

UNITED STATES PATENT OFFICE.

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MECHANICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 578,127, dated March 2, 1897.

Application filed February 12, 1896. Serial No. 579,061. (No model.)

To all whom it may concern:

Be it known that I, EMIL WELTE, a citizen of the Empire of Germany, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Mechanical Musical Instruments, of which the following is a specification.

This invention relates to certain improvements in mechanical musical instruments, such as pipe-organs, orchestrions, and similar instruments, in which not only an improved wind-chest of extra size is used in connection with an exhaust-chest, but in which improved pneumatic-actions for the registers and for the valves of the sounding devices are employed and actuated in connection with the wind-chest and exhaust-chest, so that a more compact arrangement of the pneumatic-actions relatively to the registers and sounding devices and a simpler construction and an easier working of said pneumatic-actions is obtained; and the invention consists of a mechanical musical instrument comprising the pneumatic-actions of the registers and of the valves of the sounding devices, a wind-chest extending over the register-actions and the diaphragms of the valves of the sounding devices, an exhaust-chest below the pneumatic register and valve actions, ducts leading from said register and valve actions to the register-pneumatics and to the diaphragms of the valves of the sounding devices, said pneumatics being actuated by the register-actions, and means for connecting the pneumatics with the valves of the sounding devices, and of certain features of construction and combinations of parts to be fully described hereinafter and then pointed out in the claims.

In the accompanying drawings, Figure 1 represents a vertical transverse section through the wind-chest and suction-chest of a mechanical musical instrument, showing one of the pneumatic register-actions and the connection of the same with the tracker and its perforated music-sheet and with a manual-key. Fig. 2 is a plan view showing the relative arrangement of the pneumatic register-actions and the pneumatic valve-actions of the sounding devices to the ducts and valves of the sounding devices. Fig. 3 is a vertical longitudinal section of the parts below the wind-chest on the line 3 3, Fig. 2, and of the parts

within and above the wind-chest, also in vertical longitudinal section, but in a different vertical plane from the lower part; and Fig. 4 is a vertical longitudinal section on line 4 4, Fig. 2.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the wind-chest, to which air is supplied under pressure from the bellows and from which air under pressure is supplied to the different pneumatic-actions, ducts, registers, and valves of an organ, orchestrion, or other musical instrument.

The wind-chest A is arranged below the ducts leading to the reeds, pipes, and other sounding devices S and extended over the pneumatic valve-actions, the register-bellows, and the diaphragm-valves of the sounding devices, a larger or smaller number of registers being used according to the number of rows of sounding devices in the instrument. Whenever any one of the reeds or pipes is to be sounded, the bellows of its register, as well as the valve of the special sounding device, has to be opened, so as to supply the required quantity of air from the wind-chest and produce the sounding of the reed, pipe, or other sounding device. This is accomplished by means of separate ducts B', which connect the pneumatic-actions B with the different registers, said actions being arranged in line with the pneumatic-actions C for the valves of the sounding devices. One register-action B is provided for two register-ducts and one valve-action for every duct C' of the sounding devices, as shown clearly in plan view in Fig. 2.

The pneumatic-actions for the registers and for the valves of the sounding devices are arranged at the central portion of the wind-chest A, the ranges or rows of sounding devices being grouped in any suitable manner at both sides of said pneumatic-actions, as required by the special instrument. All the pneumatic-actions B and C of the instrument are so arranged relatively to the wind-chest A and to an exhaust-chest E, which is located below said actions, that the pressure of the compressed air as well as the suction of the air operate together on the valves of said actions and assist thereby in the quick and effective working of the same. The exhaust-

chest E is connected with the suction-bellows, as shown in Figs. 3 and 4, and by special ducts *e e*, passing through the bottom of said exhaust-chest, either with a tracker and a perforated music-sheet moving over said tracker or with manual-keys, as shown in Fig. 1, according as the instrument is to be played either mechanically or as an ordinary organ by keys and stops. As the wind-chest A extends over the pneumatic-actions B C and over the diaphragms of the valves of the sounding devices, it is of comparatively large size, while the exhaust-chest E, which extends only below the pneumatic-actions B C, is of comparatively small size. The wind-chest is thereby enabled to supply all the actions and individual sounding devices with air in a uniform and reliable manner.

