

# **Specification of Charles Tapp and James Bryant Tapp : Steam boilers and furnaces for consuming smoke, &c.;**

## **Contributors**

Tapp, Charles.

Tapp, James Bryant.

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A.D. 1859, 21<sup>st</sup> JULY. N<sup>o</sup> 1714.

SPECIFICATION

OF

CHARLES TAPP  
AND  
JAMES BRYANT TAPP.

STEAM BOILERS AND FURNACES  
FOR CONSUMING SMOKE, &c.

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A.D. 1859, 21<sup>st</sup> JULY. N° 1714.

## Steam Boilers and Furnaces for Consuming Smoke, &c.

**LETTERS PATENT** to Charles Tapp and James Bryant Tapp, of Chesterfield, Derbyshire, Engineers, for the Invention of "**IMPROVEMENTS APPLICABLE TO STEAM BOILERS AND FURNACES FOR CONSUMING SMOKE AND ECONOMIZING FUEL IN THE GENERATION OF STEAM, AND IN THE APPARATUS CONNECTED THEREWITH.**"

Sealed the 11th January 1860, and dated the 21st July 1859.

**PROVISIONAL SPECIFICATION** left by the said Charles Tapp and James Bryant Tapp at the Office of the Commissioners of Patents, with their Petition, on the 21st July 1859.

We, CHARLES TAPP and JAMES BRYANT TAPP, of Chesterfield, Derbyshire, Engineers, do hereby declare the nature of the said Invention for "**IMPROVEMENTS APPLICABLE TO STEAM BOILERS AND FURNACES FOR CONSUMING SMOKE AND ECONOMIZING FUEL IN THE GENERATION OF STEAM, AND IN THE APPARATUS CONNECTED THEREWITH,**" to be as follows:—

Our said Invention relates, in the first place, to a novel construction and combination of the internal arrangements of steam engine boilers for promoting the combustion of the gaseous products of the fuel, and increasing evaporative effect, and is applicable to the boilers and furnaces of locomotive, marine, and stationary engines, and to furnaces of every description.

According to this Invention there are two fire boxes or fire-places placed



*C. & J. B. Tapp's Impts. in Steam Boilers, &c. for Consuming Smoke, &c.*

inside the boiler, having separate fire doors, these furnaces or fire boxes are to be fired up alternately, and the draught reversed by means of dampers which are opened and closed with rods and levers, or other contrivances, and actuated by the opening and closing of the fire doors. The fire box or furnace is divided into two compartments by means of a diaphragm or partition, and the 5 smoke & gases evolved from the fuel in the green or recently charged fire passing over the incandescent fuel of the clear fire becomes consumed.

The object of the midfeather or partition is to separate the two fires untill the smoke and flame rise to a certain point, and at that point they both are connected by the action of the dampers, the last fire that was charged dis- 10 charging the gases over the opposite or clear fire, in this manner the smoke and gases are ignited and consumed. At the end of the fire box a bridge is situated, the flame and smoke proceeding to this bridge, it is constructed with an aperture at the centre, and at this point by the proper regulation of the dampers, the mode of operating which will be hereafter shewn, the flame 15 and gasses from both fires cross each other before passing into the flame or mixing chamber which is situated behind the bridge; from this flame or mixing chamber two tubes run the entire length of the boiler, the flues are then carried under the boiler on both or on one side of the outer shell, and from thence to the chimney. In the fire box or fire-place pipes or tubes are placed through 20 which the water circulates; these pipes or tubes being either parallel or tapering, their lower surfaces being affixed to the diaphragm or partition, and their upper surfaces to the top of the fire box or fire-place, they will thus be effective in supporting the fire-place and increasing the heating surface; the two fire box tubes being connected at top in this mode of construction, and the tapering tubes 25 passing from the partition or diaphragm to the top of the fire box, these parallel or tapering tubes being placed either in a vertical, incline, or horizontal position.

