

J. KROOG
Filter.

2 Sheets—Sheet 1.

No. 231,335.

Patented Aug. 17, 1880.

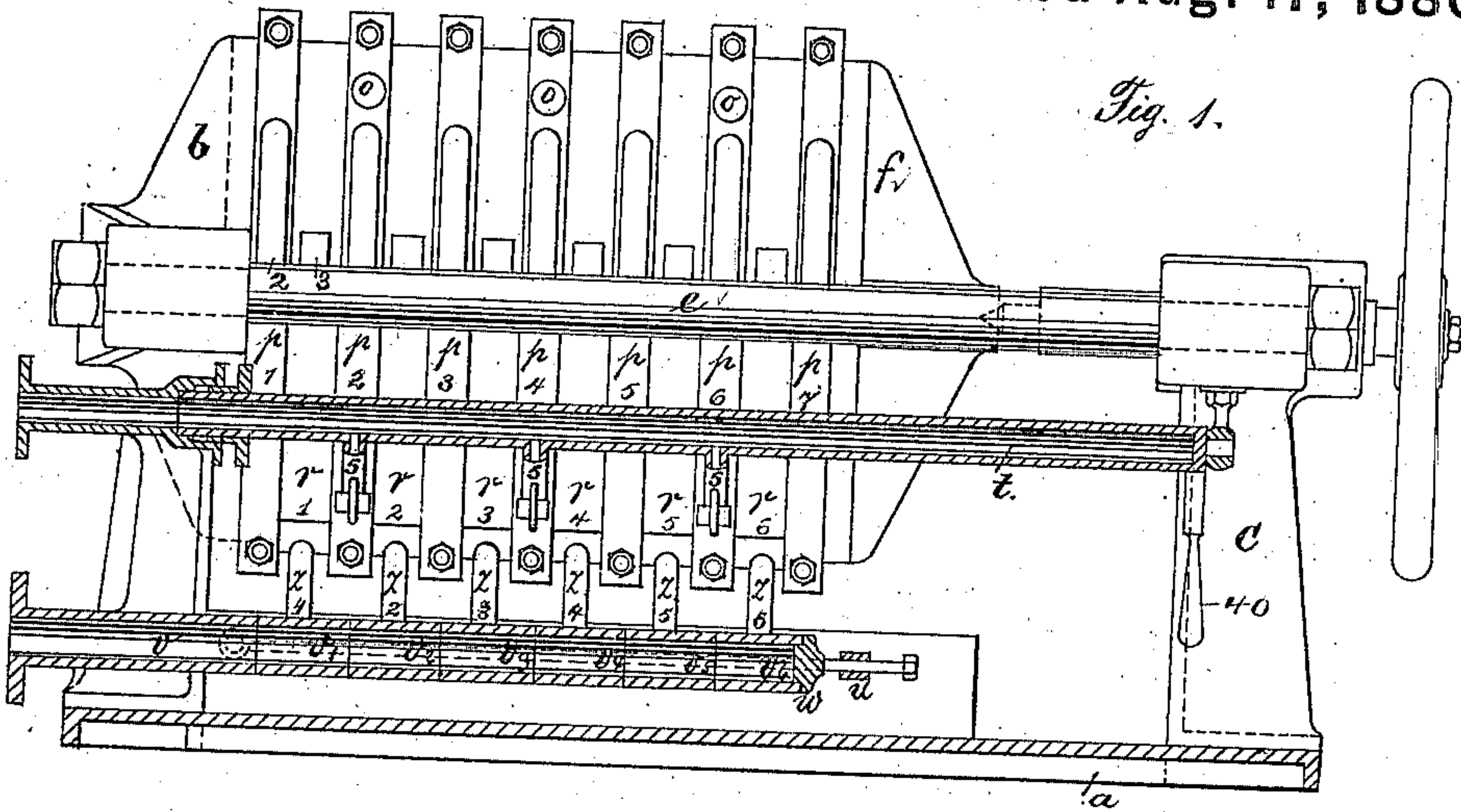


Fig. 1.

Fig. 3.

