R. Winans,

Exhaust Mechanism for Locomotives.

No. 5,056. Patented Apr. 10, 1847.

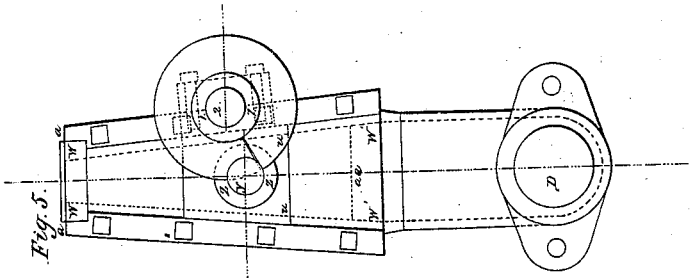

Fig. 5.

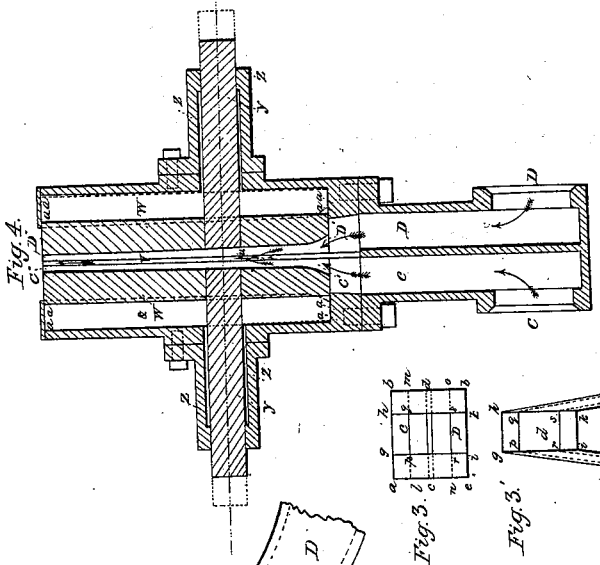

Fig. 4.

Fig. 3. Fig. 3'

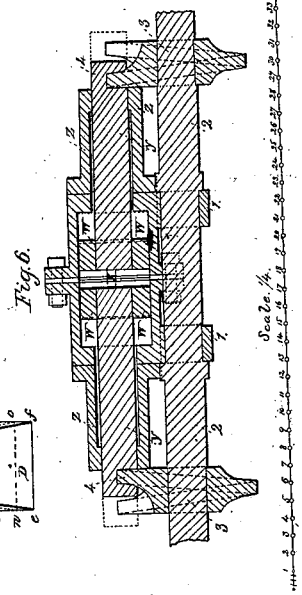

Fig. 6.

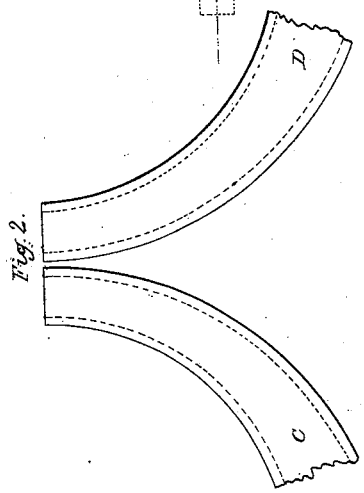

Fig. 2.

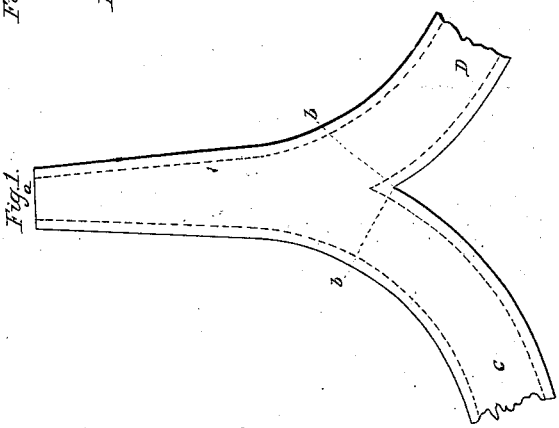

Fig. 1.

Witnesses.
Jno. H. Dalton
Phil. Otterson

Inventor.
Ross Winans

UNITED STATES PATENT OFFICE.

