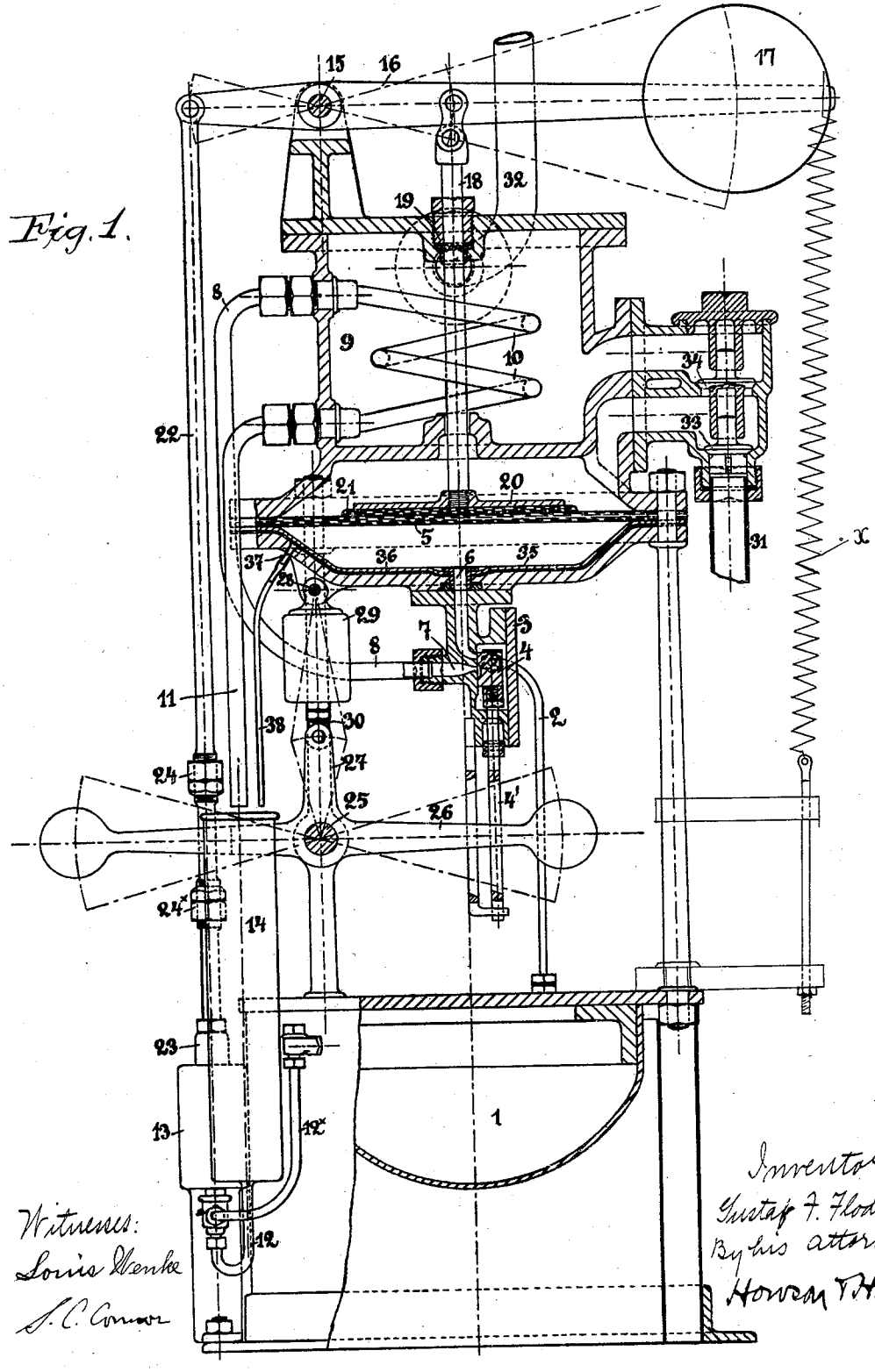
(No Model.) 2 Sheets—Sheet 1.

G. F. FLODMAN.

DIAPHRAGM PUMP.

No. 589,078. Patented Aug. 31, 1897.

Fig. 1.



Witnesses:
Louis Wenke
S. C. Connor

Inventor:
Gustaf F. Flodman
By his attorneys
Howson & Howson

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

G. F. FLODMAN.

DIAPHRAGM PUMP.

No. 589,078. Patented Aug. 31, 1897.

Fig. 2.

