

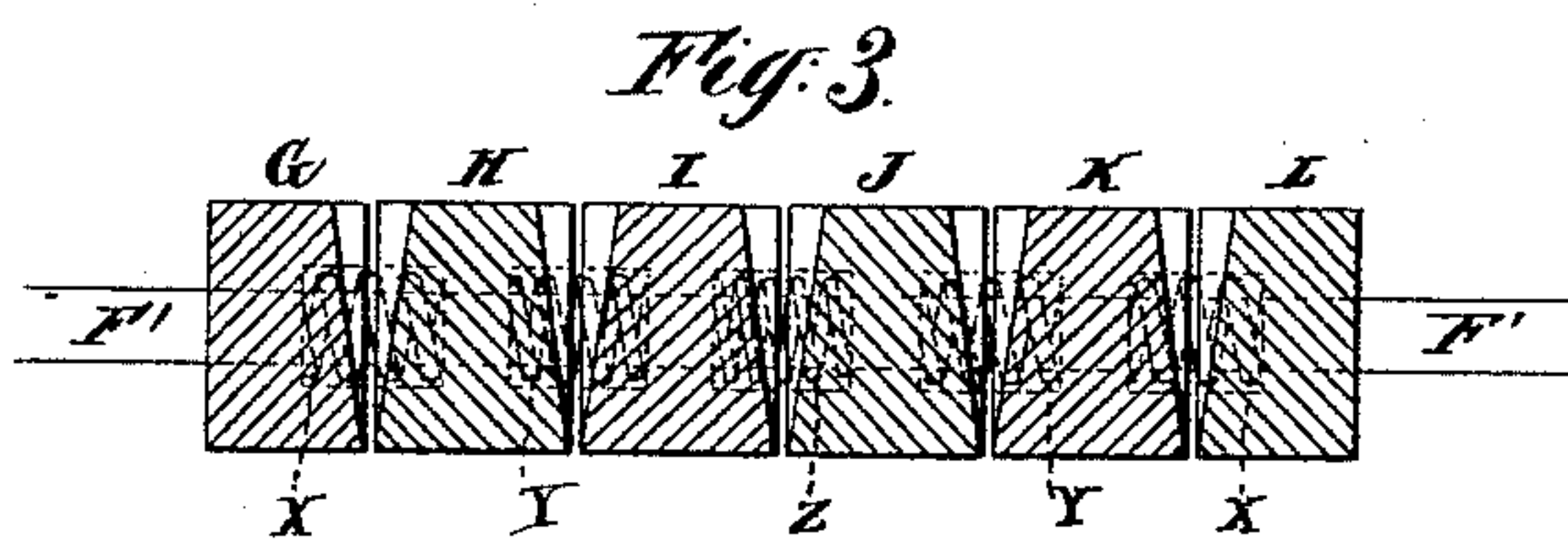
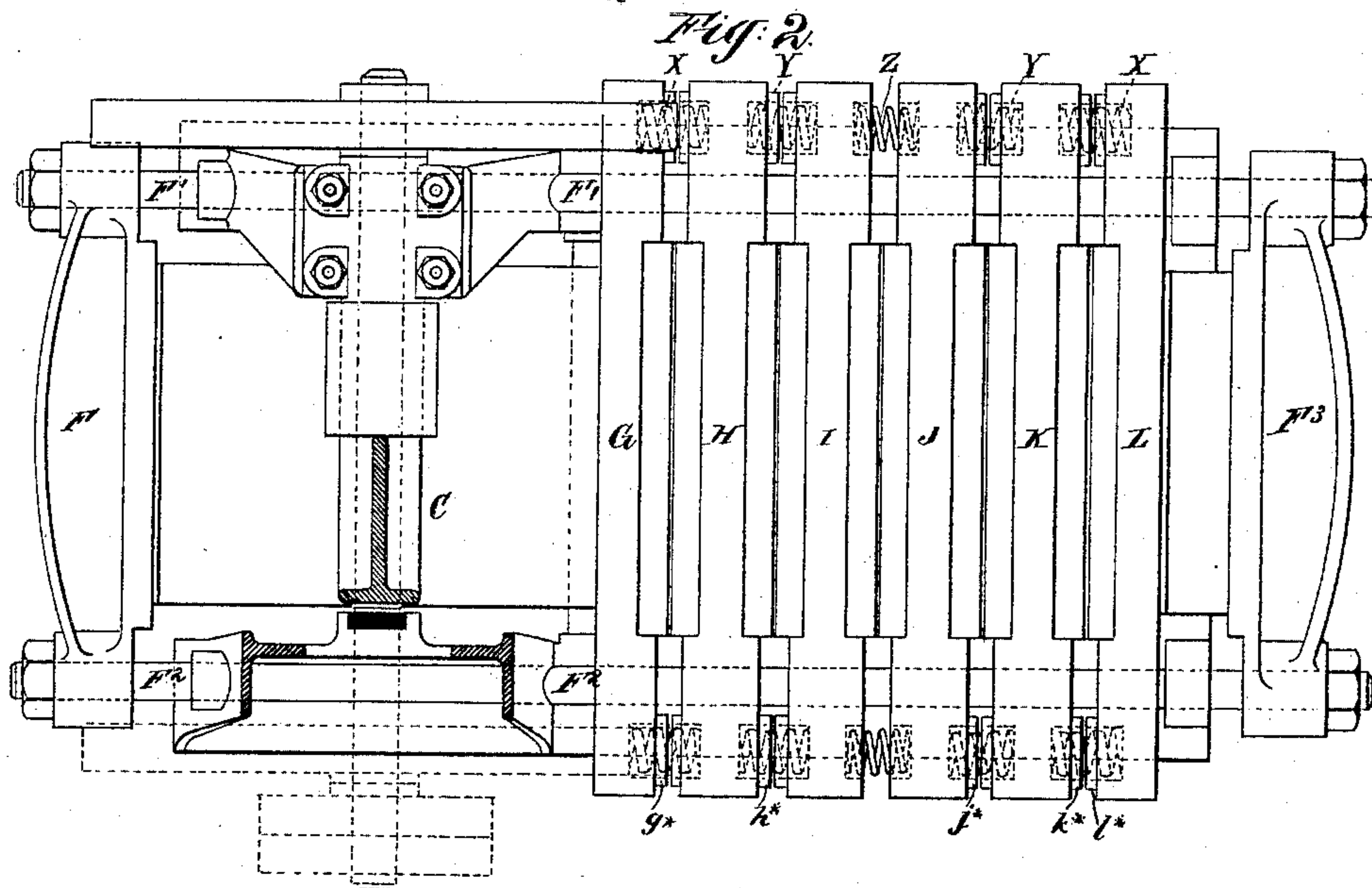
