(No Model.) 4 Sheets—Sheet 1.

H. F. GASKILL.

TRIPLE EXPANSION ENGINE.

No. 384,250. Patented June 12, 1888.

Fig. 2.

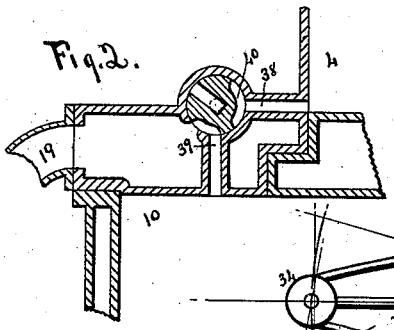


Fig. 1.

Witnesses.
C. C. Linthicum.
C. J. Ward.

Inventor.
Harvey F. Gaskill.
by Wm. S. Bates.
Atty.

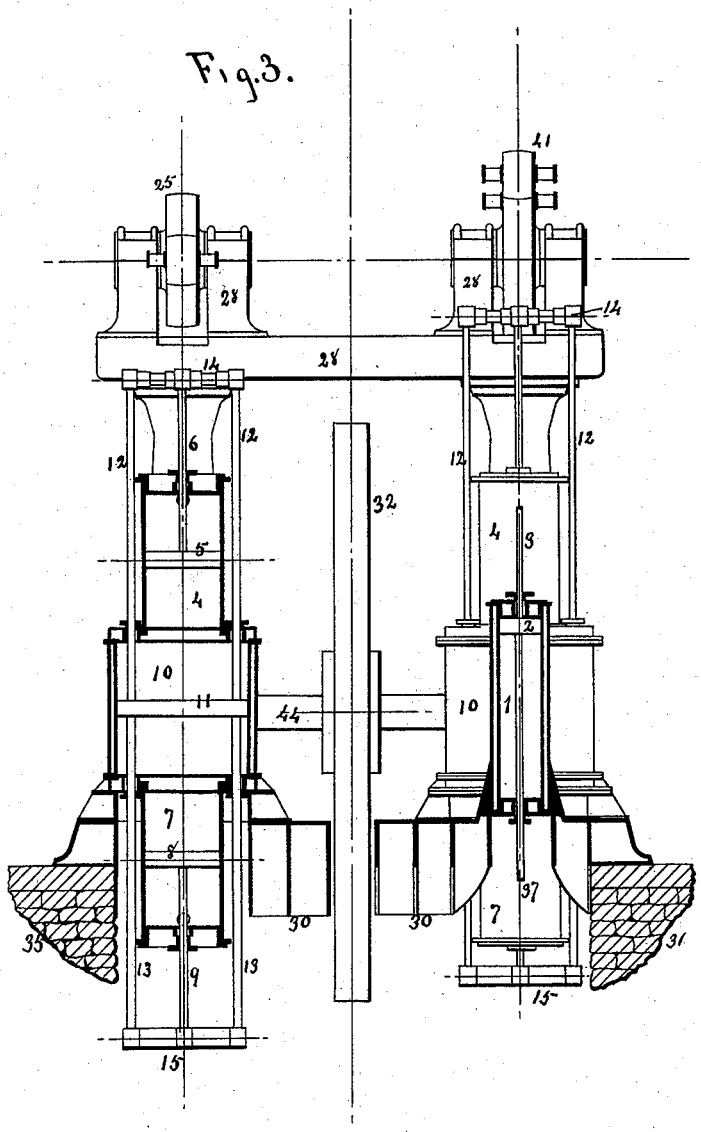
(No Model.) 4 Sheets—Sheet 2.

H. F. GASKILL.

TRIPLE EXPANSION ENGINE.

No. 384,250. Patented June 12, 1888.

Fig. 3.



Attest.
C. C. Linthicum
E. J. Hardy

Inventor.
Harvey F. Gaskill.
by Wm. S. Bates.
Atty.