The Pneumatic-Action of the Registers.

Each register is connected by an independent duct B' with its pneumatic register-action B, which is located in a proper relative position thereto, the valves of said actions extending from the wind-chest A into the exhaust-chest. Each register-action B is composed of two valves, a setting-valve and an actuating-valve, the stems of which are suspended by means of adjustable buttons *b* from an oscillating centrally-fulcrumed lever *b'*, which is supported on a shelf *b³*, located on top of the exhaust-chest, as shown clearly in Fig. 3. The actuating and setting valves of the register-action are each composed of two ordinary valves *b³ b⁴* and *b⁰ b''*, respectively, which are attached to the valve-stem with their faces toward each other, and of a diaphragm *b⁵*, which is attached to the lower end of the valve-stem, said diaphragm-valve extending over a chamber which is connected by the duct *e'* with the tracker or manual-key. On each side of each diaphragm *b⁵* is located a small duct *b⁶*, which connects the space below the diaphragm *b⁵* with the exhaust-chest E, so as to permit the escape of the air from the space below the diaphragm, as soon as the connection with the tracker and music-sheet or manual-key is interrupted, and the return of the diaphragm to its normal position.

The actuating-valve of each register-action B serves for opening or closing the register-ducts B', connected therewith, while the setting-valve has no connection with any duct, but only with the wind-chest and exhaust-chest, and serves for setting the actuating-valve, which on being set into open position places the register-duct in communication with the exhaust-chest and produces thereby the actuation of a series of bellows or pneumatics B², one for each sounding device in the range controlled by the register. All the bellows B² controlled by one register are simultaneously acted upon by the air-pressure in the wind-chest A and the suction of the exhaust-chest E, so as to be quickly actuated. Each bellows or pneumatic B² is connected by a forked extension-arm *b^x* with one of the

valves of the range of sounding devices controlled by the register-duct B', so as to hold said valve in closed position. Consequently none of the sounding devices controlled by the register can be sounded when the bellows of the register are actuated by its pneumatic-action B.

When it is desired to restore the register bellows or pneumatics B² to their normal position, so that the valves of the sounding devices connected therewith can be released and the latter sounded, air is permitted to enter through one of the openings in the perforated music-sheet to the duct *e*, connecting the tracker with the space below the diaphragm of the actuating-valve of the register-action B. The suction of the exhaust-chest causes then the lifting of the actuating-valve, so that the connection of the register-duct B' with the exhaust-chest is interrupted and simultaneously by the oscillating lever *b'* the setting-valve and its diaphragm lowered, so that the valves of the action assume the position shown in Fig. 1, whereby instantly all the bellows or pneumatics B² of the register controlled by the duct B' are expanded by their springs and the valves of the entire range of sounding devices controlled by the register released.

The changing motion of the actuating and setting valves of the register-action B is facilitated by the pressure of the air in the wind-chest on the upper valves *b³ b⁰* and by the suction of the exhaust-chest on the diaphragm *b⁵* at the lower end of the actuating-valve. The upper openings of the setting as well as of the actuating valve of the register-action B are slightly enlarged, as shown in Fig. 3, so that the raising or lowering of said valves is facilitated by the difference in pressures exerted on the same by the air in the wind-chest, and thereby the changing in the positions of the valves quickly accomplished. When any one of the registers is actuated by its controlling valve-action, the bellows of the register retain the valves of the entire range of sounding devices controlled by the register and prevent the sounding of any one of said sounding devices, while any one of the sounding devices in the remaining registers can be sounded. When none of the registers are actuated, as is the case in special forte parts of a music-piece, then all the registers are open and any sounding device in any one of the registers can be sounded.

