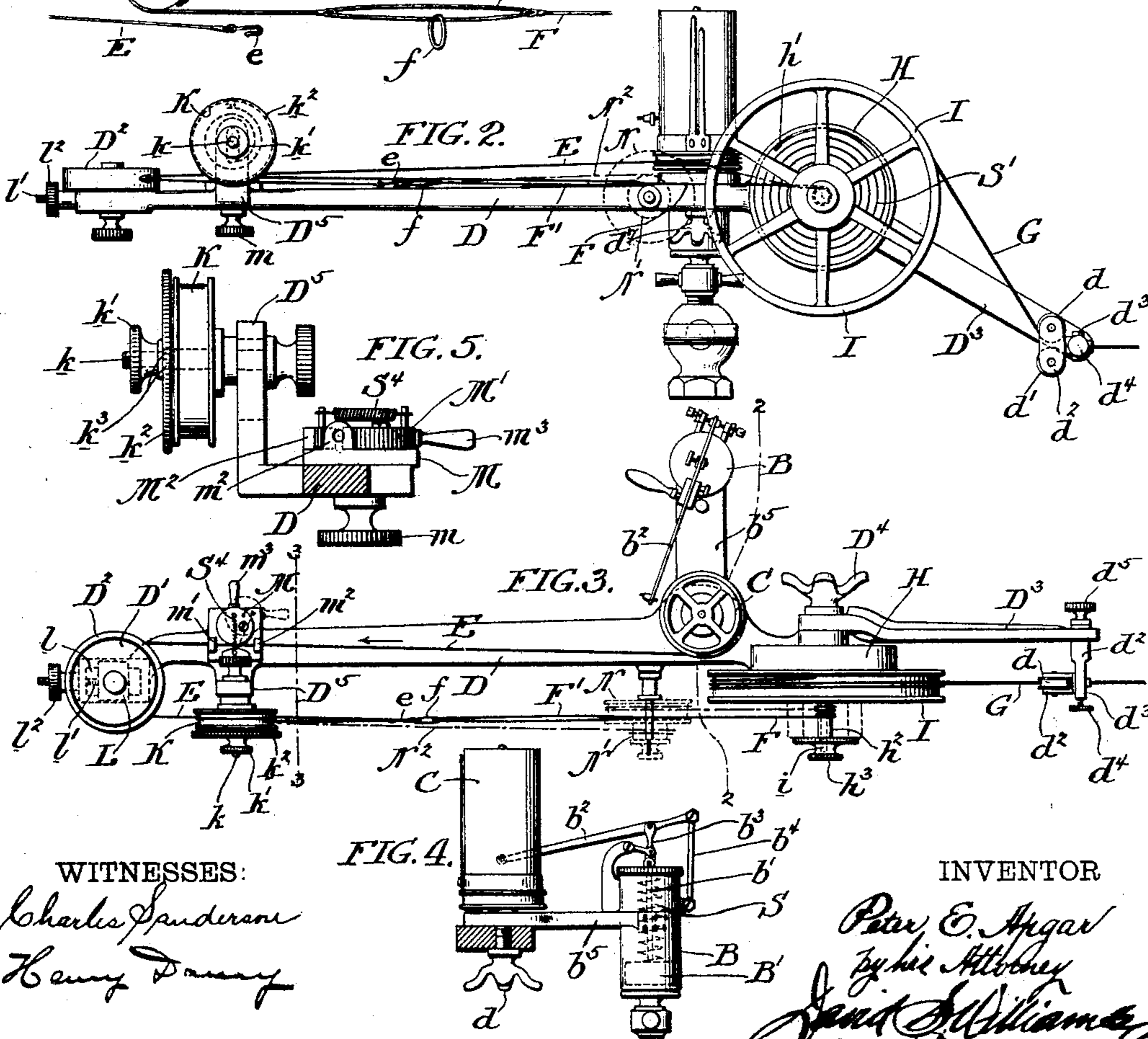
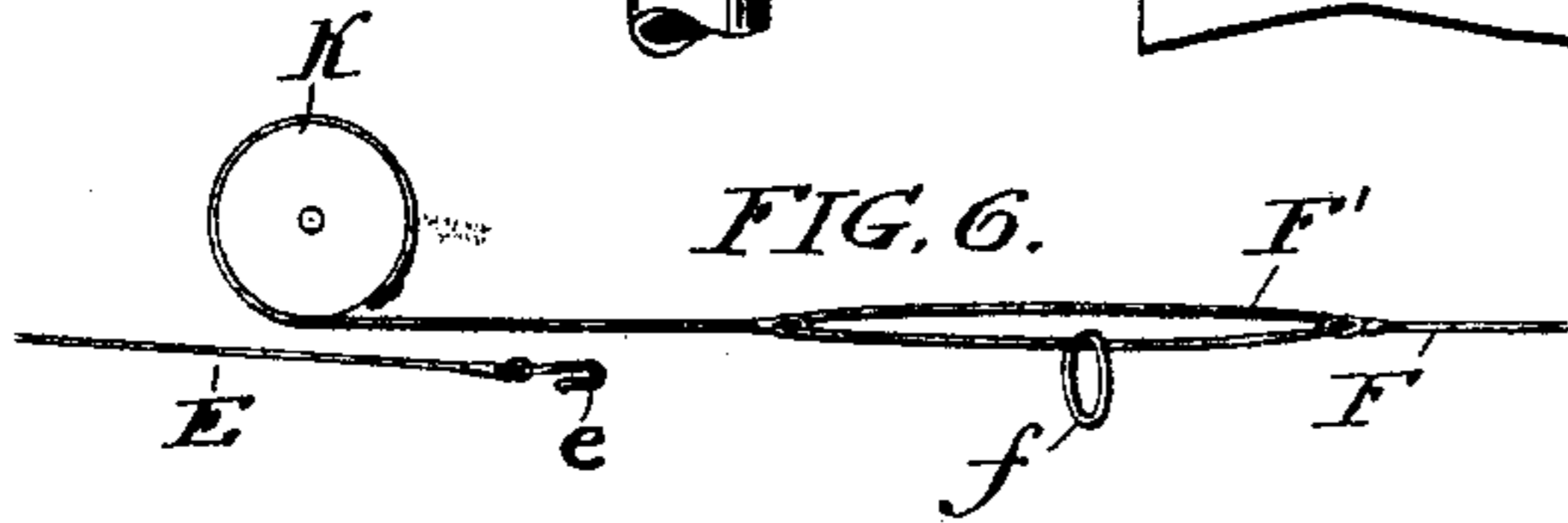


