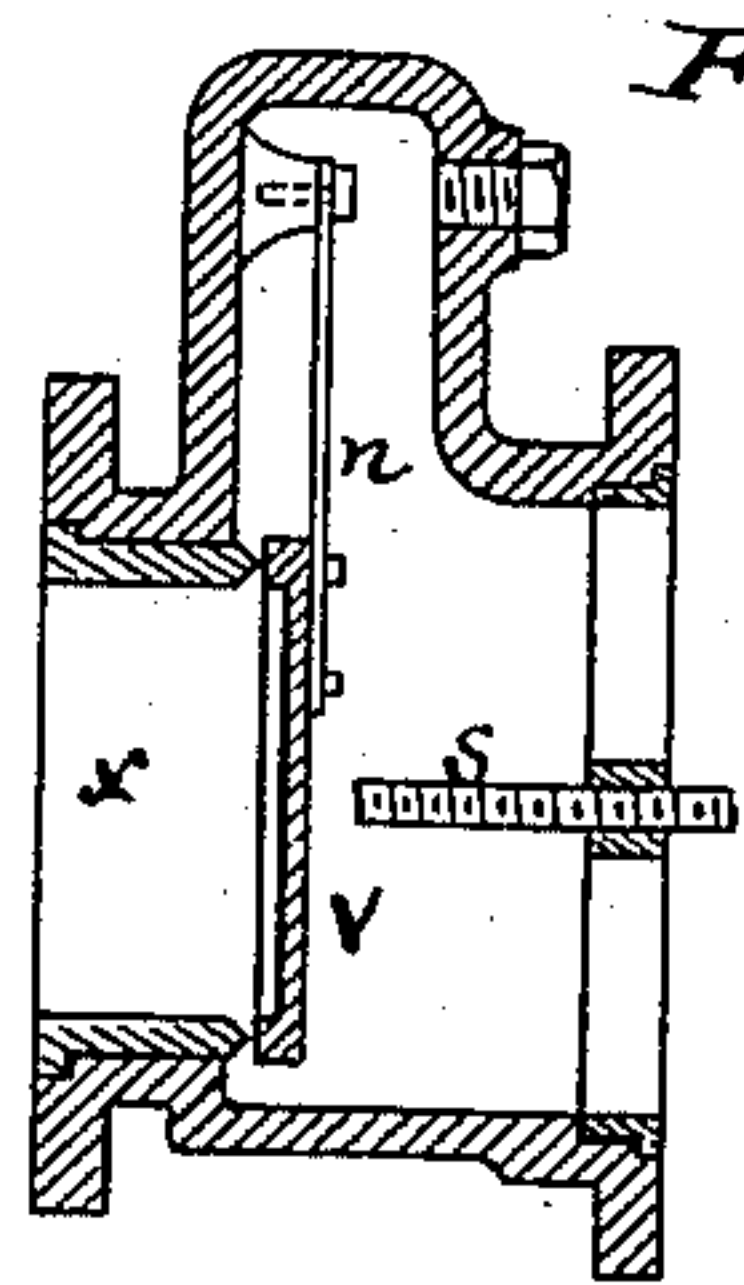
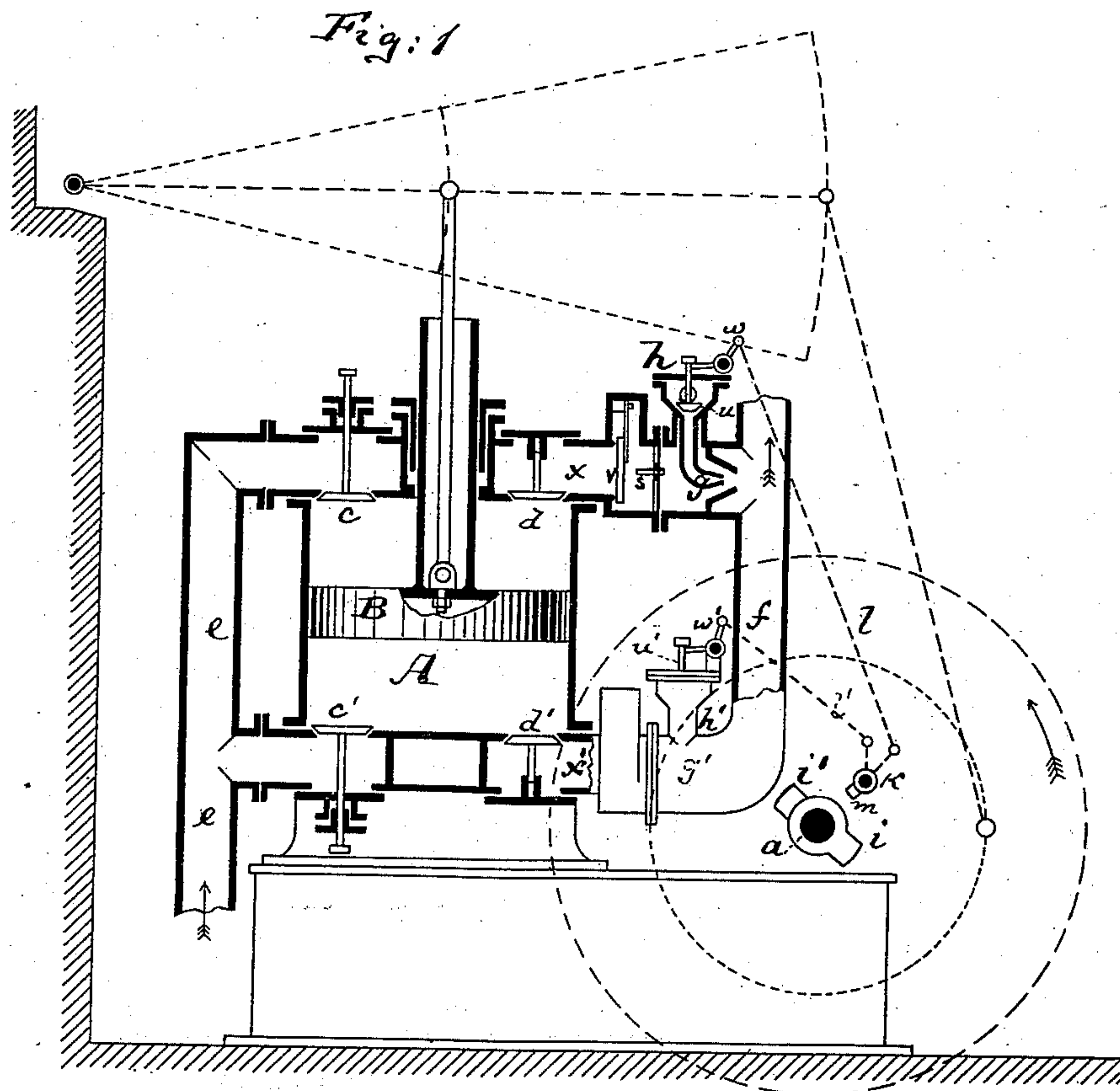


