(No Model.)

A. SIEBERT.

PUMP.

No. 482,416. Patented Sept. 13, 1892.

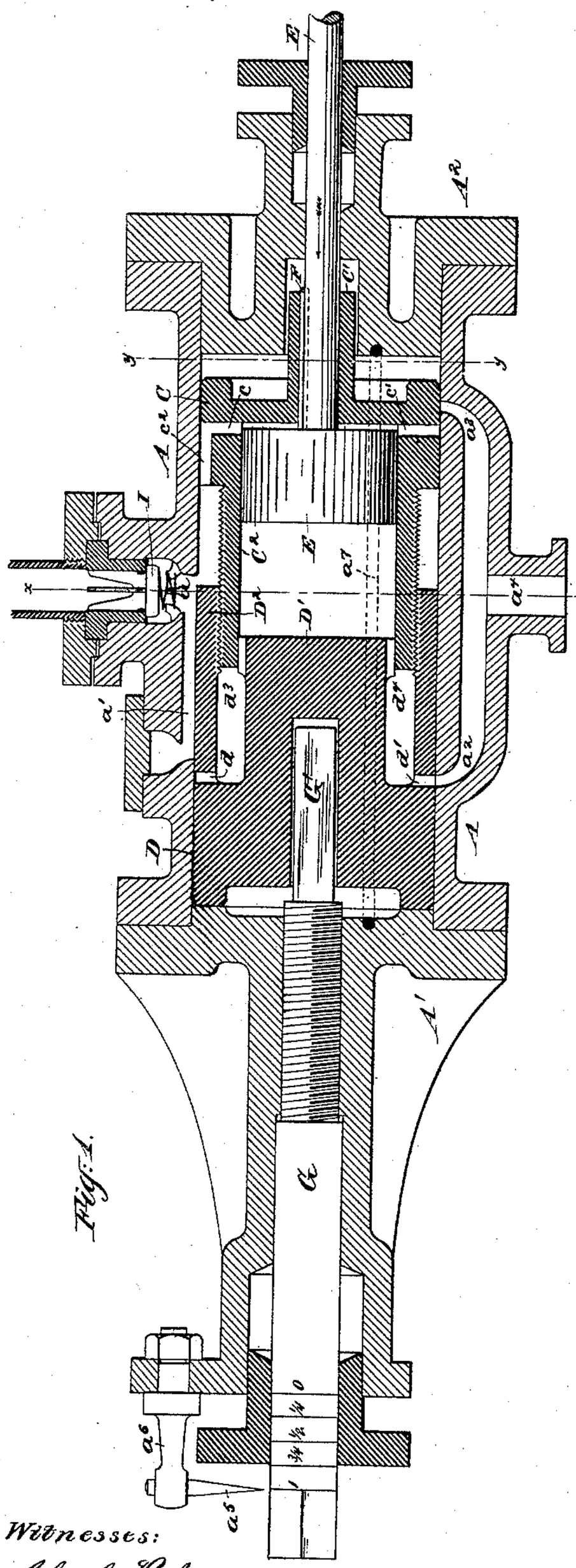

Fig: 1.

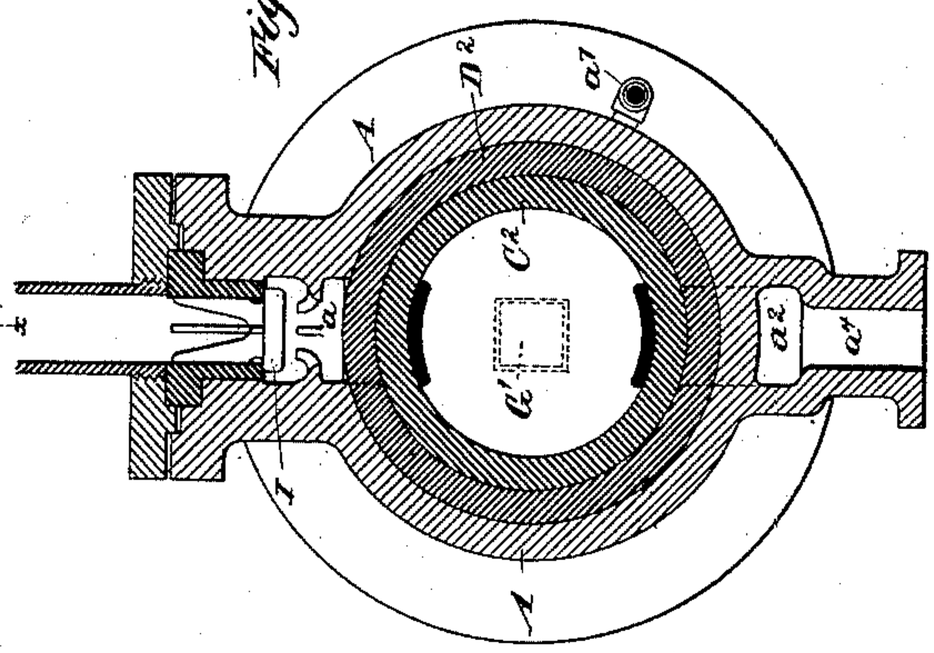

Fig: 2.

