No. 618,922. Patented Feb. 7, 1899.

J. G. WAGNER, Jr. & H. S. SEARLE.

DEVICE FOR TRANSMITTING MOTION.

(Application filed Dec. 3, 1897.)

(No Model.) 2 Sheets—Sheet 1.

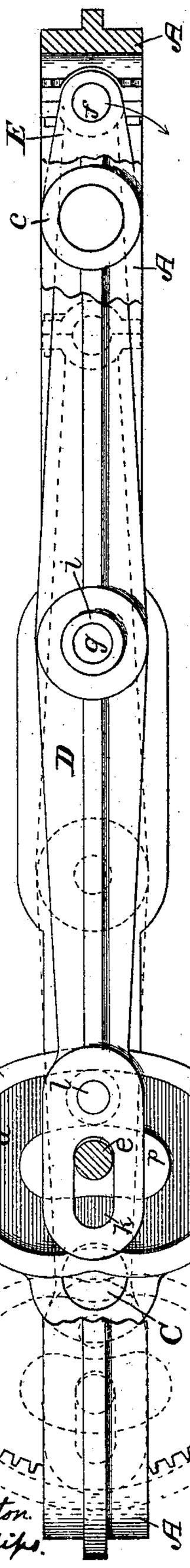

Fig. 1.

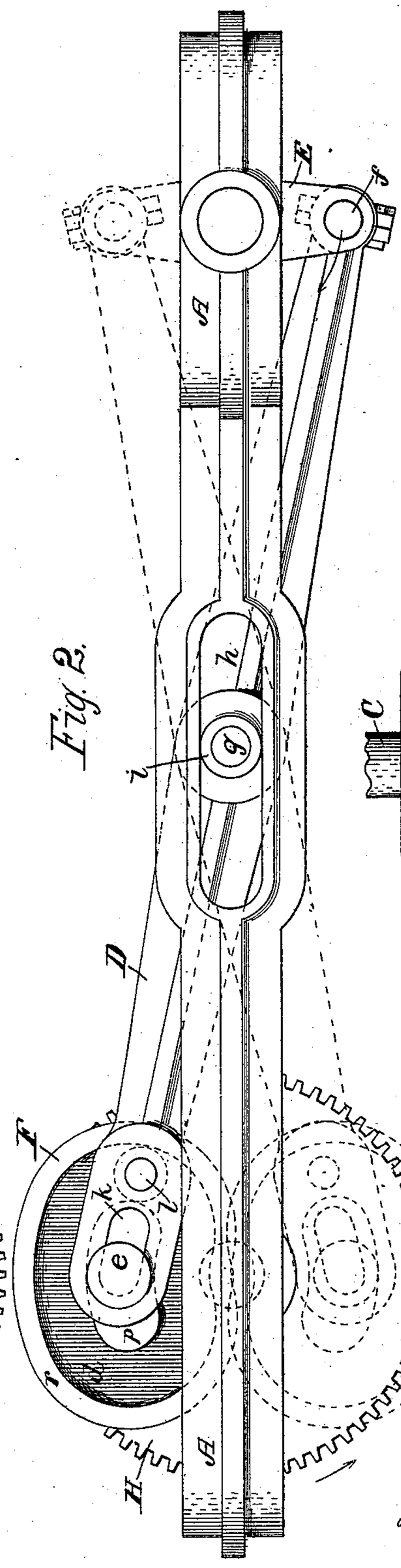

Fig. 2.