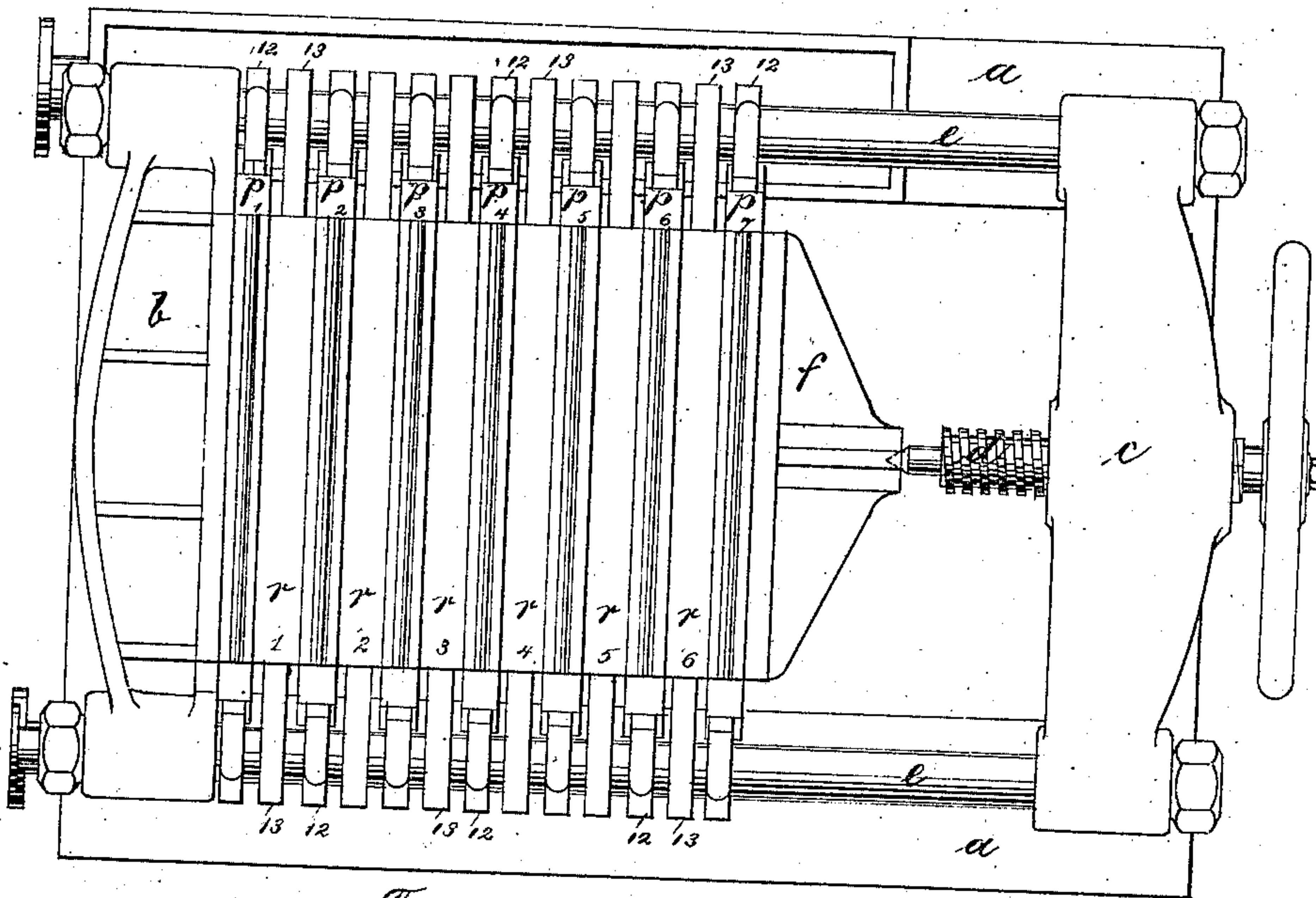


Fig. 7.

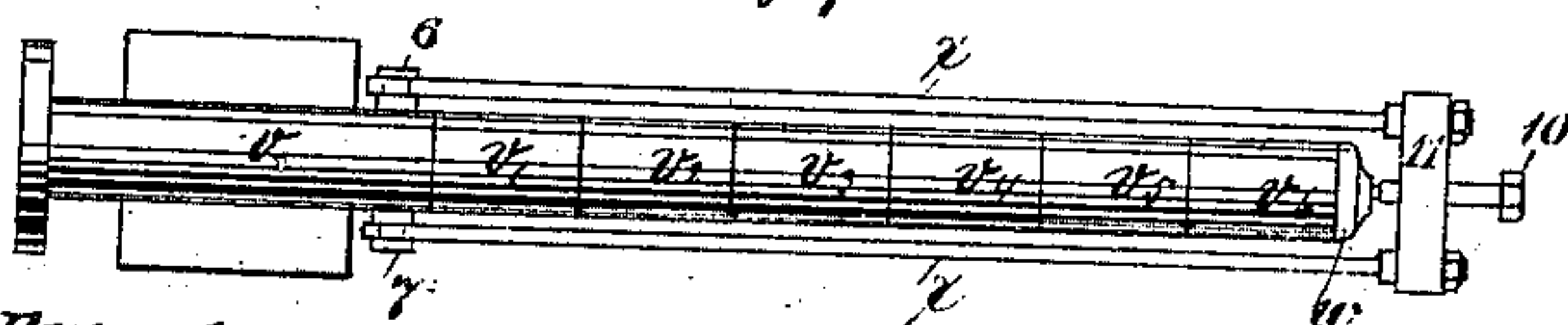


Fig. 8.



