No. 837,557. PATENTED DEC. 4, 1906.

M. GEHRE.

SPRING REGULATOR.

APPLICATION FILED JUNE 26, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

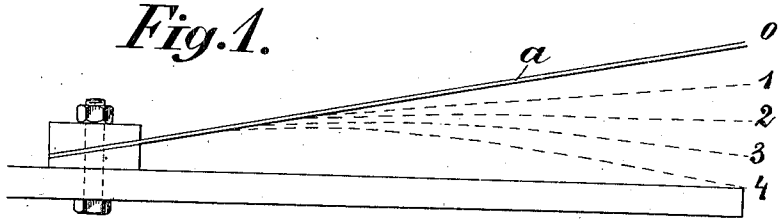


Fig. 2.

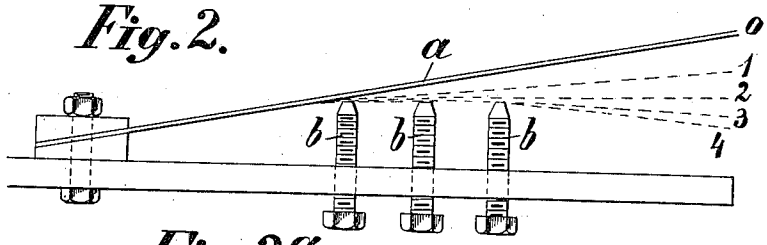


Fig. 2a

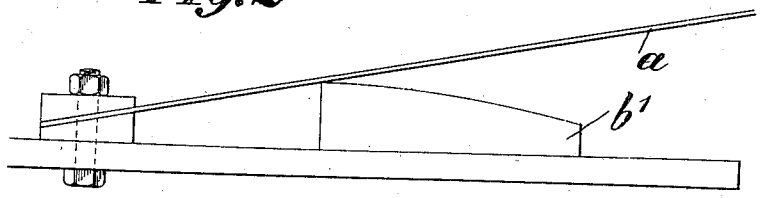


Fig. 3.

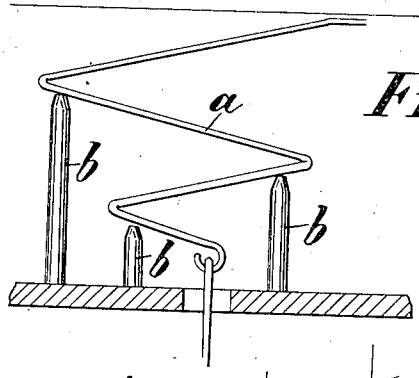
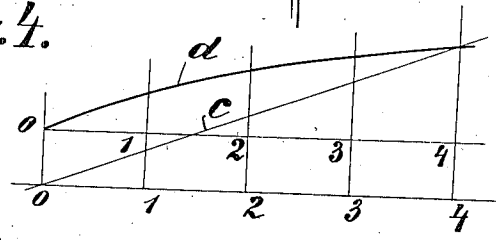


Fig. 4.



Witnesses:
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2 SHEETS—SHEET 2.