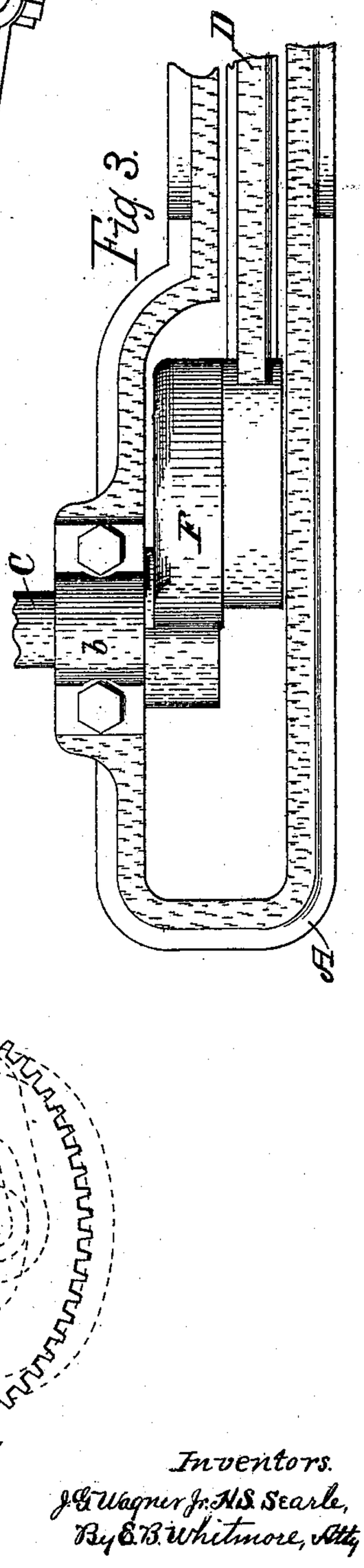

Fig. 3.

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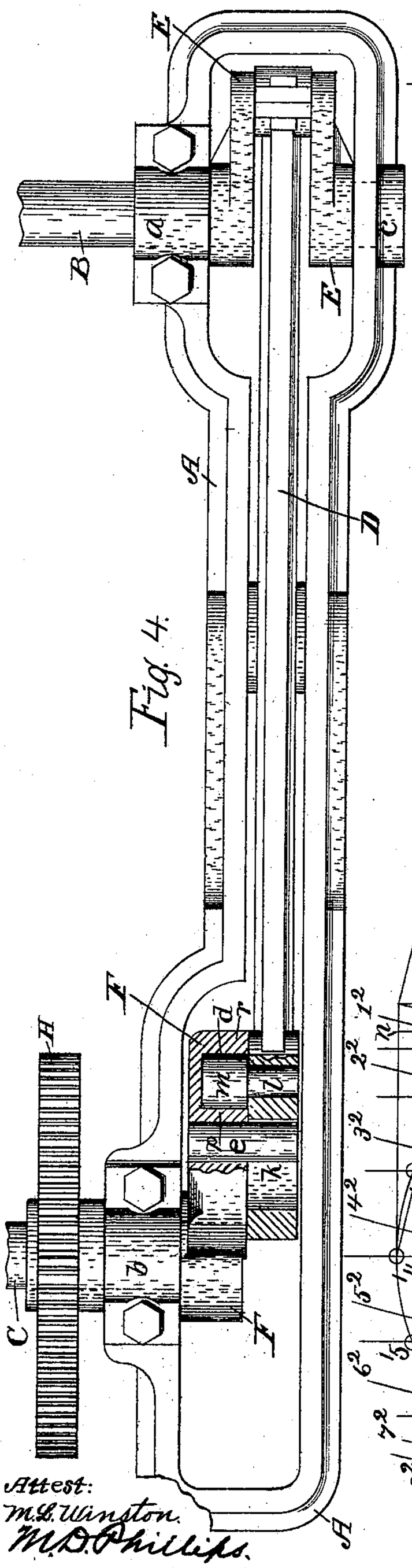

Fig. 4.

