

(No Model.)

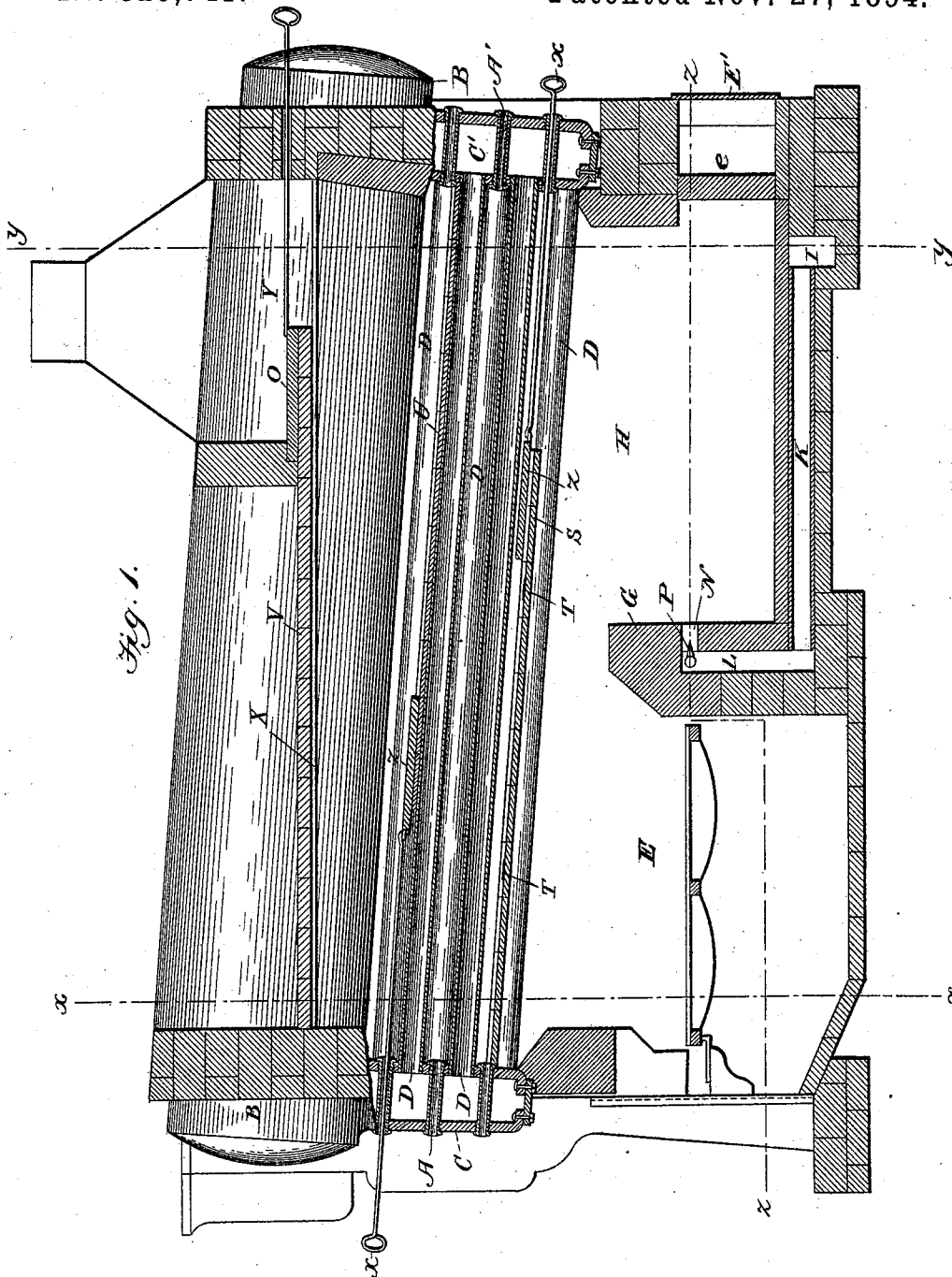
3 Sheets—Sheet 1.

E. D. MEIER.

STEAM BOILER FURNACE AND BOILER.

No. 529,741.

Patented Nov. 27, 1894.