(No Model.)

A. KUX.
VACUUM PUMP.

No. 312,644.

Patented Feb. 24, 1885.



Witnesses:
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John M. Speer.

Inventor:
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UNITED STATES PATENT OFFICE.

ADOLF KUX, OF BERLIN, GERMANY.

VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 312,644, dated February 24, 1885.

Application filed July 19, 1884. (No model.) Patented in Germany March 20, 1883, No. 24,344; in Belgium April 16, 1883, No. 61,126; in France April 17, 1883, No. 154,919, and in Austria September 12, 1883, No. 23,919.

To all whom it may concern:

Be it known that I, ADOLF KUX, of the city of Berlin, Prussia, Germany, have invented certain Improvements in Vacuum-Pumps, of which the following is a specification, reference being had to the accompanying drawings, in which similar letters denote corresponding parts, and for which I obtained Letters Patent in Germany, No. 24,344, for fifteen years, dated March 20, 1883; in France, for fifteen years, No. 154,919, dated April 17, 1883; in Belgium, No. 61,126, dated April 16, 1883, for fifteen years; in Austria, No. 28,919, dated September 12, 1883, for fifteen years.

The object of the invention is to increase the efficiency of vacuum-pumps by the addition of auxiliary steam-ejectors, which are arranged and worked in a peculiar manner.

