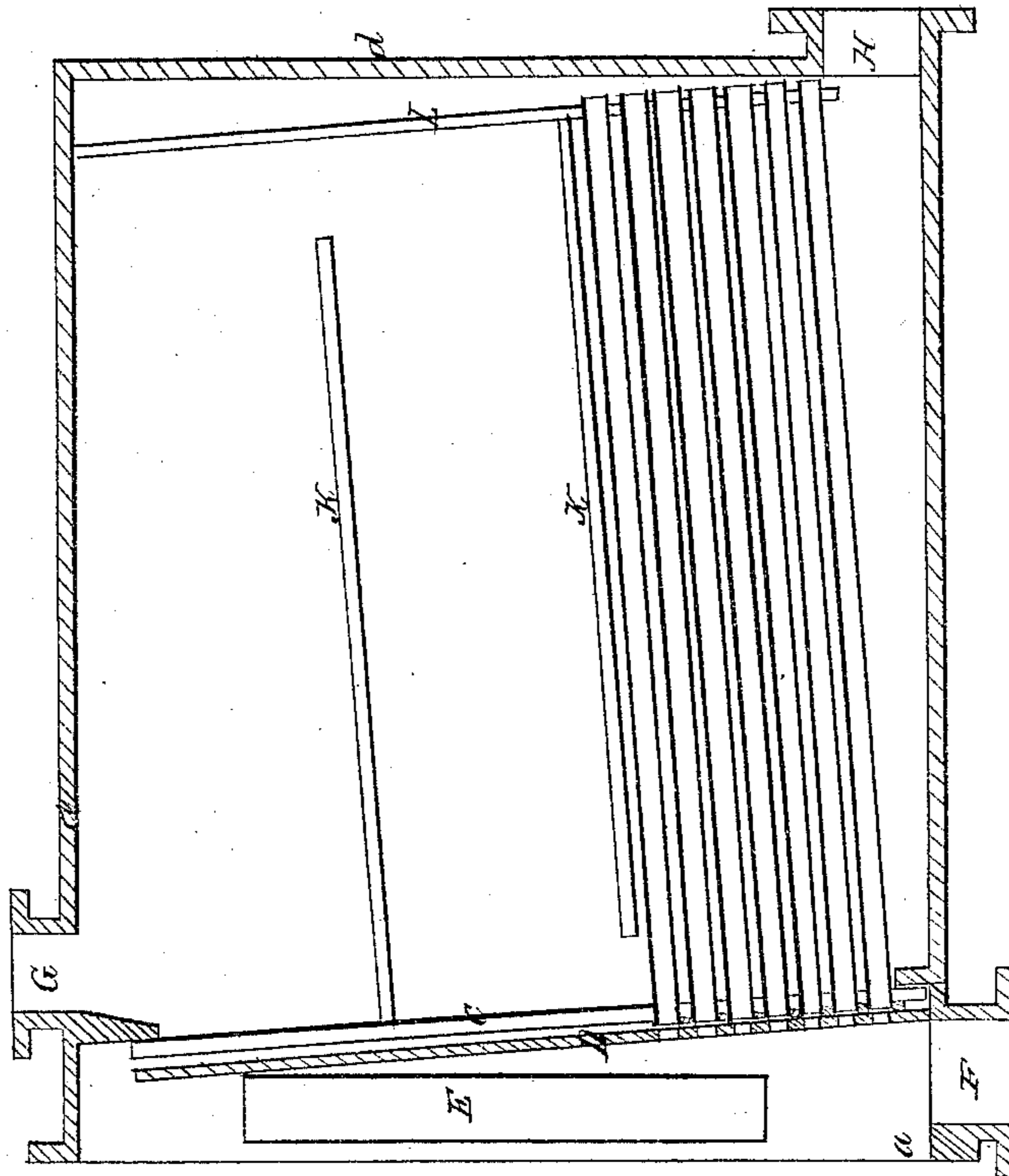


*W. Serrell,  
Steam-Boiler Condenser.*

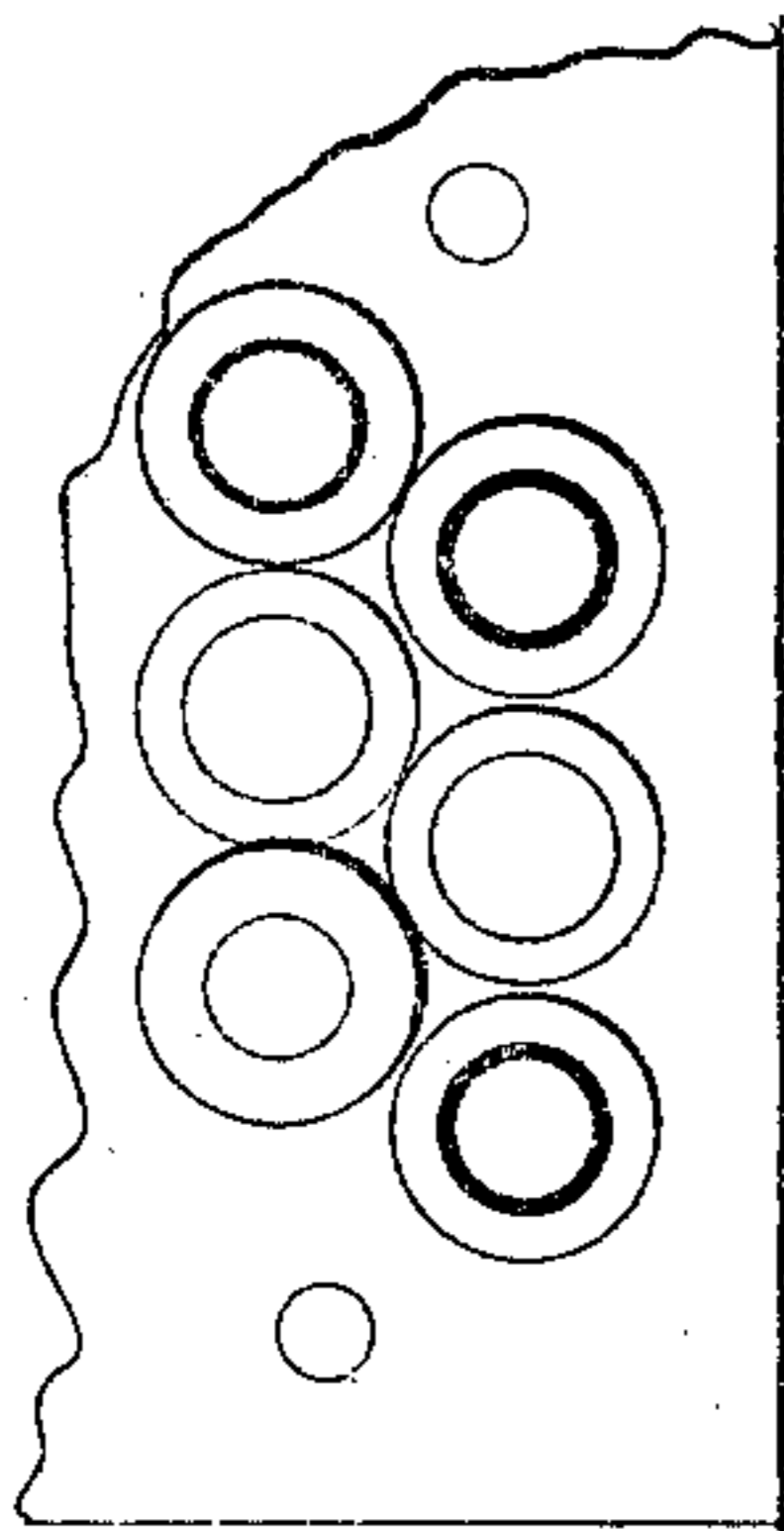
*N<sup>o</sup> 27,573.*

*Patented Mar. 20, 1860.*

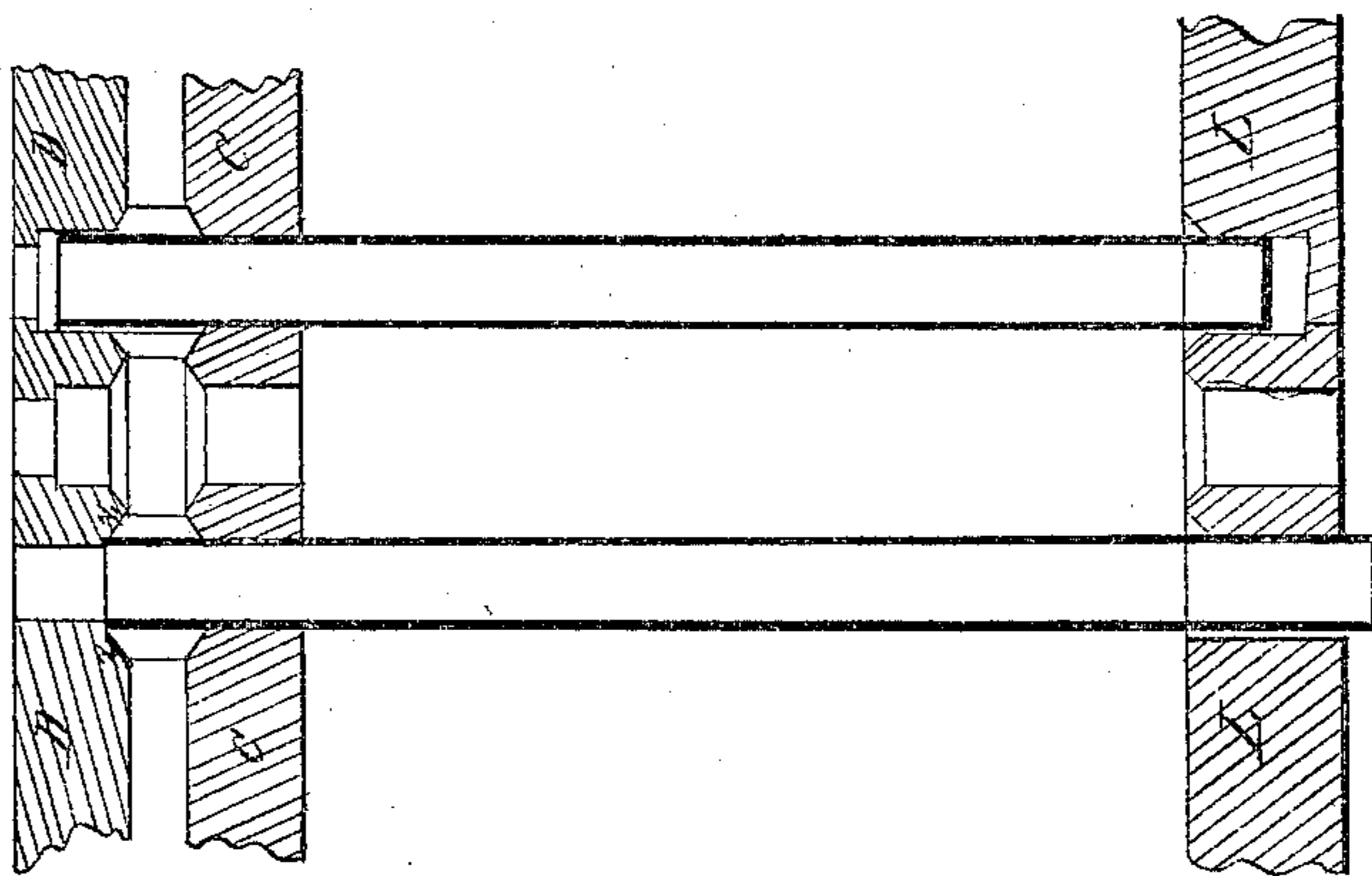
*Fig. 1*



*Fig. 3*



*Fig. 2*



*Witnesses:  
James E. Schuch  
J. W. Mullen.*

*Inventor:  
William Serrell.*

# UNITED STATES PATENT OFFICE.

WM. SEWELL, OF NEW YORK, N. Y.

## SURFACE CONDENSER FOR STEAM-ENGINES.

Specification of Letters Patent No. 27,573, dated March 20, 1860.

*To all whom it may concern:*

Be it known that I, WILLIAM SEWELL, of the city, county and State of New York, have invented certain new and useful Improvements in Surface Condensers; and I do hereby declare that the following specification, taken in connection with the drawings, is a full, clear, and exact description thereof.

10 In the drawings Figure 1 is a cross section through a condenser taken on a line parallel with the axes of the tubes. Figs. 2 and 3 are longitudinal sections through two tubes of a surface condenser