Witnesses
Edwin L. Bradford
J. M. Copehaver.

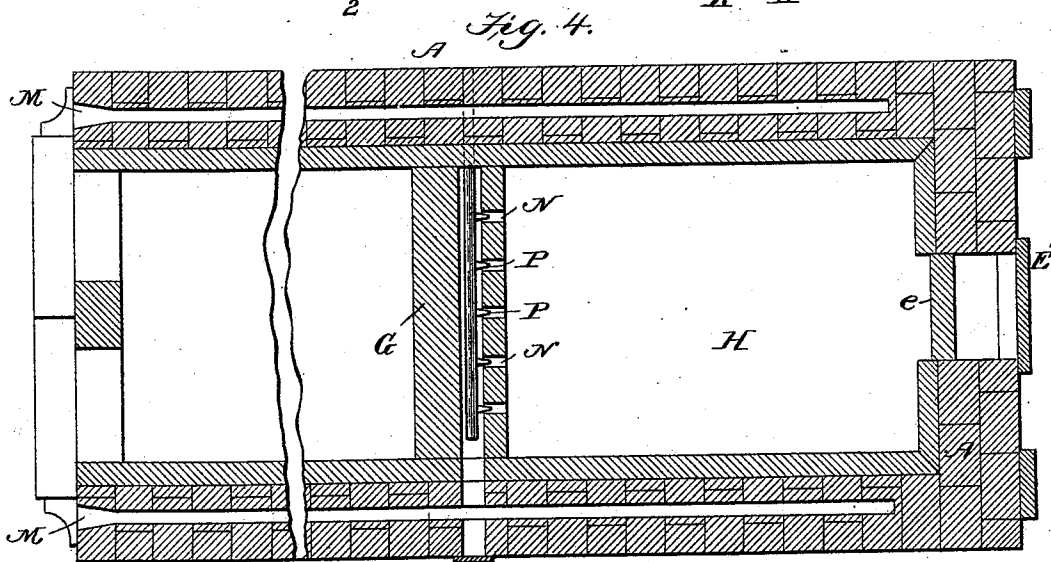
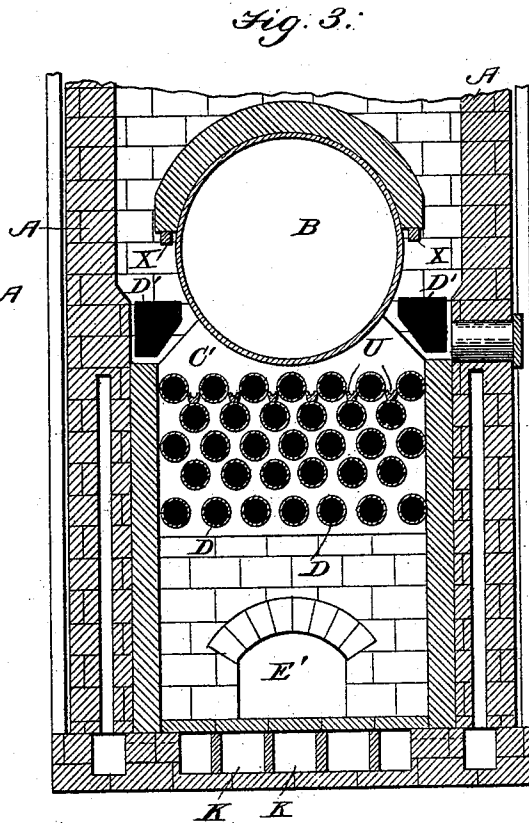
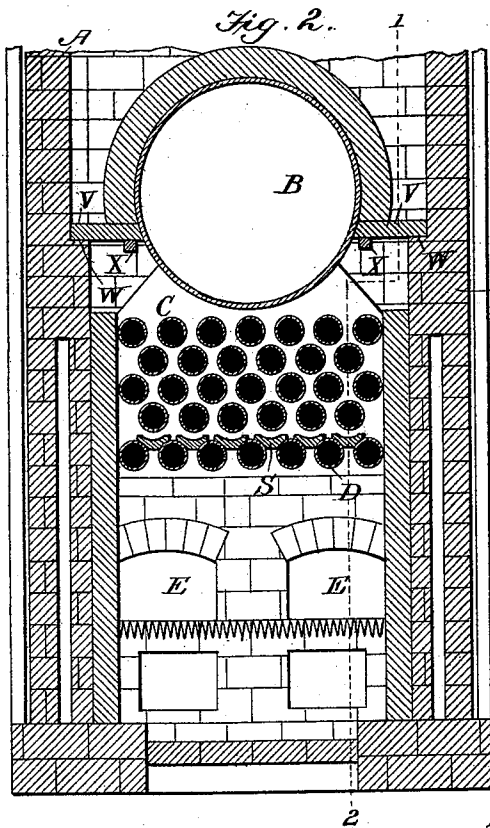
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Fig. 5.