P. E. APGAR.
STEAM ENGINE INDICATOR.

Patented May 25, 1897.



THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

PETER E. APGAR, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-ENGINE INDICATOR.

SPECIFICATION forming part of Letters Patent No. 583,274, dated May 25, 1897.

Application filed November 25, 1896. Serial No. 613,392. (No model.)

To all whom it may concern:

Be it known that I, PETER E. APGAR, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Engine Indicators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in steam-engine indicators; and it consists more particularly of mechanism employed to regulate the travel of the drum to which the card adapted to receive the diagram is attached, so that regardless of the stroke or travel of the piston the travel of the card-drum and length of the diagram will always be the same.

I further provide means by which the card-drum may be thrown in or out of action without interfering with the working of any of the parts of the device.

Referring to the accompanying drawings, Figure 1 represents a side elevation of a portion of a steam-engine with the device embodying my improvements attached thereto. Fig. 2 is a side elevation of my device detached from the engine and on a somewhat larger scale than that shown in Fig. 1. Fig. 3 is a plan view. Fig. 4 is a partial sectional elevation taken on the line 2 2 of Fig. 3. Fig. 5 is an enlarged sectional elevation taken on the line 3 3 of Fig. 3, and Fig. 6 is a diagrammatic view illustrating the manner of attaching or detaching the cord which operates the card-drum.