We have hereto appended a Drawing delineating another arrangement and combination, and shewing the contrivance for opening the fire doors, which contrivance is applicable to both descriptions of boiler. The Figure 30 represents a half section and half elevation of the boiler. According to this arrangement there are two tubes A, B, running the length of the boiler; C is a return flue formed in brick-work under the boiler; D is a damper in the passage from C to E; E is the flue leading to the chimney; F is a connection of the two tubes not more than 2 ft. 6 in. long; G, grate bars; 35 H is a fire-door; I is a rod connected by a joint to a lever projecting from the door at the hinge; J is a lever connected fast to the gudgeon or spindle upon which the damper moves; K, K, are weights to balance the damper if found necessary; L is a piston; M is a cup to supply the piston with water. Inside



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the cup is a small tap to regulate the action of the piston. N is a small balance weight to the piston; O is a long hole in the joint. The objects attained by this part of our said Invention are, firstly, to effect an absolute and compulsory charging of the two fires; secondly, to bring the smoke & 5 gases made in one furnace over and into immediate contact with the other clear fire. When the fireman opens the fire door H to charge the tube B with coals, the projecting lever on the door moves the rod I, which operates the lever J, in connection with the damper, and the lever K raises the piston L, which fills with water like a pump, and closes the damper. The fire being 10 charged the door H is closed, the long hole in the rod I, allowing the lever J to remain, and the damper to keep shut, so that the smoke from B passes through at F, over the red-hot fire in A, and is consumed after the door is closed; the piston L, moves slowly downward, its rate of speed being controlled by the small tap in the cup; when the damper falls open the lever K 15 is caught by a spring latch P; the lever K, being made fast, the fire-door H is now locked untill the piston descends to force back the spring by a small roller at q, and the door is again set at liberty for the furnace to be again charged with coals. The boiler or furnace may be constructed with or without dampers behind the bridge, and the self-acting locks may be applied to the 20 furnace doors without the dampers. Either the self-acting lock or the self-acting apparatus for opening the fire doors is applicable to any boiler or furnace that has two fires to be charged alternately.

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SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Charles Tapp and James Bryant Tapp in the Great Seal 25 Patent Office on the 14th January 1860.

TO ALL TO WHOM THESE PRESENTS SHALL COME, we, CHARLES TAPP and JAMES BRYANT TAPP, of Chesterfield, Derbyshire, Engineers, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters 30 Patent, bearing date the Twenty-first day of July, in the year of our Lord One thousand eight hundred and fifty-nine, in the twenty-second year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said Charles Tapp and James Bryant Tapp, Her special licence that we, the said Charles Tapp and James Bryant Tapp, our executors, administrators, 35 and assigns, or such others as we, the said Charles Tapp and James Bryant Tapp, our executors, administrators, and assigns, should at any time agree



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with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS APPLICABLE TO STEAM BOILERS AND FURNACES FOR CONSUMING SMOKE AND ECONOMIZING FUEL IN THE GENERATION OF STEAM, AND IN THE APPARATUS CONNECTED THEREWITH," upon the condition (amongst others) that we, the said Charles Tapp and James Bryant Tapp, our executors or administrators, by an instrument in writing under our, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that we, the said Charles Tapp and James Bryant Tapp, do hereby declare the nature of our said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the accompanying Drawings, and to the letters and figures marked thereon, that is to say:—

Our said Invention relates, in the first place, to a novel construction of the internal arrangements of steam-engine boilers for promoting the combustion of the gaseous products of the fuel, and increasing evaporative effect, and is applicable to the boilers and furnaces of locomotive, marine, and stationary engines, and to furnaces of every description.

According to this Invention, there are two fire boxes placed inside the boiler having separate fire doors; these furnaces or fire boxes are to be fired up alternately and the draught reversed by means of dampers, which are opened and closed with rods and levers or other contrivances, and actuated by the opening and closing of the fire-doors. The fire box or furnace is divided into two compartments by means of a diaphragm or partition, and the smoke and gases evolved from the fuel in the green or recently charged fire passing over the incandescent fuel of the clear fire, becomes consumed. The object of the midfeather or partition is to separate the two fires untill the smoke and flame rise to a certain point, and at that point they both are connected by the action of the dampers; the last fire that was charged discharging the gases over the opposite or clear fire. In this manner, the smoke and gases are ignited & consumed.

