

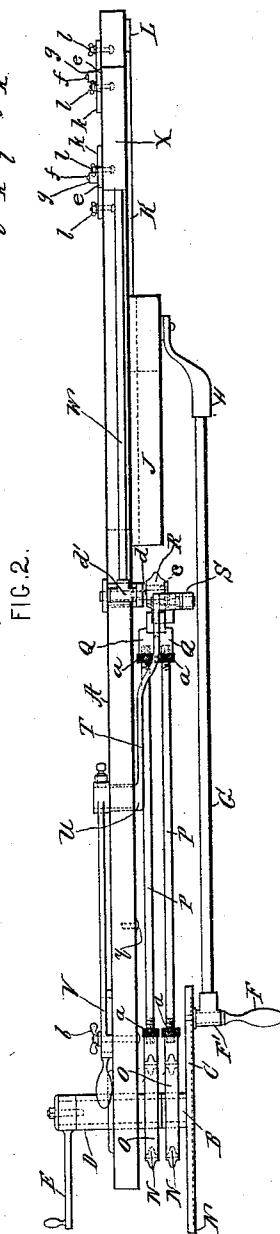
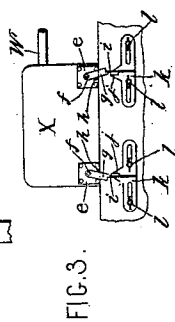
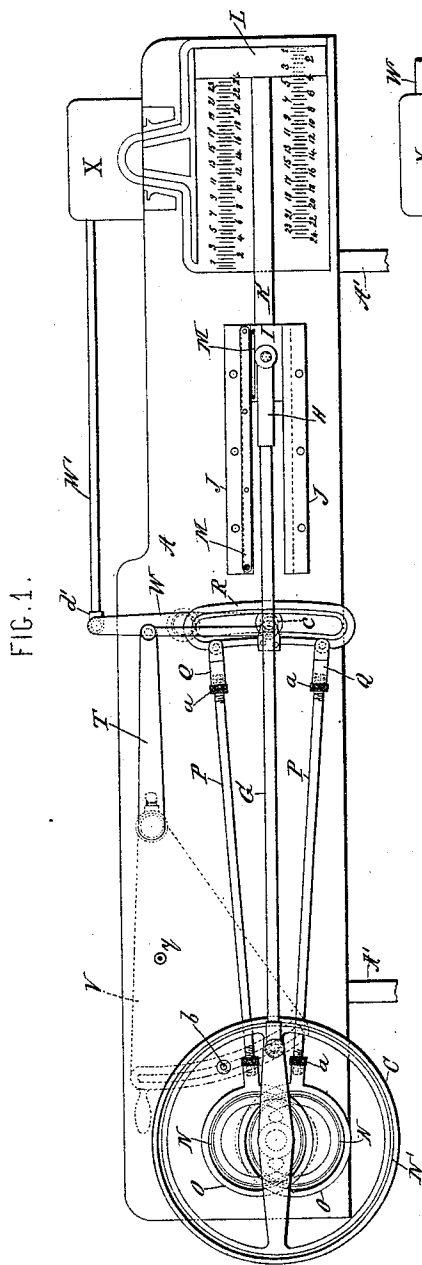
(No Model.)

2 Sheets—Sheet 1.

F. J. MILLER & J. A. HILL.
LINK VALVE MOTION MODEL.

No. 461,772.

Patented Oct. 20, 1891.



WITNESSES:

John Knicker,
L. H. Osgood,

INVENTORS:

Fred J. Miller and
John A. Hill
BY *Worth Osgood,*
ATTORNEY.

