

(No Model.)

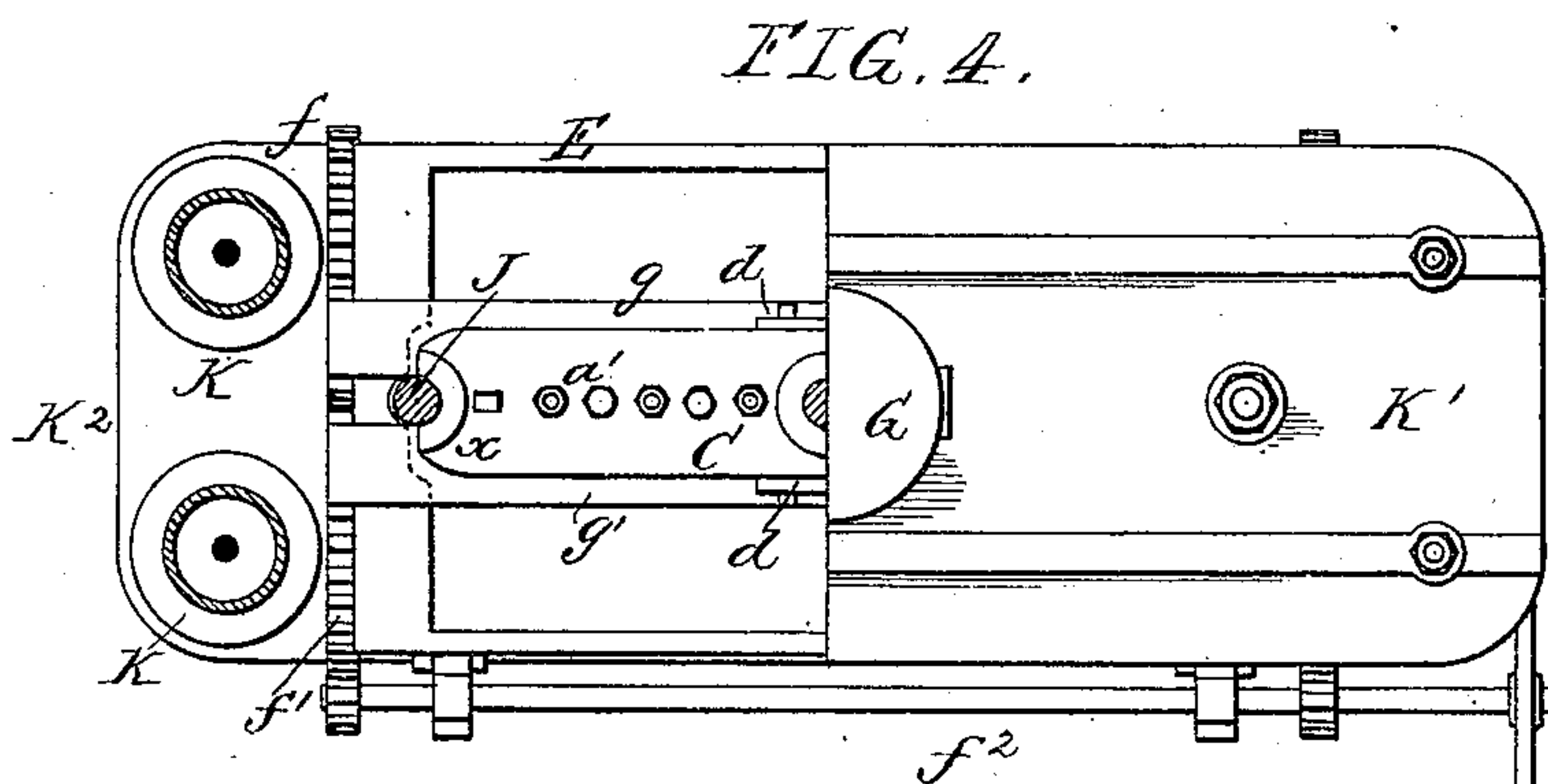