Fig. 11.

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2 Sheets—Sheet 2..

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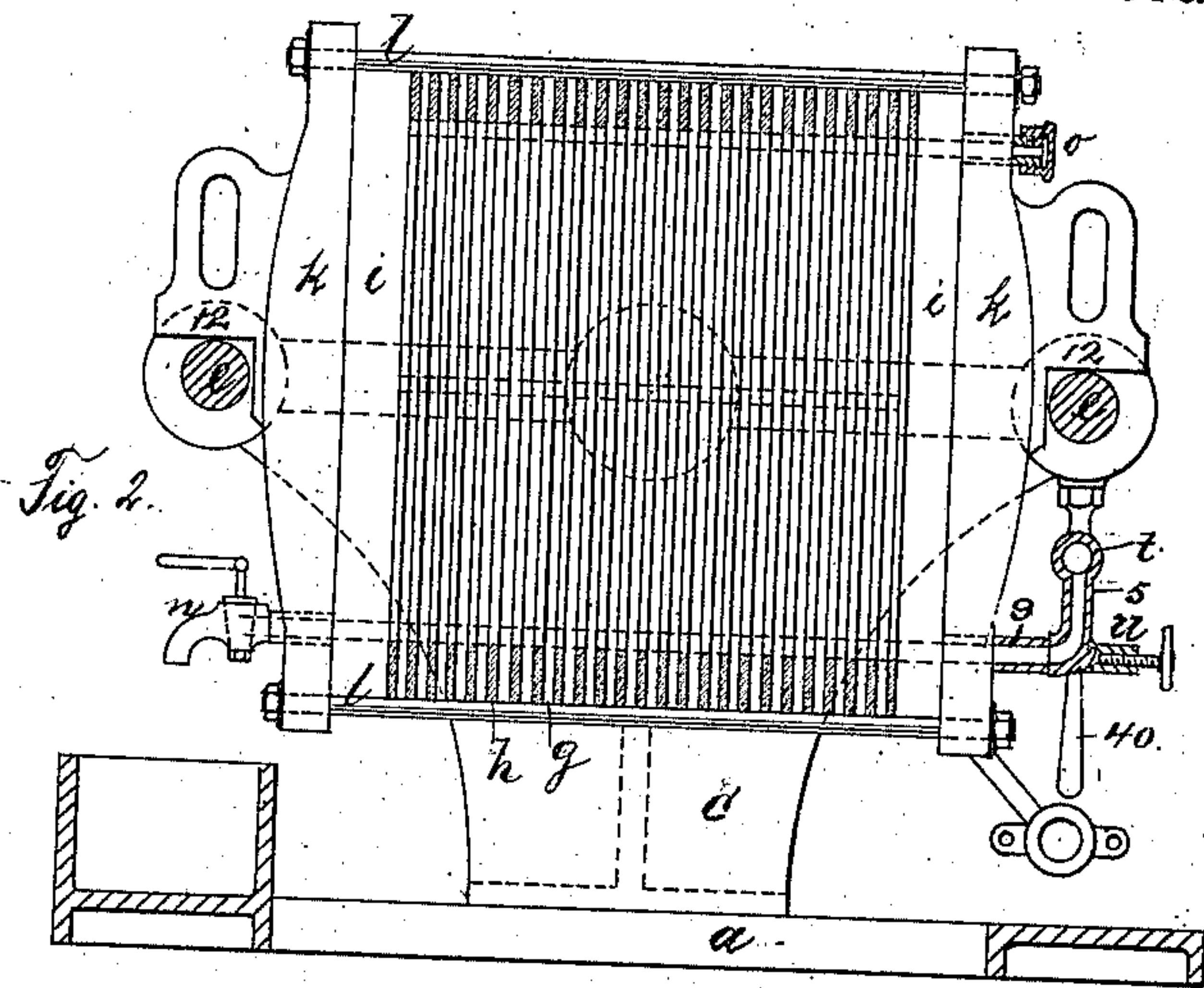


Fig. 9.