ROSS WINANS, OF BALTIMORE, MARYLAND.

USING EXHAUST-STEAM FOR INCREASING DRAFT IN SMOKE-PIPES.

Specification of Letters Patent No. 5,056, dated April 10, 1847.

To all whom it may concern:

Be it known that I, Ross WINANS, of the city of Baltimore, in the State of Maryland, have invented a new and useful Improvement in Exhaust-Pipes of Locomotive-Engines, and that the following is a full and exact description of my said improvement.

There are ordinarily two cylinders to a locomotive engine, the piston rods of which are connected to cranks operating at right angles to each other. As, in all the engines known as high pressure engines, the steam when it has driven the piston from one end of the cylinder to the other, instead of being condensed, is allowed to escape through a pipe called an exhaust pipe, which in a locomotive engine is led into the chimney, up which the steam discharges itself, creating as it does so, the draft on which the engine depends for its efficiency; and to increase the velocity of the discharged steam, thereby increasing the draft, the orifice through which it is discharged is contracted, so that its area is less than the general sectional area of the exhaust pipe. The motion of the pistons in the two cylinders being regulated by the cranks at right angles with each other as aforesaid, the steam from the cylinders is discharged up the chimney in alternate jets—sometimes the two exhaust pipes are brought into one pipe, which I call, to avoid confusion of terms, the mouth piece, the orifice of which is properly contracted and points up the center of the sectional area of the chimney. The advantage of this mode of construction is that the jet of steam from each cylinder takes place where it is most effective to produce a draft—that is, at the center of the sectional area of the chimney; but there is this disadvantage—that while the velocity of the steam is increased by being made to pass through an orifice, the area of which is less than the general sectional area of the exhaust pipe, the resistance which it there meets with has a direct tendency to make it enter the exhaust pipe from the other cylinder, or to impede the issue of steam therefrom, causing a pressure upon the piston thereof subtracting from the power of the steam then entering that cylinder from the boiler, and to that extent lessening the efficient power of the engine. This is a well known effect consequent upon the use of a mouth piece common to the exhaust pipes of the two cylinders. To obviate it, the exhaust pipes of the cylinders of some engines instead of being made to discharge the steam into the chimney through a mouth piece common to both, are allowed to discharge the steam separately into the chimney, the orifices of each being properly contracted. In this way the reaction already described is avoided, but the discharge does not take place at the center of the sectional area of the chimney, but on one side of such center, which is objectionable, because the effect of the discharge to produce draft is less than it would be were the discharge allowed to take place in the center.

In the accompanying drawings which are made a part of this specification Figure 1, represents one of these modes of construction and Fig. 2, the other.

In a patent heretofore obtained by me, I have described a mode by which the orifice of the exhaust pipe, whether the steam is discharged separately from the exhaust pipe of each cylinder, or from a mouth piece common to both of them, is regulated at the pleasure of the engine-man while the engine is in motion. But my invention, then patented, did not pretend to obviate the difficulties here mentioned.

My present invention consists of a mode by which a mouth piece common to both exhaust pipes may be used and the orifice through which the steam is discharged into the chimney may be lessened without producing the reaction whose effect has already been set forth. The advantages of both modes of construction aforesaid are thus obtained without their attendant disadvantages.

By referring to Fig. 1, it will be seen that the orifice of the mouth piece at *a*, is less than the sectional area of the two exhaust pipes leading into it at *b*, *b*, and it will be readily understood that a further lessening of the orifice at *a* must have a tendency to force a portion of the steam discharged at the time, from the cylinder connected with the exhaust pipe, say *c*, into the exhaust pipe D—or to retard the steam issuing therefrom. But if while the orifice of the mouth piece at *a* is lessened, I can, to the same extent, lessen the sectional area of the pipes C and D at *b*, *b*, this effect will be avoided; because the increase of the velocity of the steam escaping from the pipe, say C, will be given to it at *b*, before the steam en-

ters the mouth piece, and the reaction consequent upon the lessening of the orifice at *b*, will be confined to the pipe C, and will not affect the pipe D, as it would do were the reaction to take place in consequence of the lessening of the orifice at *a* only, when the steam from C would necessarily, to some extent, cause a reaction as already stated on the other piston through the exhaust pipe D. If the discharged steam passes *b* at a given velocity, and the orifice at *a* is of the same area with the sectional area at *b*, there can of course be no reaction down the opposite exhaust pipe. My invention therefore consists in increasing the velocity of the steam from the exhaust pipe of the cylinder, which is discharging at the moment, before it enters the mouth piece, by lessening the sectional area of the exhaust pipes, at the same time and to the same extent that the orifice of the mouth piece is lessened, at the pleasure of the engine-man; and the contrivance or mode of construction used by me is as follows.

