

907,120.

H. S. BOOTH.
AERIAL MACHINE.
APPLICATION FILED APR. 26, 1904.

Patented Dec. 22, 1908.
6 SHEETS—SHEET 1.

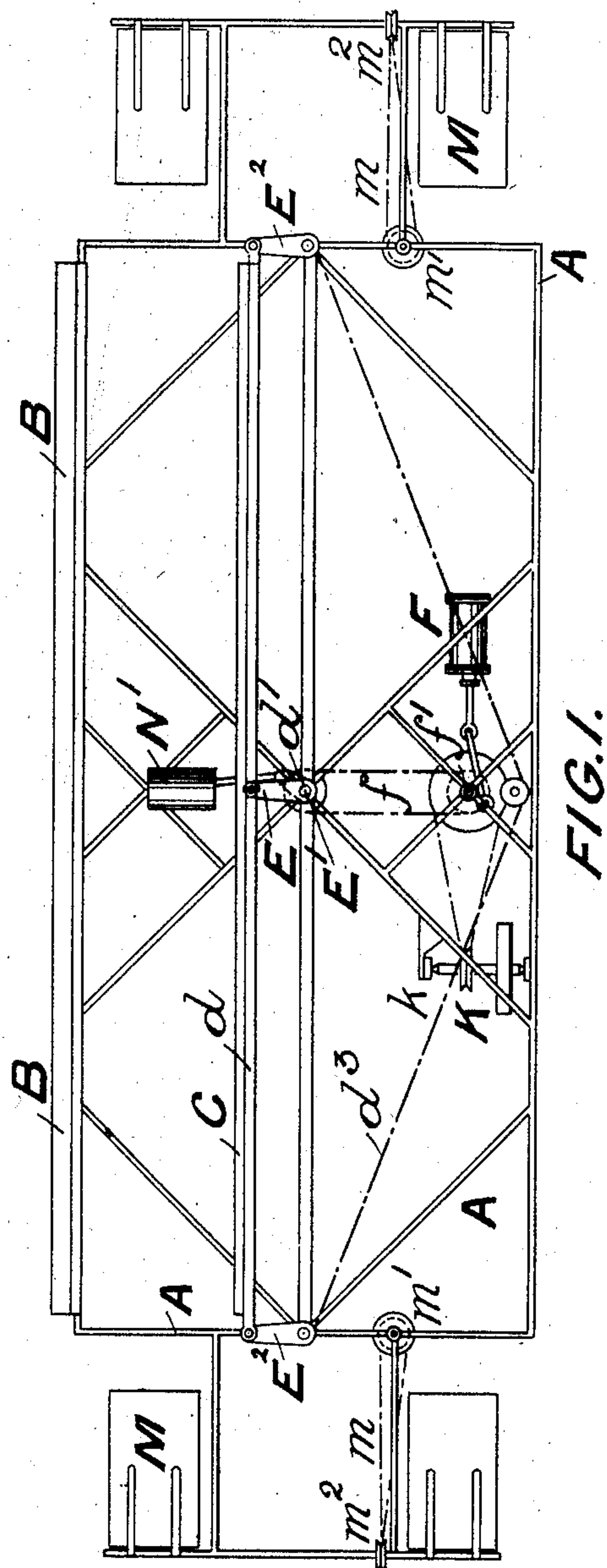


FIG. 1.

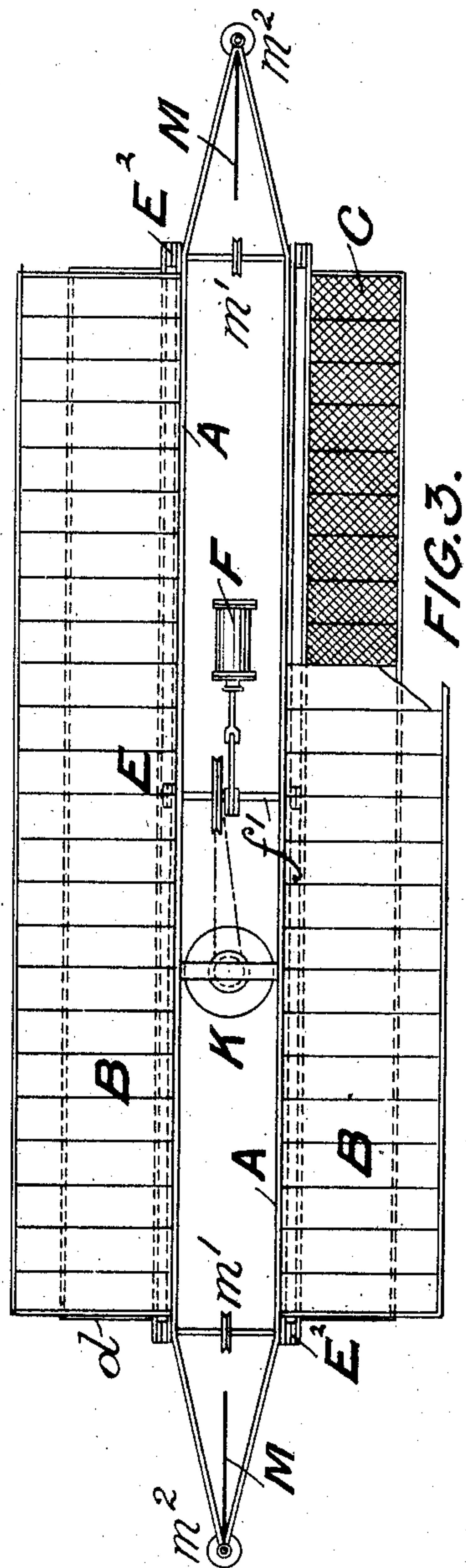


FIG. 3.

WITNESSES.
E. Howard.
Joseph Bates.