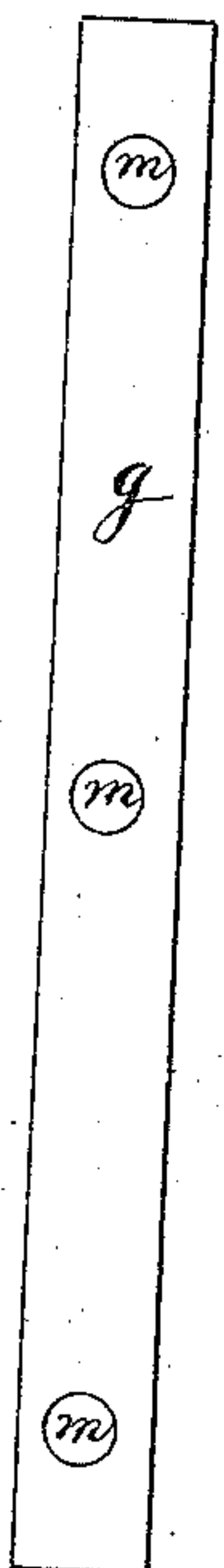


Fig. 4.

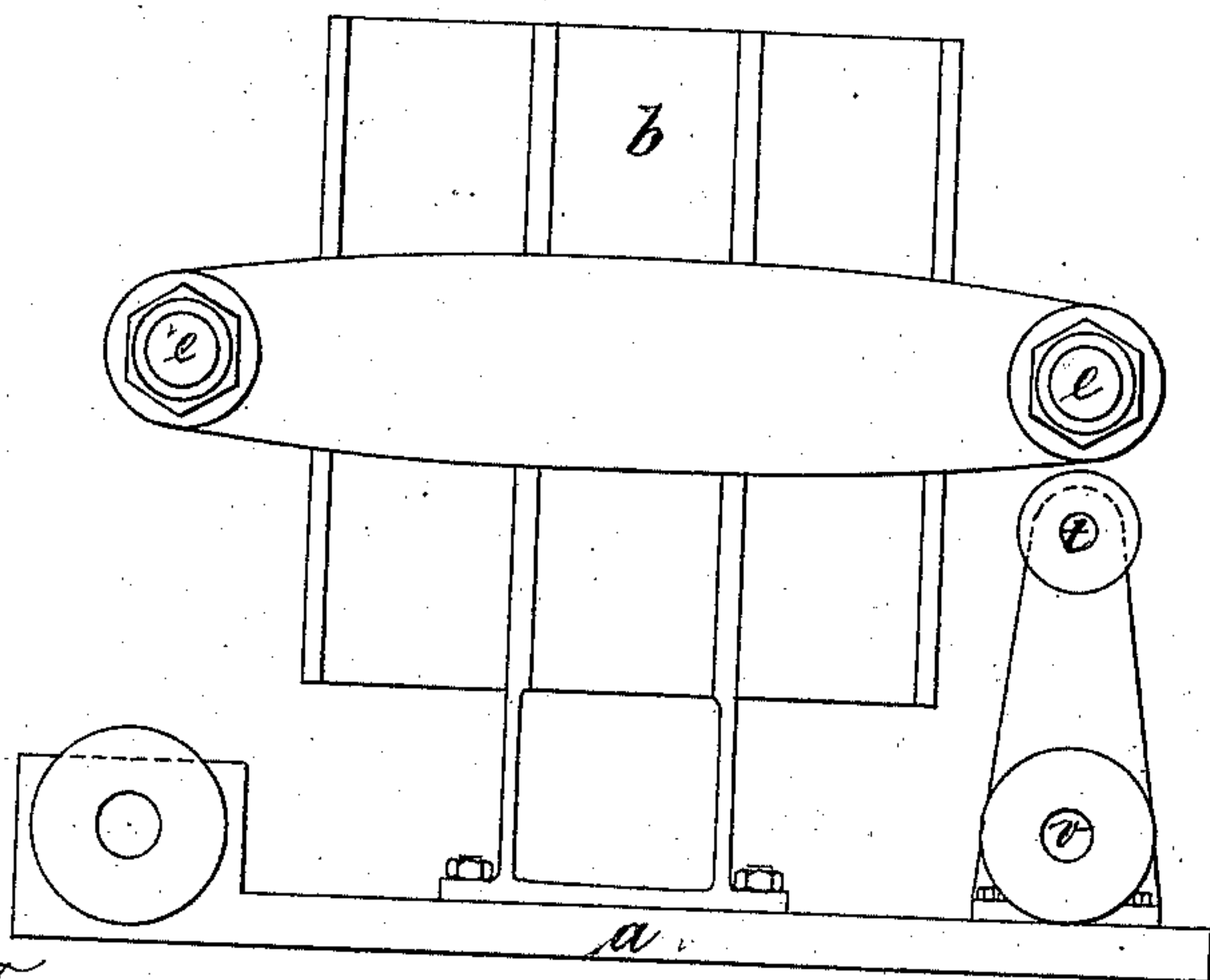


Fig. 10.