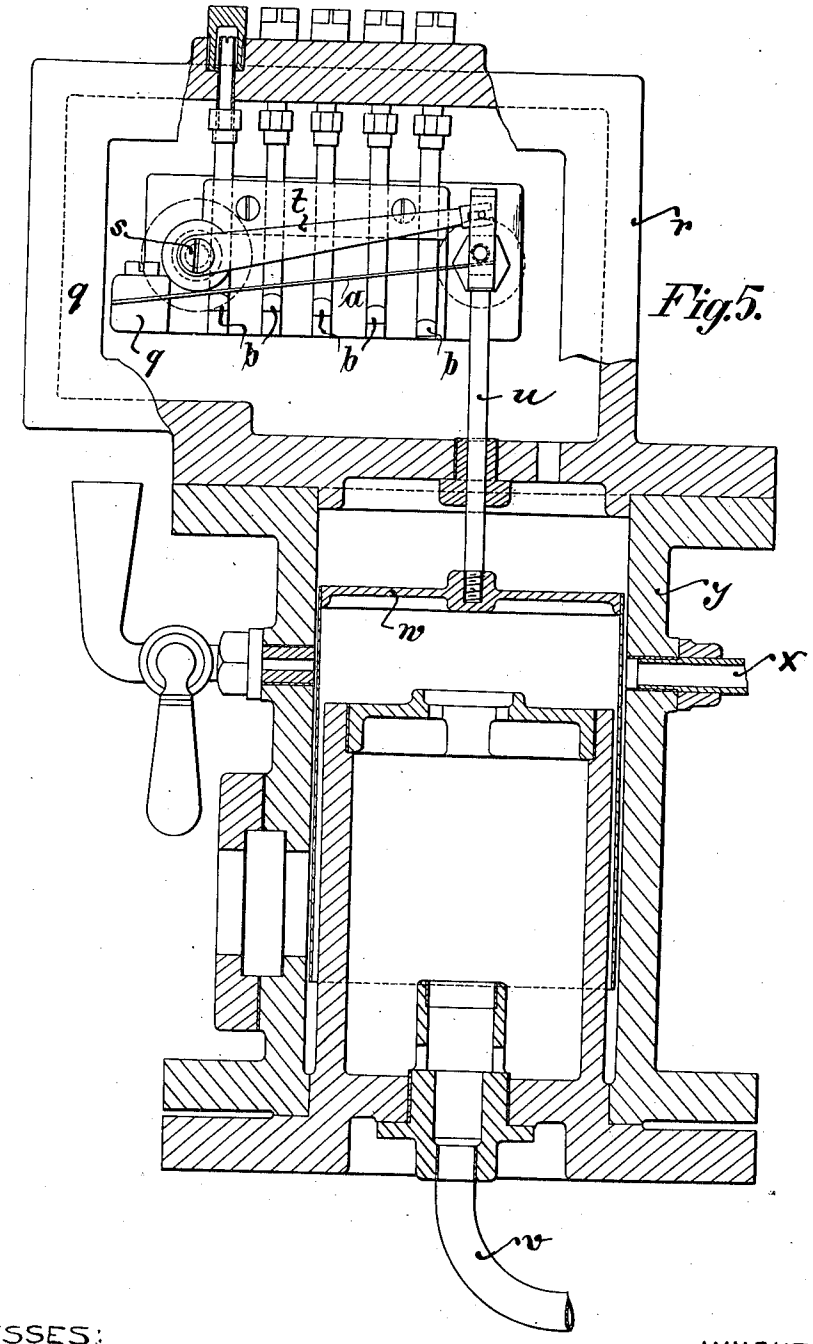


Fig. 5.

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SPRING-REGULATOR.

No. 837,557. Specification of Letters Patent. Patented Dec. 4, 1906.

Application filed June 26, 1903. Serial No. 163,190.

To all whom it may concern:

Be it known that I, MAX GEHRE, residing at Rath, near Düsseldorf, Germany, have invented certain new and useful Improvements in Spring-Regulators, of which the following is a specification.

The present invention relates to improvements in the construction of apparatus for measuring the quantity of steam passing through a contracted opening bored into a plate provided between the flanges connecting two adjacent parts of a steam-conduit pipe.

It is a well-known fact that if the pressure of steam at one side of such opening remains at the same height while the pressure at the other side of the opening continuously increases, the quantities of steam passing through said opening do not increase in the same degree as the difference between both pressures rises. In other words, a spring being bent or stretched by the pressure continuously increasing could not be used for moving or turning an indicating-lever over a uniformly-graduated scale, because such spring would be bent or stretched quite in accordance as the steam-pressure increases, while, as already mentioned, the quantity of steam passing through does not increase in accordance with the difference of the pressure. The particular object of the present invention is now accomplished by an arrangement or device by which the spring governing the position of the indicating-lever, which itself serves to show on a scale the quantity of steam passing through the aforesaid contracted opening in an intermediate flange, is progressively made ineffective as the pressure of the steam at the side of the higher pressure increases. For instance, if the said spring be formed by a flat steel band the effective free length of such steel band will be shortened continuously or by steps as the steam-pressure increases, so that the path passed through by the said free end of the spring will correspondingly with the rising of the steam-pressure become shortened. This purpose is in case of the use of a flat steel spring, as well as spiral spring, accomplished by pins arranged in straight line side by side or in a circle, as shown in Fig. 3, the free upper surfaces or ends of which pins being cut off or adjusted in such a manner that if the said spring is bent down or stretched one pin after the other will come in contact with the adjacent portion of the spring, in this way, ndeed, making ineffective one part of the spring after the other, at the same time progressively shortening the effective length of the spring and accordingly reducing the path described by the free end of the spring. It will be easily understood, also, that the path or angle through which the indicating-lever travels about its scale will be continuously shorter the more the pressure of steam passing through the opening of said intermediate flange increases.

