surface so that it may flex itself and thus conform to any slight irregularities which may develop in the flat surface.

The sliding block is usually connected to an actuating crank-shaft and it has been found that this crank-shaft, especially when operating at the high speed usual with such a device, has a tendency to set up a waste motion in the slide block which tends to cause the same to rock transversely of its line of reciprocatory movement.

Accordingly, another object of the invention incidental to the general object to conserve the pneumatic power is to provide a type of connection between the actuating crank-shaft and the sliding block which will tend to minimize the transmission of any motion other than that which causes the desired reciprocatory motion.

I attain this object broadly by providing a loose connection between the drive shaft and the sliding block, which connection is designed to permit any incidental rocking of the connections without transmitting this rocking to the portion of the slide block which engages the guide plate.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of mechanism embodying my invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

Referring to the accompanying drawings:

Figure 1 is a front view in elevation of a preferred embodiment of my invention with parts broken away to show internal construction;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a view of the rear side of a form of slide block, slightly different from the block shown in Figs. 1 and 2;

Fig. 4 is a longitudinal sectional view through another form of slide block; and

Figs. 5 and 6 are views illustrating still another form of the slide block.

The motor includes a supporting frame 10 within the uprights 11 of which is journaled a driven multi-crank-shaft 12, designed to be connected with the mechanism to be driven, such as the take-up spool in the spool box (not shown). The motor illustrated is a six-point motor with the pneumatics arranged in pairs and otherwise resembling, in its general construction, the front portion of the motor forming the subject-matter of my co-pending application for pneumatic motors, filed June 16, 1916, Serial No. 103,918.

The motor proper comprises a vertically disposed combined support and tension box 13, preferably in the form of a flat board provided with a longitudinally disposed wind-passageway or tension reservoir

chamber 14 connected by the hose connection 16 to some suitable source of pneumatic power.

In the device illustrated there is shown three pairs of pneumatics similar in construction so that the description of any one pair will be sufficient for any other pair. Describing any one pair of pneumatics and its controlling valvular mechanism it will be seen that a guide plate 17 is fixed to the front of the tension box and is provided with three parallel and vertically spaced ports communicating with passageways extending into the board. The middle port 18 opens directly into the longitudinally extending wind-passageway 14 and the upper and lower ports 19 and 20 lead by means of their alined passageways directly into their corresponding pneumatics 23 and 24 mounted in the back of the tension box. Each pair of pneumatics, considered vertically, is designed to actuate a lever 25 and all of the levers are coöperatively connected to the crank shaft 12 to rotate the same by the vibration of the diaphragms as is usual with one known form of such devices.

The guide plate 17 is provided with a smooth outer face 26 constituting the working face for a coacting sliding block 27. The slide block is mounted for reciprocatory movement vertically and longitudinally on the outer face of its corresponding guide block. The contacting faces of the block and plate are made as flat as is mechanically possible in the construction of the device. The inner face of the slide block is provided with a pocket 28 having a dimension lengthwise, sufficient to cover the middle port 18 and one of the end ports 19 or 20 depending upon the limiting position of the slide block in either of its reciprocatory directions, but this pocket is of a length less than the length which would cover the three ports in the guide plate. The slide block is actuated by a depending valve rod 29, the lower end of which is bent laterally to form a pivoting pin 30 adapted to engage in an aperture 31 in a plate 32 constituting part of a connection with the crank-shaft 12 and arranged so that the rotation of the crank-shaft will reciprocate the slide block.

Different portions of that face of the slide block which engage the guide plate are flexible relative to each other, so that the slide block will tend to engage the surface of the guide plate even though it may have become warped during use.

One means of obtaining this flexibility is to form the block of two parts shown in Figs. 1 and 2, connected across the pocket by means of any air tight joint 33. This joint is preferably a strip of leather connecting the adjacent faces of the parts of the block, in such a manner that leakage will not occur through the joint. This connection is satisfactorily attained simply by gluing opposite sides of a leather strip to the contiguous ends of the block which has been sawed transversely across its center.