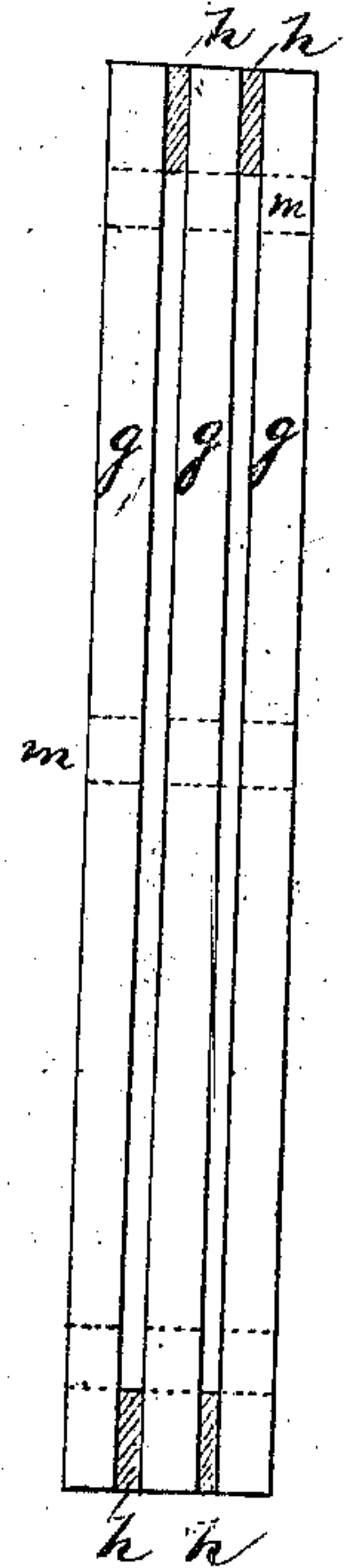


Fig. 5.

