No. 609,243. Patented Aug. 16, 1898.

R. A. SPROULS.

SURFACE CONDENSER.

(Application filed Oct. 11, 1897.)

(No Model.) 2 Sheets—Sheet 1

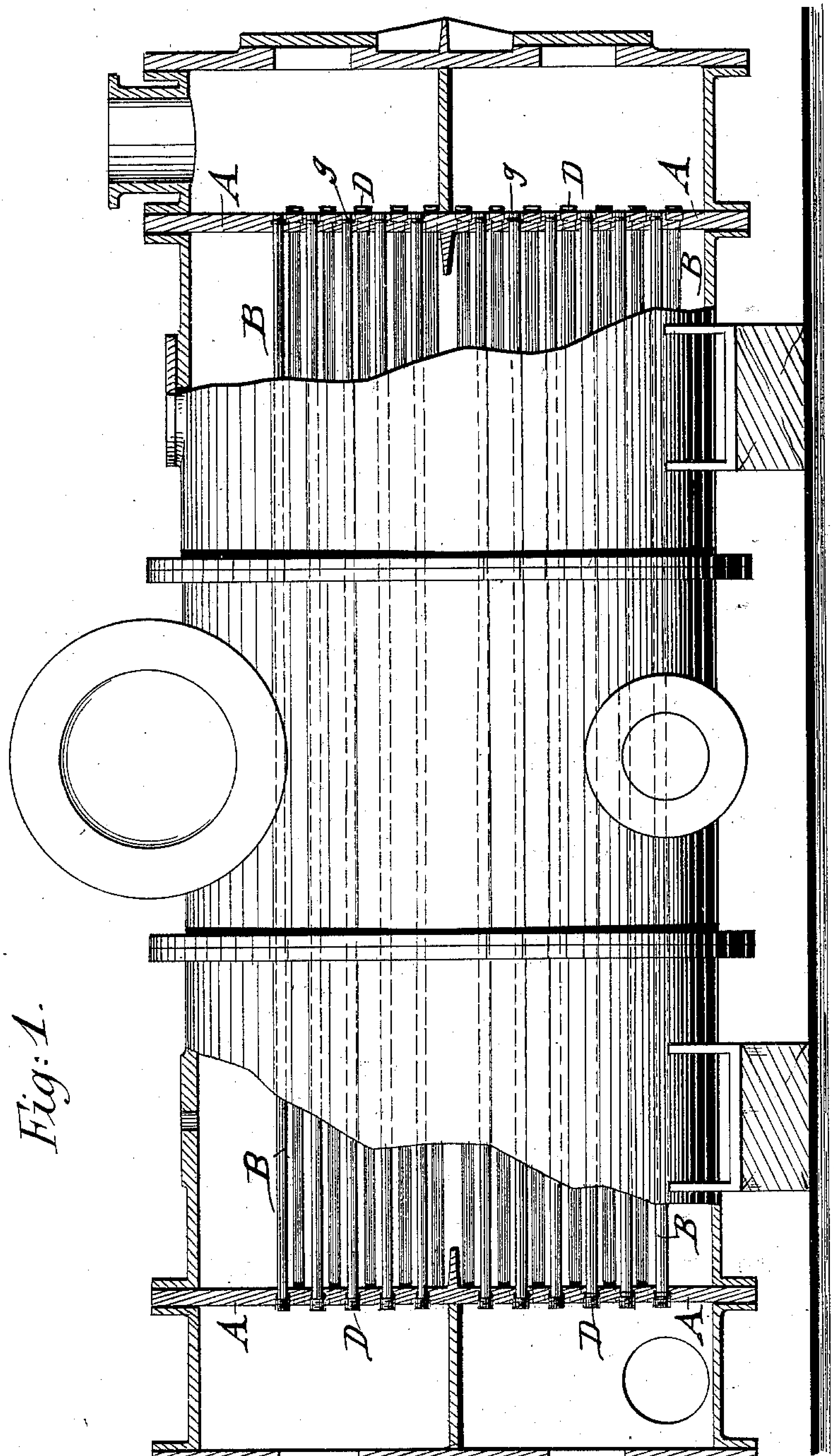

Fig: 1.