The one-joint construction shown in Fig. 1 had worked satisfactorily, especially where a high suction pressure is maintained in the tension passageway 14. It is understood of course that the vacuum in this passageway tends to maintain the parts of the valve block in close engagement with the adjacent portions of the guide plate.

As shown in Fig. 3, the block is similar to the block shown in Fig. 1, except that it is formed of four parts with three joints 34 thus providing a greater degree of flexibility than is present in the preferred form. In Fig. 4 the block is formed of a flat cork composition 34′ with fabric facings 35 on opposite sides which fabric covered cork board is designed to provide a highly flexible engaging surface for the sliding valve blocks. However, as the wooden blocks are susceptible of a high degree of polish, the preferred form is of an advantage, in that the frictional resistance is reduced to a minimum in the wooden blocks of relatively few parts.

In order to guide the slide block, the back thereof is provided with a longitudinally extending slot 36 in which is positioned a guide rod 37, one end of which is fixed to the tension box and the other end of which is free. This rod is of spring metal and bears gently on the back of the slide block, thus further tending to hold the same in close engagement with the face of the guide plate. By means of this free end construction of the guide rod, it is possible to spring the rod out of the slot and thus quickly release the sliding block from its engagement with the guide plate in case it is desired to replace the guide block or refinish or lubricate the surface of the guide plate.

In order to minimize any abnormal action of the crank shaft, or its connections, on the portion of the slide block which engages the guide plate, the connection with the guide plate is preferably a loose connection and for this purpose the portion of the block containing the slot 36 is in the form of a longitudinally extending guide strip 37′. Opposite longitudinal side portions of this strip are connected by means of a pair of leather buttons 38 to opposite sides of the portion of the block engaging the guide plate as shown in Fig. 2. As shown in the form of the invention illustrated in Fig. 4 the guide strip is fastened centrally to the plate engaging portion by means of a single projection 39. The lower end of the guide strip is formed into a pair of parallel projecting lugs 40 between which is supported a pivot pin 41 into which extends the upper end of the valve rod 29. A set screw 42 engages the valve rod to secure the same to the pin and provides a

means for adjusting the position of the rod relative to the slide block.

The slide block shown in Figs. 5 and 6 is connected directly to the rod 29 without the rocking connection shown in the other forms of the slide block. Where the crank-shaft and its connecting mechanism is formed of high class machine work, the rod 29 can be connected directly to the slide block without any material rocking effect from the crank-shaft.

In operation, it will be understood that the motor will operate as has been described in detail in my copending application above identified. In devices equipped with the flexible form of sliding blocks herein disclosed the parts of the blocks will ride across the face of the guide plate with sufficient play between the parts to cause the block to closely adhere to the surface of the guide plate even though it may be warped. The flat engaging surfaces are maintained as extensive as possible, so as to insure any easy sliding movement of the parts relative to each other and to reduce the possibility of the air passing between the block and guide plate.

Any movement which may be set up through the action of the crank-shaft will not be transmitted to the portion of the slide block engaging the guide plate so that the sliding block will be moved merely in its reciprocatory direction in which direction it will be guided by its guide rod.

While I have shown and described, and have pointed out in the annexed claims, certain novel features of my invention, it will be understood that various omissions, substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In a pneumatic motor, the combination of a guide plate having a working face provided with a plurality of openings therethrough, a slide block mounted for reciprocatory movement and having a working face engaging said working face on the guide plate to control said apertures and means for guiding the slide block parallel to said apertured working face, one of said working faces being flexible thereby to adhere closely to the other face as it is slid across the same and thus minimize leakage between the faces.

2. In a pneumatic motor, the combination of a tension box, a guide plate having a working face provided with an aperture opening therethrough and into the tension box, a slide block mounted for reciprocatory movement and having a working face engaging the working face on the guide plate to control said aperture, the working face of the slide block being flexible thereby to adhere closely to the working face of the guide plate and thus minimize leakage between the faces as the slide block is reciprocated back and forth across the guide plate.