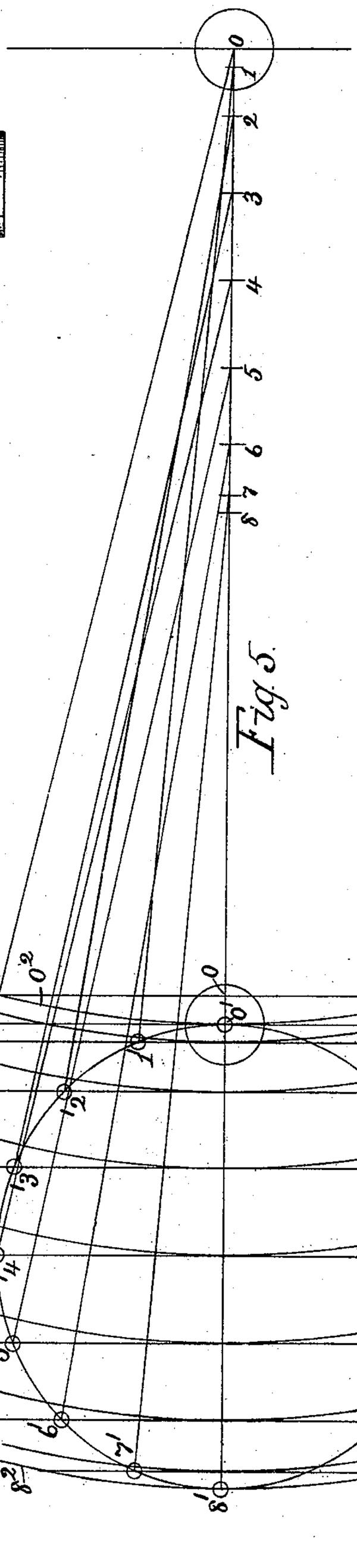

Fig. 5.

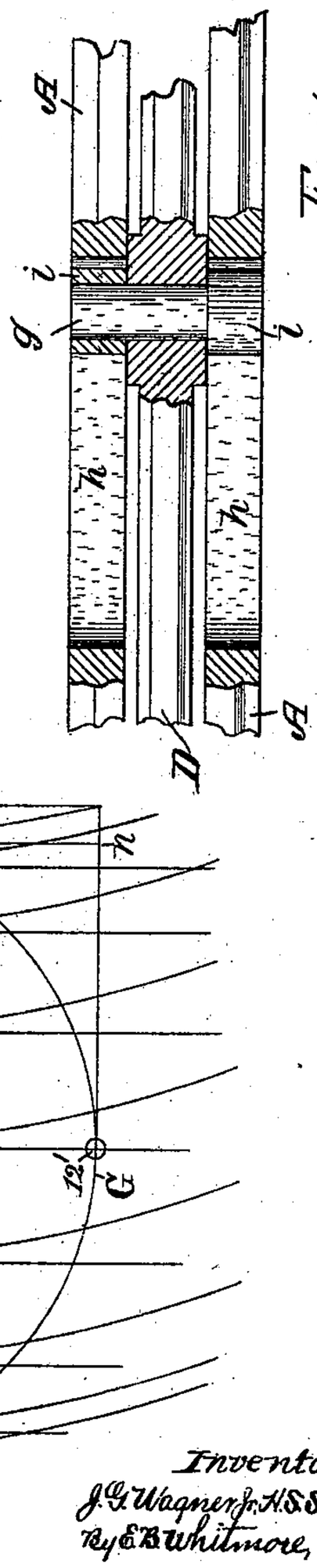

Fig. 6.

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UNITED STATES PATENT OFFICE.

JOHN GEORGE WAGNER, JR., AND HERMAN S. SEARLE, OF ROCHESTER, NEW YORK.

DEVICE FOR TRANSMITTING MOTION.

SPECIFICATION forming part of Letters Patent No. 618,922, dated February 7, 1899.

Application filed December 3, 1897. Serial No. 660,680. (No model.)

To all whom it may concern:

Be it known that we, JOHN GEORGE WAGNER, Jr., and HERMAN SAMUEL SEARLE, of Rochester, in the county of Monroe and State of New York, have invented a new and useful Improvement in Devices for Transmitting Motion, which improvement is fully set forth in the following specification and shown in the accompanying drawings.

In Letters Patent No. 592,435, of October 26, 1897, and No. 592,436, of same date, respectively, means are shown for connecting driving and driven shafts or axles with driving devices substantially in the form of pitmen—connecting chains, belts, wheels, shafts, and other similar devices in common use for the purpose being dispensed with; but it is found that the driving-shaft and the driven shaft when thus connected do not both turn at all times together and alike—that is to say, if the driving-shaft be turned at a uniform rate, for example, the driven shaft will at times move faster and at other times slower than the driving-shaft, these periods of retarded and accelerated motion occurring regularly during each revolution of the driven shaft and exactly balancing each other.