The Pneumatic-Actions of the Sounding Devices.

Separate pneumatic-actions C and ducts C' connect the exhaust-chest E with the valves *f'* of the sounding devices, as shown in Fig. 4. The construction of the actions C for the valves of the sounding devices is similar to that of the register-actions B—that is to say, each valve is composed of two individual valves *d d*, which are applied to the valve-stem with their faces toward each other, so

as to close the upper and lower openings of the ducts C' and of a diaphragm d' , applied to the lower end of the stem. The space below the diaphragm d' is connected by a separate duct e^2 with the tracker or manual-key. Small side ducts d^2 connect the space below the diaphragm d' with the exhaust-chest. The upper end of the stem of each valve C is suspended from the free end of a spring d^3 , against the tension of which the pneumatic-action is set into open or closed position. As soon as the atmospheric air enters through the duct e^2 from the tracker or key into the space below the diaphragm d' the valve C is raised by the suction action of the exhaust-chest, the exhaust is shut off from the duct C' , and air under pressure passed from the wind-chest A through the duct C' , so that an equilibrium of pressure is established on both sides of the diaphragms of the valves of the sounding devices, whereby the springs at the upper ends of the valves can lift the same into raised position ready for the actuation of the sounding devices, as shown at the right-hand side of Fig. 4. As soon as the atmospheric pressure is removed from the diaphragm d' of the action C the air quickly passes from the space below the diaphragm through the small relief-duct d^3 into the exhaust-chest, and the diaphragm, as well as the valve C , is lowered, so that the upper valve d closes the duct C' by the pressure of the air in the wind-chest A . The access of air into the duct C' is thereby interrupted, and all the diaphragms of the sounding devices are lowered by the simultaneous pressure of the air in the wind-chest and by the suction action of the exhaust-chest, so that the valves of the sounding devices are held in closed position against the tension of their springs.

The valves F of the sounding devices are composed of a stem f , a valve f' on said stem, a button f^2 , adjustable on the upper end of the stem f , a helical spring f^3 , interposed between the bottom of a valve-cap f^4 for each valve F , and a diaphragm f^5 , to which the lower end of the stem is attached. The duct C' communicates with the space below the diaphragm f^5 , above which a cushion f^6 , of felt or other soft material, is arranged for the extension-arm b^x of the bellows B^2 . The helical spring f^3 assists mainly in opening the valve F , so as to produce the quick actuation of the sounding device when the pneumatic-action C is raised, as shown at the right-hand side of Fig. 4.

In some cases, especially when extra pressure is required for the sounding devices, such as the reeds of brass instruments and the like, the modified valve construction shown at the upper right-hand side of Figs. 3 and 4 is used. This valve is intended for the purpose of preventing the objectionable prolongation of the sound, due to the gradual cessation of the pressure in the trunk of the sounding device. This is accomplished by an air-duct f^x , which extends through the cover of

the structure, so that the valve-cup f^4 is connected with the atmosphere. In this case in place of a helical spring a spiral spring f^3 is employed, which has larger convolutions at the lower than at the upper end. The upper valve f' used in this case is arranged as a double valve, which is adapted for closing or opening the duct leading to the sounding device, as well as for opening or closing the opening in the bottom of the valve-cup f^4 , which communicates with the air-duct f^x , passing to the atmosphere. When the valve f' is closed and the sound of the sounding device interrupted, the body of air still contained in the duct leading to the sounding device and in the trunk of the sounding device has a chance to pass off instantly to the atmosphere, so that the extra pressure on the sounding device is relieved, and consequently the objectionable and annoying prolongation of the sound immediately and effectively obviated.

