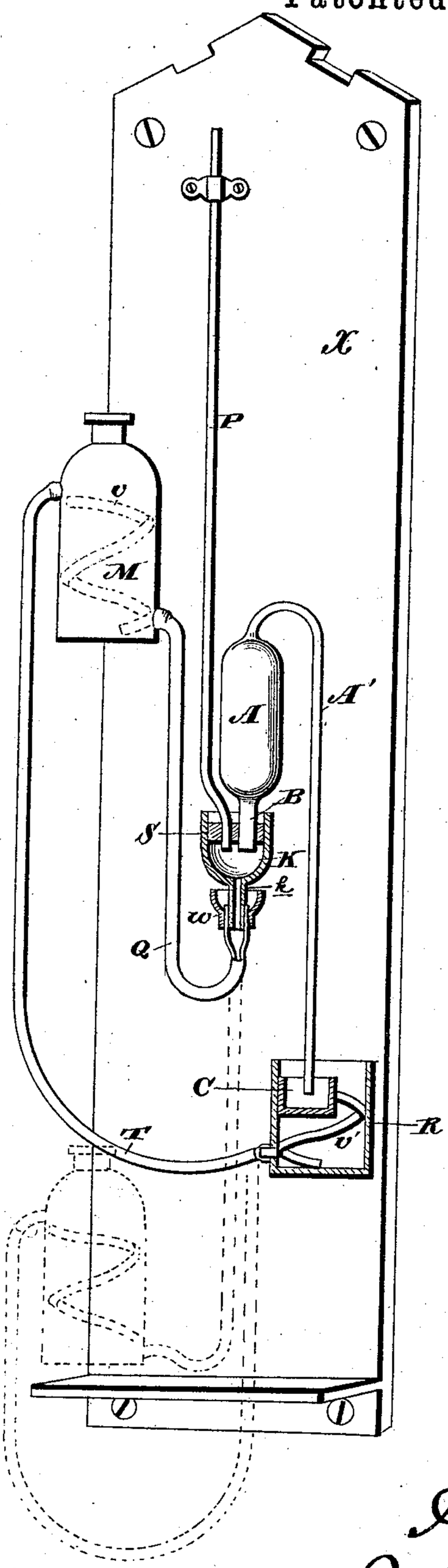
(No Model.)

G. F. DAILEY.

AIR PUMP.

No. 321,008. Patented June 30, 1885.



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GEORGE FAY DAILEY, OF LEADVILLE, COLORADO.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 321,008, dated June 30, 1885.

Application filed March 12, 1884. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. DAILEY, of Leadville, in the county of Lake and State of Colorado, have invented certain new and useful Improvements in Air-Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements on the well-known Geisler mercury air-pump, one of its objects being to dispense with all mechanical valves and cocks heretofore used in such pumps, and which have to a great extent detracted from their efficiency by retaining, in the joints and cavities incident to the construction of such valves and cocks, air, which expands in the pump and decreases the tension of the vacuum. It has the further object to provide novel means for the automatic return of the mercury to the movable reservoir after it has passed through the pump, and an additional object is to cheapen the construction and improve the general efficiency of this class of air-pumps.

To these ends the invention consists in certain novel constructions and combinations, which will be fully hereinafter described with reference to the accompanying drawing, and definitely pointed out in the appended claims.

The drawing is a view, partly in elevation and partly in vertical section, of a mercury air-pump provided with my improvements.

The letter A designates a bulb, preferably of glass, from the top of which a tube, A′, extends downward, said tube having a length from its highest to its lowest point at least as great as that of the barometric column of mercury at the place where the instrument is to be used, and it should preferably exceed this length two or three inches. At its lower end this tube enters a mercury seal-cup, C, which is supported within and near the top of a stationary overflow-receiver, R, from the bottom or near the bottom of which leads a flexible tube, T, which connects with the upper part of a vertically-movable mercury-reservoir, M, which is open at its top.

From the lower end of the bulb A a short tube, B, extends downward and enters a cup, K, from the bottom of which extends downward a short tube, *k*. The tube B is sealed into the cup K by being passed snugly through an elastic stopper or plug, S, which is inserted in the upper part of this cup. There is also passed snugly through the stopper and into the part of the cup below it the lower end of a vertical tube, P, the upper end of which extends to a height above the highest point in tube A′ at least equal to, and preferably slightly in excess of, the barometric column of mercury, as before referred to. The short tube *k* at the bottom of cup K is jointed to a flexible tube, Q, by being inserted in one end thereof, and the other end of this flexible tube is connected to the lower part of the vertically-movable mercury-reservoir M. A sealing-cup, *w*, surrounds the junction of the short tube *k* and flexible tube Q, and is to be filled with mercury above the joint for the purpose of sealing the same air-tight. A slight space is also left above the plug S in the cup K to hold mercury for sealing the joints of the plug and cup and the joints of the tubes passing through the plug.

From the point at which the tube T enters the mercury-reservoir M a spiral inclined tray or trough, *v*, leads to the bottom of the reservoir, in order that the mercury may flow smoothly downward without having air incorporated with it, as would be the case if it fell abruptly from the tube to the lower part of the reservoir. A similar trough, *v′*, leads from an orifice near the top of the mercury seal-cup C to the bottom of the overflow-receiver R for the same purpose. These troughs may be made of copper and will become amalgamated, so that as the mercury flows over them no air will be likely to be caught in between the stream and trough when the mercury begins to flow.