To further explain, viewing Figure 1 of said Letters Patent No. 592,436, the pitman being horizontal, the motion of the shaft E will retard during the first quarter-revolution and accelerate during the second quarter-revolution, the gain during the latter just equaling the loss during the former, and, furthermore, during the third quarter-revolution the motion of the shaft will be accelerated and correspondingly retarded during the fourth quarter-revolution. This irregularity of the motion of the driven shaft or wheel is objectionable, since it causes the machinery or whatever may be actuated by the driven shaft to move or operate irregularly or unsteadily, as by a series or succession of relatively slow and rapid motions.

The object of our invention is to provide means by which to overcome and avoid this irregularity in the motion of the driven shaft or part, which may be accomplished in many different ways, one of which is herein shown and described.

The invention is hereinafter fully explained, and more particularly pointed out in the claims.

Referring to the drawings, Fig. 1 is a side elevation of the device, parts being shown in two positions by full and dotted lines and parts broken away. Fig. 2 is a similar view, parts being shown in other positions by full and dotted lines. Fig. 3 is a plan at one end of the frame, showing the cam-crank and associated parts. Fig. 4 is a plan of the device, parts being in horizontal section. Fig. 5 is a geometrical diagram aiding to explain the different motions involved. Fig. 6 is a horizontal section at the middle of the frame, showing the trunnion-pin and associated parts.

The scale to which Fig. 5 is drawn is twice that of the other figures.

Referring to the drawings, A is a frame of any convenient or suitable form and kind, holding at one end a driving-shaft B and at the opposite end another shaft C, said shafts being parallel and having bearings at *a b*, respectively, upon the frame.

D is a connecting-rod or pitman between the two shafts, constituting a part of the mechanism by means of which the shaft C is driven from the shaft B. E is a driving-crank upon the latter shaft for operating the pitman, with which said pitman is connected by a journal-bearing, which crank may be made double, as shown, having a bearing at *c* on the frame.

F is a cam-crank, it being the driven crank of the device, secured to the shaft C, to which crank the opposite or driving end of the pitman is connected. The face of this driven crank is provided with a cam-race *d* in a plane at right angles with its axis of motion and with a rigid crank-pin *e*, the throw of which pin or its radius of motion is equal to that of the pin *f* of the crank E.

The pitman is provided at its middle part with a transverse trunnion-pin *g*, Fig. 6, adapted to move in horizontal slots or races *h h* in the sides of the frame A. This constitutes a convenient means for controlling the pitman at that part to give it pivotal action and to cause said part to move in a right line while the cranks are turning. The trunnion-pin may be provided with antifriction-rollers *i i* or some other device in common

use, as ball-bearings, for reducing the friction of the parts. Also ball-bearings may be employed at each end of the pitman and elsewhere in the device, as may be found convenient, this not being a part of our invention.

The pitman is not journaled onto the pin *e* of the cam-crank, but is formed with an elongated longitudinal opening or slot *k*, in which to receive the pin freely. The pitman is thus made capable of moving in longitudinal directions independently of the crank over the face of the latter as the parts are turned. The pitman is also provided with a rigid stud *l*, extending into the race *d* of the cam, being provided in said race with some well-known antifriction device, as a roller *m*, Fig. 4.

The pitman as described in said Letters Patent No. 592,436, acts at times as a lever to turn the crank F, and at other times it pushes or pulls against said crank to turn it. By referring to Fig. 1 in the drawings herewith it will be understood that as the crank E bears the adjacent end of the pitman downward the latter, acting as a lever, will bear at its other end upward against the pin *e* and so actuate the crank F, the pitman-stud *l* momentarily idling on account of its occupying a neutral part or dwell of the cam; but as the crank F moves upward the pitman, through the instrumentality of the stud *l* and roller *m*, will begin to push against the inner wall or part *p* of the cam in addition to pressing sidewise against the pin *e*. When the parts have reached the positions shown by full lines in Fig. 2, the pitman will no longer press the pin *e*, but its whole driving force will be exerted against the curved end of the part *p* to push the crank around. When the parts are in the positions shown by dotted lines in Fig. 1, the pitman, again acting as a lever, will bear sidewise downward against the pin *e* to turn the crank, the stud *l*, as before, momentarily idling. A further progress of the crank is effected by the pitman bearing jointly against the pin *e* and the side of the outer wall *r* of the cam. When the parts reach the positions shown by dotted lines in Fig. 2, the action of the pitman is wholly in the nature of a pull exerted against the outer wall of the cam to bring the crank around. Thus it will be seen that the pitman has two independent points or places of bearing against the driven crank—one against the pin *e* and the other against the cam—said bearing-places being variable as to distance apart.