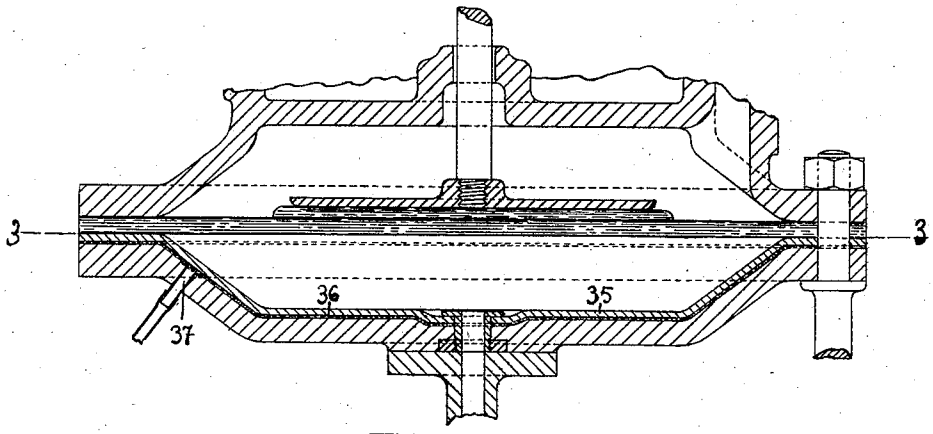
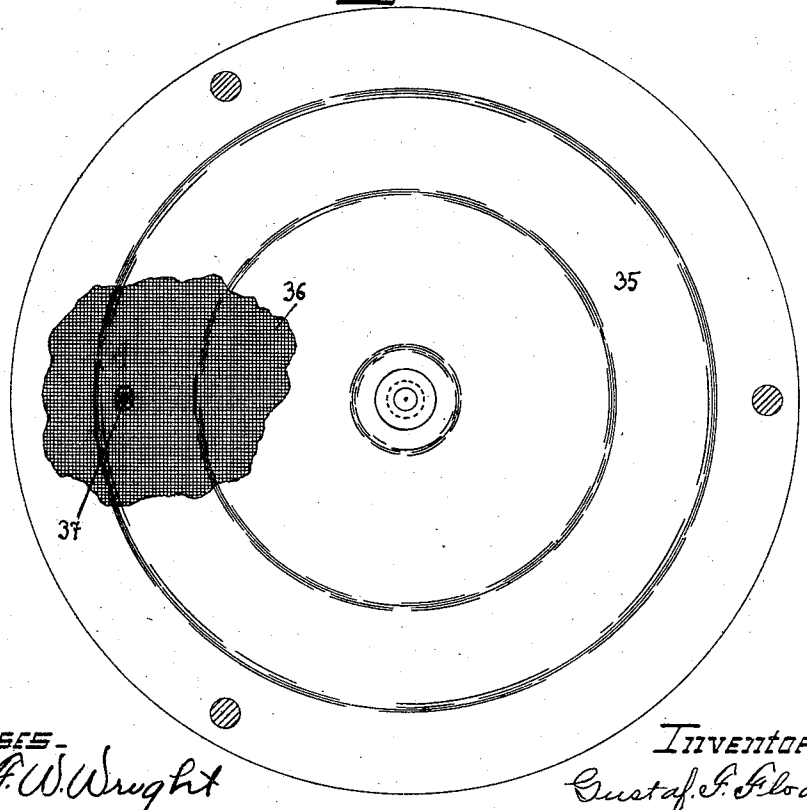


Fig. 3.



Witnesses-
F. W. Wright
A. C. Connor

Inventor
Gustaf. F. Flodman
By Howson & Howson
his Attorneys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GUSTAF FERDINAND FLODMAN, OF STOCKHOLM, SWEDEN.

DIAPHRAGM-PUMP.

SPECIFICATION forming part of Letters Patent No. 589,078, dated August 31, 1897.

Application filed May 8, 1896. Serial No. 590,681. (No model.)

To all whom it may concern:

Be it known that I, GUSTAF FERDINAND FLODMAN, a subject of the King of Sweden and Norway, and a resident of Stockholm, Sweden, have invented certain Improvements in Diaphragm-Pumps, of which the following is a specification.

This invention relates to certain improvements in diaphragm-pumps driven by steam or other equivalent motive fluid, the admission and exhaust of which is regulated by a slide-valve or corresponding contrivance. For example, such a construction of pump is shown in a patent granted to me July 21, 1896, No. 564,560.

The most important improvement is that the inner wall of the diaphragm vessel in which the steam or vapor acts is lined with material such as caoutchouc, which is a bad conductor of heat, thereby reducing the loss of temperature and condensation of the acting fluid for the purpose of economizing the expenditure of steam or other vapor employed. It is advantageous to place behind the lining a netting of brass wire or other suitable wire or a perforated sheet of metal and provide a hole through the wall of the diaphragm vessel behind or under the netting in order to give exit to the water that condenses from the steam permeating the lining material.

Another important improvement is that the diaphragm is weighted, so that it is forced in one direction by the pressure of the steam when the water or other fluid which is to be pumped is driven upward and the weight raised, and after the steam-outlet is opened the weight carries the diaphragm in the opposite direction when fresh water or fluid is sucked up in the pump. Instead of by a weight the diaphragm may be loaded by a spring or springs or by some other suitable force acting on the diaphragm in the opposite direction to the steam.

In the accompanying drawings, Figure 1 is a sectional elevation of a diaphragm-pump made according to my invention. Fig. 2 is a sectional view, drawn to a larger scale, of the diaphragm-chamber; and Fig. 3 is a sectional plan taken on line 3 3 of Fig. 2, showing a portion of the lining broken away to show the wire-netting.