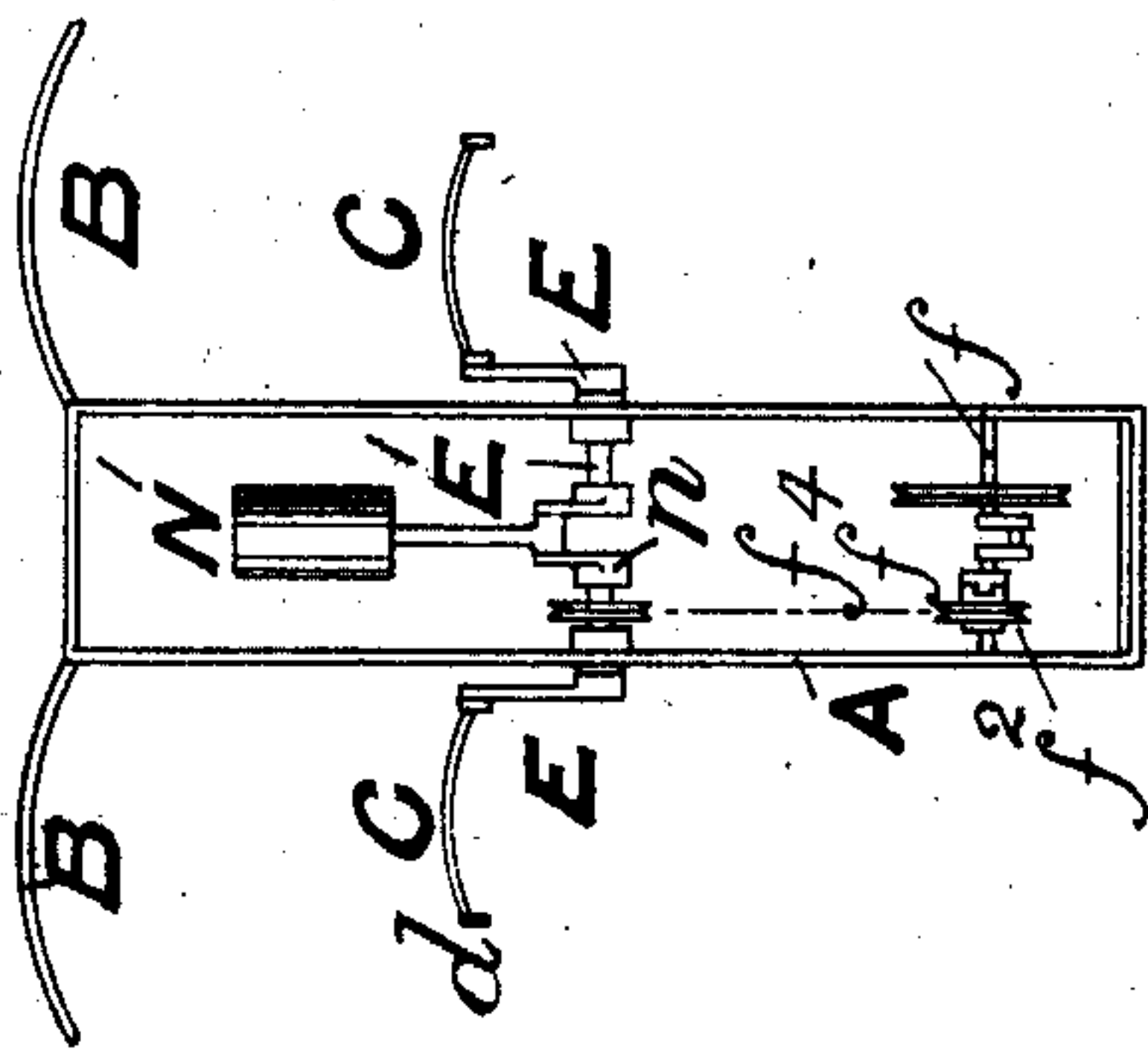


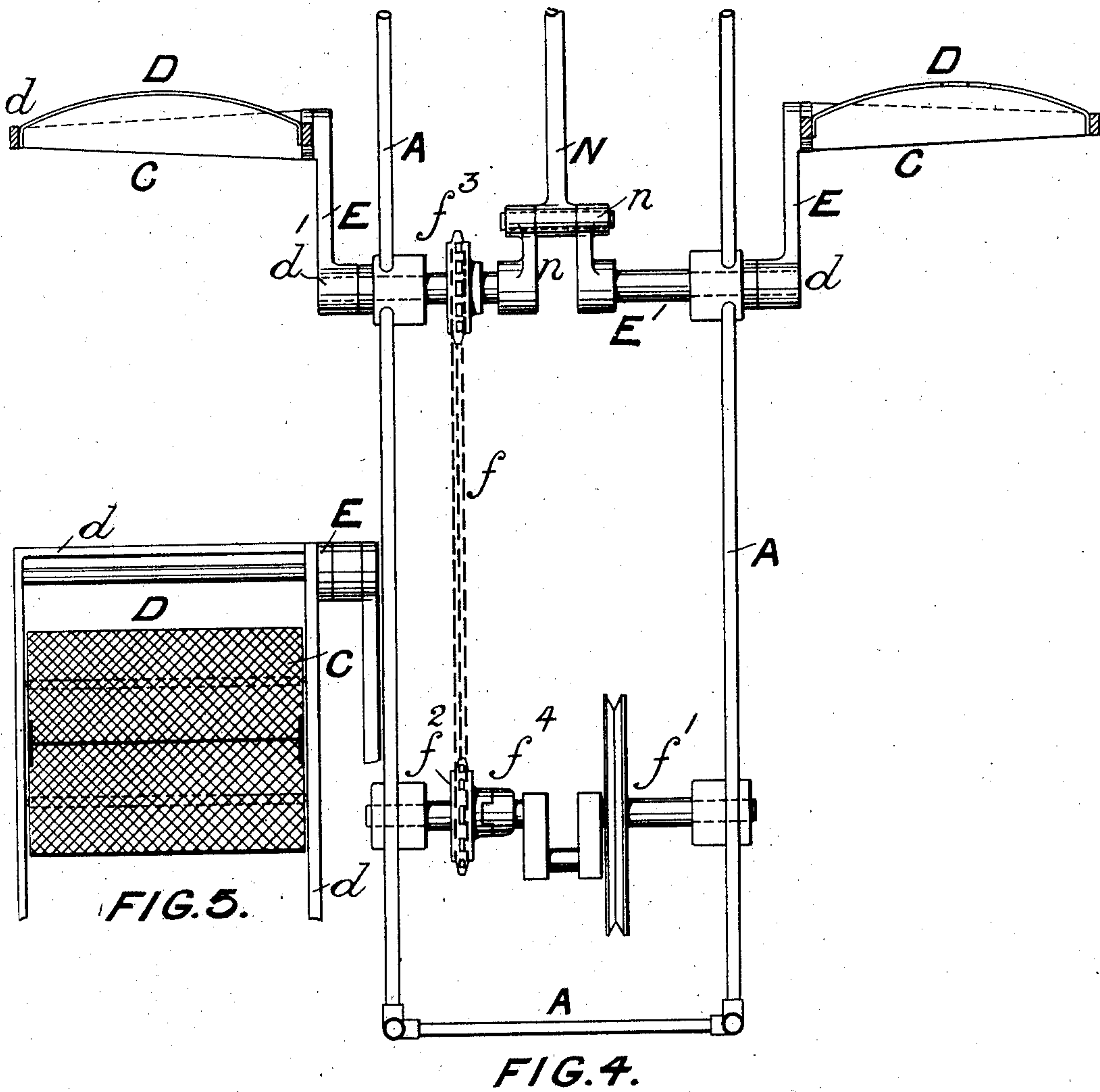
FIG. 2.

INVENTOR
H. S. Booth
by J. Howard & Co.
attys.

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WITNESSES.