At the end of the fire box a bridge is situated, the flame and smoke proceeding to this bridge, it is constructed with an aperture at the centre; and at this point by the proper regulation of the dampers, the mode of operating



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which will be hereafter shewn, the flame and gases from both fires come in contact with each other before passing into the flame or mixing chamber, which is situated behind the bridge; this flame chamber is continued the entire length of the boiler. The flues are then carried under the boiler on  
5 both or one side of the outer shell, and from thence to the chimney. In the fire box or fire-place pipes or tubes are placed, through which the water circulates; these pipes or tubes being either parallel or tapering, and placed either vertical or slightly inclined, having their lower surfaces affixed to the diaphragm or partition, and their upper surfaces to the top of the fire-box or  
10 fire-place. They will thus be effective in supporting the fire-place and increasing the heating surface; the two fire box tubes being connected at top in this mode of construction, and the tapering tubes passing from the partition or diaphragm to the top of the fire box. These parallel or tapering tubes being either in a vertical, inclined, or horizontal position, and placed at certain  
15 distances apart throughout the entire length of fire box and flame chamber, and might be continued from one extreme of the boiler to the other. The boiler or furnace may be constructed with or without dampers behind the bridge, and the self-acting lock may be applied to the furnace doors without the dampers. Either the self-acting lock or the self-acting apparatus for  
20 opening the fire doors is applicable to any boiler or furnace that has two fires, to be charged alternately.

In order that our said Invention may be thoroughly and completely understood we now proceed to describe the several illustrative Figures upon the explanatory Sheet of Drawings hereunto attached for the purpose of showing  
25 certain modifications under which our said improvements may be judiciously carried into effect.

Fig. 1, on Sheet 1 of the Drawings accompanying this Specification, illustrates one modification of our improvements in the construction of boiler furnaces and apparatus for regulating the supply of atmospheric air to the fuel.

30 Fig. 1, on Sheet 1 of our Drawings, is a transverse end elevation, one half of the Figure being shewn in section to shew the internal arrangements.

In this modification there are two fire boxes or tubes A, A<sup>1</sup>, through the entire length of the boiler, with a fire in each tube; B is the smoke passage for each tube; E, E, are side flues, formed of brickwork; F is the fire bridge;  
35 G, G, are the fire bars; C, C<sup>1</sup>, are dampers in the side flues; H is a lever with three arms I, I<sup>1</sup>, I<sup>11</sup>, one arm I of which is attached to the rod K hinged on the door L; the arm I<sup>1</sup> to the piston D, which works in a cylinder M; the arm I<sup>11</sup> to the rod J, which is attached to the damper C; N is a weight on the arm I<sup>11</sup>, to balance the damper, if required.



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When the fireman opens the fire door L to charge the fire tube A with coals, the projecting lever on the door moves the rod K which operates the lever H in connection with the damper, and the lever I<sup>1</sup> raises the piston D in the cylinder M, the lower end of which is immersed in water or other fluid contained in a cup or vessel. There is a valve placed in this cylinder which 5 closes as soon as the cylinder has become filled with the water or fluid contained in the cup or vessel, acting on the principle of the common pump. Moving a small tap to empty the fluid contained in the cylinder into the cup or vessel, the piston in its descent pressing it gradually through the tap, and being entirely regulated thereby. The fire being charged, the door L is closed, 10 the slot in the rod allowing the arm I to remain and the damper to keep shut, so that the smoke from A passes through over the red-hot fire in A<sup>1</sup>, and is consumed. After the door is closed, the piston D moves slowly downward, controlled in its descent by the small tap, presses upon the arm I<sup>1</sup>, and forces the ball or weight N upon the arm I<sup>1</sup>, beyond the centre of gravity, when it 15 falls, opening the damper C by its movement. The arm I<sup>1</sup> is caught by a spring catch, the arm I<sup>1</sup> being thereby made fast; the fire door L is now locked untill the piston D descends low enough to force back the spring catch and set the door at liberty for the furnace to be again charged with coals. The same arrangement is applied to the fire door in the fire tube A<sup>1</sup>, and the 20 damper connected therewith.

Figs. 2 and 3 on Sheet 1 of our Drawings, shew another modification of our improvements in the construction of boiler furnaces; Fig. 2, on Sheet 1, is a transverse end elevation, one half being shewn in section to shew the internal arrangements; Fig. 3 on Sheet 1, of our Drawings is a transverse longitudinal 25 section.

In this arrangement the fire box A, A<sup>1</sup>, extends through the entire length of the boiler; B is the partition or diaphragm; E, side flue; F, fire-bridge; G, G, grate bars; H, fire door; I, I, I, tube supporting fire box and partition or diaphragm. The same apparatus for opening and closing the dampers in 30 connection with the fire doors, as described in Fig. 1, Sheet 1, is applicable to this modification.