on a larger scale and exhibiting my improved method of making a tight joint between a tube and a tube sheet and two modifications of the method of preventing tubes from creeping out of their proper position and also an end view or plan of a tube sheet.

20 The advantages resulting from the employment of a good surface condenser are so well known that it is needless to descant upon them herein, neither is it necessary to do more than merely mention the facts that various plans has been devised both by myself and others for the purpose of cheapening the manufacture of such condensers and so constructing them that they shall not when in use tend to tear themselves apart owing to causes arising from their manner of construction.

30 My present invention has for its object the attainment of these same ends by contrivances different, so far as I know from those hitherto essayed or described.

40 The condenser shown in Fig. 1 is as far as its shell and apertures are concerned similar to many now in use. The shell is shown at *a a a*, and it is provided with an opening E with which the exhaust-pipe leading from the engine is to be connected and with another aperture F with which a channel way or pipe leading to the air pump is to be in connection, so that steam may enter at E and after condensation be withdrawn by the air pump through F. Two other openings G and H will serve for the entrance and discharge of condensing water, which may be forced to traverse around the tubes by means of a circulating pump or by other appropriate contrivance; while in the interior of the condenser are certain plates K which serve in a well known way to force the water to pass in succession through all parts of the condenser. The condenser is also pro-

vided with two tube sheets C and L each made fast in the shell and pierced with holes equal in number to the tubes that are to be used. These holes being so placed in relation to each other and to the position of the condenser that the open ends of the tubes shall be at a lower level than the closed ends.