Figure 1 of the drawings represents a vacuum-pump in a vertical section.

Those parts which are not essential for the invention are shown only in constructive dotted lines. Fig. 2 is a section in enlarged scale of a detail.

A is the pump-cylinder; B, the piston; *e*, the suction-pipe leading to the vessel to be exhausted or emptied of air. *c c'* are the suction and *d d'* the exhaust valves, of any improved pattern.

On account of the atmospheric pressure the air remaining in the dead-space between the cylinder-heads and the piston at the end of each stroke cannot be expelled. That is the reason why it is not possible to produce a true vacuum but only an air-rarefaction.

The object of the invention now is to remove at the end of each stroke of the piston all this inconvenient air. For this purpose the outlets of the pump are constructed as pipes or channels *x x'*, in front of which are arranged the ejectors *h h'*, working by steam by means of the steam-nozzles *g g'*. As it is necessary to expel the air only at the end of the stroke, the ejectors act only at this time, the valves *u u'*, admitting steam to the ejectors, being shut in the interval. This sudden opening of the valves *u u'* is effected by a valve-gear arrangement governed by tappets *i i'*, fixed in the proper position upon the crank-shaft *a*, driving the beam to which the piston B of the pump A is attached. The tappets

i i' actuate in their revolutions the short arms *m* of the levers *l l'* of a rock-shaft, *k*, and by means of connecting-rods, also the bell-crank levers *w w'*, which lift the valves *u u'*. As soon as the tappets *i i'* have passed the arms *m* the valves *u u'* are closed by springs, (not shown in the drawings,) or by any other equivalent device. It must be understood that the tappets *i i'* and the different levers are arranged in such a way that the opening and closing of the valves *u u'*, controlling the ejectors, will take place at the proper time—viz., the opening to commence shortly before the end of the piston-strokes, the closing to take place just when the piston has arrived in its dead positions. The ejectors expel not only the air from the pipes or channels *x x'* above and below the outlet-valves *d d'*, but also that air which remains between the cylinder-heads and the piston B at the end of each stroke. They produce a very efficient air-rarefaction of these spaces, increasing the effect of the vacuum-pump and facilitating its working. As soon as the valves *u u'* are closed the air of the outlet-pipe *f* will return and fill again the channels *x x'* and exert a corresponding pressure upon the valves *d d'*. To avoid this inconvenience a valve, *v*, hung to a light spring, *n*, Fig. 2, is provided in the channels *x x'*. The throw of the valve *v* is limited by means of a set-screw, *s*. This valve *v* closes automatically the moment when its ejector ceases to work, maintaining in the channel *x (x')* between the valve *v* and the valve *d (d')* the air-rarefaction previously produced, so that the valve *d (d')* is released from pressure and more readily opened. It is clear that by these means the effect of a vacuum-pump is increased very much without great expense, as the steam used for the ejectors, the quantity of which is, moreover, very small, may be further utilized for heating or other purposes.

It must be remarked that my invention is applicable to vacuum-pumps of a construction differing from that in the drawings, and that the proper motions of the valves *u u'* may be derived from other parts of the machinery and constructed in another way, as shown. These constructive points are of minor interest and not the object of the invention; but

What I claim as new is—

1. In a vacuum-pump, the combination of the pump-cylinder and piston with the steam-ejectors *h h'*, their valves *u u'*, and the valve-gear mechanism, consisting of the shaft *a*,
5 tappets *i i'*, levers *l l'*, shaft *k*, arms *m*, and bell-cranks *w w'*, substantially as described, for opening said valves at stated intervals to render the ejectors effective, as specified.
2. In a vacuum-pump, the combination of
10 the steam-ejectors *h h'*, with the valves *u u'*, shaft *a*, tappets *i i'*, arms *m*, rock-shaft *k*, levers *l l'*, and elbows *w w'*, for moving said valves, and with the valves *v*, springs *n*, and outlet-valves *d d'*, substantially as shown and described, and for the purposes explained. 15

This specification signed by me this 4th day of June, 1884.

ADOLF KUX.

Witnesses:

B. ROI,

CARL T. BURCHARDT.