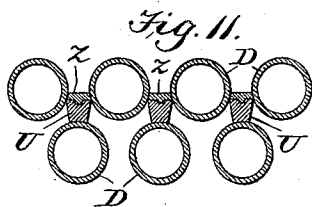
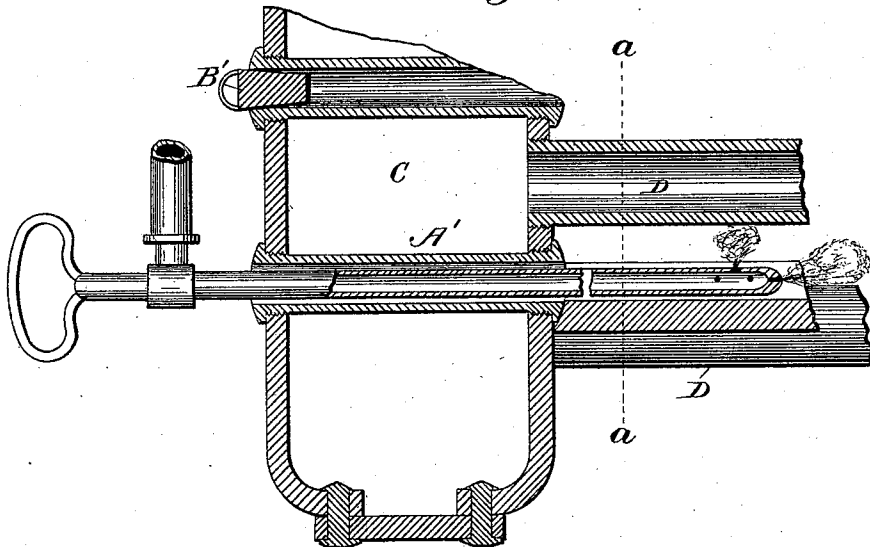


Fig. 6.

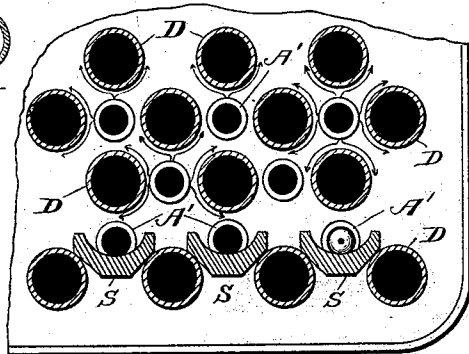


Fig. 7.

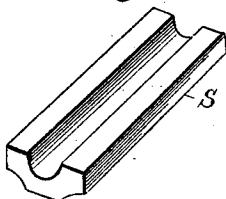


Fig. 8.

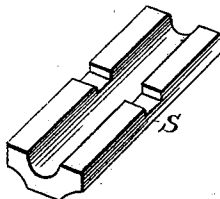


Fig. 9.

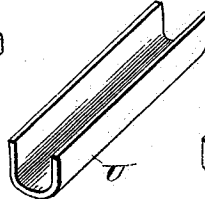
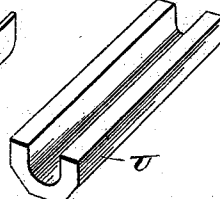


Fig. 10.



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UNITED STATES PATENT OFFICE.

EDWARD D. MEIER, OF ST. LOUIS, MISSOURI.