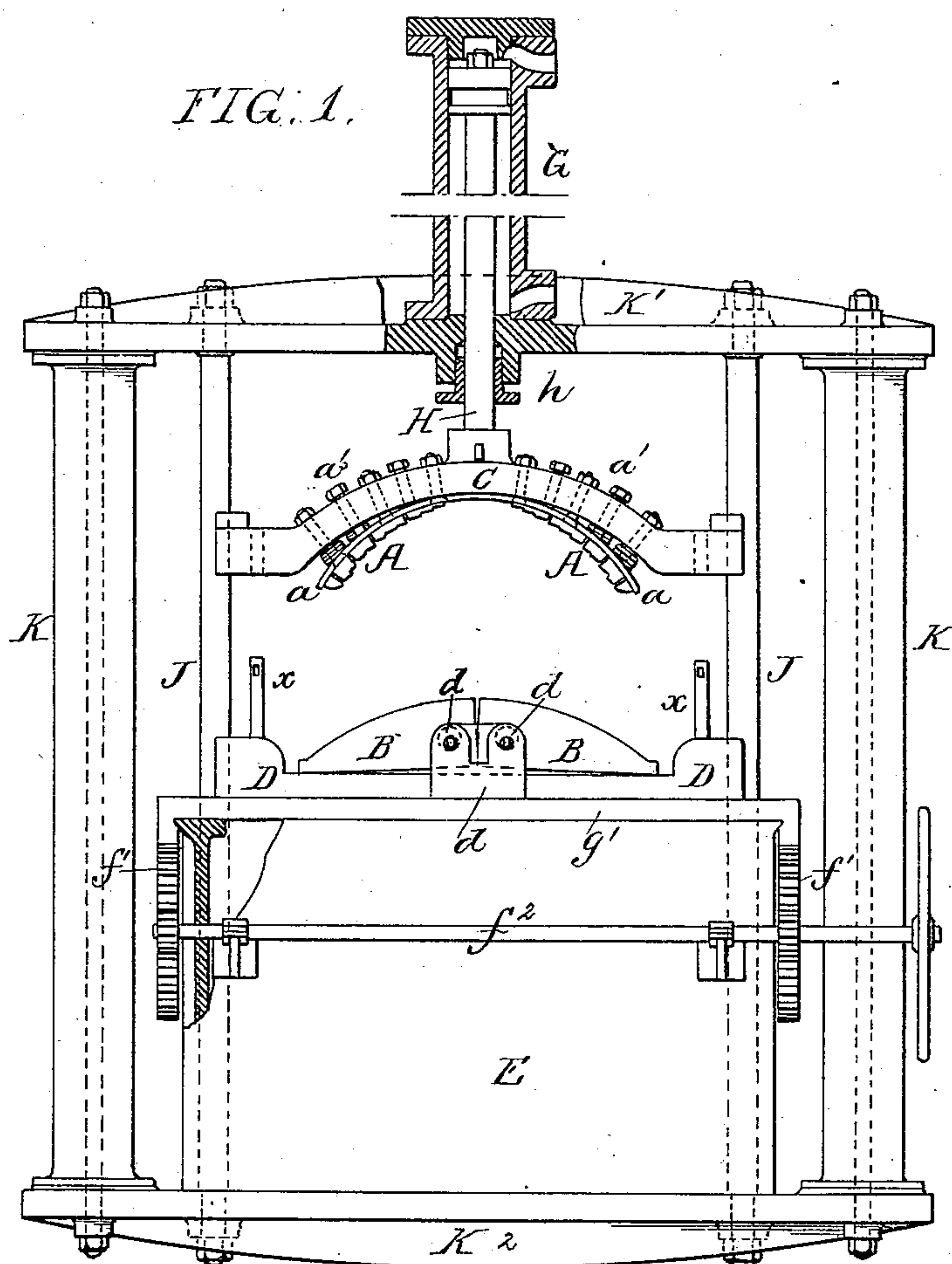
2 Sheets—Sheet 1.