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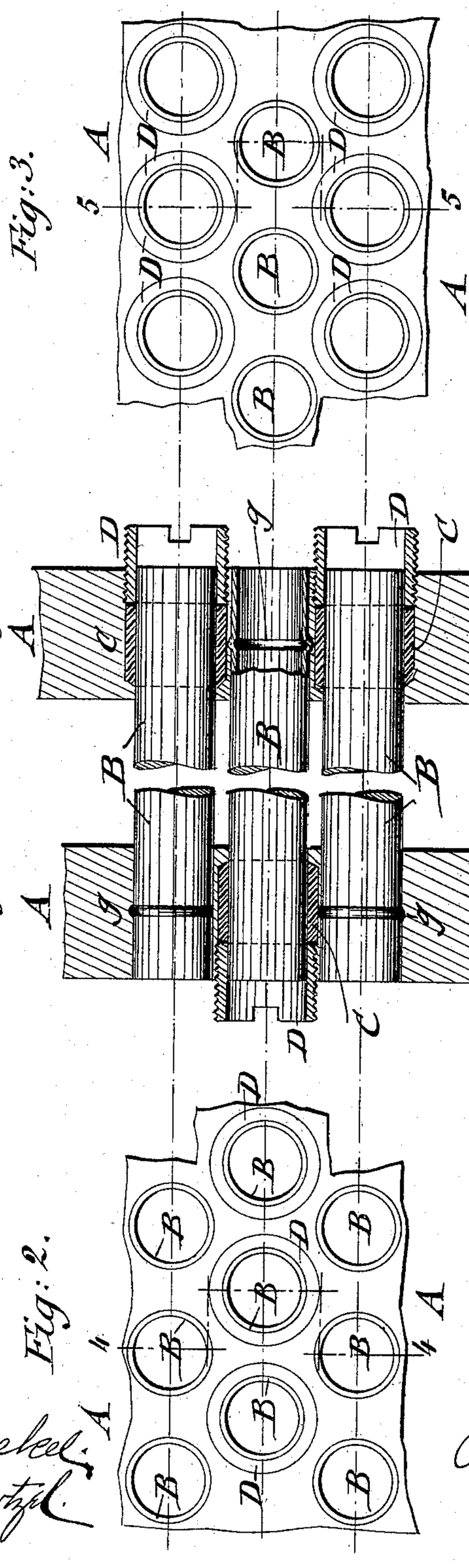

Fig. 3.

Fig. 5.

Fig. 4.

Fig. 2.

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UNITED STATES PATENT OFFICE.

ROBERT A. SPROULS, OF NEW YORK, N. Y., ASSIGNOR TO DELPHIN McLEOD COBB, OF SAME PLACE.

SURFACE CONDENSER.

SPECIFICATION forming part of Letters Patent No. 609,243, dated August 16, 1898.

Application filed October 11, 1897. Serial No. 654,808. (No model.)

To all whom it may concern:

Be it known that I, ROBERT A. SPROULS, a citizen of the United States, residing at New York, (Brooklyn,) in the county of Kings and State of New York, have invented certain new and useful Improvements in Surface Condensers, of which the following is a specification.

This invention relates to certain improvements in surface condensers, by which a larger number of condenser-tubes of a certaim diameter can be arranged in the tube-heads than heretofore and thereby the total condensing-surface considerably enlarged without increasing the size of the tube-heads; and the invention consists of a surface condenser in which the condenser-tubes are arranged in alternating rows, the tube-packings of one row being packed at one end into one tube-head and affixed stationary at its opposite end into the other tube-head, while the adjacent row of condenser-tubes is affixed to the former tube-head at one end and packed at its opposite end into the other tube-head, and so on alternately, as will be fully described hereinafter and finally pointed out in the claims.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section of a surface condenser, showing my improved arrangement of condenser-tubes. Fig. 2 is an end view of a portion of the tube-head, showing the ends of several adjacent rows of condenser-tubes. Fig. 3 is an end elevation of a corresponding portion of the other tube-head, showing the opposite ends of said rows of condenser-tubes; and Figs. 4 and 5 are vertical transverse sections, respectively, on lines 4 4, Fig. 2, and 5 5, Fig. 3.

Similar letters of reference indicate corresponding parts.