E. Howard.
Joseph Bates.

INVENTOR

H. S. Booth
by L. J. O'Connell
att'y

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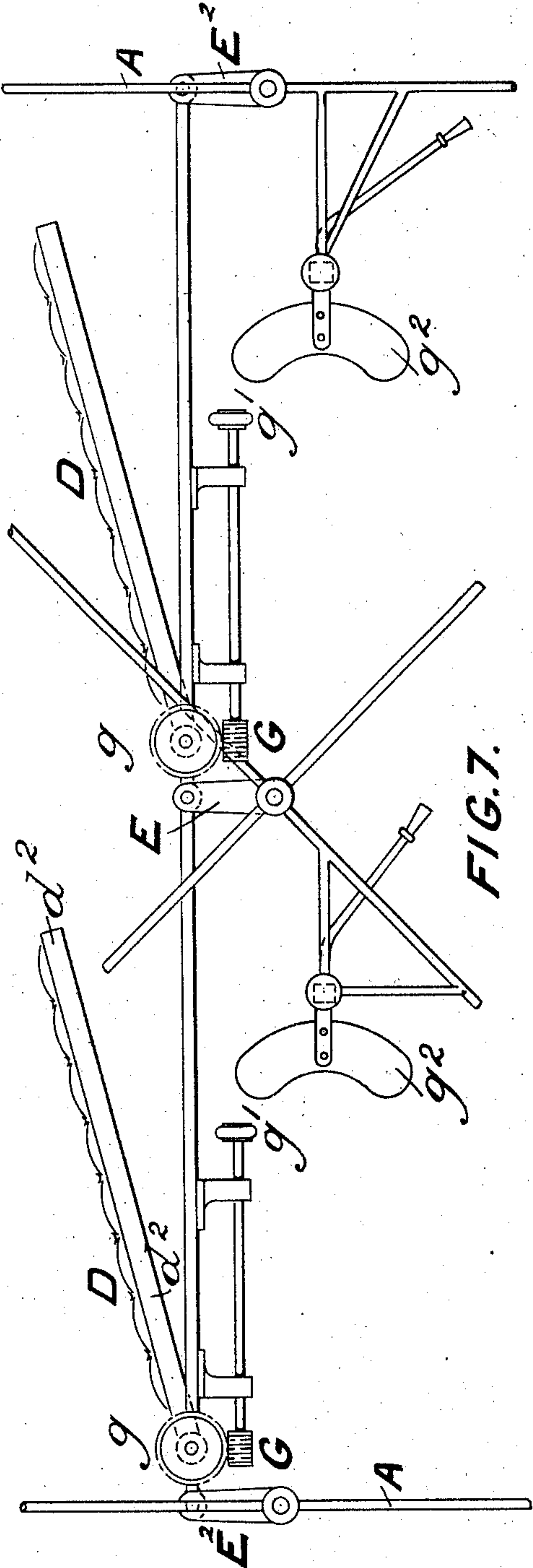


FIG. 7.