G. W. WILLFORD.

MACHINE FOR MAKING SPRINGS.

No. 256,088.

Patented Apr. 4, 1882.



WITNESSES:

Harry Smith
James F. Tobin

INVENTOR:
George W. Willford
by his attys
Howe and Fox

(No Model.)

2 Sheets—Sheet 2.

G. W. WILLFORD.

MACHINE FOR MAKING SPRINGS.

No. 256,088.

Patented Apr. 4, 1882.

FIG. 2.

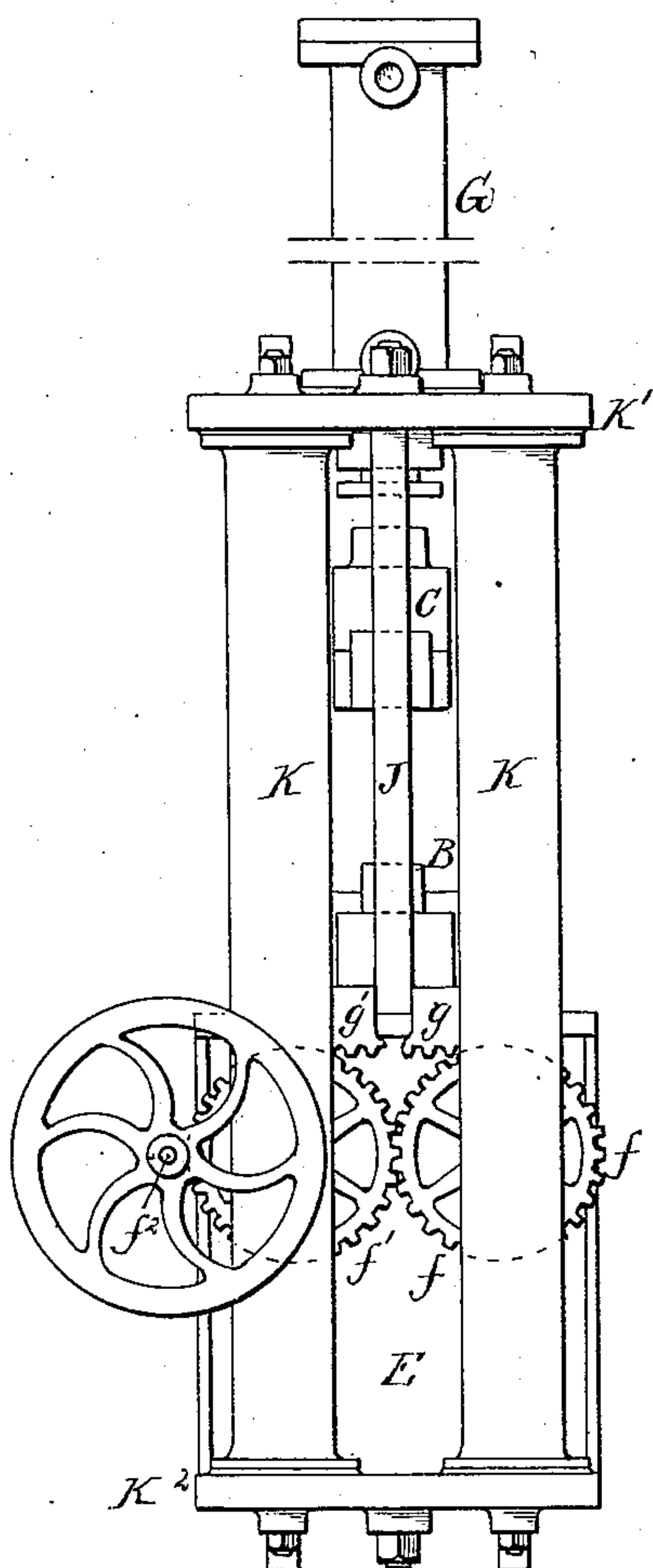


FIG. 3.