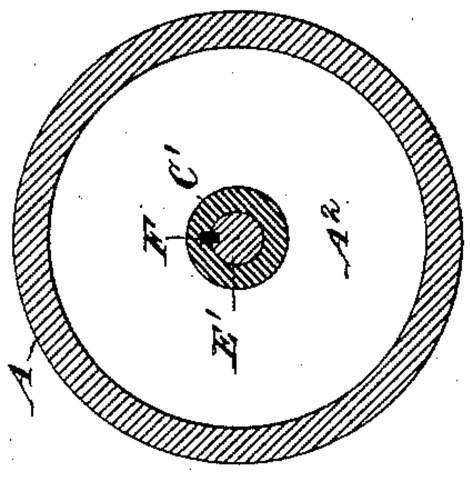

Fig: 3.

Witnesses:
Charles R. Seale
H. J. Johnstone.

Inventor:
Alfred Siebert
by his attorney
Thomas Dyer Stetson

UNITED STATES PATENT OFFICE.

ALFRED SIEBERT, OF NEW YORK, N. Y.

PUMP.

SPECIFICATION forming part of Letters Patent No. 482,416, dated September 13, 1892.

Application filed May 7, 1891. Renewed March 8, 1892. Serial No. 424,115. (No model.)

To all whom it may concern:

Be it known that I, ALFRED SIEBERT, of the city and county of New York, in the State of New York, have invented a certain new and useful Improvement in Pumps, of which the following is a specification.

I have in a patent to me, dated September 3, 1889, No. 410,458, set forth a construction of pump in which a piston reciprocated by suitable power works within a cylinder which is free to move endwise to a limited extent within a larger properly-bored cylinder, which latter is stationary, but is provided with suitable ports or passages for receiving or delivering liquid. The idle spaces outside the ends of the internal cylinder are connected together by a side passage, so that the water can flow without effect and without appreciable resistance from one end to the other through such side passage. Ports are cut through the internal cylinder close to each end, and as the internal cylinder reciprocates it opens and closes the passages for the induction and eduction of the water or other liquid which is being pumped. My present invention is based thereon. I will refer to the liquid generally as "oil."

In refrigerating-machines, in which oil is introduced into the cylinder to absorb the heat of compression and to serve other important functions, it is required to supply a determined quantity of liquid at each stroke. It is sometimes desirable in that and in other arts to vary the quantity at will. It is not easy to attain such reduction in the amount delivered as to produce a uniform measuring of the liquid by simply throttling the induction and allowing a portion of the capacity of the cylinder to be a vacuum. Variations in the speed of working and other disturbing influences militate against the success of such measuring. My invention overcomes the difficulty. I construct a pump substantially as set forth in my patent of 1889 referred to, but provide means for lengthening and shortening the internal cylinder at will. When it is lengthened to its fullest extent, there is but little end motion of the internal cylinder, and the main traveling of the piston is effective in drawing in water with the movement in one direction and expelling it usefully with the movement in the other direction. As the internal cylinder is shortened its longitudinal motion which is idle is increased, and the effective portion of the stroke, which is the movement of the piston within the internal cylinder, is decreased. The invention renders it practicable, by varying the length of the internal cylinder with nicety, to pump with any ordinary amount of force and to measure with great accuracy and to adjust the amount so pumped and measured within wide limits. The construction which I have devised for attaining this end involves the necessity for a considerable increase in the thickness of one head of the internal cylinder; but this is not, in ordinary positions, a serious objection. It is easy to provide a correspondingly-increased length in the external cylinder. Another difficulty is met in the fact that each change in the length of the cylinder presents the ports of the internal cylinder in a new position when in the act of receiving oil or other liquid. I have provided very completely for this also. I receive the liquid into the external cylinder at the mid-length and convey it to the proper port in the internal cylinder at one end through a channel formed in the internal cylinder, and I convey it to the port at the other end through a channel in the external cylinder. The ports leading through into the interior of the internal cylinder at each end are supplied with the liquid in any position in which the internal cylinder can be arrested. The ports which deliver are certain to coincide, because the internal cylinder always moves toward each end until its end strikes or nearly strikes the interior of the end of the external cylinder. In what I consider the best working it is "cushioned" by the transmission of the liquid from one end to the other, being retarded near the end of the stroke, so that the cylinder does not actually strike, but it comes sufficiently near the end at each stroke to give a proper delivering coincidence to the discharge-ports.