In the first place I make the orifice of the mouth piece of the same area with the sectional area of each exhaust pipe, where they are united with the mouth piece. All these areas I make rectangular—though this is not absolutely essential. The sum of the sectional areas of the two exhaust pipes therefore, is double the area of the orifice of the mouth piece, but the length of the sectional area of each exhaust pipe, lengthwise, say of the engine, is twice as great as the length, or width rather, of the orifice of the mouth piece in the same direction. The orifice of the mouth piece is therefore a rectangle whose greatest length is crosswise of the engine, of the same dimensions exactly with the sectional area of each exhaust pipe, whose greatest length is lengthwise of the engine, where the two come together at the bottom of the mouth piece at *b*, *b*, Fig. 1.

The mouth piece on the inside, therefore, is a truncated wedge, the area of the base of which, where the exhaust pipes come together, is just double the area or upper portion or orifice from which the steam is discharged into the chimney.

In the drawings hereto annexed, Fig. 3, represents a plan of the mouth piece *a b e f* representing the base of the wedge shaped interior and *g*, *h*, *i*, *k*, the top. Fig. 3^1 is an isometrical representation of the same.

a, *b*, *c*, *d* is the sectional area of the exhaust pipe C.

c, *d*, *e*, *f*, is the sectional area of the exhaust pipe D, *c d* being the division between the two pipes, where they enter the mouth piece, and *g*, *h*, *i*, *k* is the area of the orifice of the mouth piece at *a*, Fig. 1, and *a b c d* and *c d e f* are of the same area each as *g h i k*. Having premised thus much it will be seen that if I can move the sides of the mouth-piece *a*, *b*, and *e f* on the plan Fig. 3 and *a g h b* and *e i k f* on the isometrical projection Fig. 3^1, inward, at the same time toward the partition *c d*, I will accomplish the object I have in view, for I will contract the area of the exhaust pipes C, and D, while I contract the orifice of the mouth piece *a*. Suppose the side *a*, *b* Fig. 3, moved to *l m*, and the side *e f* to *n*, *o*, the exhaust pipe C, is lessened to *l*, *c*, *d*, *m*, and the exhaust pipe D to *c*, *d*, *o*, *n*, while the orifice of the mouth piece is reduced to *p*, *q*, *r*, *s*, which is seen on inspection is of the same area with the lessened areas of the pipes C and D. The pipe C, then reduced to *l*, *m*, *c*, *d*, discharges its steam through the mouth piece reduced to *p*, *q*, *r*, *s*, into the chimney, through openings of the same size, and of course without more resistance at the top of the mouth piece, than it encountered at the top of the exhaust pipe, which was the object to be accomplished.

The mechanical contrivance which I employ will be best understood by reference to the drawings hereto annexed.

Fig. 4 represents a vertical section of the common pipe, or as I term it, the mouth-piece, to which the two exhaust pipes are connected at the openings C and D, and which mouth piece is divided into two chambers forming continuations of the exhaust pipes by a partition *t*, ending at *u*, above which point is but one chamber *v*, whose orifice from which the steam is discharged into the chimney is at X. The sides of the chamber *v*, are formed by the movable plates W W, which are represented in the drawing as brought together so as to contract the orifice of the mouth piece. The side view of these plates is shown in Fig. 5, representing a side view of the mouth-piece, by the dotted lines *w*, *w*, *w'*, *w'*. It will be seen that the plates are attached to rods Y, Y, moving freely endwise in the sleeves *z*, *z*, which form a part of the outer case of the mouth piece. According to the description already given the line *u*, *u*, representing the top of the partition between the pipes C and D Fig. 5 is twice the length of the line *w*, *w*, Fig. 5.

