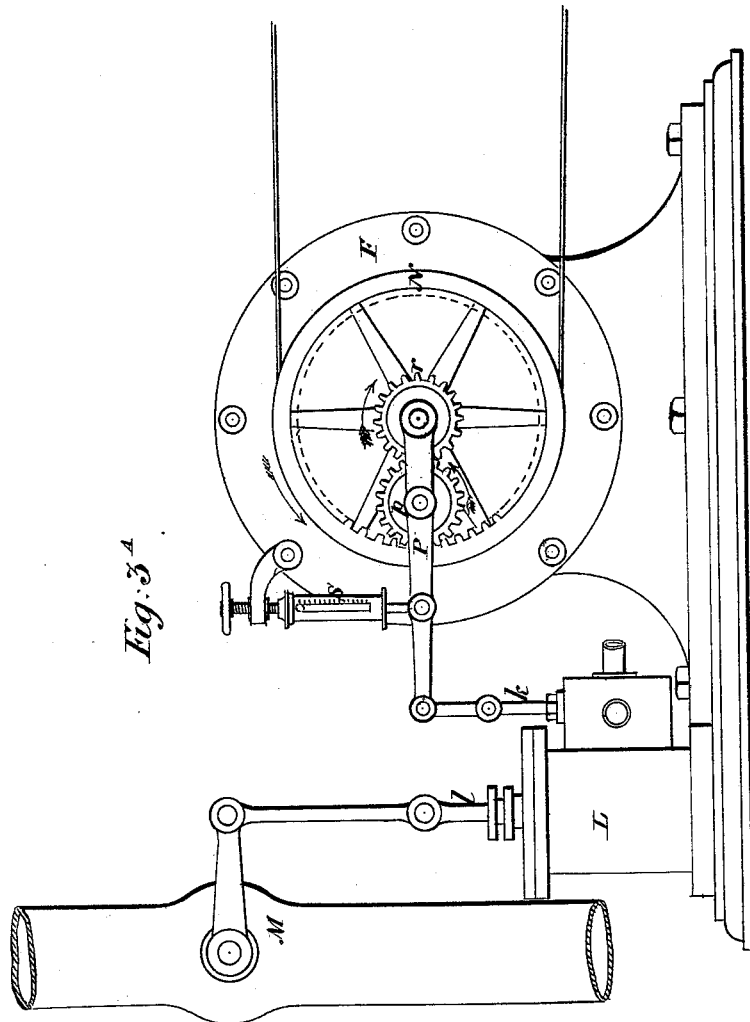




J. E. C. KOCH & F. W. DURHAM.  
Apparatus for Regulating the Supply of Steam to  
Steam-Engines.

No. 218,541.

Patented Aug. 12, 1879.



Witnesses:

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# UNITED STATES PATENT OFFICE.

JOHN E. C. KOCH, OF SOUTH KENSINGTON, COUNTY OF MIDDLESEX, AND  
FREDERICK W. DURHAM, OF NEW BARNET, COUNTY OF HERTS, ENGLAND.

## IMPROVEMENT IN APPARATUS FOR REGULATING THE SUPPLY OF STEAM TO STEAM-ENGINES.

Specification forming part of Letters Patent No. **218,541**, dated August 12, 1879; application filed  
October 28, 1878; patented in England, February 27, 1877.

### *To all whom it may concern:*

Be it known that we, JOHN EDWARD CAMPBELL KOCH, of No. 20 Queensbury Place, South Kensington, in the county of Middlesex, England, and FREDERICK WILLIAM DURHAM, of Clevedon Villa Station Road, New Barnet, in the county of Herts, England, have invented an Improvement in Apparatus for Regulating the Supply of Steam to Steam-Engines; and do hereby declare that the following description, taken in connection with the accompanying drawings, hereinafter referred to, forms a full and exact specification of the same, wherein we have set forth the nature and principles of our said improvement, by which our invention may be distinguished from others of a similar class, together with such parts as we claim and desire to secure by Letters Patent—that is to say:

In large steam-engines it frequently requires so much power to move the throttle or other valve in the steam-pipe in order to regulate the supply of steam that an ordinary governor cannot be employed for this purpose unless it is made very powerful, in which case it is not sufficiently sensitive to act efficiently under slight or sudden variations of speed.

Our invention relates to means for effecting the regulation of the steam-supply in such cases by the use of a comparatively small and sensitive governor, as we will now describe.

For this purpose, instead of connecting the governor directly to the regulating-valve, as is usually done, we connect it to the slide-valve of a small subsidiary steam-cylinder, the piston or plunger of which we connect to the main regulating-valve of the engine. Thus the governor needs only to have sufficient power to move the slide of the small cylinder, so as to admit steam thereto, and the piston of this cylinder acts with the force necessary for operating the regulating-valve.

In order that the manner in which our invention can be carried into practical operation may be the better understood, we have shown in the accompanying drawings our mode of applying for this purpose a governor of known kind, whose action depends on the resistance of liquid to a paddle-wheel revolving therein, as described in the specification of Letters Patent granted to me, the said F. W. Durham,

and to Henry Howse, on the 27th of March, 1877, No. 188,876.