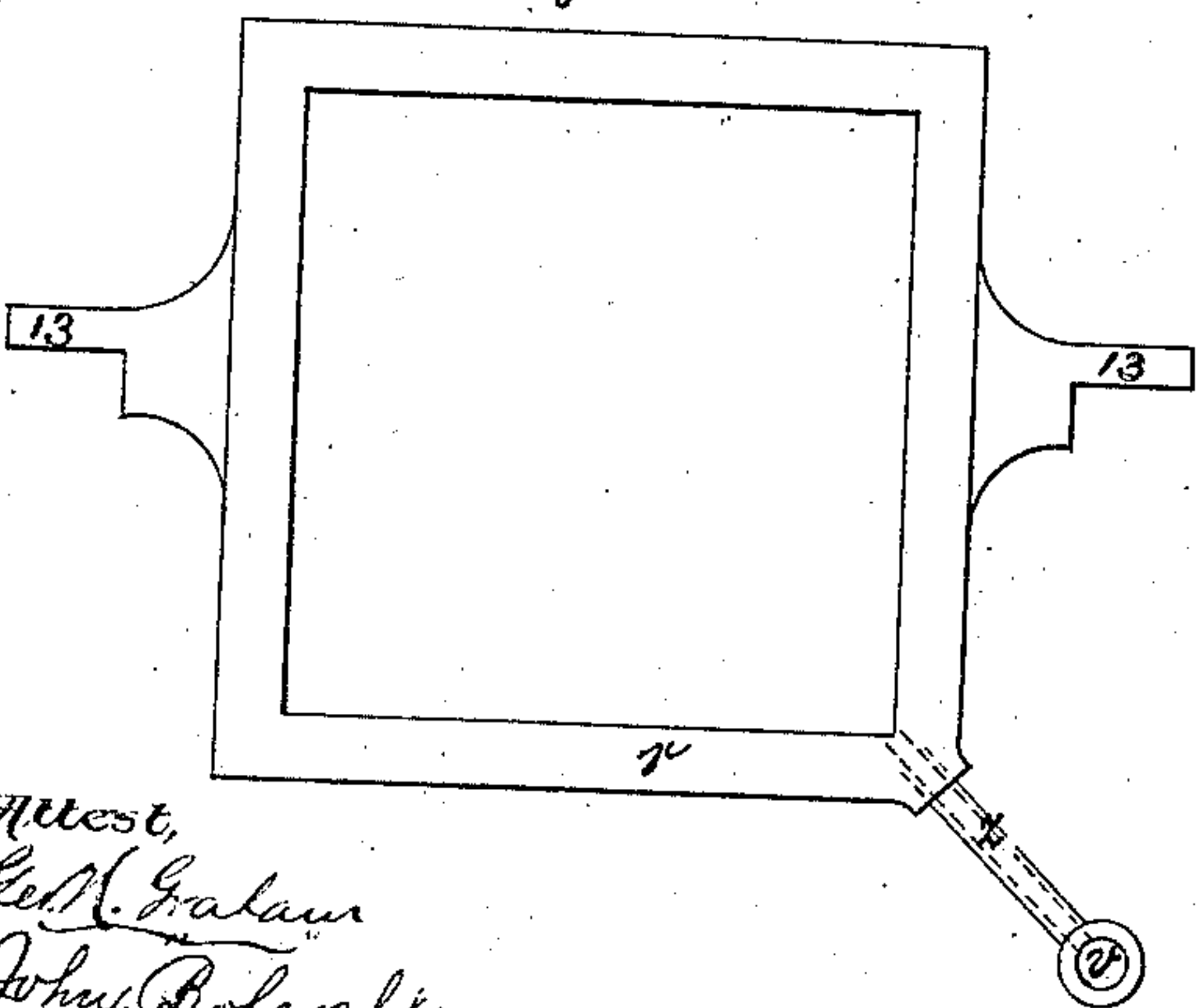
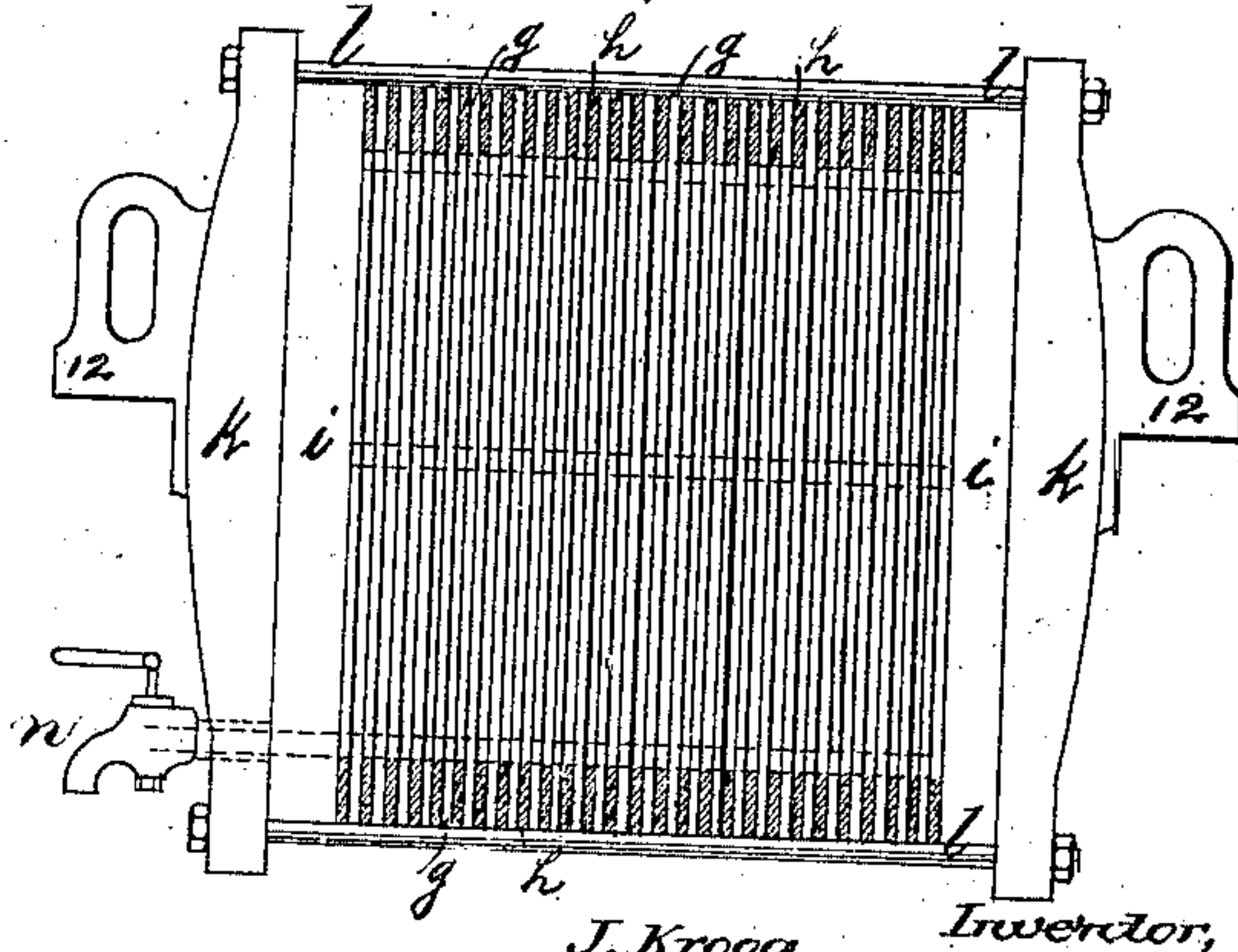


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOHANN KROOG, OF HALLE-ON-THE-SAALE, PRUSSIA.