Figs. 4 & 5, on Sheet 1 of our Drawings, shew another modification of our improvements as applied to marine boilers. Figure 4 on Sheet 1 is a transverse end elevation, shewn one half in section to shew the internal 35 arrangements; Fig. 5 on Sheet 1 is a longitudinal section.

In this arrangement there are two fire-boxes A, A<sup>1</sup>, extending into the boiler, with two fires in each fire box; B, B<sup>1</sup>, are the partitions or diaphragms for dividing the fires and separating them from each other; D, is the fire bridge;



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C, the outlet over the bridge for the gases and smoke ; G, G, are the grate bars ; E, E, E, the tubes supporting the fire-box roof and partition or diaphragm ; F, F, fire doors ; H, H, &c., are return horizontal tubes from the chamber J to the smoke box I ; K is the door into the smoke box ; L is the uptake into  
5 the chimney ; N, the steam chamber. The horizontal tubes H, H, to be made of wrought iron, brass, or copper, or steel, as may be determined ; the same may be readily renewed when required, without interfering with any other part of the boiler. The same apparatus for opening & closing the dampers in connection with the fire doors, as described in Fig. 1, Sheet 1, is applicable  
10 to this modification.

The objects of our said Invention are the ready combustion of the gases evolved from the burning fuel, economy in the consumption of fuel, and rapid generation of steam. The vertical or inclined tubes form a stay or support to the fire box, roof, and partition, being rivetted to each. The water and steam  
15 are caused to circulate freely throughout the boiler by means of the heat acting upon the vertical or inclined tubes, thereby keeping the roof of the fire-box or top of the tubes free from corrosion, and preventing the accumulation of sediment. The fire box or tubes are likewise stayed by angle or T-iron around the same. The pressure is considerably reduced on the roof of the  
20 fire box caused by the reduction of area through the insertion of the vertical or inclined tubes.

Having now described and particularly ascertained the nature of our said Invention, and the manner in which the same is or may be used or carried into effect, we may observe, in conclusion, that we do not confine or restrict  
25 ourselves to the precise details or arrangements which we have had occasion to describe or refer to, as many variations may be made therefrom without deviating from the principles or main features of our said Invention ; but what we consider to be novel and original, and therefore claim as the Invention secured to us by the herein-before in part recited Letters  
30 Patent, is,—

Firstly, the general arrangement and construction of boilers operating either in combination with, or separately, with suitable apparatus to reverse the draught over the fires alternately, thereby passing the gases from the green or recently charged fire over the clear or bright fire.

35 Secondly, the arrangement of self-acting dampers either to turn the current of heated air or gases alternately from fire box to fire box, or to regulate the admission of air to supply the furnaces underneath the fire bars, as herein-before described.

Thirdly, the arrangement & construction of the lock or spring catch in com-



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bination with the apparatus to compel alternate charging of the fires at a given period, as herein described & set forth.

Fourthly, the arrangement or combination of fire box or flues with tubes vertical, horizontal or slightly inclined from the perpendicular, attached to the roof of fire box and partition or diaphragm, with or without the self-acting dampers acting in combination with the fire-doors, substantially as herein described and set forth.

Fifthly, the arrangement and construction of boilers, in which the fire box runs the entire length of the boiler, or assumes the form of one or more tubes beyond the fire bridge, operating in combination with the self-acting apparatus and dampers.

In witness whereof, we, the said Charles Tapp and James Bryant Tapp, have hereunto set our hands and seals, this Twelfth day of January, in the year of our Lord One thousand eight hundred and sixty.

CHARLES TAPP. (L.S.) 15

JAMES BRYANT TAPP. (L.S.)

Witness,

M. HUNTER,

131, Fleet Street.

