(No Model.) 2 Sheets—Sheet 1.

E. REYNOLDS.

VALVE GEAR FOR COMPOUND ENGINES.

No. 262,476. Patented Aug. 8, 1882.

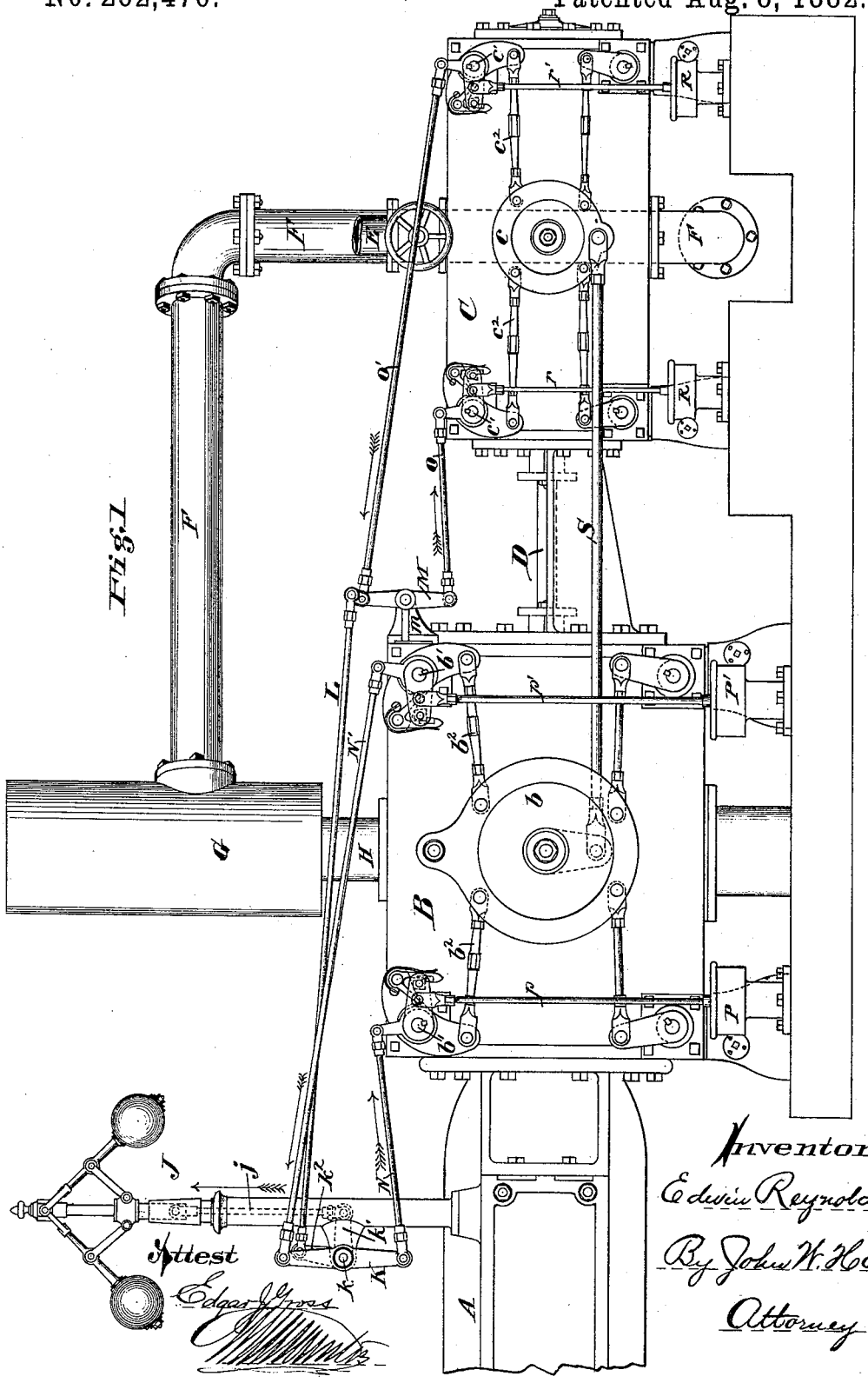

Fig. 1.