The tube and vessels, except the mercury-reservoir M and the flexible tubes, are secured in the positions shown to a supporting-board, X, by the usual means. A shelf is provided near the foot of the board, below the reservoir R, for the mercury-reservoir M to rest upon when not in use. The flexible tubes are preferably formed of india-rub-

ber, and the other tubes and vessels may be made of any suitable material which will not be dissolved or disintegrated by the mercury. Glass, porcelain, copper, or iron may be used, and if copper, the inner surface will become amalgamated, and securely air-tight joint will thus be always maintained between the tubes and vessels and the mercury within them.

The operation of the improved pump as now described is as follows: The reservoir M is to be filled with mercury, and when elevated above the bulb A, as shown in full lines, the mercury flows through the flexible tube Q and short tube *k* and enters the cup K, rising thence into bulb A and tube P, reaching in the latter the level of the mercury in reservoir M. Forcing the air out of bulb A, the mercury overflows from this bulb and flows down the tube A′ into the seal-cup C, from which it also overflows into the receiver R, passing down the spiral inclined trough *v*′. A quantity always remains, however, in the tube A′, having a height equal to the barometric column or corresponding to the atmospheric pressure. The vessel to be exhausted is to be now connected by an air-tight joint to the top of tube P. If the reservoir M be now lowered, the level of mercury in tube P will also be lowered, and if the reservoir be lowered a sufficient distance the mercury divides at the top of tube A′, and, descending in bulb A, leaves a vacuum in this bulb, and at the same time the air from the vessel to be exhausted expands behind the descending mercury in tube P. Until the vacuum in this vessel is nearly complete, the mercury lowers faster in tube P than in bulb A, so that the air from the said vessel bubbles up through the mercury into bulb A. When the reservoir M has been lowered to the position shown by dotted lines, the mercury all leaves the bulb A and tube P, thus leaving free communication between the bulb A and the vessel to be exhausted, the air from the said vessel being thus allowed to expand and become highly attenuated. While the reservoir M is in its lowermost position, the mercury which has overflowed into reservoir R passes through the flexible tube T back to the reservoir, and runs down the inclined way *v*, as before explained. The reservoir M, now replenished with mercury, is to be again raised, as at first, and the mercury, flowing into tube B and bulb A, forces the air out of the bulb through tube A′, driving the mercury out of said tube, and refilling it after the air has escaped. The mercury this time rises a little higher in the tube P, owing to the air in the vessel being partially exhausted. On again lowering the reservoir the operation already described is repeated. As the reservoir M is repeatedly raised, the mercury each time rises higher in the tube P, and when the vacuum in the vessel to be exhausted is complete the level of the mercury in the said tube will stand about thirty inches, or the height of the barometric column, above the level in the reservoir. The exhausted vessel may then be removed in the usual manner.

The discharge tube A′ should be of small and uniform caliber—say about one-eighth of an inch or less—and dip below the level of the mercury in the cup C. Angles in this tube forming cavities should be avoided; hence it should connect with the highest point of bulb A.

The bulb A, tube A′, reservoir M, and tube Q form, essentially, a Geisler air-pump; and the leading feature of my improvement is the combination, with such a pump, of the vertical tube P, extending upward a sufficient distance to prevent its overflowing when mercury is forced in the bulb A in sufficient quantity to force the air out through the discharge-tube A′ or any other discharging device. Minor features will be pointed out in the claims.

I do not, of course, limit myself to the precise construction shown in my drawing, but may vary the same in any manner not inconsistent with the essential principles of my improvement.

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

1. The combination, with the bulb having a downwardly-extending discharge-tube connected to the upper end thereof, a mercury-vessel, in which said discharge-tube terminates, and the exhaust-tube in communication with the lower end of the bulb, and extending upwardly to or above the height of the barometric mercury column, of the movable reservoir, a flexible tube connecting the reservoir with the exhaust-tube and bulb, and a flexible tube leading from the upper portion of the reservoir to the lower part of the mercury-vessel, in which the discharge-tube terminates, substantially as set forth.

2. The combination, with a mercury-reservoir provided with an inlet at its upper portion and an outlet at its lower portion, of an inclined way leading from the inlet to the lower portion of the reservoir, substantially as and for the purpose set forth.

3. The combination, with the Geisler pump having the short tube B extending downward from its bulb, of the cup K, having its lower end connected by a flexible tube with the reservoir, and its upper portion provided with a plug, through which the said short tube B and the lower end of vertical tube P are sealed into said cup, substantially as described.

4. The combination, with the bulb open at the top and bottom, a downwardly-extending tube connected to the upper end of the bulb, the vertically-movable reservoir communicating with the lower end of said bulb through the intervention of a flexible tube, and a vertical tube, P, communicating at its

lower end with said reservoir and extending upwardly above the height of the barometric mercury column, of the mercury seal-cup receiving the lower end of the downwardly-extending tube, the receiver inclosing the seal-cup, and a flexible tube connecting the receiver and movable reservoir, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

GEORGE FAY DAILEY.

Witnesses:
W. C. BROWN,
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