Figure 1 represents a longitudinal section, and Fig. 2 a front view, of regulating apparatus according to our present invention applied to the working of a throttle-valve in a steam-pipe, Fig. 3 being a part plan, showing the gearing of the governor. Fig. 4 is a vertical section, showing the modification of the apparatus which we employ when the regulation of the steam-supply is effected by a shut-off valve.

A is a spindle, which may be worked by gearing or by a belt and pulley from the main shaft of the engine, being speeded thereto in any desired proportion. On this spindle is fixed a bevel-wheel, *a*, gearing with two bevel-wheels, *b*, mounted on a block fixed on a second spindle, B, which is in line with, but loose from, the spindle A.

The spindle B passes through a sleeve, C, on which are fixed two bevel-wheels, the one of which, *c*, gears with the wheels *b*, and the other, *c'*, gears with a bevel-wheel, *d*, on an upright spindle, D. On the spindle D is fixed a paddle-wheel, E, within a casing, F, containing water or other liquid, the said casing having fixed blades *f*, projecting inwardly from its sides, to prevent the liquid from acquiring a continuous rotary motion. The spindle B, continued forward, has fixed on it a pulley, G, connected by a chain, *g*, with a helical spring, H, the face of which can be adjusted by a screw, *h*. On the spindle B there is also fixed a pinion, K, which gears with a rack on the rod *k* of the slide of a subsidiary cylinder, L, which is supplied with steam from the main steam-pipe. The piston-rod *l* from the cylinder L is connected to the lever of the throttle-valve M, either directly, as shown in the drawings, or it may be through suitable levers and rods when necessary.

The action of the apparatus is as follows: The spindle A, being caused to rotate, acts through the bevel-gearing *a*, *b*, *c*, *c'*, and *d*, causing the paddle-wheel E to rotate in the liquid in F. When, owing to excess of speed, the resistance to the rotation of E exceeds the force of the spring H, then the bevel-wheels *b* are caused to revolve partly round the

wheel *c*, as planet-wheels round a sun-wheel, and thus the spindle *B* is partly turned in opposition to the spring *H*. The partial rotation of *B* and of its pinion *K* moves the slide-rod *k* and the slide attached to it, whereby steam is admitted into the cylinder *L*, to act on its piston, giving it such movement as to close, or partly close, the throttle-valve *M*, and so reduce the supply of steam to the main engine. When, in consequence of the reduction of supply, the speed of the engine becomes again moderated, the resistance to the paddle-wheel *E* becomes lessened, and the spring *H*, acting by the chain *g* on the pulley *G*, causes the spindle *B* to turn backward, and the slide-rod *k* to be thereby moved back, so as to cut off or reverse the supply to the cylinder *L*, the throttle-valve *M* being thus caused to remain where it had been previously set or to reopen.

Instead of the bevel sun-and-planet gear shown in Figs. 1, 2, and 3, spur sun-and-planet gear may be employed for the governor, as shown by the side elevation, Fig. 3<sup>A</sup>. According to this arrangement, a pulley or wheel, *N*, having internal cogs is driven by strap or otherwise from the engine. It revolves loosely on the shaft of the governor-paddle, and its teeth gear with those of a pinion, *p*, which gears with a pinion, *r*, fixed on the shaft of the governor-paddle, which revolves within the casing *F*. The intermediate pinion, *p*, is mounted on a lever, *P*, which is linked to the slide-rod *k*, and also to an adjustable spring, *S*. The piston-rod *l* is linked, as before described, to the lever of the throttle-valve *M*. By means of a hand screw-wheel the spring *S* is adjusted to such force that the lever *P* is held stationary while the motion of *N* is conveyed through the pinion *p* to the pinion *r* and the paddle of the governor, causing it to revolve in the liquid within the casing. Should the engine-speed vary, then, the resistance of the paddle being correspondingly varied, the lever *P* is caused

to move downward or upward, as the case may be, thereby moving the slide attached to *k*, and so determining the passage of steam to and from the cylinder *L* to act on the piston in that cylinder, and thereby alter the position of the throttle-valve *M* in the main steam-pipe.

A shut-off valve may be employed for regulation of the supply, as shown in Fig. 4. In this case the cylinder *L* is fitted with a piston somewhat larger in area than the valve *N*, and is supplied with steam, by the pipe *O*, from the main steam-pipe. The slide-rod *k* being worked, as described, by a governor, steam is either admitted to or allowed to escape from the cylinder *L*, according as the speed of the engine is increased or diminished, and the valve *N* is thereby more or less closed or permitted to open.

Having thus described the nature of our invention, and the best means we know of carrying it into practical operation, we claim—

The combination of the shaft *A*, carrying a belt-pulley and bevel-wheel, *a*, shaft *B*, carrying the block and bevel-wheels *b b*, the sleeve *C*, carrying bevel-wheels *c c*, paddle-wheel *E*, the shaft of which carries bevel-wheel *d*, the adjustable spring for regulating the movement of shaft *B*, the cylinder *L*, having its slide-valve connected with said shaft, and its piston-rod adapted for connection with the throttle-valve of a steam-engine, substantially as described.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 5th day of October, 1878.

JOHN EDWARD CAMPBELL KOCH.  
FREDERICK WILLIAM DURHAM.

Witnesses:

ALBERT C. C. HENRY,  
JNO. P. M. MILLARD.