Attest
Edgar Gross

Inventor
Edwin Reynolds
By John W. Hill
Attorney

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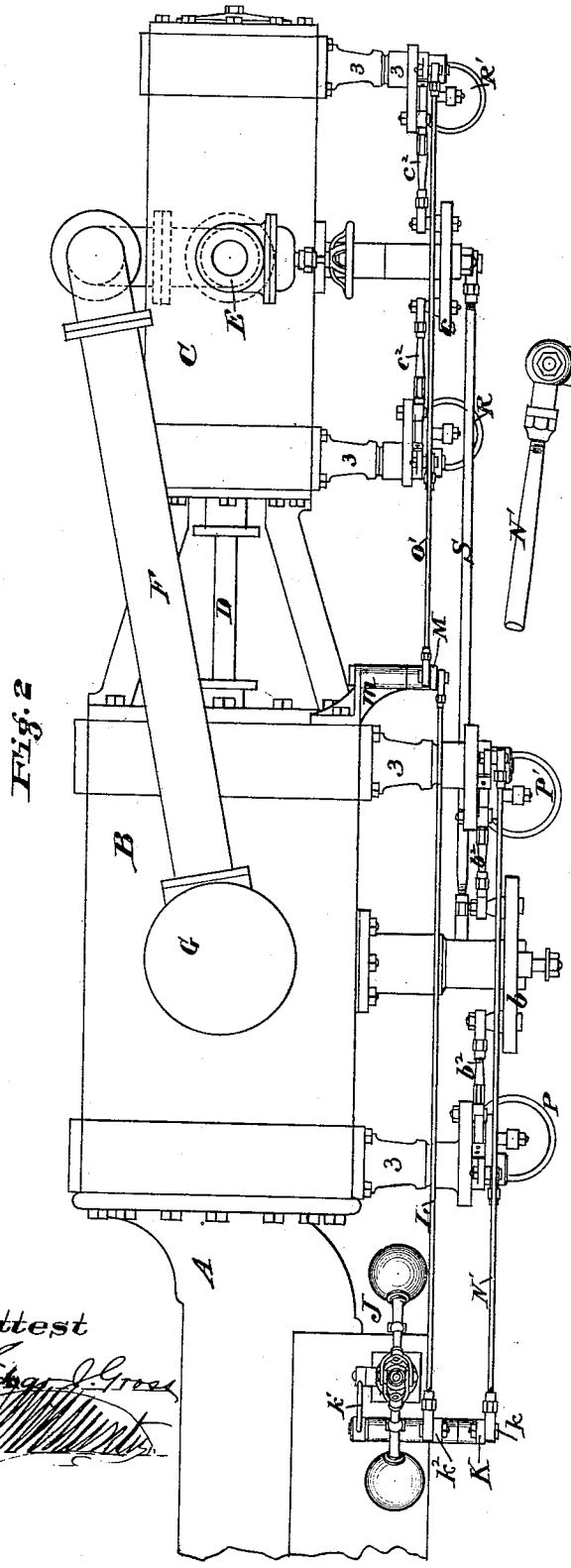

Fig. 2

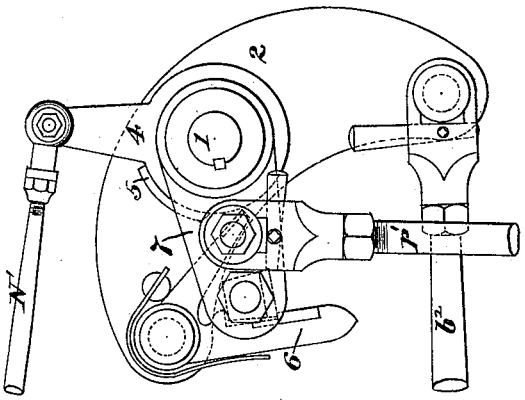

Fig. 3

Attest
Edgar J. Gross

Inventor
Edwin Reynolds
By John W. Kibb
Attorney

UNITED STATES PATENT OFFICE.

EDWIN REYNOLDS, OF MILWAUKEE, WISCONSIN.

VALVE-GEAR FOR COMPOUND ENGINES.

SPECIFICATION forming part of Letters Patent No. 262,476, dated August 8, 1882.

Application filed April 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, EDWIN REYNOLDS, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Valve-Gear for Compound Engines, of which the following is a specification.

My invention relates to that class of steam-engines which consists of two or more steam-cylinders, one or more of which are arranged to receive steam direct from the boiler, and one or more of which are arranged to receive steam from the exhaust of the former-mentioned cylinder or cylinders, or from an intermediate receiver into which said exhaust is first delivered. Compound engines, or engines containing two or more cylinders, usually contain one high-pressure cylinder, taking steam from the boilers, and one low-pressure cylinder, taking steam from the exhaust of the high-pressure cylinder, or from an intermediate receiver set between the two cylinders and connected to the exhaust-outlet of the high-pressure cylinder and steam-inlet of the low-pressure cylinder. Compound engines are sometimes constructed with one high-pressure steam-cylinder and two low-pressure steam-cylinders, or with two high-pressure steam-cylinders and one low-pressure steam-cylinder.

My invention further relates to that variety of compound engines which are automatic in their action—that is, in which the cut-off of steam is controlled by a suitable governor to regulate the speed of engine and proportion the consumption of steam to the load carried.

In the construction of automatic compound engines heretofore the governing or regulating gear has been connected only with the steam-valves of the high-pressure cylinder, the valve-motion of the low-pressure cylinder being constant in all its functions. Thus, when the cut-off of the high-pressure cylinder is lengthened or shortened, indicating respectively an increase or reduction of load and diminution or increase of speed, the high-pressure piston, while disposed to promptly restore the proper mean speed and adapt the consumption of steam to the precise demands upon the engine, is resisted by the low-pressure piston, which, with its constant cut-off, is disposed to move at the increased or retarded speed, and, per consequence, no effect either in regulation of speed or in the consumption of steam can be had from the low-pressure half of the engine, except through the exhaust of the high-pressure cylinder or the intermediate receiver into which the high-pressure cylinder exhausts.