In the surface condensers for condensing steam-engines the exhaust-steam is forced through the condenser and condensed by contact with the large surface presented by the condenser-tubes, through which cold water is circulated by means of a pump. The larger the surface of the tubes the quicker and more effective is the condensing action of said tubes on the exhaust-steam. The condenser-tubes were heretofore so arranged that both ends were secured by screw-glands and suitable packings into the tube-heads, so as to expand in both directions.

In my improved arrangement of condenser-tubes the tube-packings instead of being applied to the ends of all of the tubes of a condenser are arranged only at one end of the tubes, while the opposite end of the tubes is affixed to the tube-head, the packings for the ends of one row of tubes alternating in one tube-head with the stationary unpacked ends of the adjacent row of tubes, the tube-heads being for this purpose provided alternately with rows of openings of larger and smaller size. By this arrangement a larger number of tubes of a certain diameter can be supported in the tube-heads and thereby a larger condensing-surface for the steam-exhaust furnished.

In the drawings, A A are the tube-heads, and B B the condenser-tubes, of my improved surface condenser. The tubes B B are arranged in alternating or staggered rows in the tube-heads, one row of condenser-tubes being packed into the tube-head at one end and securely affixed at the opposite end to the other tube-head, while the adjacent row of tubes is affixed at one end to the first tube-head and provided with suitable packing C and screw-glands D at the opposite end in the other tube-head, as shown clearly in Figs. 2 and 4 and 3 and 5. It is obvious that any approved packing, whether with or without screw-glands, can be used. The stationary ends of the condenser-tubes are slightly enlarged by a reaming-tool, so as to engage small grooves *g* in the openings of the tube-heads, as shown in Figs. 4 and 5, or any other means of securing the ends of the tubes B may be employed.

By my improved disposition of the condenser-tubes and their packings alternately at opposite ends of adjacent rows of tubes a larger number of tubes of a certain diameter can be arranged with a given size of tube-heads, so that the total surface area of all the condenser-tubes is greatly enlarged, and thereby a more effective condensing action of a condenser of a given size obtained. Besides the increase in the condensing-surface, however, other advantages result from my im-

proved construction—namely, that the expansion and contraction of the tubes takes place simultaneously in opposite direction, by which the strain on the tube-heads is reduced. Further, the adjustment of the screw-glands of the tube-packings is more easily accomplished in the tube-heads, as they are not arranged as closely together as heretofore, while only half the number of packings are required. The arrangement of the tube-packings at opposite ends of adjacent rows of condenser-tubes permits also, when removing the bonnets, of the employment of men at both tube-heads when resetting the packings, so that the revision or readjustment of the tube-packings of a condenser can be attended to within a shorter time than heretofore, for the reason that the screw-glands of both ends of condenser-tubes had to be adjusted, while in the improved arrangement only the packings of the ends of every second row require to be readjusted or repaired.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A surface condenser, in which one row of condenser-tubes is packed at one end into one tube-head and affixed at its opposite end, stationary into the other tube-head, and in which the adjacent row of condenser-tubes is affixed at one end, stationary to the first tube-head and packed at its opposite end with the other tube-head, substantially as set forth.

2. A surface condenser provided with alternating rows of condenser-tubes one row of condenser-tubes being provided with tube-packings at one end in one tube-head, while the adjacent row of condenser-tubes is provided with packings at the opposite end in the other tube-head, for the purpose of arranging a larger number of condenser-tubes in said tube-heads, substantially as set forth.

3. A surface condenser, the tube-heads of which are provided with rows of openings, the openings of one row being made of larger diameter than the openings of the adjacent row so as to provide for the packing of the alternating ends of the rows of condenser-tubes, substantially as set forth.

4. In a surface condenser, the combination of tube-heads provided with alternating rows of openings, the openings of one row being of larger diameter than the openings of the adjacent row, condenser-tubes the end of one row of which is packed into a row of larger openings in one tube-head, while the opposite end of said row of condenser-tubes is attached into a row of smaller openings in the other tube-head, the adjacent row of condenser-tubes being attached at one end stationary into a row of smaller openings of the first tube-head, while the opposite ends of said tubes are packed into a row of larger openings in the other tube-head, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

ROBERT A. SPROULS.

Witnesses:

PAUL GOEPEL,

GEO. W. JAEKEL.