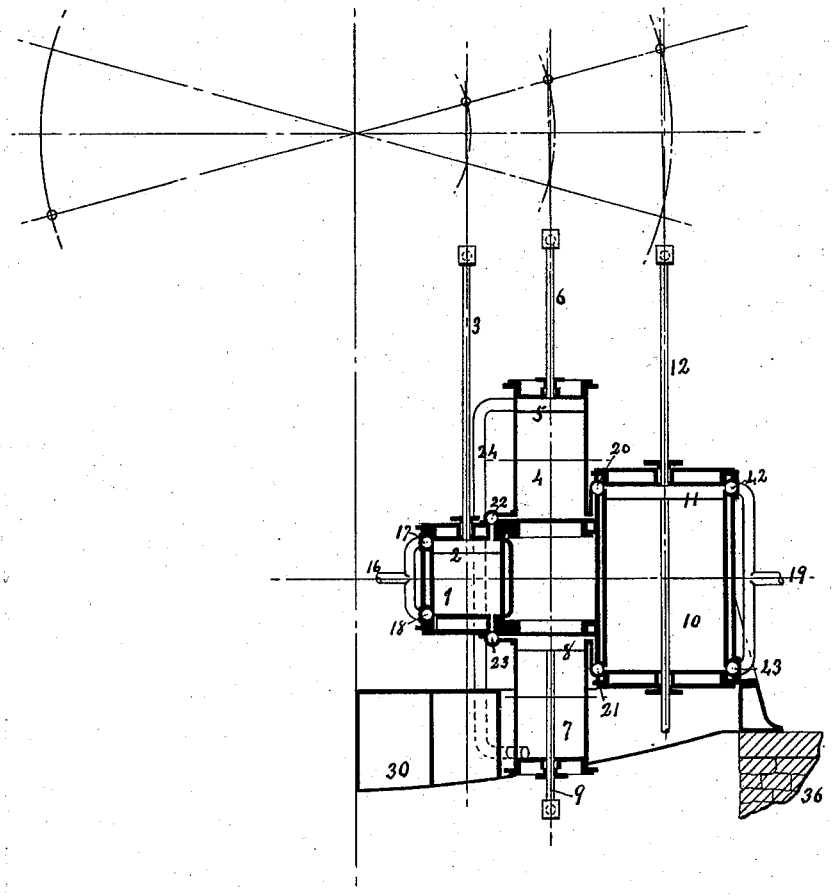
(No Model.) 4 Sheets—Sheet 3.

H. F. GASKILL.

TRIPLE EXPANSION ENGINE.

No. 384,250. Patented June 12, 1888.

Fig. 4.



Attest.
C. C. Linthicum
C. J. Hazel

Inventor.
Harvey F. Gaskill.
by Wm. S. Bates.
Atty.