In the views the invention is shown as applied to a steam diaphragm-pump with a horizontal diaphragm and boiler of its own, which is heated by a petroleum-lamp, though any other source of heat may be used at will. The pump is shown in section.

1 is the boiler; 2, the steam-pipe, leading to the slide-box 3 with the slide-valve 4, the latter controlling the inlet-channel 6, leading to the chamber under the diaphragm 5, as also the outlet-channel 7. This last-mentioned channel is prolonged by the pipe 8, which is connected with the upper end of the spiral or coil 10, placed in the chamber 9, which spiral is cooled by the water forced up by the pump, and the other end of which spiral is connected with the descending pipe 11, the lower end of which is above the upper open end of the vertical vessel 14, that communicates by a pipe 12 with the suction-valve of the feed-pump 13.

$12^{\times}$ is the feed-pipe of the boiler.

35 is the non-conducting lining, and 36 the wire-netting underneath.

37 is a hole through the wall, and 38 a tube by which the condensed water is conveyed to the vessel 14.

On the diaphragm 5, which is not weakened by rivet-holes through it or otherwise, there lies a metal plate 20, and in the apparatus shown there is a somewhat larger intermediate plate 21, made of flexible material in order to protect the diaphragm. The plate 20 is attached to a guided rod 18, which passes up through the pump-chamber and out through a stuffing-box 19. Outside the pump-chamber the rod 18 is jointed by means of a link to the weighted arm 16 (weight marked 17) of a beam oscillating on the pivot 15. Instead of the weight 17 the arm 16 may be joined to a spring (or springs) x, the lower end of which is fixed to the framework of the pump, as shown in dotted lines.

The suction-pipe of the pump is 31, and 32 its discharge-pipe, while 33 is the suction-valve, and 34 the discharge-valve.

The valve motion (represented in the drawings in its middle position) is of the following construction: On the left-hand side of the pivot 15 of the beam the beam is jointed to the rod 22, which operates both the slide-valve and the plunger 23 of the feed-pump.

Pivoted upon a fixed axis 25 there is a double-armed lever 26, which, with its one arm suitably shaped for this purpose, embraces the rod 22 between its two adjustable tappets 24 24×, while the second arm traverses an elongated groove in the slide-valve rod 4′. The lever 26 also has an arm 27, extending upward, which is hinge-jointed to a rod 30, influenced by a spring (not visible in the drawings) placed in the case 29, swinging upon the fixed pivot 28, and thus forming with 27 a sort of toggle-joint.

The pump shown on the drawings works in the following manner: When there is no pressure of steam on the under side of the diaphragm, this sinks under the action of the weight 17 or spring *x* and the water is sucked in through the suction-pipe. At the same time the rod 22 rises, carrying with it the lower tappet 24×, that strikes against the arm of the lever 26 above the tappet, which arm is lifted. The toggle-joint 27 30 is thereby made to pass the center line, and no sooner has it done so than the spring in the case 29 throws the other end of the lever 26 against the lower edge of the groove in the slide-valve rod 4′, when the slide-valve is rapidly drawn down and opens the inlet-channel 6. If there be steam in the boiler 1 and the steam-valve (not shown in the drawings) is open, the steam enters the chamber under the diaphragm, driving the latter upward and forcing the water out through the pipe 32. The rising of the diaphragm also causes the rise of the rod 18 and the weight 17 and the sinking of the rod 22, when the plunger 23 forces the water into the boiler, and the upper tappet 24 of the rod 22 reverses the slide-valve, as previously described, so that the slide-valve places the chamber under the diaphragm in connection with the outlet-channel 7. The steam under the diaphragm now passes through the refrigerating-spiral 10 and is condensed. The weight 17 then presses down the diaphragm, and the water is sucked in by the pipe 31, while at the same time the plunger of the feed-pump, which sucks in the condensed water collected in the vessel 14 through the pipe 12, is raised, and the lower tappet 24× on the rod 22 reverses the slide-valve at the proper moment, so that the steam is again admitted under the diaphragm, when the action is repeated. The cooling of the spiral 10 may be accomplished in any other convenient manner instead of as shown. Thus it may be located in the suction-pipe, if desired, or it may be cooled otherwise. The pump may also be applied to existing steam-boilers and be driven by the steam therefrom, in which case the boiler 1, with its feed-pump, is not required, nor is the condenser needed. The rod 22 must in that case be guided below. The valve motion may also be differently arranged; but it is preferable to operate it from the beam, as shown.

I wish it to be understood that in my claim I use the word "weighted" as applied to the lever in a sufficiently general sense to include the actuation of the lever either by a weight or a spring.

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

In a diaphragm-pump worked by steam or other gaseous motive fluid, the combination of a diaphragm, a weighted lever and connections between the weighted lever and the diaphragm to cause the weighted lever to press on one side of the diaphragm, with means for distributing the motive fluid to and from the steam-chamber on the other side of the diaphragm, a non-conducting lining resting on a penetrable layer of metal and covering the inner wall of said steam-chamber, and a hole through said wall, substantially as set forth.

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

GUSTAF FERDINAND FLODMAN.

Witnesses:
FREDRIK L. ENQUIST,
OSKAR RINGSTRÖM.