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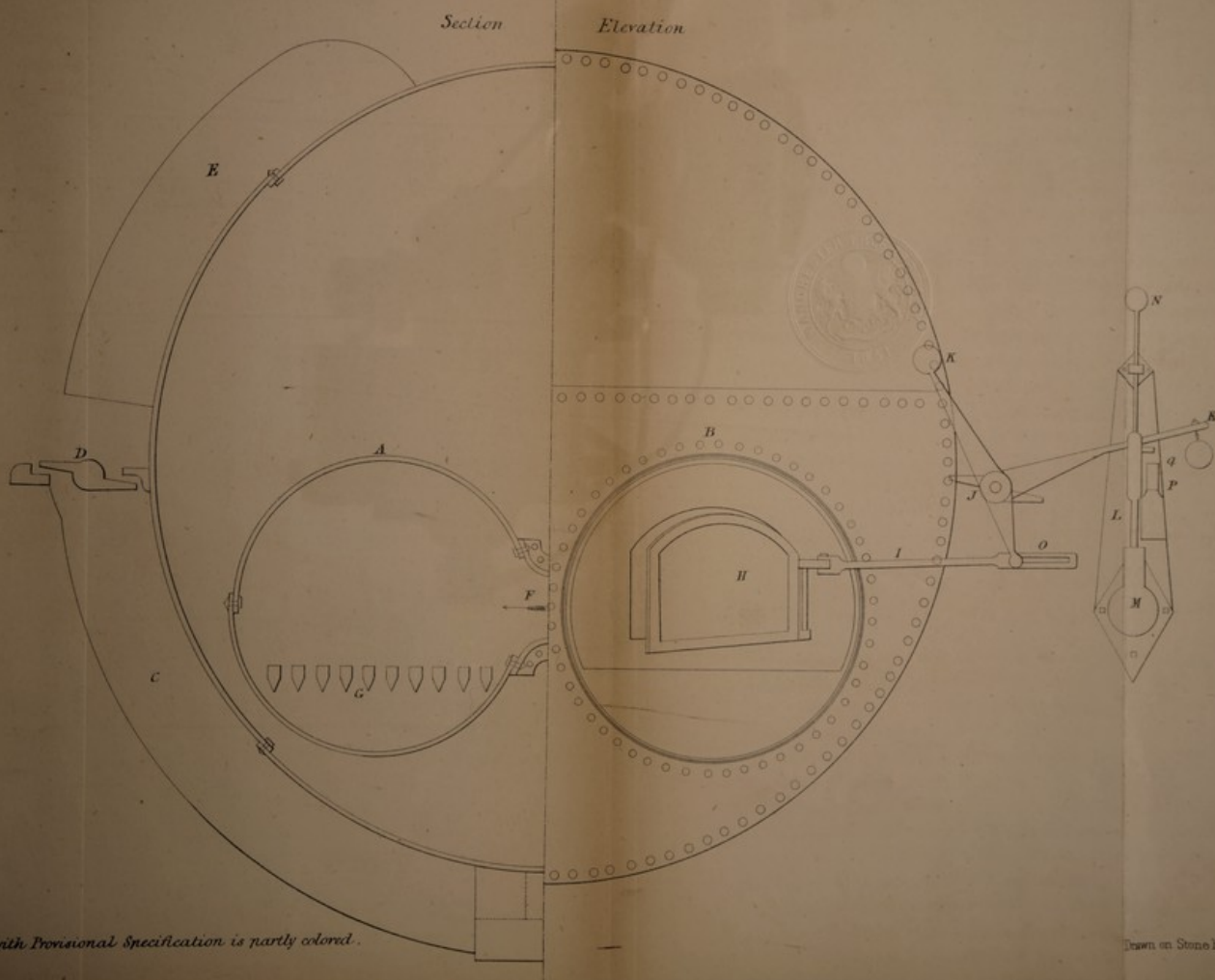
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Printers to the Queen's most Excellent Majesty. 1860.



A. D. 1859, JULY 21, N°1714.  
C & J. B. TAPP'S PROVISIONAL SPECIFICATION.

(1 SHEET.)



The drawing left with Provisional Specification is partly colored.