60 If the first part of my invention is used the tube sheet C only need have a tight joint between it and the shell of the condenser and the tubes are to be slipped in with their open ends projecting through the tube sheet C while their closed ends lie in the sheet L which serves merely as a rack to keep the closed ends of the tubes in proper position. The tube sheet supporting the open ends of the tubes, is to be countersunk around each tube as clearly shown in Figs. 2 and 3, and a small ring or thick washer of india rubber is to be placed around the tube and with one side resting against the tube sheet; another plate D is then to be taken, and placed in front of the open ends of the tubes. This plate has as many holes in it as there are tubes, and each hole is to be opposite a tube, and to be drilled substantially in the manner shown in the drawings, that is to say of larger diameter on the side nearest the tube sheet. This plate is then by means of proper screws or otherwise to be forced to approach the tube sheet clamping up the india rubber washers tightly between the plate and the tube sheet and compressing the washers so that they make a tight joint between the tube sheet and the exterior of the tubes. By this contrivance many washers can be clamped up and many joints made by the agency of a single clamping plate, and if the holes in that plate be smaller in diameter than the exterior of the tubes, it is clear that the tube will after it strikes that small part of the hole be prevented from creeping any further in a direction toward the clamping plate. The tubes might however tend to creep in the other direction and to prevent this I use either a plan heretofore described and patented by me or a new plan which I now claim as my invention. The former plan is exhibited in Fig. 2 where the hole in the rack plate is shown as drilled of larger diameter than the tube only part of the way through the sheet, while for the remainder of the distance it is smaller in diameter than the tube thus forming a shoulder against which the tube will strike if it tends to creep toward the rack plate. The

other plan is to form a flange or lip such as  $x x$  around the end of the tube, and in using a tube thus constructed the tube is to be slipped inside of the washer before the tube is entered into the tube sheet; the flange will then lie as represented in Fig. 3 between the washer and the clamping plate and will by virtue of its confinement between the two prevent the tube from creeping in either direction. This flange also renders the joint more secure for if it should so happen that the interior of the washer failed to hug tightly all parts of the tube, it is certain that the rubber would fit tight both against the flange and the tube sheet thus insuring a perfect joint.

My method of making a tight joint between condenser tubes and tube sheets may be used at each end of open tubes as well as in the special application of it here described to the open end only of closed end-tubes and closed tubes may be applied according to the principle of my invention either with the tube sheet joints described or with other tube sheet joints.

When the condenser is made as specially described the steam will enter the open ends of the tubes, pass into them and be condensed and the condensed water will run out at the same open ends and be removed by the air pump. The tubes are inclined as described to aid the water in passing out and my object in using closed end tubes is twofold, first to save expensive joints of any kind by reducing their number one half and second to decrease the chances of leakage by leaving one end of the tube practically free, to move as may be required when contracting expanding twisting or bending under the influence of the varying temperature to which various parts of it are exposed when in use; and by a closed-end-tube I mean an ordinary straight or nearly straight tube

closed at one end by a disk making part of and moving with the tube, and not a tube with another tube either cylindrical or conical inside of it, or a tube having one of its open ends abutting against a plate, with a joint between such open end and the plate.

The clamping plate used by me may cover the whole tube sheet or be in sections each making pressure against the washers or vulcanized india rubber rings of a number of condensing tubes, and by its use many joints may be made tight at one operation and with one set of screw bolts or their equivalents, only applied as a means of setting tight all the joints, which when made will be tight, will admit of some movement of each tube in its place, and can easily be loosened so as to permit of the examination or removal of tubes. The joints moreover are not expensive.

I claim as my own invention—

1. The combination and use in the manner herein shown and described with the tubes and tube sheet and follower or plate D, of a series of independent elastic rings for the purpose set forth.

2. The simultaneous compression of the whole or a portion of said series of elastic rings, by means of a plate D, either whole or divided, substantially in the manner and for the purpose herein shown and described.

3. The employment of the flanged tubes in combination with plate D and said rings, as and for the purpose herein shown and described.

In testimony whereof I have hereunto subscribed my name in the city of New York on this 19 day of Nov. A. D. 1858.

WILLIAM SEWELL.

In presence of—

REEVES E. SELMES,  
I. W. McMULLEN.