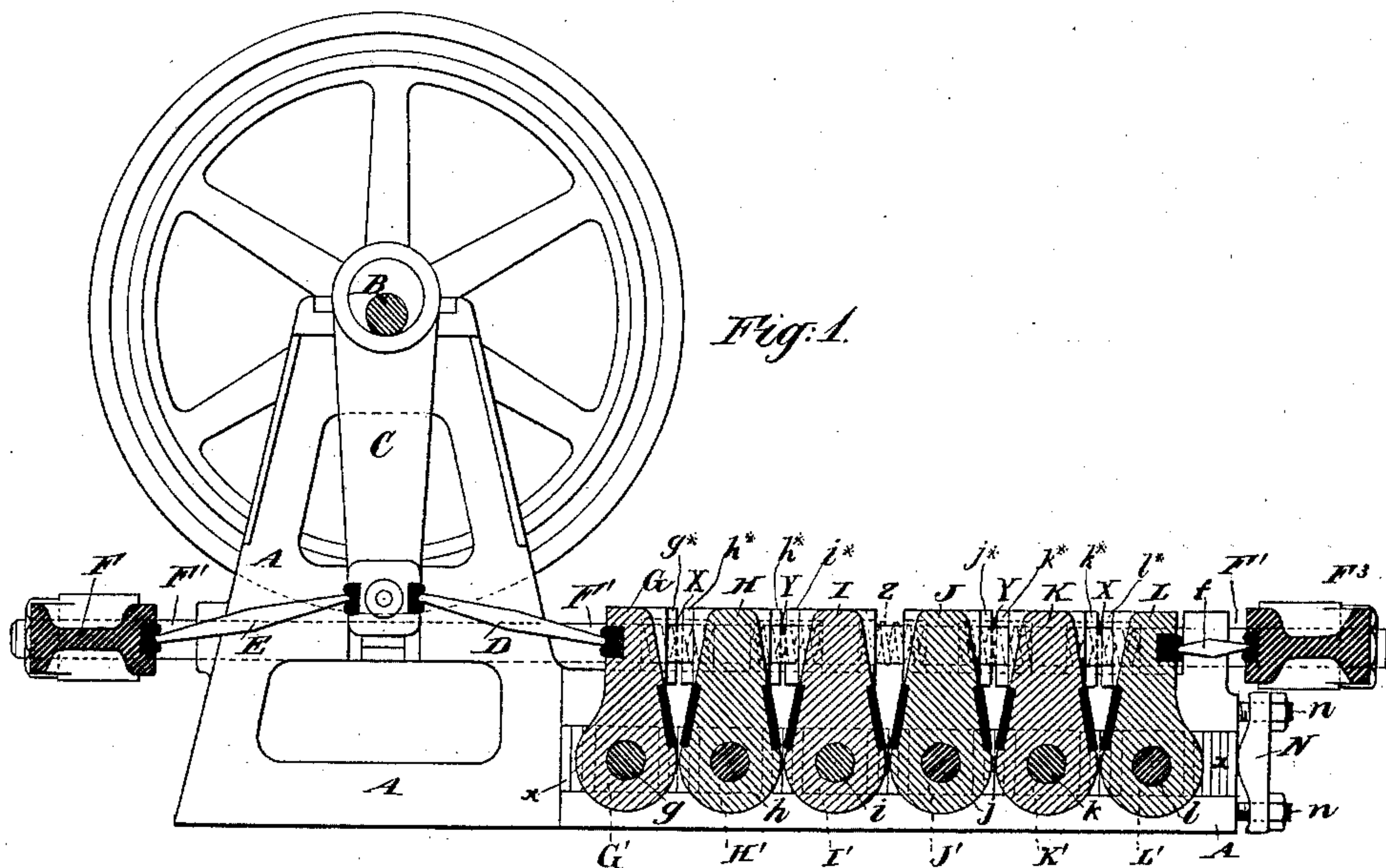
(No Model.)