When the pitman acts wholly as a lever, its only effective bearing against the crank F is exerted through the pin *e;* but as the crank turns the pressure against the pin decreases and the pitman begins to bear against the cam. The pressure upon the pin *e* diminishes and that upon the cam increases until the crank reaches its upper position, when the condition is reversed—that is to say, the effective pressure of the pitman is now wholly against the cam—the pin *e* idling. Following the crank onward the pressure of the pitman on the cam will diminish and wholly cease temporarily when the crank reaches its left horizontal position, the pressure of the pitman in the meantime being gradually transferred to the pin *e*, which sustains the whole pressure when the crank is at its last-named position. The crank moving to its lowest position, the pressure of the pitman upon the cam, it being a pull, will be again substituted for that against the pin *e*, the pressure against the pin again becoming the only pressure exerted by the pitman when the crank returns to its original position.

The stud *l* of the pitman moving along the curves of the cam *d* as the crank turns controls the motion of the latter, causing it at times to move faster or slower, as the case may be, than the pitman would move it were said pitman simply journaled upon the crank-pin *e*. The cam is given such elongated shape that the crank F will at all times during a complete revolution keep exact pace with the motion of the driving-crank E, moving, however, it will be understood, in the opposite direction—that is to say, while the crank E moves through any given part of a revolution, as one-sixteenth, one-fourth, or other fractional part, the crank E will also move through the same fractional part of a revolution. Were the pitman journaled directly onto the pin *e* the two cranks would make complete revolutions in the same time and complete half-revolutions in the same time between the two horizontal positions of the cranks; but at all other points in a revolution the pin *e* would be either back of or in advance of the position of the pin *f* of the driving-crank. The action of the cam prevents this and keeps the two crank-pins *f e* relatively in the same position at every point throughout a revolution.

During every revolution of the crank F the pin *e* traverses twice along the slot *k* in the pitman, and it will be understood that the motion of the pitman over the face of the driving-crank is not circular, but varies therefrom. These vibrations of the pin in the pitman are produced by the action of the cam.

The matter of the comparative motions of the cranks E and F will be clearly understood by inspecting the diagram Fig. 5. Suppose the circle made by the crank-pin *f* (not shown in the figure) in completing a revolution to be divided into, say, sixteen equal parts. Then starting with the cranks at their right horizontal positions the trunnion-pin *g* would be at first at the point 0 and then at the successive points 1 to 8, inclusive, as the crank-pin *f* passed the successive sixteenth-division points while making a half-revolution. Furthermore, if the circle G represent the travel of the pin *e* during a revolution of the crank F and its upper half be divided into equal parts 0′ to 8′, inclusive, these divisions will correspond with sixteenths of the entire circle and also with the positions of the pin *f* when at its successive points of division dur-

ing a half-revolution, and likewise with the successive positions of the trunnion-pin from 0 to 8 in case the two cranks move alike; but it will be observed by the arcs of circle 0^2 to 8^2, inclusive, that the pitman, if journaled on the pin *e* and unassisted, would hold said pin back of the respective positions 1′ to 7′, inclusive, giving to the crank F a varying rate of progressive motion and different from that of the crank E. It will also be observed from these arcs that the motion of the crank F, in case the pitman were journaled directly on the pin *e*, would be retarded during the first quarter-revolution 0′ to 4′ and accelerated during the second quarter-revolution 4′ to 8′, the gain in velocity during the second quarter just equaling the loss in velocity during the first quarter. It will be further observed that during the third quarter-revolution 8′ to 12′ the pitman would urge the crank into an accelerated velocity, which would be retarded during the fourth quarter-revolution from 12′ to 0′. This falling back and forging ahead at times of the driving end of the pitman results from its vibrations across the center line 0 8′ while carrying the cam-crank through a revolution. As said end of the pitman moves away from the center line it relatively draws back or toward the right, as shown by the divergence of the arc o^2 from the tangent *n n*, and as it returns to the center line from either side it throws forward or ahead. This drawing backward and throwing forward of the head of the pitman during its vertical vibrations across the center line equals the distance *o′ o* or the versed sine of the arc o^2 of vibration. The action of the cam *d* compensates for these relative backward and forward throws of the head of the pitman while carrying the crank around, eliminates their effects, and gives to the crank F a steady progressive motion like that of the driving-crank E.