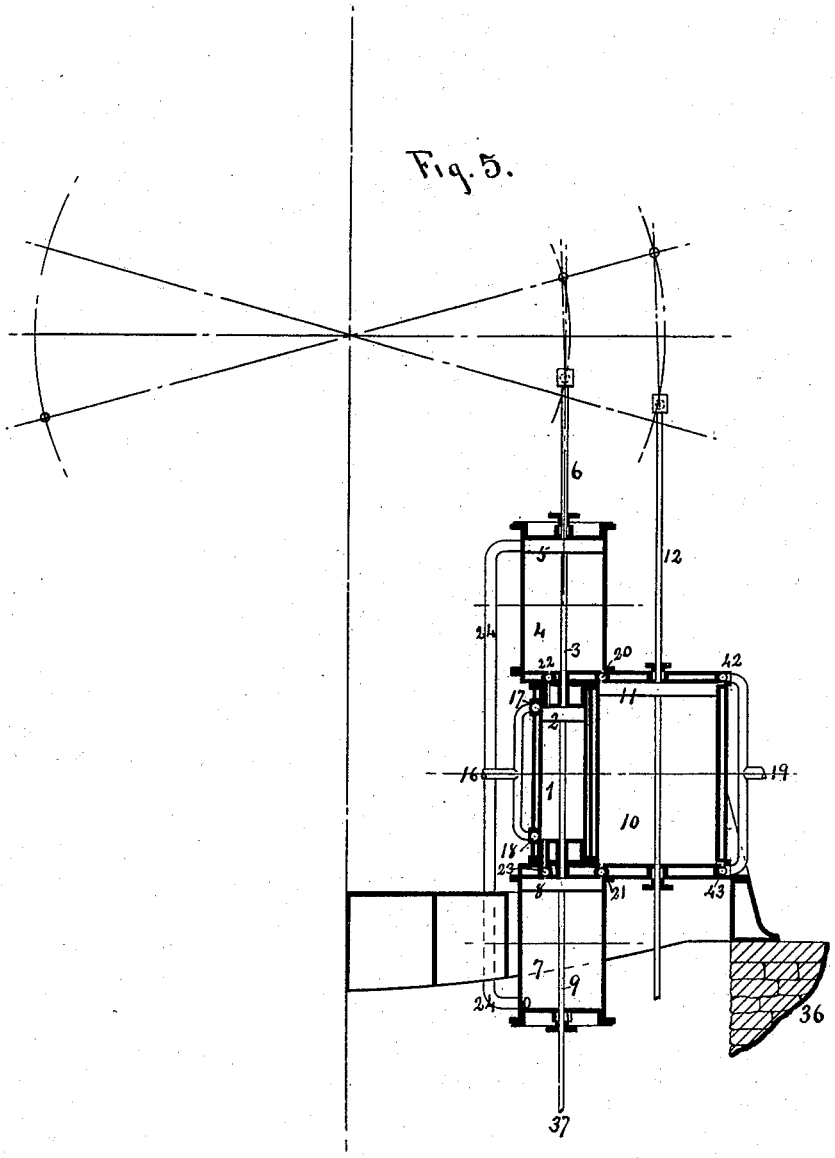
(No Model.) 4 Sheets—Sheet 4.

H. F. GASKILL.

TRIPLE EXPANSION ENGINE.

No. 384,250. Patented June 12, 1888.

Fig. 5.



Attest.
C. C. Linthicum.
C. J. Ward.

Inventor.
Harvey F. Gaskill.
by Wm. S. Bates.
Atty.

UNITED STATES PATENT OFFICE.

HARVEY F. GASKILL, OF LOCKPORT, NEW YORK.

TRIPLE-EXPANSION ENGINE.

SPECIFICATION forming part of Letters Patent No. 384,250, dated June 12, 1888.

Application filed September 20, 1887. Serial No. 250,168. (No model.)

To all whom it may concern:

Be it known that I, HARVEY F. GASKILL, of Lockport, New York, have invented certain new and useful Improvements in Triple-Expansion Engines, of which the following is a specification.

The main object of this invention is to use steam economically.

In carrying out my invention I employ three grades of cylinders—viz., high-pressure, low-pressure, and intermediate-pressure—so arranged that the steam-passages are comparatively short and direct; and the invention consists in certain devices or combinations, as designated in the claims at the end hereof.

In the accompanying drawings I have shown a double-walking-beam engine for carrying my invention into effect in the form preferred by me.

Figure 1 is a side elevation showing the cylinders in section. Fig. 2 shows one of the valves used between the intermediate and the low pressure cylinders, in section. Fig. 3 is an end elevation, but showing the high-pressure cylinder of one engine in section at the right and the intermediate and low pressure cylinders of the other engine in section at the left. Figs. 4 and 5 show modifications in the relative arrangement of the cylinders.

In this apparatus (shown in the drawings) I have arranged four cylinders vertically. The high-pressure cylinder and the low-pressure cylinder are placed side by side and are double-acting, and the intermediate-pressure cylinders are single-acting and are placed one at each end of the other two. As shown in Figs. 1 and 3, the intermediate-pressure cylinders are in line with the low-pressure cylinder.

1 is the high-pressure cylinder. 2 is its piston; 3, its piston-rod. It is double-acting and receives steam through the steam-pipe 16 and the valves 17 and 18.

4 is a single-acting cylinder at the upper end of cylinder 1, and communicating with it by a short direct steam-passage provided with a valve, 22. The lower end of cylinder 4 is its active end, its upper end being passive.

5 is the piston, and 6 the piston-rod, of cylinder 4.