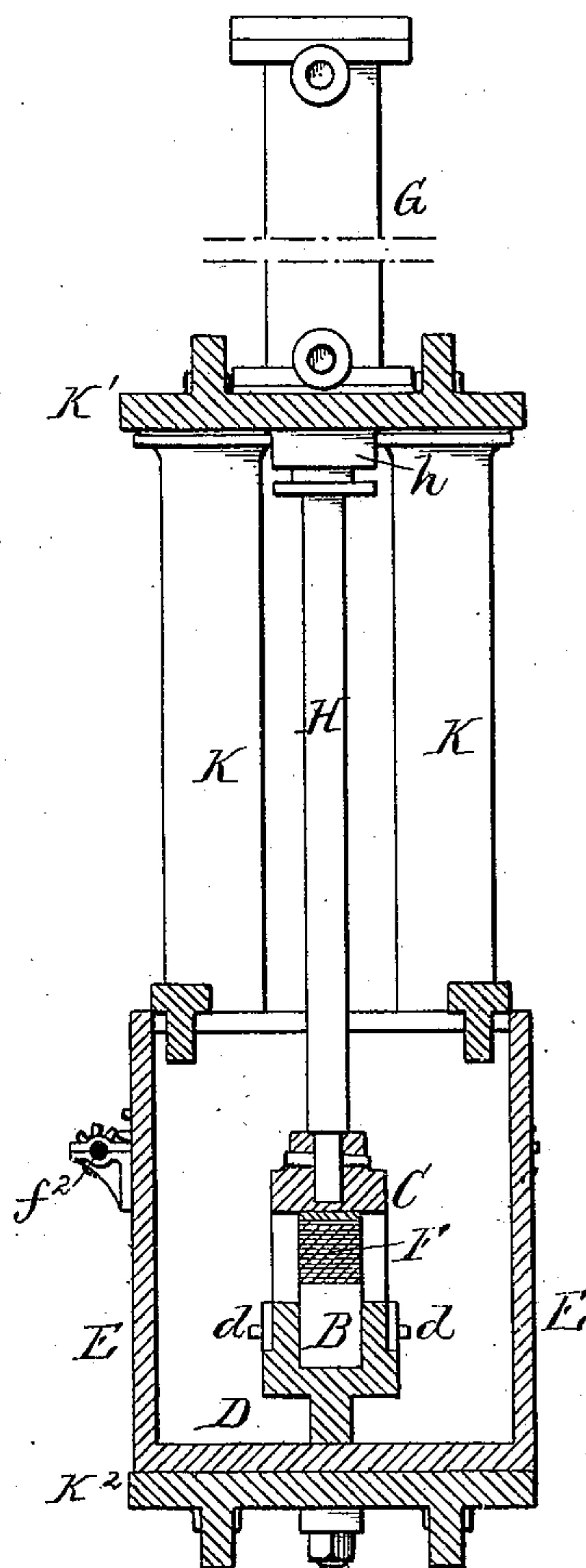
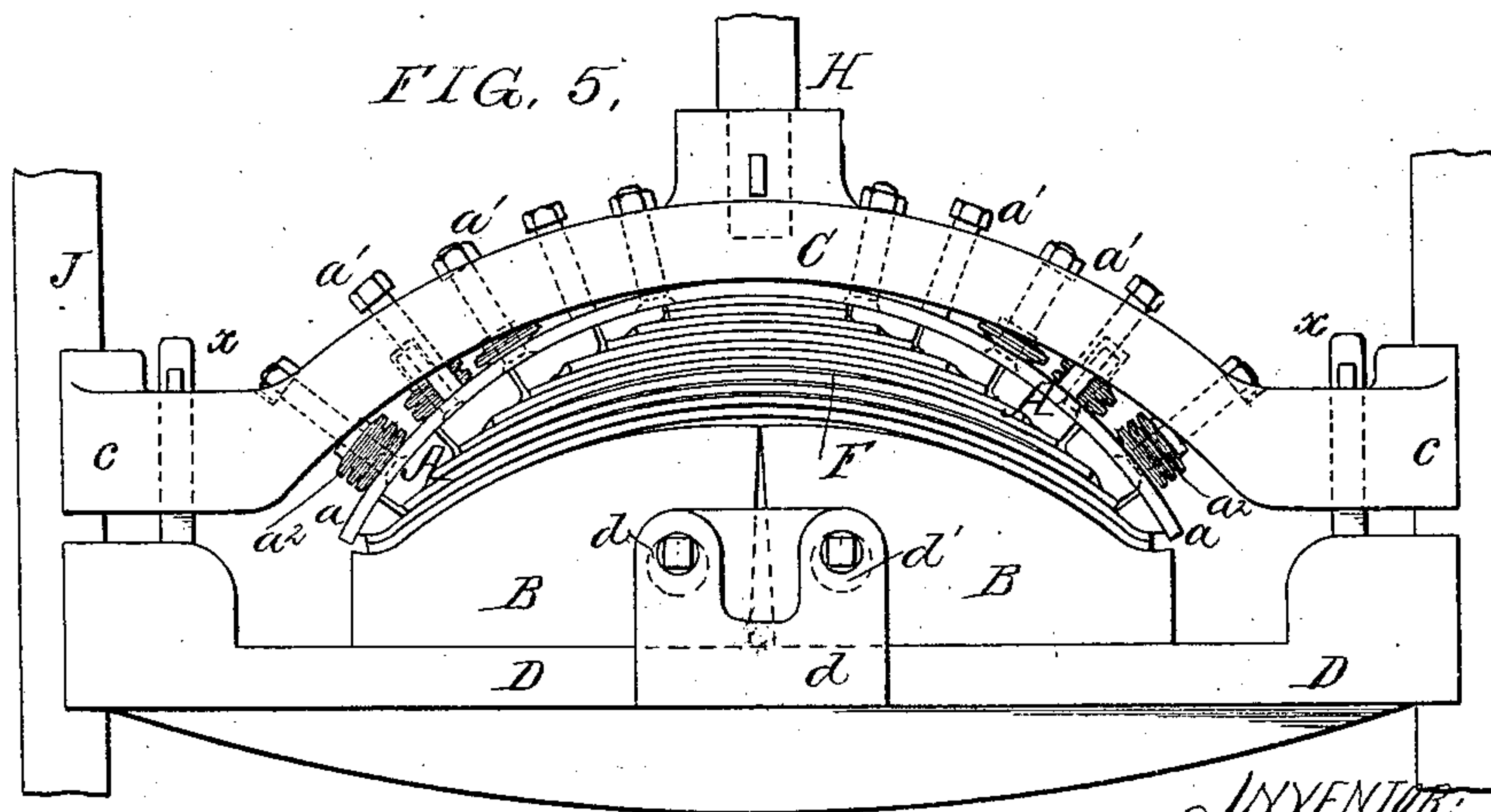