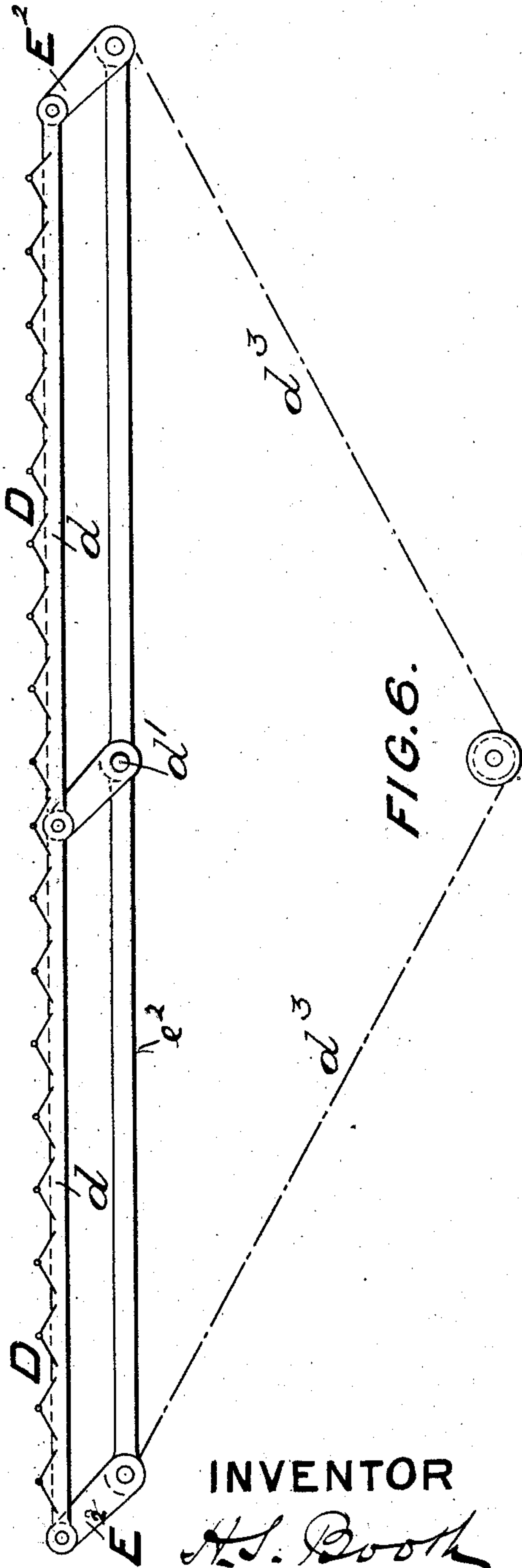


FIG. 6.

WITNESSES.

E. Howard.
Joseph Bates.

INVENTOR

H. S. Booth
by J. S. [unclear]
att.

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6 SHEETS—SHEET 4.

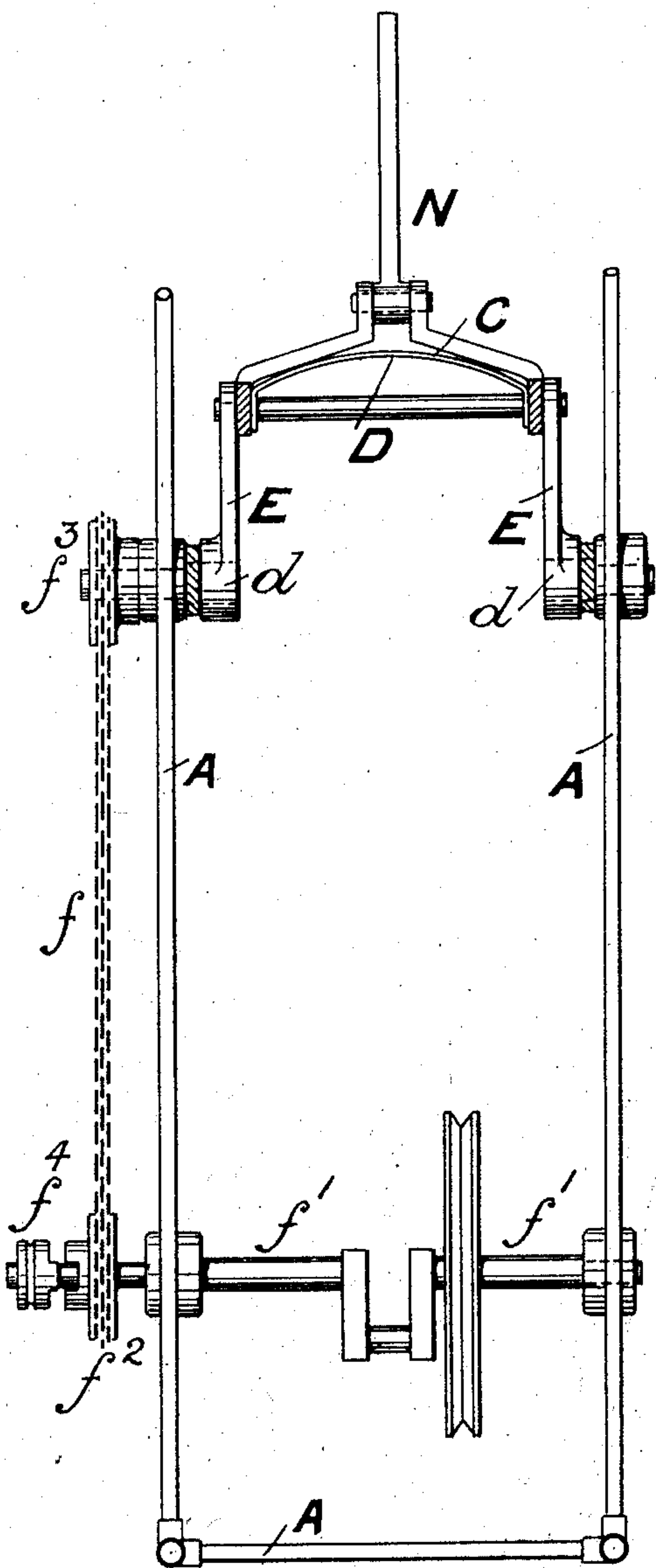


FIG. 8.