7 is a single acting cylinder at the lower end of cylinder 1, and communicating with it by a short direct steam-passage provided with a valve, 23. Its lower end is passive and its upper end active.

8 is the piston, and 9 the piston-rod, of cylinder 7. The passive ends of cylinders 4 and 7 may be connected with the steam-jacket system by means of the pipe 24, which connects them with each other.

10 is a double-acting cylinder at the side of cylinder 1. In the arrangement shown in Figs. 1 and 3 it is between and in line with cylinders 4 and 7.

11 is the piston of cylinder 10.

12 and 13 are rods in Figs. 1 and 3, extending from piston 11 past cylinders 4 and 7 at the sides thereof, and connected, respectively, with their piston-rods by the yokes 14 and 15. The upper end of cylinder 10 communicates with the active end of cylinder 4 by a short steam-passage provided with a valve, 20. The lower end similarly communicates with cylinder 7 by a passage and valve, 21. The valves 20 and 21, when desired, may also be capable of throwing cylinder 10 into communication with its exhaust 19. In such case they may be constructed as shown in Fig. 2, which shows the valve in position for the cylinder 10 to exhaust. An oscillation to the right from the position shown in Fig. 2 causes the space 40 in the valve to connect the ports 38 and 39, and cylinders 4 and 10 are then in communication with each other.

25 is a walking-beam for transmitting the motion of the pistons to the crank and fly-wheel, with all of which it may be connected by suitable links or connecting-rods in the ordinary manner. I prefer to connect the pistons which are not in line with each other to different points on the beam, as I thereby secure lightness of the moving parts.

41 is the beam of the right-hand engine. (See Fig. 3.)

In operation, supposing the pistons to be moving downward, steam is admitted through pipe 16 to the upper end of cylinder 1. Its admission is governed by valve 17, valve 18 being closed. The steam in the lower end of cylinder 1 remaining from the preceding stroke passes through valve 23 into the upper end of cylinder 7, where it acts expansively on piston 8. The steam in cylinder 4 remaining

from the preceding stroke passes through valve 20 into the upper end of cylinder 10, where it acts by expansion on piston 11. The steam in the lower end of cylinder 10 from the preceding stroke passes through valve 21 to the exhaust 19, whence it may go to the condenser. Similarly, on the upstroke steam is admitted to the lower end of cylinder 1 from pipe 16, and steam exhausts from the upper end of cylinder 1 into cylinder 4 from cylinder 7 into the lower end of 10 and from the upper end of 10 to 19.

This engine is adapted for a power-engine or a pumping-engine. When used as a pumping-engine, the main pump may be connected to rod 37 of cylinder 1, and the air-pumps may be driven from yoke 15; or the pumps may be otherwise connected.

The cylinders may be so proportioned as to best secure the ends in view. I have found it a good plan to make cylinders 4 and 7 of two and a half times the cubic capacity of cylinder 1, and to make cylinder 10 of seven times the cubic capacity of cylinder 1.

What I claim is—

1. The combination, substantially as set forth, in a triple-expansion engine, of a double-acting high-pressure power cylinder and a double-acting low-pressure power-cylinder arranged side by side, and two single-acting power-cylinders for intermediate pressure, arranged at the ends of the double-acting cylinders, whereby the exhaust from one grade into the next grade is through short and direct passages.

2. The combination, substantially as set forth, in a triple-expansion engine, of two double-acting power-cylinders arranged side by side, and two single-acting power-cylinders arranged at the ends of the double-acting cylinders, when the pistons of said cylinders move synchronously together in the same direction.

3. The combination, substantially as set forth, in a triple-expansion engine, of the high-pressure, the intermediate-pressure, and the low-pressure power-cylinders with the beam, when said cylinders have their pistons connected to the beam at two or more different points on the same side of its center.

4. The combination, substantially as set forth, in a triple-expansion engine, of the high-pressure power-cylinder, the low-pressure power-cylinder at the side thereof, and the intermediate-pressure power-cylinders at the ends thereof and in line with the low-pressure cylinder.

HARVEY F. GASKILL.

Witnesses:
F. H. SEYMOUR,
F. P. LUCE.