STEAM-BOILER FURNACE AND BOILER.

SPECIFICATION forming part of Letters Patent No. 529,741, dated November 27, 1894.

Application filed January 26, 1892. Serial No. 419,302. (No model.)

To all whom it may concern:

Be it known that I, EDWARD D. MEIER, a citizen of the United States, residing in the city of St. Louis, Missouri, have invented certain new and useful Improvements in Steam-Boiler Furnaces and Boilers; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain improvements in steam boiler furnaces and boilers, and is an improvement upon the invention for which Letters Patent of the United States were granted to Hermann Heine, August 26, 1884, No. 304,195.

The invention has for its object to provide for the thorough combustion of the fuel and inflammable gases produced by the partial combustion thereof in the fuel chamber before permitting the products of combustion to pass to the heating surfaces of the boiler so that the said products, at their greatest temperature, will be applied directly to boiler tubes, the most effective heating surfaces of the boiler, before reaching the steam drum and overheating the same, and thus prevent injury to the riveted plates thereof.

My invention further has for its object to provide a free passage for the products of combustion around the water tubes and lower portion of the boiler unobstructed by any partitions or deflecting walls, which by interfering with the draft, tend to reduce the steam generating capacity of the boiler.

My invention has also for its object to prevent the top or crown of the furnace above the fire box and the boiler, from burning out, melting down or becoming warmed or displaced, or otherwise injured by the intense heat of the furnace.

My invention has also for its object to arrange the details of construction so that the outer portion of the boiler and boiler tubes may be readily cleaned and the deposited soot quickly removed without lowering the temperature of the furnace, and consequently interfering, for the time, with the generation of steam.

My invention further has for its object to so construct the furnace that the various interior parts may be readily and conveniently

put together or removed and replaced when repairs are necessary, all as more fully hereinafter set forth.

In the drawings, Figure 1, is a longitudinal sectional view of my improved furnace, taken on the line 1—2 of Fig. 2. Fig. 2, is a transverse vertical section of the same, taken on the line $x-x$ of Fig. 1, looking forward. Fig. 3, is a transverse vertical section taken on the line $y-y$ of Fig. 1, looking backward. Fig. 4, is a horizontal sectional view, taken on the line $z-z$ of Fig. 1. Fig. 5, is an enlarged sectional view of a portion of the boiler and furnace, showing the hollow stay bolts and their stoppers or closing devices, and a steam nozzle for blowing off soot. Fig. 6, is a sectional view, taken on the line $a-a$ of Fig. 5, looking forward. Figs. 7 and 8, are perspective views of the tiles of the lower row. Fig. 10, is a perspective view of the upper row of tiling and Fig. 9 a metallic substitute for the tile shown in Fig. 10. Fig. 11 is a section showing the arrangement of slides and tiles.

A A are the outer walls of the furnace, which are constructed of brick work, as usual in this class of furnaces.

B is a steam drum which forms the upper section of the boiler and C C' are two chambers or water legs, at the front and rear of the boiler, connected to and communicating with the drum or upper section of the boiler, as shown. From the inner sheets of these chambers extend the water tubes D D, which, with the chambers, form the lower section of the boiler, the water tubes communicating respectively with the separate chambers.

The side water tubes are "staggered," or in other words, the tubes are placed in parallel rows one above the other, the spaces between the tubes in one row alternating with the tubes in the adjacent rows, and vice versa, as shown in Figs. 2 and 3 of the drawings. When a proper relation is preserved between the conducting capacity of the water tubes and the throats of the water legs, the inclination of the boiler as a whole may be reduced to a minimum, and I find that an inclination ranging from one foot in height to ten in length, to one foot in height to fourteen feet in length, is quite sufficient to insure free circulation, permitting the steam to pass quickly to the steam drum.