FIG. 5.



WITNESSES
Harry Smith
James J. Tobin.

INVENTOR:
G. W. Willford
by his Attys
Howson and Son

UNITED STATES PATENT OFFICE.

GEORGE W. WILLFORD, OF SHEFFIELD, COUNTY OF YORK, ENGLAND.

MACHINE FOR MAKING SPRINGS.

SPECIFICATION forming part of Letters Patent No. 256,088, dated April 4, 1882.

Application filed July 5, 1881. (No model.) Patented in England March 22, 1879.

To all whom it may concern:

Be it known that I, GEORGE WILLIAM WILLFORD, a resident of Attercliffe, Sheffield, Yorkshire, England, and a subject of the Queen of Great Britain and Ireland, have invented certain Improvements in Methods of and Apparatus for Making Springs, (for which I have obtained British Letters Patent No. 1,155, March 22, 1879,) of which the following is a specification.

This invention relates to improvements in the manufacture of plate or leaf springs and apparatus for forming the springs from forged bars or strips of steel; and the object of my invention is to make or fit one complete spring at one operation.

In the accompanying drawings I have illustrated a construction of apparatus by which the springs are fitted in accordance with my invention.

Figure 1 is a front view in elevation; Fig. 2, an end view; Fig. 3, a transverse section, showing the dies and spring depressed into the tempering-bath; Fig. 4, a plan view, partly in section; and Fig. 5, a view of the dies containing the spring, drawn to a larger scale.

The four vertical pillars K K, with the cross-pieces K' K², constitute the frame of the machine. The upper cross-piece, K', supports a central vertical steam or hydraulic cylinder, G, the piston-rod H of which passes through a stuffing-box, h, in the beam K', and carries at its lower end the curved cross-head C. This cross-head C has its opposite ends adapted to the guide-rods J, and carries the adjustable dies A A, which are secured to the spring-plate a, the latter being secured to the cross-head by bolts and nuts a', while the dies are set to the proper position by inserting washers a² between the plate a and cross-head. The lower die, B B, made in two parts, is carried by a plate, D, the latter being provided on opposite sides with lugs d, forming bearings for eccentrics d' d', which are adapted to openings in the dies B B, so that by turning these eccentrics the dies may be adjusted to the positions shown in Fig. 1 or those shown in Fig. 5.