F. H. McDOWELL.

ORE CRUSHER.

No. 328,132.

Patented Oct. 13, 1885.



Witnesses:

E. Brookes
M. F. Boyle.

Inventor:

Frederick H. McDowell
by his attorney
Shuman & Sons, Boston

UNITED STATES PATENT OFFICE.

FREDERICK H. McDOWELL, OF BROOKLYN, NEW YORK.

ORE-CRUSHER.

SPECIFICATION forming part of Letters Patent No. 328,132, dated October 13, 1885.

Application filed March 16, 1885. Serial No. 158,991. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK H. McDOWELL, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Ore-Crushers, of which the following is a specification.

I employ a number of jaws, transmitting the pressure from one to another, in combination with springs of different forces, the springs near the middle being of less force than those at each end of the series of jaws. The jaws are actuated from both ends of the series, the outermost being simultaneously driven inward from each end at the same time, and then allowed to return again simultaneously.

Instead of the jaws opening gradually and evenly throughout the series, the ends of the series open first, afterward the intermediate spaces, and last of all the middle of the series. Each set of jaws opens to nearly or quite its full extent before any of the jaws separated by weaker springs commence to move.

In closing the jaws together there is a tendency to reverse these conditions, closing fully at the center first and afterward in the intermediate spaces, and last of all at each end. The difference of force of the springs may be due to difference in diameter of coils and in size of the steel from which the coils are formed. All the springs are relieved from force and at rest when the jaws are fully open.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a longitudinal vertical section. Fig. 2 is a plan view partly in horizontal section. Fig. 3 shows a modification. It is a central longitudinal section of a portion.

Similar letters of reference indicate corresponding parts in all the figures where they occur.

A is a fixed framing, of cast-iron or other suitable material. B is a revolving shaft turned by a belt from a steam-engine or other suitable motor.

C is a pitman operated by a crank or eccentric on B, and giving a vertical reciprocating motion to the two toggle-levers D E.

G, H, I, J, K, and L are crushing-jaws,

turning on the respective trunnions or centers *g, h, i, j, k, and l*, supported in stout boxes supported in the framing A. The series of jaws is operated from each end.

The toggle D acts against the first jaw, G, and the toggle E acts against the jaw L, through a train of connections as follows: Toggle E acts directly on a stout movable cross-head, F, which, by stout reciprocating rods *F' F²*, connects with a corresponding opposite movable cross-head, *F³*. This latter acts through a short link, *f*, against the last jaw, L, of the series. At each depression of the pitman C the first jaw, G, is moved to the right, and the corresponding jaw, L, is moved to the left. Each acts on the ore between it and the next to crush it. At each ascent of the pitman the jaws are allowed to separate. The separation is induced by a series of coiled springs, *X Y Z*, housed in recesses in the jaws. The forces of the several springs are unequal.