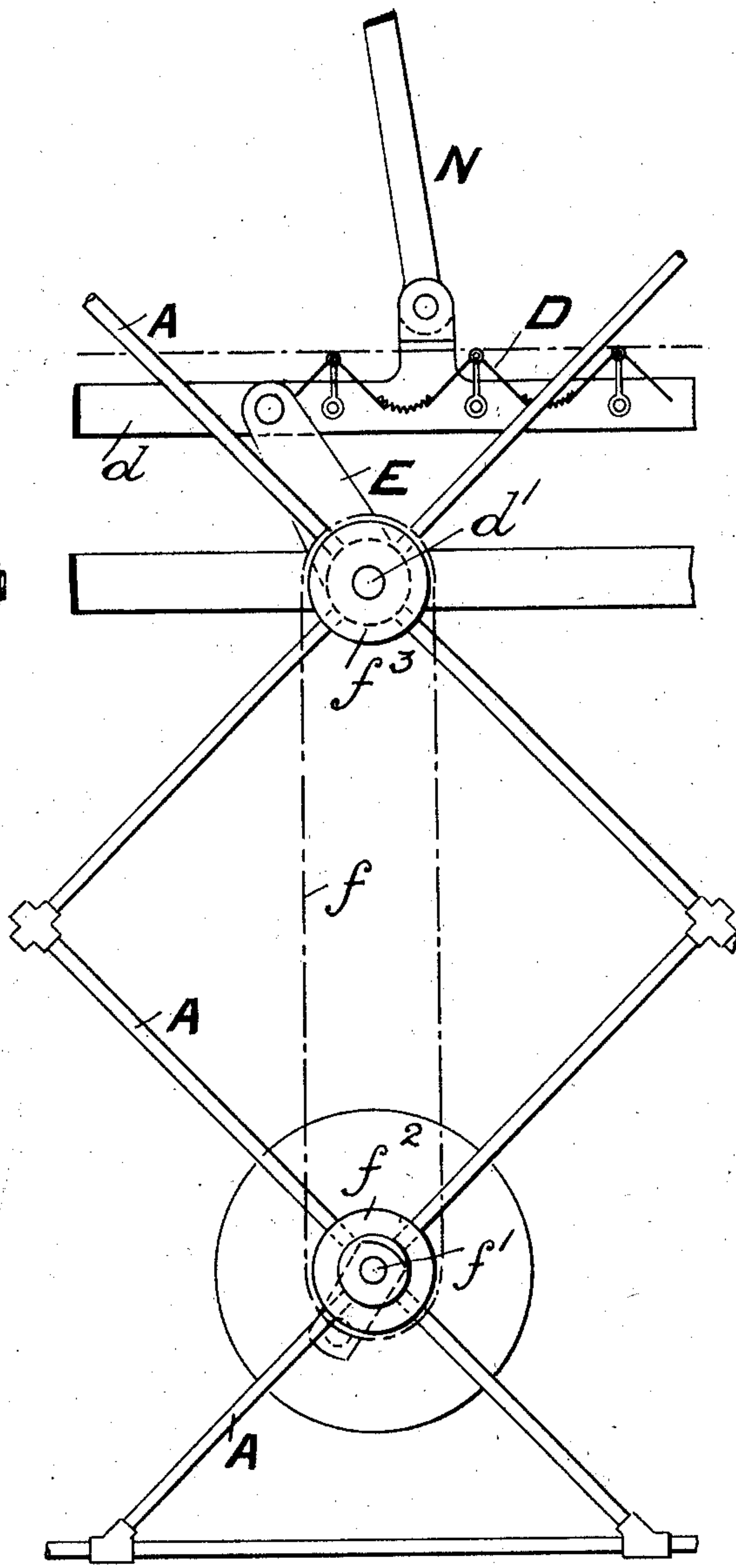


FIG. 9.

WITNESSES.

E. Howard.
Joseph Bates.

INVENTOR

H. S. Booth
by J. Owen Thomas
att'y

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6 SHEETS—SHEET 5.