We have constructed various other devices than the cam here shown for accomplishing this result; but for the uses to which this device has been put we find the cam to be the most desirable. However, we do not confine ourselves to this particular means for accomplishing the object desired.

For communicating motion from the shaft C to other machinery or operating parts any well-known device, as a gear H or a belt-pulley or other device, may be employed, or the crank F itself may constitute a part of a gear or other wheel for communicating motion, the particular application of this device or manner of its use not being essential to the invention.

What we claim as our invention is—

1. A device for transmitting motion, comprising a driving part, a driven part, and a connector for said parts, a frame at opposite ends of which the driving and driven parts have their bearings and in which the connector slides and is controlled at its center, and means for adapting the connector to move independently of the driven part while carrying the latter forward, substantially as set forth.

2. A device for transmitting motion, comprising a driving part, a driven part, and a connector for said driving and driven parts slidingly controlled at its center, and means for adapting said connector to move faster or slower than the driven part while moving the latter onward, substantially as and for the purpose specified.

3. A device for driving or turning one shaft or revolving part from another revolving part, comprising, in combination with the driving and the driven parts, a connector for said parts, slidingly controlled at its center and adapted to move with the driving part, and to move independently of the driven part, substantially as described.

4. A device for transmitting motion, comprising a driving part, and a driven part, and a connector for said parts, and means for adapting the connector to move independently of the driven part while carrying the latter forward, said connector being controlled at its middle to move in a right line, substantially as described.

5. A device for transmitting motion, comprising a driving part, and a driven part, and a connector for said parts, and means for adapting the connector to move independently of the driven part while carrying the latter forward, said connector having a bearing midway of its length, substantially as shown and described.

6. A device for transmitting motion, consisting, in combination with a driving part and a driven part, of a connector for said parts, slidingly controlled at its center and having two separate and independent places of bearing upon the driven part whereby the latter is propelled, substantially as described.

7. The combination, in a device for transmitting motion, of a driving part, and a driven part, and a connector for said parts, slidingly controlled at its center and having two independent places of bearing upon the driven part whereby the latter is propelled, said places of bearing being variable as to the distance between them, substantially as specified.

8. In a motion-transmitting device, a revolving driving-crank, a revolving driven crank, and a rod or pitman for connecting said cranks, slidingly controlled at its center and having a journal-bearing upon the driving-crank, and a bearing upon the driven crank allowing of a free longitudinal motion thereon, substantially as specified.

9. In a motion-transmitting device, a revolving driving-crank, a revolving driven crank, and a rod or pitman for connecting said cranks, having a journal-bearing upon the driving-crank, and a bearing upon the driven crank allowing of an independent motion for the pitman, said motion of the pitman upon the driven crank being irregular

or varying from a circle, said pitman being slidingly controlled at its center, substantially as set forth.

10. A motion-transmitting device comprising a revolving driving-crank, a revolving driven crank, and a rod or pitman for connecting said cranks, said rod or pitman slidingly controlled at its center and being connected with the driven crank by means of a pin rigid in the driven crank occupying a cavity in the rod, and a stud rigid in the rod occupying a cavity in the driven crank, substantially as and for the purpose specified.

11. A motion-transmitting device, comprising a revolving driving-crank, a revolving driven crank, and a rod or pitman for connecting said cranks, said rod or pitman slidingly controlled at its center and being connected with the driven crank by means of a pin rigid in the driven crank occupying a cavity in the rod, and a stud rigid in the rod occupying a cavity in the driven crank, the cavity in the rod being longitudinal and the cavity in the crank being curvilinear, substantially as shown.

In witness whereof we have hereunto set our hands, this 26th day of November, 1897, in the presence of two subscribing witnesses.

JOHN GEORGE WAGNER, JR.
HERMAN S. SEARLE.

Witnesses:
ENOS B. WHITMORE,
M. L. WINSTON.