The advantages of my improved pneumatic-actions for musical instruments are, first, the facility by which the bellows or pneumatics of the registers, as well as the valves of the sounding devices, are actuated by the joint action of the air under pressure in the wind-chest and the suction action of the exhaust-chest on the actions of the register and on the valves of the sounding devices; secondly, the compact arrangement of the actions for the registers and valves of the sounding devices, by which considerable space is saved, inasmuch as all the actions are arranged centrally to the different registers and sounding devices; thirdly, owing to the arrangement of a wind-chest of large size which extends over the action-valves, as well as over the register-bellows and over the diaphragms of the valves of all the sounding devices, the required quantity of air necessary for sounding any one of the same can be readily supplied from the wind-chest without affecting the pressure of the air in the wind-chest, so that a uniform supply of air to the sounding device is provided whether a larger or smaller number of the same are actuated at one time; fourthly, the construction of the pneumatic register-actions, as well as the pneumatic-actions of the valves of the sounding devices, is greatly simplified, so that the expense of the instruments can be considerably reduced, and thereby a mechanically-played pipe-organ or orchestrion placed within the reach of people of moderate means; fifthly, by the simultaneous action of the compressed air in the wind-chest and the suction action of the exhaust-chest on the bellows and diaphragm-valves of the actions of the registers and valves of the sounding devices a quicker response of the bellows and valves of the instrument is obtained, and the same thereby played with greater ease and perfection.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a pneumatic musical instrument, the combination, with the pneumatic-actions of the registers and for the valves of the sounding devices, of a wind-chest extending over
 5 the register-actions and the diaphragms of the valves of the sounding devices, an exhaust-chest below the pneumatic register and valve actions, ducts leading from said register and valve actions to the register-pneumatics and to the diaphragms of the valves
 10 of the sounding devices, said pneumatics being actuated by the register-actions, and means for connecting the pneumatics with the valves of the sounding devices, substantially as set forth.

2. The combination, with a number of registers, of a pneumatic-action for each register, each action being composed of a setting and actuating valve, a centrally-fulcrumed
 20 lever connecting the setting and actuating valves of each action, a wind-chest extending above the pneumatic-actions of the registers, an exhaust-chest located below said actions, ducts connecting the wind and exhaust chests
 25 with the register-pneumatics, and pneumatics actuated by said actions and adapted to retain or release the valves of the sounding devices, substantially as set forth.

3. In a pneumatic-action for the registers of
 30 organs, and similar instruments, the combination of a setting-valve connected with a diaphragm at its lower end, an actuating-valve also connected with a diaphragm at its lower end, a centrally-fulcrumed lever connecting
 35 the upper ends of the setting and actuating valves, and ducts leading from the actuating-valves to the registers, the upper portions of said valves being located in the wind-chest and the lower parts of said valves in the exhaust-chest, substantially as set forth.

4. In a pneumatic-action for the registers of

organs and similar instruments, the combination of a register-action composed of a setting-valve and an actuating-valve a centrally-fulcrumed lever connecting the upper ends of
 45 the setting and actuating valves, and ducts leading from the wind and exhaust chests to the registers, the ends of said ducts terminating in the wind-chest being made somewhat larger than the ends terminating in the exhaust-chest for facilitating the actuations of
 50 the register-valves, substantially as set forth.

5. The combination, with the sounding devices and the valves of the same, of pneumatic-actions for operating the valves of said sounding devices, ducts leading from the pneumatic-actions to said valves, a wind-chest extending over said pneumatic-actions and the diaphragms of the valves of said sounding devices, and an exhaust-chest located below said
 60 valve-actions, the wind-chest and exhaust-chest being connected with the ducts leading from the pneumatic-actions to the valves of the sounding devices, substantially as set forth.

6. A valve for the sounding devices requiring a heavy pressure of air, such as trumpets &c., consisting of a stem, a double valve on the upper part of said stem, a diaphragm at the lower end of the stem, a valve-cup open
 70 at the bottom and connected at its upper part with the atmosphere, a button at the upper end of the stem, and a spring between the button and the bottom of the valve-cup, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

EMIL WELTE.