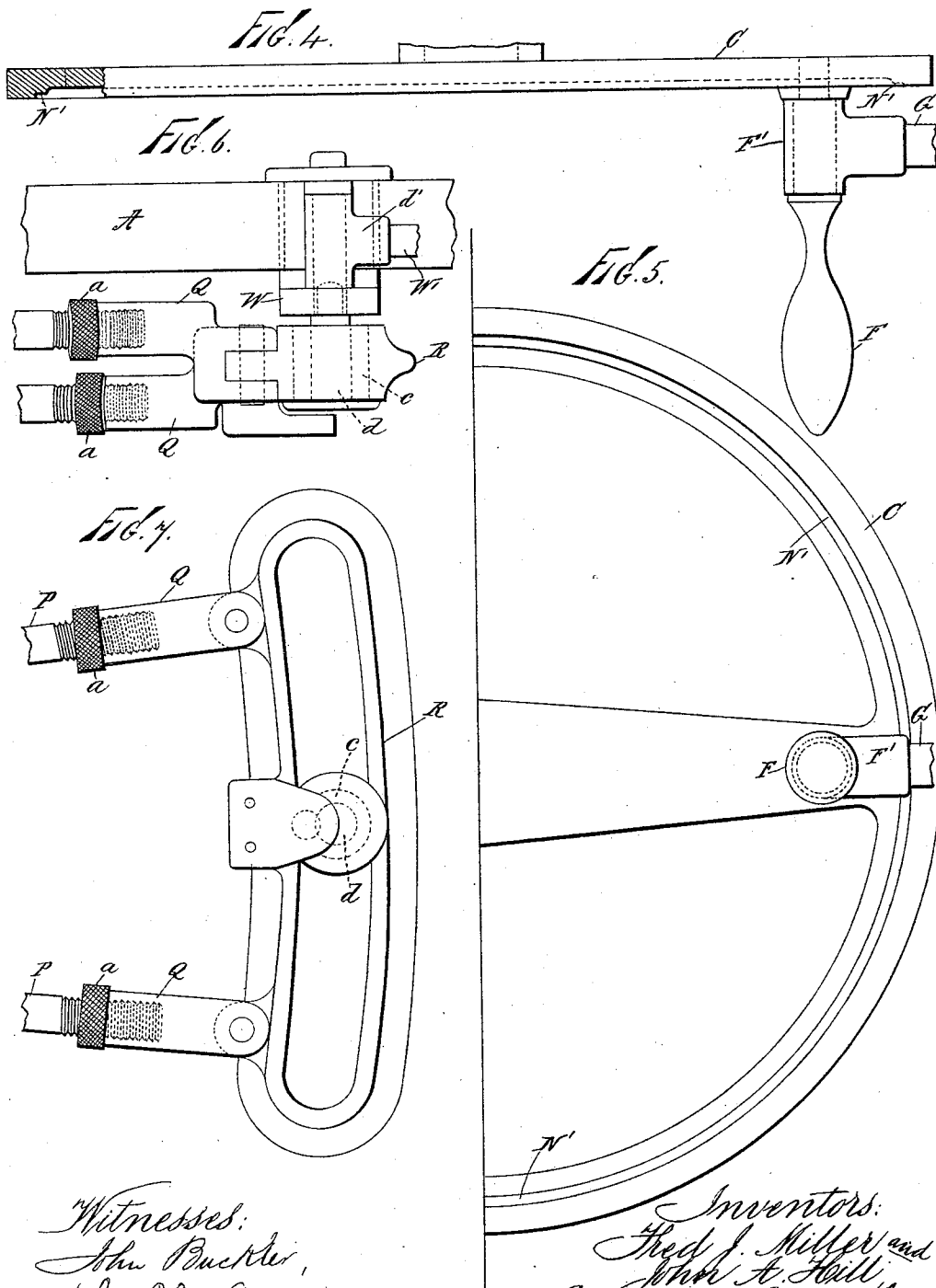
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Witnesses:
John Buckler,
L. H. Osgood,

Inventors:
Fred J. Miller and
John A. Hill,
By North Osgood
Attorney.

UNITED STATES PATENT OFFICE.

FRED J. MILLER, OF PLAINFIELD, NEW JERSEY, AND JOHN A. HILL, OF
NEW YORK, N. Y.

LINK-VALVE-MOTION MODEL.

SPECIFICATION forming part of Letters Patent No. 461,772, dated October 20, 1891.

Application filed December 19, 1889. Serial No. 334,318. (No model.)

To all whom it may concern:

Be it known that we, FRED J. MILLER, of Plainfield, county of Union, and State of New Jersey, and JOHN A. HILL, of New York city, county and State of New York, have jointly
5 invented certain new and useful Improvements in Link-Valve-Motion Models, of which the following is a full, clear, and exact description, reference being had to the accompanying
10 drawings, and to the letters of reference marked thereon.