A represents the cylinder of the engine, and *a* the threaded opening by means of which my device is secured.

The pressure-cylinder B of the indicator is of the ordinary type, containing a piston B' and rod *b'*, together with a spring S, properly adjusted to resist the variable pressure acting upon the piston B.

The lever *b*² is connected to the piston-rod *b'* by a link *b*³ and to the cylinder B through the medium of a link *b*⁴. The lever *b*² is also provided at one end with a socket to receive

a lead-pencil by which the diagram upon the card is traced. All these parts, together with the drum C, which is spring-actuated, are old and well known, and in common practice a cord is secured at one end to said drum, the other end being connected to the cross-head or other moving parts, the movement of the latter imparting motion to the drum, upon which a card to receive the diagram is placed.

In carrying out my invention I provide in addition to the construction above set forth a frame D, which is secured by a screw *d*⁷ to the arm *b*⁵, which connects the cylinder B with the drum C. At the end of this frame is a pulley D', provided with an annular casing D², the cord E, which is attached to the spring-actuated drum C, passing through holes in the annular casing D² and around the pulley D', the end of said cord being provided with a hook *e*, adapted to engage a ring *f* on the cord F. The cord G is secured to a lever *a'*, which is bolted to the cross-head A', said cord passing between the small pulleys *d* and *d'*, mounted upon a hanger *d*², which is adjustably secured to the stem *d*³ by means of a set-screw *d*⁴, the stem *d*³ being adjustably secured to the arm D³ by means of a set-screw *d*⁵, thereby imparting to the rollers a universal movement, so as to enable the cord G to lead off in any direction.

The arm D³ is pivotally secured to the frame D by a thumb-nut D⁴, which holds the arm firmly in position after the same has been properly adjusted.

Formed upon the frame D is a drum or casing H, which incloses the spring S', and upon a central sleeve *h*² is mounted a wheel I, to which one end of the spring S' is secured, the other end being secured at a point *h'* to the drum H. Said sleeve *h*², fastened to and forming the hub of the wheel I, carries the cord F, and a thumb-screw *h*³ is adapted to hold the wheel I in position upon the fulcrum-pin.

Upon the cord F is formed a loop F', to which is adapted the ring *f*, and mounted upon an upright projection D⁵ is a spring-actuated pulley K, mounted upon a stem *k*, which is adapted to a slot in the projection D⁵ and held in position by a thumb-screw *k'*, a washer *k*² being interposed between the pulley K and thumb-screw *k'* and adapted to a square shoulder *k*³, formed upon the stem *k*.

The cord E, which, as can be seen in Fig. 6, is capable of being readily hooked or unhooked when the working parts of my device are in motion, passes around the pulley D', which is mounted upon a block L, said block being capable of lateral adjustment in the slot *l* by means of a stem *l'*, secured to said block, and a thumb-screw *l''*, adapted to said stem.

A block M is secured to the frame D and adjustable in respect thereto, the same being held in position by a thumb-screw *m*. Upon said block are projections *m'* and *m''*, provided with holes through which the cord E passes, and an eccentric M', provided with a handle *m''*, having a spring S⁴ arranged to hold said eccentric in or out of engagement with the cord E, which passes between the same and a segmental block M², the arrangement being such that the eccentric after having been thrown into engagement with the cord E will allow the same to travel in the direction of the arrow shown in Fig. 3 to the full extent of its movement, but when the movement is reversed the eccentric will tightly bind the cord E against the block M², and thus check the movement of the card-cylinder C, while the other parts of the device may still continue in motion.

In order to increase or decrease the travel of the card-drum, the hub *h'* of the wheel I can be provided with collars of greater or less diameter, as shown in dotted lines in Fig. 3, and by removing the thumb-screw *h''* which hold said collars in position a collar of greater or less diameter may be adjusted and a change of travel quickly made without deranging any of the working parts.