The accompanying drawings form a part of this specification and represent one of the best means of carrying out the invention.

Figure 1 is a central longitudinal section.

Fig. 2 is a cross-section on the line $x\,x$ in Fig. 1. Fig. 3 is a cross-section on the line $y\,y$ in Fig. 1.

Similar letters of reference indicate like parts in all the figures where they appear.

A is the external cylinder, certain portions thereof being designated, when necessary, by additional marks. The heads are marked, respectively, A′ A². The oil or other liquid is received through a port a at mid-length. The channel a' extends therefrom longitudinally of the cylinder A along the interior and terminates abruptly. On the opposite side of this cylinder A are delivery-ports a^2 a^3, which unite in a common delivery-passage a^4, to which is connected a pipe (not shown) through which the liquid is conveyed to any desired point.

The internal cylinder is made in two distinct parts C and D, certain portions of each being designated, when necessary, by additional marks. The exteriors of the outer ends or heads are accurately finished to match the interior of the cylinder A and slide tightly and easily therein.

E is a piston, which may be packed in any ordinary or approved manner and is adapted to reciprocate in a smoothly-bored portion of sufficient length in the part C. The piston-rod E′ extends out through a stuffing-box and connects to a suitable mechanism (not shown) for strongly reciprocating it. The feather F connects the neck C′ on the part C to this piston-rod and forbids one being revolved relatively to the other, but allows the parts to move freely endwise upon each other. The part C of the internal cylinder is of full diameter for a portion of its length and then is suddenly contracted, and the remainder C², of less diameter, is screw-threaded. Narrow ports c c' serve, the former as an induction or receiving port and the latter as an eduction or delivery port. A longitudinal channel c^2 is cut or otherwise produced in the exterior, communicating between the induction-port c and the annular space exterior to the part C², which latter is, in all positions of the internal cylinder, in free communication with the passage a', allowing the oil to be freely received. The part D of the internal cylinder is formed with an annular shell of full diameter and of such length that it shall always extend to or beyond the mid-length of the cylinder. This shell D² is screw-threaded on its inner surface to match the screw-threads on the part C². In the interior of the part D is an extension D′, reaching inward or toward the mid-length of the cylinder, as shown. A square recess extends in the line of the axis from the outer end nearly to the inner end of the part D′, which performs an important function, as will presently appear. Induction-ports d receive the oil or other liquid into an annular space between the parts D′ and D². On the opposite side of the cylinder are eduction-ports d', which deliver the oil from such annular space into the proper eduction-port a^2. Liberal annular spaces d^3 d^4 are provided for the free movement of the oil between the interior of the part C² and the ports d d', respectively.

G is an adjusting-spindle having a squared and smoothly-finished end G′, which matches loosely in the square recess in D. The outer end of the shaft G is square and may be turned by a suitable wrench (not shown) operated by the attendant. Turning this shaft G correspondingly turns the part D of the internal cylinder. The engagement of the screw-threaded exterior of the part C² with the screw-threaded interior of the part D² causes the turning of the part D in one direction to shorten the internal cylinder. By moving the part D nearer to the part C and turning it in the opposite direction correspondingly lengthens the internal cylinder. There are screw-threads on a portion of the length of the shaft G, and there are marks on the exterior of the same shaft. As the shaft is turned in one direction or the other, these screw-threads cause it to enter farther into the internal cylinder or to be drawn out of it. An index a^5, supported by a pin a^6 on the stuffing-box, indicates to the attendant by means of marks on the shaft how far the part D of the internal cylinder has been turned, and thus how the length of the internal cylinder is adjusted. A passage a^7 is provided, extending along at a proper line and making a free connection between the spaces at each end, respectively. Through this passage the oil may flow idly in one direction or the other as the internal cylinder reciprocates. When there is a large amount of motion of the internal cylinder, the cylinder being adjusted to its shortest condition, much oil is thus transferred idly at each stroke; but when the internal cylinder is adjusted in or near its longest condition the quantity thus transferred without effect is greatly reduced.

To adjust the internal cylinder to give its greatest length, the shaft G, and consequently the parts D D′ D² of the internal cylinder, is revolved in the direction to increase the length until the mark "1" on the shaft G coincides with the index H. In this condition the internal cylinder is so nearly the full length of the interior of the external cylinder that it has only a small amount of end motion, just sufficient to allow the ports of c' d' to be moved out of coincidence with the corresponding delivery-ports a^2 a^3 and serve as delivery-valves. At the induction side of the cylinder when thus adjusted the port c can receive oil from the central port a through the channel c^2 on this side.