E is the fire box located in the front of the furnace, as usual, and G, the bridge wall, at the rear of the fire box. Back of the bridge wall between the same and the rear of the furnace is a combustion chamber H, into which the hot gases from the fire box pass before passing to the lower section of the boiler, so as to insure the thorough combustion of the unconsumed gases passing from the fire box, before reaching the heating surfaces of the boiler and thus thoroughly utilize the heat, economize fuel, and avoid as far as possible the deposition of soot upon the heating surfaces or tubes of the boiler. In order to effect complete combustion in the combustion chamber, and at the same time utilize the heat which would otherwise be absorbed by the walls of the furnace and radiated and wasted, the walls surrounding the furnace, as well as the bridge wall, are provided with connected flues, I, K, L, leading from the open air at M, Fig. 4, into the combustion chamber through slots in the upper portion of the bridge wall, at N. To increase the draft and intensify the combustion in the chamber, a series of steam jets P extending from a suitable pipe, are arranged behind the openings N, so as to inject steam into said combustion chamber when desired, the pipe being properly connected with the generator for the purpose and supplied with a regulating valve. Those portions of the fire box which are subjected to intense heat are lined with fire brick as usual, and the bridge wall, the internal walls of the combustion chamber as well as the floor of the combustion chamber are so lined.

The roof of the fire box is located at a suitable distance above it and extends backward at the same inclination as the lower boiler section partially over the combustion chamber, as shown in Fig. 1. Said roof is formed partly by the lower row of water tubes and partly of a series of fire clay tiles S which are supported by the tubes and bridge the spaces between them. These tiles are trough shaped, having a groove on their upper faces of somewhat greater radius than the tubes, which serves to collect the soot and ashes carried along with the products of combustion, and enables the tiles to be inserted, removed and replaced with facility without disturbing the other parts of the furnace or boiler. To introduce the said tiles, they are inserted edge-wise between two adjacent tubes of the lower row from below and turned around the tube next the hollowed portion or the tile until the tile has passed upward and some distance beyond the central line of the tube, when the said tile can be readily moved into place. The groove also when the tile is adjusted comes under the tubes of the row next above them, thus permitting the second row to be brought nearer the first than hitherto possible without interfering with the setting or removal of the tiles. The lower row of tubes is always made a "long row," that is, it al-

ways contains one more tube than the row above it, thus enabling the roof to be completely closed without attaching any portion of the same to the side walls of the furnace, which would be necessary if the lower row of tubes were a "short row," and which would by expansion and contraction rack the walls, produce cracks and leaks in the same, and consequently reduce the efficiency of the furnace and boiler. One or more cross rows of the tiles have transverse grooves in their upper faces, in which are placed anchor bars T that enter the side walls to prevent the tiles from sliding down the tubes. They have, however, considerable play in all directions to avoid the injurious consequences of expansion and contraction.

U U are tiles or concavo-convex blocks which in connection with the upper row of tubes form a partition or diaphragm which extends from the rear toward the front of the furnace. The tiles rest between said tubes on the row below similarly to the tiles forming part of the roof of the fire box, before mentioned. The said partition, as will be seen, inclines upward from the rear to the front of the furnace and as its rear rests against the rear wall of the furnace, no anchor bars are needed.

V is the roof or crown of the furnace. This roof is also composed of tiles or blocks of other suitable material which rest upon shoulders W at the sides of the furnace, and the supporting bars X, extending along the sides of the upper section of the boiler, at or a little below the water level. The said roof extends from the front of the furnace toward the rear thereof and terminates at the opening Y, leading to the smoke stack.

The chambers forming the heads of the lower section of the boilers are provided with hollow stay bolts A' similar to those employed in the patent before mentioned. The said bolts are of a greater diameter, however, to permit of the insertion of the injecting nozzle when desired, for the purpose of removing soot and deposits from the outer surfaces of the tubes and boiler, as more fully hereinafter explained.

The hollow stay bolts are arranged at points midway between the ends of three or four of the adjacent tubes throughout the series, so that when the injecting tube or nozzle is inserted it can be worked between three or four adjacent tubes of the set, and by means of side jets, as shown, cause currents of steam or steam and air to play upon the outside of the tubes or heating surfaces of the boiler, and thus effectually cleanse them, at the same time supplying air to support combustion of the soot, and thereby augment the heat in the furnace. The outer ends of the stay bolts are provided with plugs or stoppers B' for closing them when not in use, so as to prevent access of cold air to the furnace and the diameter of the passage through them is such that the nozzle will about fit therein, so that

very little cold air can pass them into the furnace when in use.