Figure 1 illustrates the flexion of a spring *a*, which flexion is equal for every unit of additional mass, and this flexion is graphically illustrated as the straight line *c* in Fig. 4. Fig. 2 shows the employment of screws *b* as stops. The increase of the flexion of the spring is smaller than and not proportional to the increase of the mass. This effect is due to the stops *b*, which are preferably capable of being adjusted as desired. The flexion in this case is graphically illustrated by the curve *d* in Fig. 4. Fig. 2ª shows a modification of the arrangement represented in Fig. 2. Instead of several stops *b* a single one is provided—for instance, in the form of a plate *b'*, one edge of which is curved. Fig. 3 shows a spring of another form with its stops *b*. Fig. 5 is a vertical section through a measuring apparatus constructed in accordance with the present invention.

The tube *x* connects that part of the cylinder *y* above the bell-shaped piston *w* with the higher pressure of steam. Another tube *v* connects the lower side of the cylinder *y* with that side of the intermediate flange at which the steam has the lower pressure. The piston-rod *u* is connected with the spring *a*, as well as with the lever *t*, the axle *s* of which passes through the one vertical wall of the casing *r*, the bottom of which forms the cover of the cylinder *y*. The spring *a* is securely clamped between the strong metal pieces *q*, and *b* represents the stops on which one part of the spring after the other finds its abutment the more the piston *w* decends under the pressure transmitted through the tube *x*.

It is of course to be understood that oil or some other packing is interposed between the piston *w* and its walls.

It is to be remarked that an instrument, as shown in Fig. 5, can be used in measuring the quantities of steam, feeding a steam-engine when the latter is to be driven with different

power or speed, the said intermediate flange being then located within the main steam-pipe of said engine.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a gage for indicating volume measurements, a spring rigidly supported at one end, a piston rigidly connected to the other end of said spring, a cylinder containing such piston, air-tight tubes connected to both ends of said cylinder, one of them leading fluid of high pressure against that side of the piston adjacent to the spring, while the other tube is adapted to lead fluid of lower pressure against the opposite side of the piston, a plurality of stops arranged to engage the spring successively when the latter is deflected by the high pressure acting against said piston, as set forth.

2. In a gage for indicating volume measurements, a flat spring rigidly supported at one end, a piston rigidly connected to the other end of said spring, a cylinder containing such piston, air-tight tubes connected to both ends of said cylinder, one of them leading fluid of high pressure against that side of the piston adjacent to the spring, while the other tube is adapted to lead fluid of lower pressure against the opposite side of the piston, a plurality of stops arranged to engage the spring successively when the latter is deflected by the high pressure acting against said piston, as set forth.

3. In a gage for indicating volume measurements a spring, rigidly supported at one end, a piston rigidly connected to the other end of said spring, a cylinder containing such piston, air-tight tubes connected to the ends of said cylinder, one of them adapted to lead fluid of high pressure against that side of the piston adjacent to the spring, while the other tube is adapted to lead fluid of lower pressure against the opposite side of the piston, a plurality of adjustable stops supporting the spring one after the other when the latter is deflected by the high pressure acting against said piston, as set forth.

4. In a gage for indicating volume measurements, a flat spring rigidly supported at one end, a piston rigidly connected to the other end of said spring, a cylinder containing such piston, air-tight tubes connected to the ends of said cylinder, one of them adapted to lead fluid of high pressure against that side of the piston adjacent to the spring, while the other tube is adapted to lead fluid of lower pressure against the opposite side of the piston, a plurality of adjustable stops supporting the spring one after the other when the lattter is deflected by the high pressure acting against said piston, as set forth.

5. In a gage for indicating volume measurements, a spring fixedly secured at one end, means controlled by the pressure connected to the free end of said spring, and means whereby a plurality of adjustable abutments are successively presented to said spring when the same is flexed so as to gradually vary the resistance to flexion of its free end.

In testimony whereof I have hereunto set my hand in the presence of two witnesses.

MAX GEHRE.

Witnesses:
WILLIAM ESSENWEIN,
PETER LIEBER.