FILTER.

SPECIFICATION forming part of Letters Patent No. 231,335, dated August 17, 1880.

Application filed January 6, 1880.

To all whom it may concern:

Be it known that I, JOHANN KROOG, of Halle-on-the-Saale, Prussia, have invented a new and useful Improvement in Filtering Apparatus, which improvement is fully set forth in the following specification and accompanying drawings, in which—

Figure 1 is a side elevation of an apparatus constructed according to the said invention, but shows the pipe *t* and the feeding-pipe in section. Fig. 2 is a vertical transverse section of the same, taken through one of the filtering-plates. Fig. 3 is a plan of a frame filter-press of six chambers constructed according to this invention. Fig. 4 is a view showing the fixed head-piece, hereinafter described, and parts connected therewith. Fig. 5 is a view of a frame, hereinafter described. Fig. 6 is a view of a filtering-plate, hereinafter described. Fig. 7 is a plan of the feeding-pipe, hereinafter described. Fig. 8 is a section through an elbow-pipe, hereinafter described. Fig. 9 is a side view of a filtering-bar. Fig. 10 is an edge view of three such bars as adjusted in place, and Fig. 11 is a view of two filtering-bars modified in construction.

Like letters indicate the same parts throughout the drawings.

The general arrangement of the said filtering apparatus or filter-press is the same as is usual with such apparatus.

The fixed head-piece *b* and standard or end piece, *c*, are fastened to the foundation *a*. The rods *e*, which connect the head *b* to the standard *c*, are arranged to support the filtering-plates *p* and their intervening frames *r* in such a manner that each may be displaced or shifted—that is to say, each of said plates *p* and frames *r* rest vertically upon said rods by means of their lateral arms 12 13, and thus may be removed and replaced in any order. These plates *p* and frames *r* are numbered in consecutive order from left to right, so that each may be individually referred to in the description of their use. These rods *e* also support the movable head-piece *f*.

I will now proceed to describe the construction of the filtering-plates forming the chief feature of the said invention, also the peculiar arrangement of the tubes or conduits, serving

partly for effecting the feeding of the mass to be filtered and partly for effecting the feeding of other fluids or gases to be used in the apparatus.

Each of the filtering-plates *p* is formed by narrow bars *g*, placed side by side, but separated a distance apart by intermediate pieces, *h*, placed between their top and bottom ends, as shown in Figs. 2, 6, and 10 of the drawings. The first and last bars, *g*, of each filtering-plate are separated in the same manner from the side pieces, *i*—that is to say, by means of intermediate pieces, *h*, at their upper and lower ends. The bars *g*, intermediate pieces, *h*, and side pieces, *i*, are held fast by the end beams, *k*, and the tightening screw-bolts *l*. Thus a filtering-plate is formed furnished with a great number of slits or openings, the said plate being smooth and level on both sides.

Each bar *g* is provided with apertures *m*, as shown in Figs. 9 and 10, which, when the several bars are in place, form traverse or cross tubes connecting the slits or openings between the bars, as is indicated by dotted lines in Figs. 2 and 6.

In case the material used for the bars should render it desirable, I may provide the slits between the bars by removing a portion of their sides, so as to provide them with heads, as *h*, Fig. 11, so that when the bars are placed side by side slits or openings between them will be formed, as is shown in said Fig. 11.

If it should be desired to give the filtering-plates a circular or round shape, I may form them by employing concentric rings placed one within the other and separated a distance apart by intermediate pieces or heads, *h*.

The slits or openings are shown very wide in Figs. 2 and 6; but in practice these slits are made so fine and narrow as to allow the liquid portion only of the contents of the apparatus to pass through them during the filtering process, and thence to pass out through the cocks *n*, with which each filtering-plate may be provided, and which constitute a continuation at one end of the conduit formed by the lower apertures, *m*. Any solid parts suspended in the fluid are thus prevented from entering the said slits or cocks. Thus the construction of the said plates permits of the

filtration of fluid without the application of the ordinary filtering mediums, such as cloth, wool, felt, porous plates, or the like. Consequently, as the construction of the plates according to this invention admits of arranging the width of the said slits or openings according to the liquid or substance to be filtered, and as every material which can be worked into bars may be used for forming the said plates, I am enabled to produce a filtering apparatus without employing filtering-cloth.