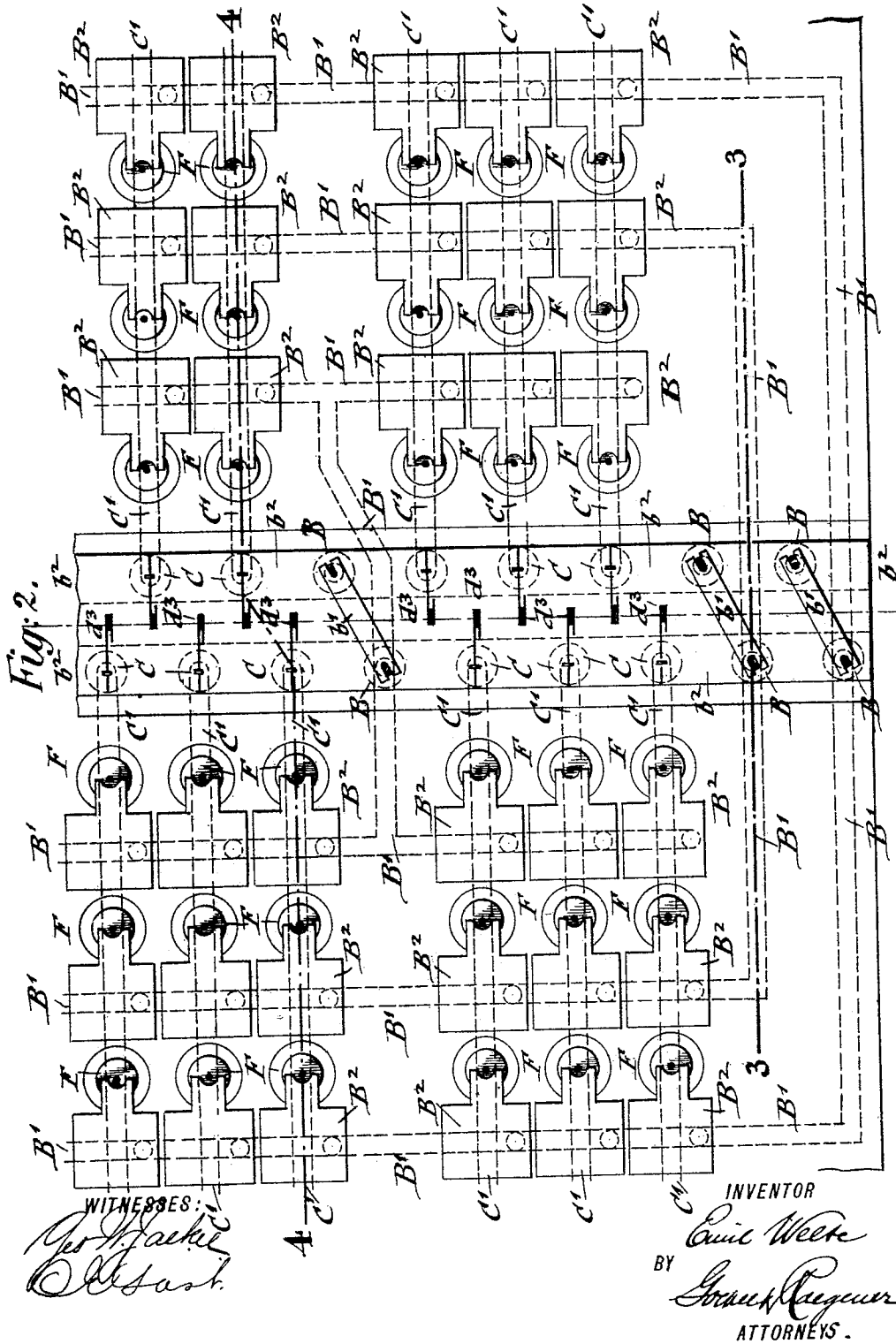
Witnesses:

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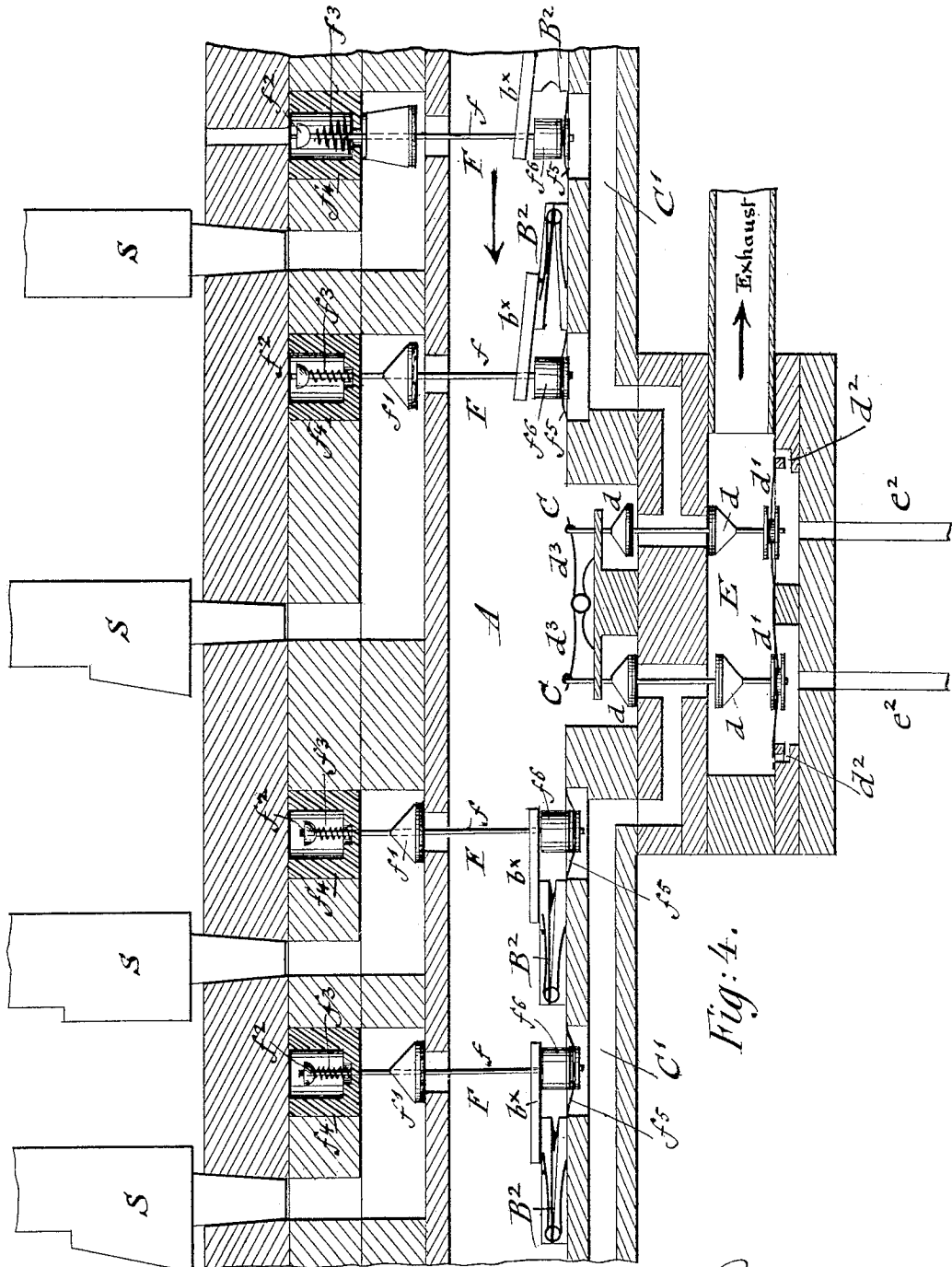


Fig. 4.

WITNESSES:

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