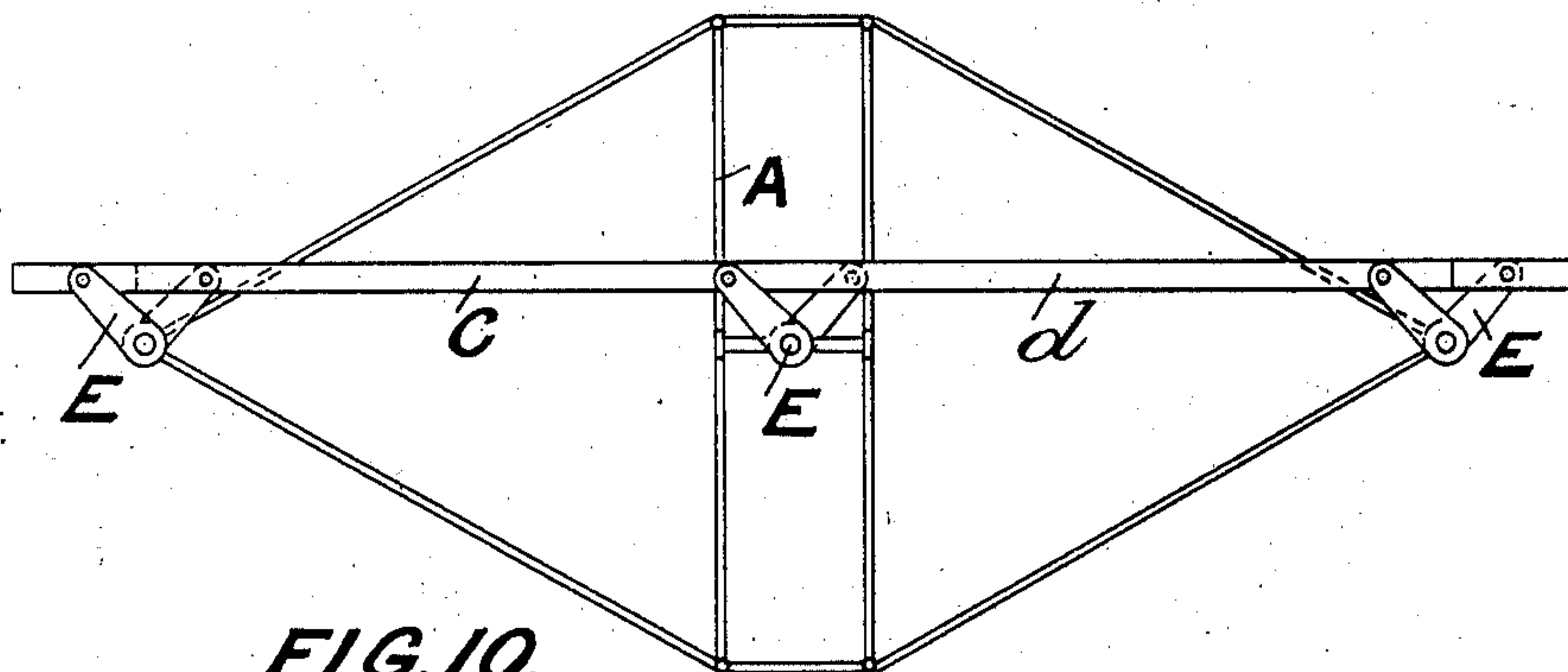
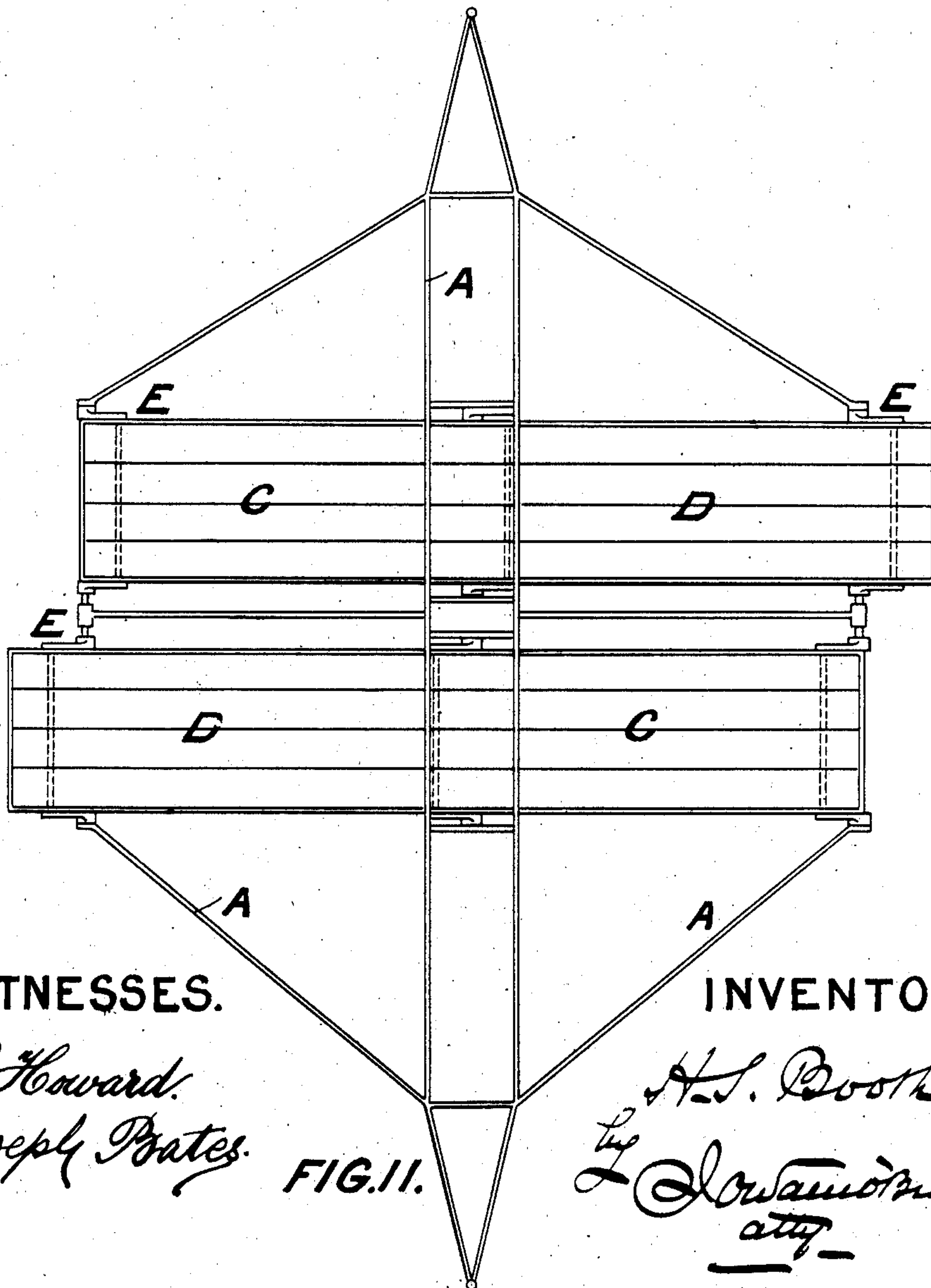


FIG. 10.



WITNESSES.

E. Howard.
Joseph P. Bates.

FIG. 11.

INVENTOR

H. S. Booth
By *Lawson & Co.*
attys.

UNITED STATES PATENT OFFICE.

HENRY S. BOOTH, OF MANCHESTER, ENGLAND.

AERIAL MACHINE.

No. 907,120.

Specification of Letters Patent.

Patented Dec. 22, 1908.