A further reduction in the travel of the cross-head may be made by employing an additional set of pulleys N and N', as shown by dotted lines in Figs. 2 and 3, in which case the cord will be secured to the pulley N, and a cord N² will connect the pulley N' with the spring-actuated pulley K; but as cases are rare in which such a reduction is required it is not thought necessary to enter into further details regarding this particular portion of the device.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An indicator for steam-engines comprising in combination with the pressure-cylinder lever operated therefrom and the card-cylinder, a frame provided at one end with a wheel acted upon by a spring, and having a grooved pulley, a cord adapted to the grooved periphery of said wheel, an adjustable arm secured to said frame and provided with pulleys for guiding the cord, a second cord secured at one end to the hub of said wheel, a spring-actuated pulley to which the opposite end of said cord is secured the same being adjustably secured to said frame and a third cord detachably secured at one end to the latter cord and guided by an adjustable pulley

mounted upon the end of the frame, the said cord being secured at the other end to the spring-actuated card-cylinder, substantially as specified.

2. An indicator for steam-engines, comprising in combination with the pressure-cylinder and card-cylinder, a frame provided with an adjustable arm, a cord guided thereby leading to the cross-head or other working parts of the engine, a spring-actuated wheel pivoted to said frame, and having a grooved periphery for taking up the slack of said cord, a hub upon said wheel, a collar upon said hub, a cord secured to the same, a spring-actuated pulley, adjustably secured to the frame for taking up the slack of the last-mentioned cord, a loop in said cord, a ring hung to said loop, a cord leading from the card-cylinder and provided with a hook to engage the said ring, a pulley mounted upon the end of the frame and guiding the last-mentioned cord, stop mechanism mounted upon the frame for locking the latter cord after it has traveled to the full extent of its movement in one direction, said stop mechanism being interposed between the card-cylinder and pulley mounted upon the end of the frame, substantially as specified.

3. An indicator for steam-engines comprising in combination with the pressure-cylinder and card-cylinder, a frame detachably secured to the card-cylinder and provided at one end with an adjustable arm having pulleys universally adjustable in the end thereof, a cord adapted thereto, a wheel acted upon by a spring, mounted in a drum or casing in the frame, said wheel having a grooved periphery receiving said cord, the drum or casing secured to or forming part of the frame, a hub projecting out from said wheel, a cord adapted to said hub, a spring-actuated pulley adjustably secured to the frame near the opposite end thereof, receiving the last-mentioned cord, a pulley mounted upon a sliding block guided in the end of the frame, a thumb-screw mounted upon the stem in said block and capable of adjusting the position of said pulley and a cord carried by said pulley, substantially as specified.

4. A reducing-gear for steam-engine indicators, comprising an operating-cord, a spring-actuated wheel acting upon the same, an intermediate cord adapted to a reduced portion of said wheel, a spring-actuated pulley, adapted to the latter cord, an indicator-cord adapted to the last-named pulley and to a loop in the intermediate cord, and acting upon the card-cylinder, substantially as specified.

5. A reducing-gear for steam-engine indicators, comprising an operating-cord, a wheel rotatable in one direction by said cord, spring means for operating the said wheel in the opposite direction, an intermediate cord secured to the hub of said wheel, a pulley acted upon in one direction by said intermediate cord, spring means for operating said pulley in the opposite direction, an indicator-cord secured

to the intermediate cord and operating the
card-drum and mechanism for acting upon
the indicator-cord after the same has trav-
eled to the full extent of its motion in one
5 direction, substantially as specified.

6. A stop-motion for steam-engine indica-
tors, comprising an eccentric or cam and a
block arranged upon opposite sides of the

cord and a spring acting upon said eccentric
or cam and adapted to lock said cord. 10

In testimony whereof I affix my signature
in presence of two witnesses.

PETER E. APGAR.

Witnesses:

SAMUEL MCCLERKIN,

ROBERT W. LLOYD.