The chamber of the mouth piece & &, Fig. 4, is made so large that when the plates are drawn fully back, the area of the full open orifice at X is equal to the area of each of the exhaust pipes C, and D, and when the plates are moved forward toward each other, the area of the contracted opening of the exhaust pipe, say D at the point *u* Fig. 4, or the line *u u* Fig. 5, at which the two exhaust pipes come together is equal to the contracted area of the orifice of the mouth piece at X as shown in Fig. 4. This necessarily results from the fact that the plates move parallel to each other, while the width of each plate at *u* is double the length of

the top of it. Were the division *t* continued up to X instead of stopping at *u*, then the opening at D″ would be but half the area of the opening at *u*, but as the division of the exhaust pipes ceases at *u* and the chamber *v* is thereafter common to both, the area of the opening at C″ is to be added to the area of the opening at D″ and this makes of course the orifice of the mouth piece X equal to the sectional area of the exhaust pipe at the point *u*, and thus the object aimed at is accomplished.

The object to be obtained which is to prevent the escape steam from one cylinder causing a reaction on the piston of the other, may perhaps be still better obtained by making the orifice at X slightly longer than the orifices of the exhaust pipes at *u*, although I have found a correspondence in the size of the orifices to answer well in practice. The lessening of the orifices of the exhaust pipes, as compared with that of the mouth piece, is readily accomplished by merely extending upward the division *t*.

It will be seen, Fig. 4, that the corners of the lower inner edges of the plates are beveled to facilitate the passage of the steam and that the plates are steadied in their motion by the ease of the mouth piece at *a a*, *a a*.

Fig. 6, represents a horizontal section of the mouth piece through the center of the rod Y Y, and from the three Figs. 4, 5 and 6, drawn to the same scale the construction of the mouth piece is apparent. It is of cast iron throughout except the rods Y Y, which are of wrought iron.

It now only remains to describe the manner in which I give to the engine-man the power to regulate the draft by advancing or drawing back the plates W, W, while the engine is in motion. For this purpose I attach to the mouth piece as represented in the drawings Fig. 5, two boxes 1, 1, see also Fig. 6, to contain a shaft 2, 2, projecting beyond the rods Y Y, and the axis of which I place above the axes of the rods Y Y, though it may be placed on a line with or below them. To this shaft I attach two wheels or pulleys 3, 3, the peripheries of which form the one turn of an endless screw, and fit into notches 4, 4, in the rods Y Y, as represented in Fig. 6. The pitch of the screw is regulated by the extent of motion to be given by one revolution of the wheels to the plates W, W, and the screws are one a right and the other a left hand one, so that the plates W, W, to which they give motion are made to move in opposite directions when the shaft 2, is turned around. The engine man can turn the shaft by any of the known means such as a small bevel cog wheel placed at one end of it, which end is projected beyond the smoke box for the purpose, into which bevel wheel meshes another and similar wheel at the end of a rod reaching back to within reach of the engine man. This mode of transmitting motion is well understood by machinists and need not to be represented or more particularly described.

The drawings accompanying this specification are to a scale of three inches to a foot, and show what I have found in practice to be a good proportion of parts, though this proportion may be varied without affecting the principle of my invention.

What I claim as new and desire to secure by Letters Patent is—

1. The diminution of each of the openings of the exhaust pipes of a locomotive engine with two cylinders while the engine is in motion at the pleasure of the engine man, and where the exhaust pipes discharge themselves through a mouth piece or pipe common to both, while the orifice of such common pipe or mouth piece, is at the same time diminished to the same or similar extent for the purpose above set forth.

2. I do not claim the diminution of the orifice of the pipe common to both exhaust pipes, or the diminution of the orifices of the exhaust pipes, where they discharge their steam separately into the chimney, for a patent for such an invention has been already granted to me, but I do claim the diminution of the orifice of the common pipe or mouth piece in combination with the diminution at the same time of the openings of the two exhaust pipes before they are united in the common pipe.

3. I also claim as new the mode of doing this by the use of the wedge shaped plates hereinbefore described acting in the manner described.

ROSS WINANS.

Witnesses:
JNO. H. B. LATROBE,
PHIL W. KEYSER.