To automatically control the cut-off of both cylinders by connecting the steam-valves thereof with one or two regulators or governors is the object of my invention.

In the accompanying drawings, Figure 1 is an elevation of one style of compound engine known as the "tandem" type, consisting of a high-pressure cylinder mounted behind a low-pressure cylinder, with the pistons of said cylinders secured to a single piston-rod common to both. Fig. 2 is a plan of Fig. 1, and Fig. 3 is a detached view of the steam-valve gear.

Similar letters of reference indicate similar parts.

A is the frame or girder of a steam-engine of the "Corliss" type, one end of which is bolted to the low-pressure steam-cylinder B.

C is the high-pressure steam-cylinder.

D is the piston-rod, to which the pistons of cylinders B and C are secured.

E is the live-steam pipe; *e*, the stop-valve; F, the exhaust-pipe from the high-pressure cylinder; G, the intermediate receiver, taking the exhaust from the pipe F and delivering through the pipe H to the low-pressure cylinder B.

b is the wrist-plate of the low-pressure cylinder, actuated by the customary eccentric and eccentric-rod from the engine-shaft, and *c* the wrist-plate of the high-pressure cylinder, actuated by the rod S from the wrist-plate *b*.

b' b' are the steam-valves of the low-pressure cylinder, worked by the rods b^2 b^2 from the wrist-plate; *b* and *c' c'* are the steam-valves of the high-pressure cylinder, worked by the rods c^2 c^2 from the wrist-plate *c*.

J is the regulator or governor, mounted on the girder A.

K is a double rocker-arm, mounted on the shaft *k* and actuated by the regulator J through the rod or link *j* and arm *k'*. (Shown in dotted lines, Fig. 1.)

L is a rod or link operated from the rock-shaft *k* by the arm k^2, and connected to the second double-rocker arm, M, mounted in a

bracket, *m*, to the rear end of the low-pressure cylinder B.

N N′ are the regulating-rods to the low-pressure steam-cylinder valves *b′ b′*, and O O′ the regulating-rods to the high-pressure steam-cylinder valves *c′ c′*.

The valve-gear shown in the drawings is of the drop cut-off type, and is clearly detailed in the detached view, Fig. 3, of which 1 is the stem of the well-known Corliss rotative slide-valve; 2, a crescent-shaped rocker-arm pivoted to the bonnet 3, Fig. 2, and actuated by the rods *b′ b′* or *c′ c′*. 4 is an arm pivoted concentric with the valve-stem 1 and rocker-arm 2, which is provided with a circular projecting segment, 5, against which "wipes" the inner arm of the hook 6. The arm 4 is actuated by the regulating-rod N. As the arm 5 is rolled to the right or left the hook 6 is released earlier or later in the stroke of the piston, and the steam-valve closed by the vacuum dash-pot P P′ or R R′, acting through the rods *p p′* or *r r′* and arm 7, keyed to the valve-stem 1.

The peculiar form of valve-detaching gear shown is not material to my invention. Indeed, it is equally applicable to that class of automatic engine which contains a steam-valve permanently connected with a variable eccentric or with an adjustable link.

By reference to Fig. 1 the arrows indicate the direction in which the rods or links L, N N′, and O O′, and *j* move to shorten the cut-off, and of course motion in an opposite direction has the effect to lengthen the cut-off.

My experience shows that the steam-valves of both cylinders of a compound engine for maximum economy shall be subject to governor control in order that the speed shall be practically constant, and that the consumption of steam shall be proportioned to the demands of the load—conditions which cannot be attained with one set of steam-valves (high-pressure cylinder) only, subject to governor control, and the other set (low-pressure cylinder) having an invariable motion.

In the type of compound engine shown in the drawings, one governor can be arranged to control the cut-off of steam to both cylinders; but with the two cylinders set parallel and separated some distance to enable the pistons to connect with cranks at quarters on the engine-shaft, two governors, one for the steam-valves of each cylinder, may be found preferable.

Having described my invention, what I claim is—

1. The combination of the steam-valves of the high and low pressure cylinders and an intermediate receiver which receives the exhaust-steam from the high-pressure cylinder and delivers it to the low-pressure cylinder, with automatic governor mechanism for regulating the steam-valves of both cylinders and causing them to simultaneously cut off earlier or later in the strokes of the piston, substantially as described.

2. The combination, with the gears giving motion to the steam-valves of the two cylinders of a compound engine, of the regulator J, rocker-arms K and M, and links or rods L, N N′, and O O′, arranged to simultaneously lengthen or shorten the cut-off or closing movement of said valves, substantially as described.

In testimony whereof I have signed my name to the foregoing specification in the presence of two subscribing witnesses.

EDWIN REYNOLDS.

Witnesses:
G. H. TUCKER, Jr.,
G. M. HINKENY.