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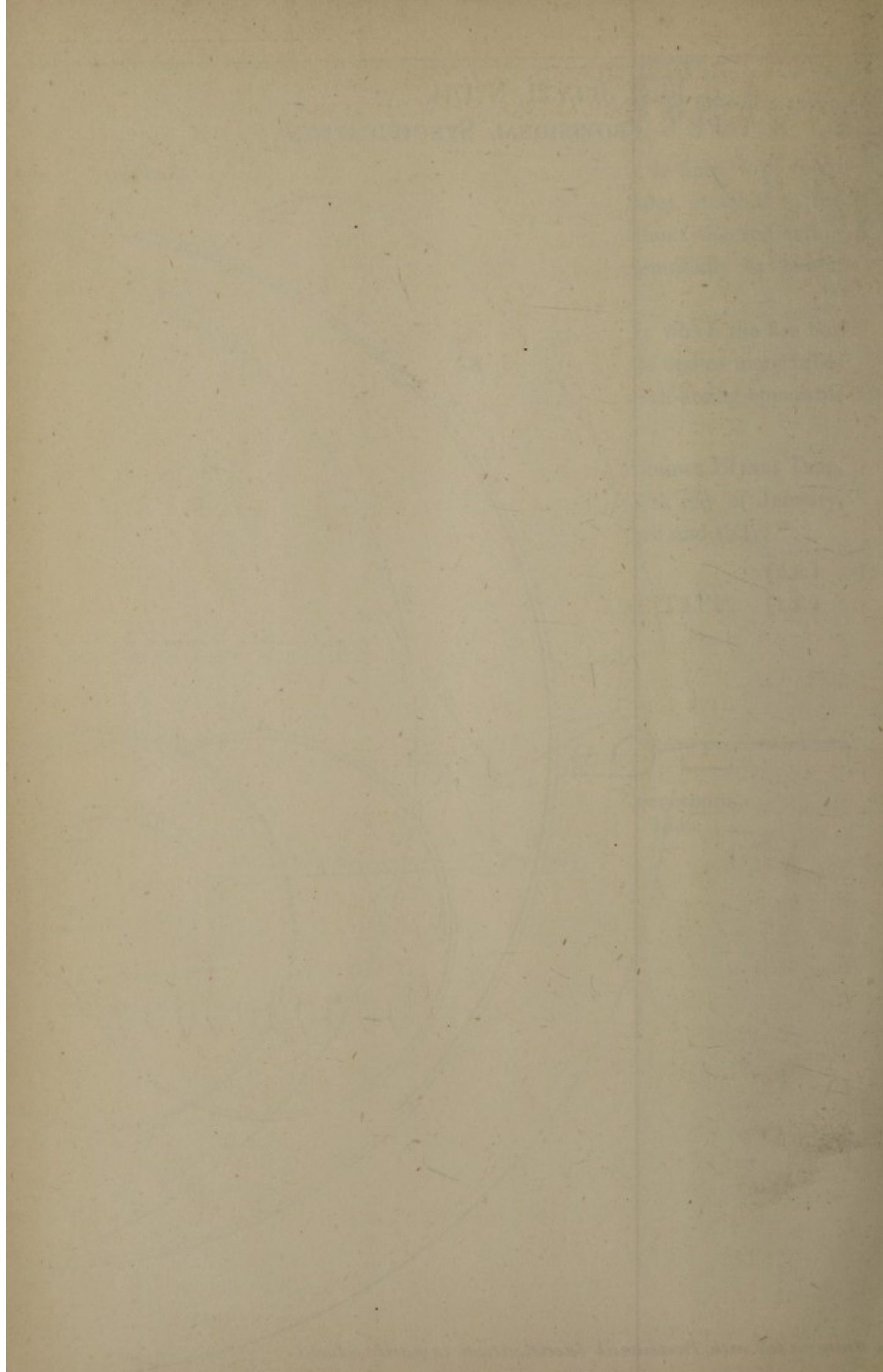




FIG. 1

FIG. 5.  
*Longitudinal Section.*

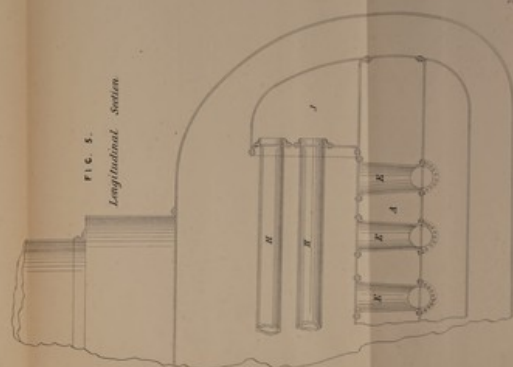


FIG. 4.

End Elevation Transverse Section

*The blood drawing is poorly colored*

Lawson: *Practical Geology*. Engleau, Fry, and Williams, Springfield.



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