Application filed April 26, 1904. Serial No. 205,052.

To all whom it may concern:

Be it known that I, HENRY SHEPLBY BOOTH, a subject of the King of Great Britain, and resident of Manchester, in the county of Lancaster, England, have invented certain new and useful Improvements in Aerial Machines, of which the following is a specification.

This invention relates to that class or type of aerial machine which is raised and maintained in position in the air without an aerostat by means of a series of wings and air planes acting upon the air and is designed more particularly to provide improved means for applying force to such wings, for accumulating force to be applied thereto and also for steering and maintaining the equilibrium of the machine.

The invention consists essentially in a machine constructed with large wings comprising a number of small air planes mounted upon two or more pairs of coupled cranks to which a rapid downward thrust is applied and in means whereby a very greatly intensified force or power is applied to the wings during a portion of their downward thrust, such power being accumulated during the other portion of the stroke and released to give effect at the desired moment, and also in steering mechanism comprising rudders placed at both ends of the machine capable of being rotated completely round upon their axes.

The invention will be fully described with reference to the accompanying drawings in which as an example one form of a machine is shown.

Figure 1. side elevation. Fig. 2. end elevation. Fig. 3. plan. Fig. 4. enlarged end elevation of part of the machine showing details of driving mechanism. Fig. 5. plan of part of the wings. Fig. 6. side elevation showing detail of the mechanism for setting the wings at an inclination. Fig. 7. side elevation showing a modified construction of the wings. Fig. 8. end elevation showing a modified arrangement of the wings. Fig. 9. side elevation of same. Fig. 10. end elevation showing another arrangement of the air planes. Fig. 11. plan of same. Fig. 12. side elevation showing a further modification.

The machine is constructed of any suitable shape of light tubular framework A braced together and fitted with a set of aeroplanes B and a set of wings C to act upon the air, the aeroplanes B being fixed or sta-

tionary relative to the framing A and the wings C being given an oscillating or reciprocating movement so as to alternately move up and down. The aeroplanes B serve to maintain the machine or retard its downward movement and the wings C serve to elevate it or propel it in an upward and forward direction, also to maintain it in elevated position and stop or retard the forward movement in order to bring the machine to rest.

Each of the aeroplanes B and the wings C are built up of a number of air planes D of light material such as oil silk mounted in a frame *d*, to offer resistance to the air when moving in a downward direction and to allow the air to pass through when moving in an upward direction. These air planes D may be strips of silk secured along one edge by a wire the other edge being free and resting against a wire or a number of cross wires to limit its movement.

Each frame *d* of the wings C is mounted upon a driving crank E and two or more auxiliary cranks E² coupled together by the sides of the frame *d* the rotation of the cranks E, E² giving the desired movement thereto. The ends of the crank move in a circular path giving what may be termed a rotary movement to frames *d* and wings C.

The cranks E are rotated at the desired velocity by a driving chain *f* driven by a motor F or other source of power such as a treadle. By thus mounting the oscillating or reciprocating wings C upon the cranks coupled together a rotary motion is obtained with a substantially downward and upward movement of the wings, thus securing a rapid downward or partially downward thrust upon the air without the shock and loss of power entailed by a direct or rectilinear up and down movement. The louvers or air planes D can be extended to give surfaces of any desired extent which press upon the air during the downward stroke and by the action of the louvers opening automatically present but little resistance to the air on the upward stroke.

The cranks E² may be pivoted to the frame A or on a bar *e*² as shown in Fig. 6, so that the frame *d* carrying the louvers or air planes D of the wings C may be set at any inclination to the frame A or aeroplanes B. The adjustment of the angle can be effected while the cranks E are in motion. As shown in Fig. 6, the combination of

cranks and air planes of the wings C together with the frame d and bar e^2 which carries them are fitted upon the main shaft forming a common center d' and by cores d^3 or other suitable means either end can be raised or depressed thus altering the angle of inclination, at which the louvered surfaces of the wings C will act on the air. Or the louvers or air planes D of the wings C may be mounted on frames d^2 pivoted or hinged at one end as in Fig. 7, the angle of inclination of which can be adjusted. By thus adjusting the frame carrying the louvered surfaces of the wings C at an angle the pressure on the air can be arranged to produce an upward and forward motion or an upward or backward motion.

As shown in Fig. 7, the frame which carries the cranks may be rigidly connected to the frame A and the louvered surfaces D made in sections or lengths on the frames d^2 the latter being pivoted to the frame d , and capable of being raised or depressed and the angle of inclination altered by the worm G and wheel g . To the spindle of the worm G a friction roller g' is attached, and friction plate g^2 is mounted upon the frame. By pressing the friction plate g^2 against the roller g' during the portion or the upward stroke of the cranks, when the roller is rising nearly vertically it will be rotated and rotating the worm G will alter the angle of inclination of sectional frame d^2 .

The motor F drives a crank shaft f' on which is placed the driving wheel f^2 over which passes the driving chain f to the driven wheel f^3 . The crank shaft f' is connected to the driving wheel f^2 by a clutch f^4 so that the wheel may be thrown into and out of gear at any time. A fly wheel K placed in a horizontal plane on a vertical spindle k is driven by a band or chain from the crank shaft f' . By thus placing the fly wheel the gyrostatic action when running at a high velocity will tend to keep the machine in a horizontal plane while permitting it to be freely steered to the right or to the left.

By means of the clutch f^4 the motor F and the fly wheel K can be disconnected from the driving wheel f^2 and chain f and the power be all applied to raise the rotation of the fly wheel to a high velocity thereby storing up a great amount of force in the fly wheel, which can be applied for a short period of time when starting the machine or in an emergency when an available force is required considerably above the normal motive power. When the inertia of the machine is overcome as less force will then be required to keep it in motion the force can be applied at longer intervals and for shorter periods until the maximum velocity of the fly wheel is restored, when it will again form a reserve force for use in an emergency.