Each shift of the position of the internal cylinder closes one induction-port and opens the other. In the position shown the port c is receiving oil through the channel c^2 from the annular space outside of the part C², and the oil is not allowed to escape through the opposite induction-port d at the other end, because the channel a a' abruptly stops with-

out reaching that port. When the internal cylinder shifts its position, it reverses the conditions at the delivery side in the obvious manner, causing c' to coincide with a^3 and d to connect with a'. Now to shorten the internal cylinder the attendant applies his wrench to the projecting end of the shaft G and revolves it in the proper direction. The part C of the internal cylinder is held by the feather F on the piston-rod, so that it cannot turn. The screw-threads connecting the parts C^2 and D^2 must be made sufficiently easy to to allow the parts to be revolved upon each other by a sufficient force impressed through the shaft G. When the index-mark on the shaft G coincides with the index H, the attendant knows that he has shortened the internal cylinder proportionately. In this shortened condition, the reciprocations of the piston E being maintained to precisely the same extent as before, the internal cylinder is moved idly to a greater extent than before, and the piston C moves effectively within it only the remainder of the stroke after the idle part has been completed. In this condition, as before, the internal cylinder moves idly until it strikes the end of the cylinder A, or cushions on the oil therein at a point near striking, so that the delivery-ports c' a^3 will coincide when the piston moves to the right and the ports d' a^2 will coincide when the piston moves to to the left. On the induction side the longitudinal channels a' c^2 continue, as before, to receive the oil from the central passage a and allow it to enter through the ports c d during the induction period at each end, respectively, and during the delivery period the communication between this port c or d, respectively, and the passage a is closed tightly, the induction on the left by the want of coincidence of the port d with the longitudinal abruptly-terminated grooved channel a' and on the right by the end of the part D^2, closing the communication with the passage a.

In all conditions of the internal cylinder it is certain to commence to move longitudinally with the commencement of the movement of the piston E. The first part of its motion is idle, resulting simply in the transfer of the water, oil, or other liquid which is in advance of the internal cylinder to the corresponding position in the rear of it, and in each condition the last part of the stroke of the piston is effective in expelling the oil from the interior of the internal cylinder through the proper port c' or d', and in each condition the termination of the movement of the internal cylinder not only puts the delivery-ports in the condition for delivering properly, but also puts the induction-ports in the condition for receiving properly; but the proportion of the part of the stroke which is idle to that which is effective may be varied between wide limits by increasing or diminishing the length of the internal cylinder, and this may be effected by turning the shaft G. It will be preferable under ordinary conditions to stop the pump while the change of length of the internal cylinder is being made; but theoretically the changes can be made while the pump is working, and if the screw-threads between the parts C^2 and D^2 are sufficiently free so as to allow the part D to be turned easily on the part C the shifting of the condition while the pump is working may be practiced with success. The check-valve I in the induction-passage a prevents the movement of the water backward at each stroke and insures the prompt movement of the inside cylinder. It also prevents leakage backward when the pump is stopped.

Modifications can be made by any good mechanic without departing from the principle or sacrificing the advantage of the invention. Any other form of check-valve may be used. I can connect the induction at other points than the mid-length of the cylinder. The blank flange at the left of the mid-length in Fig. 1 may so serve. It is only important that it shall connect with the longitudinal channel a', so as to deliver freely into it and allow the water to be taken from it to either end. So, also, the delivery-passage a^4 may be at other points than the mid-length of the cylinder.

Other means may be provided for holding the part C of the internal cylinder against being revolved.

I claim as my invention—

1. In a pump, in combination with an external cylinder A, having suitable ports and an internal piston and piston-rod with suitable operating means for the latter, an internal cylinder made in two separate parts C D, with provisions, as internal screw-threads in one part and external screw-threads in the other part, engaged together, as shown, for changing the length of the internal cylinder, and thereby varying the quantity of liquid pumped at each stroke, as here specified.

2. In a pump, in combination with an external cylinder A, having suitable ports and an internal piston with suitable operating means, an internal cylinder made in two separate parts C D, with provisions, as internal screw-threads in one part and external screw-threads in the other part, engaged together, as shown, for changing the length of the internal cylinder, and provisions, as the feather engaging the piston-rod with one of the parts of the internal cylinder, for holding such part against being revolved, and provisions, as the revoluble rod having the squared end engaged in a corresponding socket in the other part of the internal cylinder, for revolving such part relatively to the other by operating on the outside of the pump, substantially as herein specified.

3. The pump described, having the external cylinder A, piston B, and piston-rod b, in combination with each other and with the internal cylinder made in two parts C and D,

engaged together by screw-threads, the part C being held against rotation and the other part D being capable of being rotated, and with the screw-threaded rod G engaged with the part D, as shown, so as to control its revolution, but leave it free to move axially, the rod G being graduated, as shown, and with an index H, adapted to show by inspection on the outside the condition of the internal cylinder and therefore the quantity which the pump is delivering at each stroke, all substantially as herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

ALFRED SIEBERT.

Witnesses:
RAE HARRISON,
M. F. BOYLE.