I do not wish it to be understood that I consider the employment of filtering apparatus without filtering-cloth to be in all cases best and cheapest, as I am aware that in many cases the application of filtering mediums, and particularly of filtering-cloth, will prove to be more profitable than without the same; but in these cases such filtering mediums, in connection with my said filtering apparatus, will afford very great advantages.

By reason of the facility with which, according to this invention, I may form plates having slits of any desired width and bars of any thickness that may be necessary, and of any material, I am able to provide for every filtering medium an under layer best suited for the purpose to which the apparatus may have to be applied.

The cleansing of my improved plates is very easily effected, for the reason that there is complete communication through the slits or openings.

I will now proceed to describe the tubes or conduits above mentioned.

If the apparatus is to be used for filtration only, all the plates are made in the manner illustrated in Fig. 6; but if the apparatus is to be used for lixiviation also, the plates *p* designated 1, 3, 5, and 7 will remain in communication with the outside air, as is that shown in Fig. 6—that is to say, they will only have one connection with their interior, namely, a cock, *n*. The plates *p* numbered 2, 4, and 6 will have the same connection with the outside air; but besides this connection they will be provided with an air-valve, *o*, communicating with the upper conduit formed by the apertures *m*, and said plates also have a small pipe, 9, communicating with one end of the lower conduit formed by the apertures *m*. (See Figs. 8 and 2.)

The elbow-pipe 5 is pressed tightly against the pipe 9 by means of a screw in the movable bow *u*. (Shown in Fig. 8.) The elbows 5 depend from the pipe *t*, one end of which is movable in a stuffing-box, while the other end turns on a pivot, so that when emptying the apparatus, after having turned down the bows *u*, the elbows 5 may be turned outward from the apparatus by means of the handle 40, mounted on the end of the pipe *t*, said pipe being thus swung outward and preventing any damage being done to the said elbows when moving or displacing the frames *r* and plates *p*.

The pipe for feeding the mass to be filtered is composed of the section *v*, fastened to the foundation *a*, and of the sections *v'*, *v''*, *v'''*, *v''''*, *v''''''*, and *v''''''''*, and with a cover, *w*. The pipe-section *v* is provided with pivots 6 7, (see Fig. 7,) to which rods *x* are connected, whereby the lengths or sections of pipe are pressed tightly together through the medium of a screw, 10, passing through the cross-piece 11, in which the opposite ends of the rods *x* are seated. The lengths or sections of pipe *v'*, *v''*, *v'''*, *v''''*, *v''''''*, and *v''''''''* are each as long as the width of a plate, *p*, and a frame, *r*, and each connects with its respective frame *r* by means of small pipes *z*, which pipes are numbered respectively 1, 2, 3, 4, 5, and 6, to indicate their association with said frames. The said small pipes are made sufficiently long in comparison with their diameter to render the material of the said pipes sufficiently elastic to insure a tight connection of the lengths of pipe notwithstanding any slight inexactitude which might occur.

By means of the arrangement of the tubes and conduits, as above described, a minimum of tightening-surface is attained. While with the usual formation of conduits the feeding-tube for a frame filtering apparatus of six chambers has twelve tightening-surfaces, the same will have, if built according to my improved construction, seven tightening-surfaces only, including the lid or cover. Furthermore, the lixiviation-tube for a frame filtering apparatus of six chambers of the ordinary construction will have twelve tightening-surfaces likewise, while it will have but three according to my said invention.

The operation of the apparatus is as follows—that is to say, after the same has been screwed up the mass to be filtered is poured into the frame *r* through the pipe *v*. The fluid flows off through the slits or openings in the filtering-frames, and thence through the cocks *n*, while the compact or solid particles form cakes within the frames, and when these are formed the induction is stopped. After the cocks of the plates *p* marked 2, 4, and 6 have been closed the fluid intended for lixiviating is let into the said plates through the pipe *t*, and the air contained therein passes out through the air-valves. This being effected, the lixiviating fluid enters the cakes, driving the fluid contained in the said cakes into the plates *p* marked 1, 3, 5, and 7, whence it runs out through the cocks *n*, the same having been opened. After the lixiviation has been completed the influx of the lixiviating-fluid is cut off, the elbows 5 are turned from the apparatus in the manner above described, and the bow *u*, having been loosened, is rested upon the foundation *a*. These proceedings having been finished, the removal of the said cakes is effected by displacing or shifting the plates and frames.

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

1. The filtering-plates, constructed of a series

of bars separated by intermediate pieces or heads, *h*, substantially as described.

2. The combination, with the frames and plates, of the sectional feeding-pipes, substantially as described.

5 3. The combination, with the filtering-plates, of the movable lixiviating-pipe *t*, provided with elbows 5, substantially as described.

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

JOHANN KROOG.

Witnesses:

ROBERT R. SCHMIDT,
OTTOMAR WAGLER.