The fixed aeroplanes B composed of a number of louvers or air planes retard the falling of the machine in the intervals between the downward strokes of the wings C and when such surfaces are at rest. The aeroplanes B are preferably placed over or above the wings C or they may be placed at either side of them as may be found most convenient. The aeroplanes B may be louvered in the same manner as the wings C so as to allow any suction of air caused by the thrust of the wings to be drawn through the louvers and to prevent the resistance to the upward movement of the machine that would be caused by air planes with fixed surfaces. At each end of the machine rudders M are fitted to steer the machine in either direction. The rudders M are arranged to turn completely round on their axes to enable the machine to be steered from either end in varying currents of air so as to present the supported edge of the rudder to the initial pressure of the wind should the wind be traveling faster than the machine. They may be operated by cords m passing round pulleys m' m^2 .

The central pair of cranks E is fitted to the shaft E' provided with an auxiliary or secondary crank n , the shaft being driven by the wheel f^3 from the chain f . The wheel f^3 is fitted internally with a free wheel clutch to permit of the shaft E' being driven at a greater speed than the crank shaft f' without having to accelerate the rotation of that shaft or the motor F or the fly wheel K.

To the auxiliary crank n of the shaft E' is coupled the piston rod or connecting rod N of an auxiliary motor N' by which the shaft E' and with it the cranks E can be rotated independently of the motor F. To elevate the machine the wings C have to be forced downwards at a high velocity and to maintain such a degree of velocity continuously would require enormous power. I find that by applying an intensified amount of force—in the nature of a jerk—while the wings C are moving through a portion of their downward stroke the required velocity and effect are produced with a great reduction of force. This intensified down stroke is obtained by the auxiliary motor N' acting upon the crank n of the shaft E'. The charge of the motor N' is compressed by the upward stroke of the crank n as the air surfaces C are rising and the full force of the stroke of the motor is exercised in a downward direction on the top center being passed. Or a lead may be given to the cranks E so that the full force of the motor N' will come into operation on the closing of the louvers by the downward motion and the air surfaces C receive the full force when traveling in a nearly vertical direction. The velocity of the downward stroke will be governed solely by the resistance of the air to

the movement of the air surfaces C as the free wheel f^3 will allow their speed to be accelerated unrestrained by the drag of the motive mechanism.

5 Instead of a motor N' an auxiliary spring motor N^2 Fig. 12 may be employed to give the intensified down stroke or additional force to the downward movement of the wings C. Such spring motor may be fixed
10 between the wings C and the frame of the machine so that the springs are compressed or extended on the upward stroke and will exercise their full force in a downward direction on the top center being passed. The
15 springs may be more conveniently attached to auxiliary cranks on the spindles of the rotary cranks as by giving a lead to the latter the springs will come into action when the louvers are closed by the downward motion and the wings C receive the full force
20 when they are traveling in a nearly vertical direction. The wings may be placed at the sides of the frame, as in Fig. 4, or between the sides of the frame as in Fig. 8. It is to
25 be understood that the detachable fly wheel in which the force or power can be accumulated and applied at intervals may be employed alone without the auxiliary motor or springs.

30 In a modification shown in Figs. 8 and 9 a wing C is placed between the sides of frames A instead of at the sides as in Fig. 4.

In the modification shown in Figs. 10 and 11 the movable air surfaces C are placed
35 transversely to the longitudinal axis of the machine instead of parallel therewith as in the other figures.

The machine is operated as follows:—On the motive shaft f' being rotated the fly
40 wheel K is brought to a high velocity so as to accumulate a large amount of force and by its gyrostatic action to keep the machine in a horizontal position or plane. On putting the clutch f^4 into gear with the pulley f^2
45 the cranks E and the wings C are rotated. The piston of the motor N' will be moved to draw in a charge of air and vapor and compress it and then an explosion of the vapor and air will be effected in the usual way. On
50 the explosion taking place the piston will drive the cranks E and with them the wings C downwards with great velocity, the free wheel f^3 allowing this to be done without interfering with the motive mechanism.

When the speed of the cranks is reduced by 55 the pressure of the air on the wings the free wheel will come into operation and continue to rotate them thus bringing about a similar cycle until a further explosion takes place in the motor N' . When sufficient speed is at- 60 tained the supply of explosive material may be cut off; the force of the air compressed in the cylinder on the up stroke of the piston will then on alternate down strokes accelerate the speed of the wings. 65

What I claim as my invention and desire to protect by Letters Patent is:—

1. A flying machine comprising in its construction, a plurality of movable wings mounted upon frames, which frames are connected to a plurality of cranks arranged to convert the rotary movement of the cranks into a movement of the frames and wings, which is chiefly upward and downward in relation to the pressure they exercise on the 75 air, cranks upon which the frames and wings are mounted, an auxiliary motor acting on the cranks frames and wings only during their downward movement to greatly intensify the force applied to the wings during 80 their downward motion and a free wheel or slip motion to permit the auxiliary motor to exercise its full force unrestrained by the inertia of the main motor substantially as described. 85

2. In a flying machine the combination with a structural frame A of a plurality of aeroplanes B, stationary relative to the framing A, a plurality of wings C mounted on cranks the rotary movement of which is converted into a reciprocating upward and downward movement, rotary cranks E upon which the wings C are mounted, a motor F for driving the wings, a flywheel K placed to rotate horizontally with means for dis- 95 engaging it from the movable air surfaces an auxiliary motor N' to give intensified force to the wings on the downward movement and rudders M capable of making a complete rotation substantially as described 100 and shown.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

H. S. BOOTH.

Witnesses:

J. OWDEN O'BRIEN,
H. BARNFATHER.