3. In a pneumatic motor, the combination of a guide plate having a working face provided with an aperture opening therethrough, a slide block mounted for reciprocatory movement and having a working face engaging said working face on the guide plate to control said aperture, said block being formed of a plurality of parts coacting to form the working face in parts movable relative to each other during the movement of the block along the working face of the guide plate.

4. In a pneumatic motor, the combination of a guide plate having a working face provided with an aperture opening therethrough, a slide block mounted for reciprocatory movement and having a working face engaging said working face on the guide plate to control said aperture, said block being formed of a plurality of parts coacting to form the working face in parts movable relative to each other during the movement of the block along the working face of the guide plate, and an air-tight joint for flexibly connecting the parts.

5. In a pneumatic motor, the combination with a tension box designed to have an air pressure therein less than atmospheric pressure, of two valve members having engaging faces mounted to slide relative to each other, one of said valve members having an opening extending therethrough and open to the low pressure in said tension box thereby constituting pneumatic means acting on said members to maintain the same in sliding engagement, one of said members including a flexible sliding surface adapted to compensate for irregularities in the engaging faces of said members as they slide relative to each other, said flexible surface acting to minimize leakage between the members during their relative sliding movement.

6. In a pneumatic motor, the combination of two valve members having engaging faces mounted to slide relative to each other, one of said members having a pair of apertures extending therethrough, means for guiding said members relative to each other, pneumatic means acting on said members and tending to maintain the same in sliding engagement, one of said members including means for compensating for irregularities in the engaging faces of said members and thus minimizing leakage between the members, a driving member and a flexible connection between said driving member and one of said valve members.

7. In a pneumatic motor, the combination

of a member provided with a slide surface having an aperture opening therethrough, a block slidably mounted on said surface to control said aperture, said block including two parts and a joint connecting said parts whereby the parts are capable of relative movement, said joint extending transversely of the line of travel of the block.

8. In a pneumatic motor, the combination of a member provided with a surface having a pair of apertures opening therethrough, a block slidably mounted on said surface and provided with a pocket adapted, when the block is in one position over the aperture, to open simultaneously to both of said apertures, said block being formed of two parts, and a joint extending across the block at the pocket and connecting said parts whereby the part at one end of the pocket possesses movement relative to the part at the other end of the pocket.

9. In a pneumatic motor, the combination of a member provided with a surface having a pair of apertures opening therethrough, a block slidably mounted on said surface and provided with a pocket adapted, when the block is in one position over the aperture, to open simultaneously to both of said apertures, said block being formed of two parts, and a joint extending across the block at the pocket and connecting said parts whereby the part at one end of the pocket possesses movement relative to the part at the other end of the pocket, said joint being air-tight whereby leakage out of the pocket through the joint is minimized.

10. In a device of the class described, the combination of a crank-shaft, a guide plate, provided with an aperture extending therethrough, a block slidably mounted on said plate to control said aperture, a guide strip, flexible means for loosely connecting the guide strip to said block, a guide rod engaging said strip to confine the movement of said block in one direction and a connection between said guide strip and said crank-shaft.

11. In a device of the class described, the combination of a crank-shaft, a guide plate provided with an aperture extending therethrough, a block slidably mounted on said plate to control said aperture, and means for connecting said block with said crank-shaft, said means including a universal connection with the block whereby the sliding engagement of said block on the guide plate is not affected by a lateral movement of said connecting means.

12. In a device of the class described, the combination of a pair of valvular members slidable relative to each other, a crank shaft for causing said relative movement, guiding means including a strip loosely connected to one of said valvular members, a guide rod engaging said strip to guide the same, and a valve rod pivotally connected to said strip and to said crank-shaft.

13. In a device of the class described, the combination of a pair of valvular members slidable relative to each other, a crank shaft for causing said relative movement, a guiding strip loosely fastened to one of said members, said strip provided with a guiding groove and a guiding rod fixed in position and disposed in said groove to confine the movement of the strip in one direction, said strip being free to rock about said rod as an axis.

Signed at Newark in the county of Essex and State of New Jersey this twenty sixth day of September A. D. 1917.

FRANK G. LYNDE.

Witness:
S. R. CAIRNS.