The device to which our invention relates may be called a "link-valve-motion model;" and it is intended for use by locomotive or
15 stationary engineers and firemen or any others in studying the principles involved in link-valve motions as used on locomotive, marine, and other engines, and to afford such persons a convenient means for practice in
20 setting the valves, eccentrics, and other parts of such motions and adjusting them to their proper positions.

The purpose of our invention is to produce a simple, accurate, and efficient machine or
25 implement of the character above outlined which will afford the desired facilities for study, investigation, comparison, demonstration, and practice; and to accomplish all of this our invention consists in a certain new
30 and useful machine or implement and various arrangements or combinations of parts thereof, which will be herein first fully described and then pointed out in the claims.

In the accompanying drawings we have
35 shown at Figure 1 a front elevation, and at Fig. 2 a top or plan view, of a machine or implement constructed and arranged for operation in accordance with our invention and
40 embodying our improvements. Fig. 3 is a rear elevation of a fragment of the valve-piece and the way upon which it travels. Fig. 4 is an edge view, with a portion in section, showing the hand-wheel with the square
45 shoulder, and Fig. 5 is a face view of half of said wheel, both being enlarged beyond previous figures. Fig. 6 is a top view of a fragment, and Fig. 7 a side view, (both enlarged beyond previous representations,) showing the link-roller and stud, omitting other parts for
50 convenience of illustration.

In all the figures like letters of reference,

wherever they occur, indicate corresponding parts.

The bed or frame A of the model is preferably of wood and has holes bored through it, 55 which are bushed with metal for the reception of various working parts. This is sustained at convenient height and in convenient position by any suitable legs or standards, as A' A'. 60

B is the main axle, preferably cast solid with the wheel C, which in this model represents the driving-wheel of a locomotive or engine. The axle is fitted in and journaled in a sleeve D, attached to frame A, as by
65 screws passing through the flange of said sleeve. This axle extends through the sleeve at the back of the frame, and is supplied with a suitable crank-handle E, by which it may be turned. 70

The wheel C is made as open as possible—that is, it has only two arms, so that the movements of the eccentrics may be at all times observed, and so that they may be always accessible and easily reached for adjustment. 75 To one of these arms is attached a crank-pin F the outer end of which is made in the form of a handle, and to which is coupled by a T F' the connecting-rod G. The other end of the connecting-rod is screwed into a piece H, 80 which by a suitable screw is connected with a cross-head I. This cross-head is adapted to slide back and forth between guides J J. The guides and cross-heads are preferably made of wood, and upon the back of the cross- 85 head is attached a strip of wood K, which represents the piston-rod of an engine. To the outer end of strip K is attached another strip L, which represents the piston of an engine, this strip being arranged to pass back 90 and forth over a representation of an engine-cylinder, which is painted or otherwise applied upon the frame. On this representation of the cylinder two scales are provided, as indicated in the drawings, one reading 95 from right to left and the other from left to right, over which scales the piston passes, the two being so divided and numbered as to indicate at any time the part of the stroke which has been completed and the part yet remain- 100 ing to be passed over in either direction and without the trouble of making subtractions.

These scales of course are not intended as a means of measuring the actual distance passed over by the piston of the model; but the distance which would have been passed over by the piston of a full-sized locomotive or engine with the same angular movement of the crank-pin, for which purpose of course the scales are suitably graduated. Painted or otherwise applied above the piston on the frame is a representation of a section through the cylinder of an engine showing the steam-ports and exhaust-ports, &c. Attached to the cross-head and to the upper one of the two guides are strips of brass M M, upon which lines can be drawn for facilitating the operation of finding the exact dead-centers when setting the valve; and upon the outside face of wheel C is a square shoulder N', which is turned true and is used for convenience in striking arcs of circles on the wheel in finding the true dead-centers. This shoulder is turned in the wheel in order to save turning or truing the whole wheel, and the cylindrical margin of the shoulder represents the inside surface of the tire of a locomotive drive-wheel, for instance, which surface remains uninjured or undisturbed in use, and to or on which one end of the tram is applied in practical tramming. On the model the true surface of shoulder N' is utilized in the same way.

