

The engineer's handy-book

Stephen Roper

ENGINEER'S HANDY-BOOK.

CONTAINING

A FULL EXPLANATION OF THE STEAM-ENGINE
INDICATOR, AND ITS USE AND ADVANTAGES
TO ENGINEERS AND STEAM USERS.

WITH FORMULÆ

FOR ESTIMATING THE POWER OF ALL CLASSES OF STEAM-ENGINES;
ALSO, FACTS, FIGURES, QUESTIONS, AND TABLES FOR ENGINEERS
WHO WISH TO QUALIFY THEMSELVES FOR THE UNITED
STATES NAVY, THE REVENUE SERVICE, THE MER-
CANTILE MARINE, OR TO TAKE CHARGE OF
THE BETTER CLASS OF STATIONARY
STEAM-ENGINES.

With Illustrations.

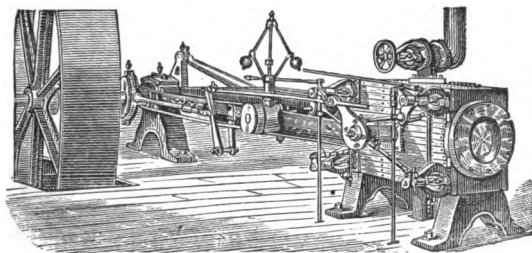
BY

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Author of

"Roper's Catechism of High-Pressure or Non-Condensing Steam-Engines,"
"Roper's Hand-Book of the Locomotive," "Roper's Hand-Book of
Land and Marine Engines," "Roper's Hand-Book of Modern
Steam-Fire Engines," "Improvements in Steam-Engines,"
"Use and Abuse of the Steam-Boiler," "Questions and
Answers for Engineers," etc., etc.

SEVENTH EDITION. NINTH THOUSAND.

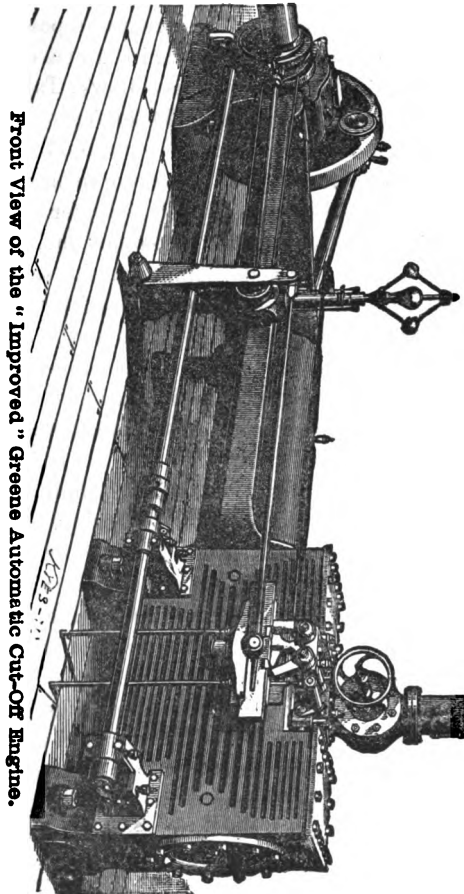


PHILADELPHIA:
E. CLAXTON & COMPANY,
930 MARKET STREET.

1884.

The Improved Greene Automatic Cut-Off Engine.

The illustration represents the "Improved" Greene Automatic Cut-Off Engine, of which the Providence Steam-Engine Company, Providence, R. I., are sole builders.



Front View of the "Improved" Greene Automatic Cut-Off Engine.

The bed-plate is of the girder pattern, symmetrical in appearance, and of ample strength. The slides are cast *separate*, and secured to bed-plate by dowels and bolts. The main journal-boxes are made in four pieces, and provided with set-screws and check-nuts, which permit of convenient and accurate adjustment. The governor is of the Porter pattern, and is driven by a flat belt from the main shaft. The valve-gear is detachable, and is so controlled by the governor that the cutting off may be effected from zero to three-quarters of the entire stroke. The valves are four in number—two steam and two exhaust

—and are of the *flat-slide pattern*. The power which moves them

is applied parallel to and in line with their seats, so that they cannot rock or twist—thus obviating the tendency to wear unevenly. The steam-valves when tripped, are shut by the combined action of a weight and *the pressure of the steam on the large valve-stems*, thereby insuring a *quick cut-off*, and the *positive* closing of the port, under all circumstances of speed and pressure. The steam-valves are operated by toes, on the inner ends of two rock-shafts that connect with the valve-stems outside the steam-chest. The outer ends of the rock-shafts are furnished with steel-tipped toes.

There is a sliding-bar carrying tappets which receive a reciprocating rectilinear motion from an eccentric on the main shaft. Below the sliding-bar is a gauge-plate connected with the governor, which receives an up and down motion from a reverse action of the governor balls.

The tappets in the sliding-bar are supported by springs, the lower ends of which rest upon the gauge-plate; the ends of the tappets projecting through the gauge-plate with nuts upon them secured by pins. As the sliding-bar moves, one of the tappets is brought in contact with the inner face of the toe on the rock-lever, causing it to turn on its axis, thereby opening the steam-valve at one end of the cylinder; the other tappet, meanwhile, passes under the rock-lever,—without moving it,—the toe and tappet being so bevelled that the tappet will be forced down against the action of the spring, till it has passed the toe, when the spring causes it to resume its original position, prior to opening the steam-valve at the opposite end of the cylinder upon the return stroke of the bar.

As a result of this motion, the tappet always gives the valves the same lead, and as the bar moves in a straight line, while the toe describes the arc of a circle, the tappet will pass by and liberate the toe, which is brought back to its original position by a weight, and the steam pressure on the large valve-stem, which thus closes the valve and cuts off the steam. The liberation of the toes will take place sooner or later, according to the elevation of the tappet; that is, the lower the tappets are, the sooner the toes will be liberated, and *vice versa*. By the elevation or depression of the

gauge-plate, the period of *closing* the valves is changed, while the period of *opening* them remains the same. The adjustment of the gauge-plate is effected directly by the governor.

Both the exhaust-valves and seats are convenient of access, and removable from the outside of cylinder. These valves receive their motion from a separate eccentric, thus allowing of easy adjustment, without interference with the steam-valve mechanism. All the connections are on the outside, are few in number, and have ample bearing surfaces, insuring freedom from rapid wear and derangement.

A safety stop-motion is combined with the governor, preventing the admission of steam should the governor-belt run off or break.

The cross-head gibs are directly opposite the centre of pin, thus avoiding any cross strain upon the piston-rod; a lack of attention to this point has been the cause of many serious accidents. The steam-ports are large, thus insuring the full pressure of steam to the point of cut-off. A very desirable feature of this engine, and one that will be appreciated, is the method of connecting the steam-valves with their stems, by which, if water should accumulate in the cylinder, and the engine be started without the usual precautions, the valves will *lift*, giving a *free passage* of the water through the steam-ports. The engine is extremely sensitive to the action of the governor, and is, therefore, particularly adapted to those situations where perfect regulation is required. All parts are well proportioned, made of best material, accurately fitted, and highly finished.

The Dead-Centre.

All reciprocating steam-engines have one dead-centre in each stroke and two in each revolution, and that point is the point at which the steam is exhausted, and the centre of the crank-pin is parallel with the centre of the axis of the cylinder. The centre of the cross-head, in some cases, may be above or below the centre of the cylinder; but by placing a spirit-level on the top or bottom