The plate D, which is guided by the rods J, is supported in position by the two-part table gg', adapted to horizontal dovetailed guideways on the top of the tank E, Fig. 1. The pro-

jecting under edges of each part of the table are provided with racks, into which gear wheels ff', the latter being geared with pinions on a shaft, f², provided with a hand-wheel. By turning this hand-wheel in one direction or the other the two parts g g' of the table may be caused to move toward or away from each other, and when moved to the latter position allow the dies to be lowered into the cold water or other tempering-liquid contained in the tank E.

In making a spring on the above-described machine, the flat spring-plates composing one complete spring are placed in their forged and heated state between the top and bottom dies, A and B, the bottom dies, B, being in the raised position shown in Fig. 1. Steam, hydraulic, or other pressure is then admitted to the cylinder G above the piston, so as to force down the upper die and curve the spring-plates F over the bottom dies, thus bending all the plates, forming the complete spring at one operation, the common method being to bend the plates successively, one at a time. The plate D is then secured to the cross-head C, so as to confine the plates F between the dies by introducing keys through the ends of the bolts x, which pass through vertical openings in the said cross-head C. The eccentrics d' d' are then turned so as to lower the central portion of the two-part die B B, thereby allowing the spring-plates to set clear of each other in the center, Fig. 5, pressure being exerted only at the extreme ends, so that when the dies with the spring are lowered into the tempering-liquid the latter may pass between the central portions of the plates F, and thereby harden or temper the spring more uniformly than if the liquid had access only to the edges of the plate F.

The top dies may be so constructed and provided with eccentrics d' d' as to be movable like the bottom dies when it is desirable to set out the spring-plates from one another to a greater extent than would be the case when the bottom dies only are drawn back from the center of the spring-plates after the latter have been compressed between the dies. After the spring has been properly tempered the dies are raised, the two parts g g' of the table are moved toward each other, so as to support the dies,

the upper and lower dies are separated, and the spring removed for the next operation.

Instead of employing a cylinder and piston to operate the dies, a rack and pinion or equivalent device may be employed, if found desirable, for the purpose.

Instead of constructing the dies so as to be adjustable to set the plates F apart in the center, packing-pieces may be inserted between each of the flat spring-plates before or while being curved in order to produce the desired setting out of the plates from one another; or, if preferred, the spring-plates may be first curved in the said machine and curved packing-pieces then inserted between adjoining plates, after which the plates, with the packing-pieces between them, should be compressed between the dies to set up the spring-plates clear of each other, the said packing-pieces being taken out before cooling and hardening the plates.

The tank to contain the liquid for hardening the plates may be connected with a water-supply main of suitable pressure, and the tank may be open, as described, or be made capable of being closed and secured, so that a great pressure of water may be maintained therein. Instead of constructing the apparatus so as to permit the depression of the dies into the tank, the tank may be raised while the spring is held between the dies; or, in place of the water-tank, or in combination with it, a system of water-pipes may be employed, from which jets or streams of water may be forced onto and between the plates in the dies.

In order to give an improved form to the spring-plates during or after the operation of curving and fitting, packing-pieces, as matrices, of the required form, would be inserted between each spring-plate, and the said plates (with the said matrices between them) would be subjected to blows or pressure in the above-described apparatus until the plates were curved

by the dies and impressed with and by the form of the said matrices.

I wish it to be understood that I do not desire to claim in this case the method described of tempering the spring, as I propose to make this the subject of a separate application for a patent.

I claim as my invention—

1. In a spring-bending machine, the combination of two dies with devices, substantially as described, for moving one of the dies toward or from the other at the center while keeping the ends of the dies in substantially the same relation, as and for the purpose set forth.

2. In a bending-machine, the combination of the upper dies with a plate, D, and die B made in two parts, and provided with devices for raising and lowering the two parts in the center, substantially as specified.

3. The combination of a die, B, with dies A, spring-plate carrying the latter, cross-head, and devices, substantially as described, for adjusting the spring-plate.

4. The combination of movable dies A B and plate D with movable table *g g'*.

5. The combination of the guides J, cross-head C, plate D, and dies with movable table *g g'*.

6. The combination of the dies, cross-head C, plate D, and fastening devices *x* with movable supports for said plate D.

7. The combination of dies and support D with two-part table *g g'*, having racks at the end, and gear-wheels *f f'*, all substantially as set forth.

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

GEORGE WILLIAM WILLFORD.

Witnesses:

HENRY ANTY,
F. F. HIBBERT.