Fitted to axle B are two eccentrics N N, the hubs of which are preferably of sufficient length to just fill the space between the back of wheel C and the end of sleeve D, which projects through the frame A. Filling this space as they do they are prevented from being displaced laterally when the set-screws which hold them to the axle are loosened for the purpose of adjusting the eccentrics. Each of these eccentrics has fitted to it an eccentric-strap O, to extensions of which are fitted by screw-threads brass tubes P P, which answer for what are usually called "eccentric-blades." The other ends of these blades are fitted by screw-threads to pieces Q Q, which are connected by pins, substantially as shown, to the link R. One end of each blade has a right-hand thread, and the other end a left-hand thread, so that by turning the blades in one direction the distance between the eccentrics and the link will be increased, while if they are turned in the other direction this distance will be diminished, or, in other words, by turning tubes P one way or the other the length of the eccentric-blades can be regulated or adjusted. Threaded and knurled collars or nuts a a a are fitted one to each end of tubes P, by which the tubes can be locked in position to which adjusted.

The link is supported in place by means of a link-hanger S, the same being suspended from the end of the tumbling-shaft arm T, which arm has cast upon it a cylindrical part U, which corresponds to the tumbling-shaft of a locomotive and is journaled in a bearing

provided for the purpose in frame A, and which is lined with a piece of brass tubing. The tumbling-shaft extends beyond frame A at the back and has fitted to it by a set-screw, in such a manner as to be adjustable, a piece V. (Shown in dotted lines in Fig. 1.) This piece V corresponds to the reverse lever of a locomotive and is also so shaped as to answer the purpose of a counter-balance for the weight of the link and its connections, so that they will remain at any height to which they may be placed. The piece V is provided with a curved slot by which the movement of the link is limited, and by means of which, in connection with a bolt and thumb-nut b, it can be fixed in any desired position.

The ends of the slot in link R are made circular instead of square, as usually found upon locomotives, and instead of the usual square link-block a roller c is used, which is of such diameter as to just fill the slot in the link, and it is fitted to a pin or stud d, which is fixed rigidly in the lower end of the rocker-arm W. This rocker-arm has a cylindrical projection at its center which fits a bearing provided for the purpose in the frame and which is lined with a piece of brass tubing to form the bearing. The upper end of the rocker-arm is provided with a stud, to which is fitted a T-shaped piece d', to which is attached by screw-thread a brass tube W', which corresponds to the valve-rod of a locomotive. The other end of the valve-rod is connected with a block of wood X, which is arranged to slide back and forth on the top of frame A, and on this block is painted or otherwise represented a section of a slide-valve, such as are employed on locomotives. To the block X and at the back are secured two plates e e, at about the center of which are studs or rivets f. Fitted loosely to these studs are tappets g g, which ordinarily or when in action rest against pins h in the position shown. The lower ends of tappets g are arranged to engage with the upper ends of flat springs i, and, as block X moves, to deflect the springs alternately away from the pieces j, against which they rest, until by the continued motion of block X the tappets g are carried beyond the springs, so that the latter are released, and then springing back against the pieces j produce a snapping noise, intended to be audible to those about the machine. As the tappets return in the opposite direction and come again into contact with the springs, they rise from pins h, upon which they rest, and pass over the springs, dropping into position on the other side. The springs i are riveted to plates k, which are secured to frame A by bolts and thumb-nuts l l, which pass through slots in plates k, so that the latter can be adjusted endwise to make the snap take place at any point in the travel of the valve-block X. When it is not desired to produce the snap, the tappets g g can be turned about the studs f until they rest against the other sides of the pins h, when they will not come in con-

tact with the springs. The object in making frame A of wood and in the shape shown is to provide a frame not easily broken, light, and which can be painted black or other color to form a contrast with the moving parts of the model and thus make them to be easily seen and their various positions easy to be noted when at some distance from the model. This, together with the fact that the valve-block X is also of wood, facilitates the application to them by thumb-tacks of pieces of paper having different proportions of valves and cylinder-ports in such manner as to cover those marked directly on the parts A and X, thus affording facilities for studying the effects upon steam distribution of valves and ports of various proportions.

We place all the important working parts of the model on one side of frame A, so that their movements may be simultaneously observed and the relative positions of the various parts readily seen. The relative location of these parts is such as to make the operation of setting valves and making other adjustments practically the same on the model as on an actual locomotive.