The springs *X Y Z* have different degrees of resisting force, those marked *X X* having a force of, say, one hundred units, the units being of any value—say one pound or one thousand pounds—those marked *Y Y* having a force of, say, fifty units, and those marked *Z Z* having a force of one unit. Those springs which have the greatest force (marked *X X*) are arranged between the outer pairs of jaws—that is, between the jaws G H and K L. The springs *Z Z*, those having the least force, are arranged between the jaws which are central, or nearly so, in the series, (shown in the drawings as jaws I J,) while the springs *Y Y*, those having the medium force, are arranged between the intermediate jaws, as J K and H I. The several springs are arranged in pairs, two springs being between each pair of jaws near their ends.

When the pitman C rises, the elastic force of the springs separate the several jaws, but such separation is not simultaneous throughout the series. The outermost jaw on each end of the series moves away from its neighbor first, the next follows them, and, lastly, the innermost pair separates. Each pair of jaws makes nearly its full opening movement before the next pair commences to open. There is a continued movement of the outermost jaws, G L, after those next, H K, have com-

menced to move, and the jaws H K continue to move while the central pair, I J, are separating.

The stout "boxes" in which the axes of the jaws turn may be adjusted farther apart or closer together by inserting or removing shimming-pieces. G' H' I', &c., are the boxes, *x x* &c., the shimming-pieces, and N a stout binder, which holds them by the aid of screws *n n*.

There are sufficient holes in the jaws G H I, &c., at the proper points to allow the tie-rods F' F² to reciprocate and the several jaws to vibrate to the extent required without touching.

The jaws are formed with a metal re-enforce around the cavity for each spring. These re-enforces are marked, respectively, *g* h* i**, &c. The parts are so proportioned that when the outermost jaws are closed together to the proper extent, those rims *g* h* i**, &c., bear fairly the one against the other, and transmit the force by direct contact of metal with metal. These rims are omitted only between the inner faces of the jaws I and J. There is no limit prescribed to determine how nearly these jaws may close together. They may close up to any extent, to allow for any adjustment of the parts.

I prefer that all the jaws shall, in closing, close together about equally, and that all the jaws shall, in opening, open so that the openings between one jaw and the next shall be equal; but it is important that they do not open and close simultaneously, but on the contrary, successively. My invention, by insuring that the space between each pair of jaws is held closed until the proper moment, and then opened promptly to the proper extent, and remains open to that extent a considerable period, greatly facilitates the prompt reception of the material of coarse and fine together into each space, the reduction of all to about uniform sizes, and the prompt delivery of the whole thus crushed.

The strain to crush the material in the space between the innermost jaws, I and J, is trans-

mitted at first through the stiff springs X X, which hold apart the outer jaws, and, later, through the positive contact of the stout castings which form the jaws. The action of all the parts is reliable and uniform.

I have shown another form of crusher in Fig. 3. In this the jaws or crushing parts corresponding to the jaws G H I, &c., are not centered on pivots, but slide on the rods corresponding to F' F².

Further modifications may be made. I can change the number of the pairs of jaws. The forms and proportions may be varied within wide limits. The relative stiffness of the springs may be varied considerably, so long as there is sufficient force in the springs Z to separate the innermost jaws promptly when the crushing force is relaxed and a sufficiently greater force in the outer springs to transmit inward the necessary crushing strain.

I claim as my invention—

1. In an ore-crusher, the combination of the several jaws G H I, &c., and the differential springs X Y Z, arranged between said jaws, substantially as described.

2. In an ore-crusher, the jaws G H I, &c., formed with recesses, as shown, in combination with springs, as X Y Z, partially inclosed in such recesses, reciprocating rods F' F², playing through holes in the jaws, connecting cross-heads F' F³, and means for operating said rods and heads, all arranged for joint operation substantially as herein specified.

3. The combination, in an ore-crusher, of the series of jaws G H I, &c., having bearing-surfaces *g* h* i**, &c., arranged as shown, and the differential springs X Y Z, all arranged and serving as and for the purposes set forth.

In testimony whereof I have hereunto set my hand, at New York city, this 25th day of February, 1885, in the presence of two subscribing witnesses.

FREDERICK H. McDOWELL.

Witnesses:

F. M. DAVIS,

CHARLES R. SEARLE.