It will be seen that the temperature of the furnace will not be reduced while cleansing the heating surfaces at the time when the heat is most needed, but will be augmented by the consuming soot,—a manifest advantage over the ordinary methods of cleaning where large apertures are necessary for the insertion of the cleansing tools or instruments. The nozzles each consist of a straight tube of a width adapted to pass through the stay bolts, contracted at the end and perforated at the sides and they are of sufficient length to enter the boiler to more than half way between its front and rear, so that the entire surfaces of the tubes may be cleaned. Where it is only practicable to work the nozzles from the front, they may be made the whole length of the tubes as sufficient space in front of the boiler is generally provided in the boiler room for the insertion of the boiler tubes, and of course would be ample for the proper working of the nozzles.

To provide for cleaning the upper portion of the furnace above the diaphragm U, openings D' are provided in the side or end walls of the furnace which are closed by suitable covers and to remove ashes and deposits from the combustion chamber, it is provided at its rear with an opening closed by movable block e and a cap E'.

In the operation of my improved furnace and boiler it will be perceived that the hot products of combustion and unconsumed gases from the burning fuel in the fire box instead of passing directly into the chamber in which the lower or tube section of the boiler is located are directed back by the roof of the fire box into the combustion chamber, where they meet with a current of heated air and steam, by which all unconsumed gases are ignited. The products intensely heated then pass into the lower rear end of the chamber containing the tubes, striking the most effective heating surfaces. The products then pass freely forward through the nest of tubes, meeting with no obstructions, such as vertical partitions or inclined deflecting walls, so that all the tubes are in the single flue traversed by the products of combustion and thence freely back under the water space of the steam drum to the smoke stack, thus effectively utilizing the heat and preventing the burning or overheating of the riveted portions of the boiler and consequent injury to the same.

By the present construction, the chamber in which the tubes are located is made of ample dimensions and the opening into it or the exit from it may be increased or decreased at will by simply adding to or removing a portion of the tiles from the diaphragms S and U respectively so that the amount and nature of

the contact of the gases of combustion and the heating surfaces are under control and can be varied to suit varying circumstances of fuel and draft. Moreover the tiles being easily removed and replaced there is little difficulty when making repairs.

It is often found in practice after careful adjustment of the tiles to regulate the size and character of the opening from one chamber to another, that the draft will be greater at one side than the other or greater in the middle than at the sides, and to overcome this difficulty and also to provide for ready adjustment of the draft after the furnace has been erected and while in operation, I arrange a series of slides *z z* one over each row of tiles adapted to be moved back and forth by means of hooks or bars *x x* inserted through the hollow stay bolts. Dampers *o o* are also arranged to increase or diminish the opening from the upper chamber to the stack, as shown.

Having now described my invention, what I claim is—

1. In a boiler furnace, the combination of a fire box, a nest of staggered tubes arranged above said fire box and tiles or blocks grooved substantially as described so that they may be inserted and removed from below the tubes to facilitate construction and repairs of the furnace and boiler, substantially as described.

2. In a boiler furnace, the combination of a nest of staggered water tubes, and tiles or blocks longitudinally grooved to facilitate adjustment and transversely grooved to provide for anchoring them in place in the furnace, substantially as described.

3. In a boiler furnace, the combination of a fire box, a combustion chamber, a nest of staggered water tubes above the same, the lower row of tubes containing one more tube than that above it and tiles or blocks arranged between the lower row of tubes to form the roof of the fire box independent of the side walls of the furnace, substantially as described.

4. In a boiler furnace, the combination of a combustion chamber, a nest of water tubes above said chamber, a row or rows of tiles arranged between and supported by said tubes, and a series of slides arranged and operating as described.

5. In a boiler furnace, the combination of a combustion chamber, a nest of staggered water tubes above said chamber, a row of tiles arranged between and supported by said tubes, a series of slides arranged as described, and detachable handles for operating the slides, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

EDWARD D. MEIER.

Witnesses:

A. F. RANDALL,

V. D. STOCKBRIDGE.