The crank-handle on the back, for turning the model, is for the convenience of any one who may be explaining its action to an audience, enabling him to stand behind the model, having an unobstructed view of it in front. At the same time the handle E is placed in such position as to serve as a counter-balance for the handle F and connecting-rod G, so that the wheel will stand in any position in which it may be placed. Brass tubing is chosen for the connecting-rod, eccentric-rods, and valve-stem for its lightness, firmness, and fair appearance at small cost, and, in the case of the eccentric-rods, for the ease with which provision may be made for lengthwise adjustment by screw-threads, as above explained.

The usual notched quadrant reverse-lever and reach-rod are replaced by the piece V for simplicity, cheapness of construction, to make it possible and easy to adjust the valve to "cut off" at any part of the stroke, regardless of lost motion, and to make it equally well adapted to valves having various proportions, such as more or less inside or outside lap.

The ends of the slot in the link are rounded, instead of square, and the usual square block replaced by a collar or roller for cheapness of construction and to diminish friction and wear. A rivet *y* is driven or set into frame A, and has on its upper surface a center-punch mark in which to rest one point of a tram when tramming to determine the true dead-centers. The strips of brass M M on the guides and cross-head are also used in this operation, to be marked or lined as is done in actual practice.

Engine-men are accustomed to judge of the action of an engine somewhat by the sound of the exhaust. The appliance represented in Fig. 3 is intended to make the point in the travel of the valve of the model correspond-

ing to the exhaust audible, though the appliance is made adjustable, so that it can be made to announce any other function of the valve, when desired, instead of the exhaust—such, for instance, as the point of admission, cut-off, or the beginning of compression. Another object of the adjustable feature of the sounding device is to make the device useful on valves or ports of different dimensions or proportions, such as variations in outside or inside lap. This enables one to watch any part of the model when in motion and note its position at the time of admission, exhaust, cut-off, or commencement of compression. This appliance or its equivalent, mechanical or electrical, could be placed upon any part of the model, having a motion in unison with that of the valve without changing the nature of the appliance or the principle involved. It might be necessary or advisable at times to substitute small gongs, bells, or other sonorous objects for the pieces *j*, against which the springs or contact-pieces strike when released by the tappets *g* or other contact-pieces, and all such substitutions would be within the scope of our invention. Though the graduations of the scales on the representation of the cylinder may be less than half an inch apart, they are preferably numbered to represent half-inches of stroke, so that for any position of the valve or for any given angular motion of the drive-wheel the corresponding position of the piston in a full-sized engine will be indicated directly by the graduations. The model machine thus constructed and arranged, in addition to answering all the purposes or objects of the invention above indicated, will be found to afford numerous advantages in use, which will be readily appreciated by all concerned, with link-valve motions.

Having now fully described our invention, what we claim as new herein, and desire to secure by Letters Patent, is—

1. In a link-valve-motion model, the combination, with the movable valve-block and the stationary part or frame, of contact-pieces brought together by the movable parts and arranged to produce an audible sound, substantially as and for the purposes explained.

2. In a link-valve-motion model, the combination, with the valve, of tappets applied thereto, and springs actuated by said tappets to produce an audible sound, substantially as and for the purposes explained.

3. In a link-valve-motion model, the combination, with tappets applied upon or movable in unison with the valve, of springs mounted upon adjustable plates by which they may be set at any desired points to produce a sound at any desired point of travel of the valve, substantially as set forth.

4. In a device of the character named, the combination of the driving-shaft, disk, rod, and rod-carrying cross-bar, the eccentrics on the driving-shaft, the link, the rods connecting the link and eccentrics, the arm pivoted

to the frame and having an arm pivoted thereto carrying a roller arranged in said link, the adjusting-piece pivoted to the first-named arm, the rod having the valve-block at its
5 outer end and having the arm at its lower end adapted to be acted upon by the link, the tappets on the valve-block, and the springs on the frame adapted to be struck by the tappets to produce a sound.

10 5. In a device of the character named, the combination of the link, the arm having the roller engaging the link, the arm connected to said arm, the adjusting-piece connected to the latter arm, the valve-rod carrying the

valve-block, the arm on the rod adapted to be 15 operated upon by the link, the tappets on the valve-block, and the springs on the frame adapted to be struck by the tappets to produce a sound.

In testimony that we claim the foregoing 20 we have hereunto set our hands in the presence of two witnesses.

FRED J. MILLER.
JOHN A. HILL.

Witnesses:
JOHN BUCKLER,
WORTH OSGOOD.