

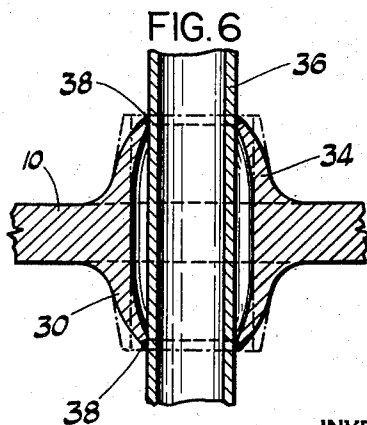
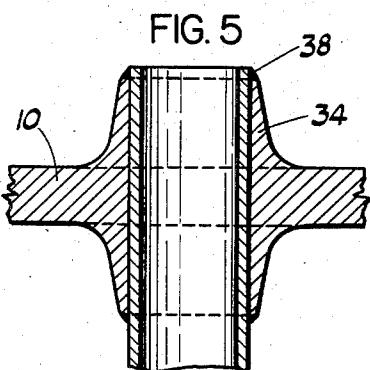
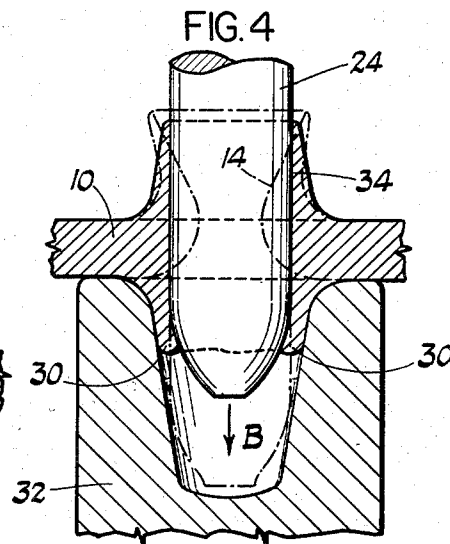
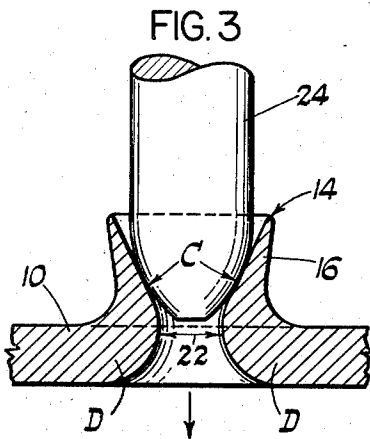
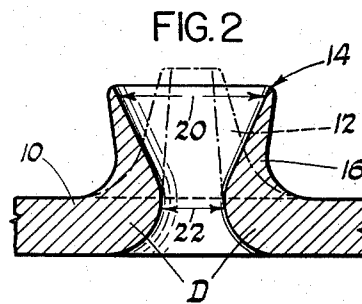
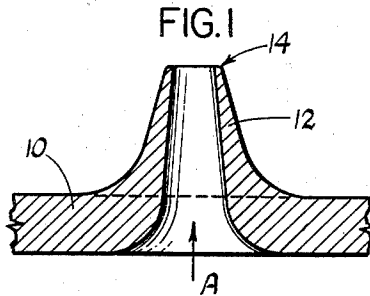
May 19, 1959

A. HUET

2,886,881

TUBE AND PLATE CONNECTION

Filed March 5, 1957



INVENTOR
ANDRE HUET

BY *James F. Wilson*
ATTORNEY

1

2,886,881

TUBE AND PLATE CONNECTION

André Huet, Paris, France, assignor to Combustion Engineering, Inc., New York, N.Y., a corporation of Delaware

Application March 5, 1957, Serial No. 644,075

2 Claims. (Cl. 29—157.5)

The present invention relates to heat exchangers; in particular to improvements in a tubular type exchanger. The plates which seal off the ends of such heat exchangers are pierced with circular holes in which the ends of the tubes constituting the tube bank of the exchanger are seated and fastened, generally by tube expanding.

It is possible to replace the holes cut in the plates by nozzle-like necks to constitute tube connections, these being produced, for instance, by punching the tubular plate, the said neck providing around each opening a boss, or rim, to which the tube is connected.

Practice has shown that it would be of importance to be able to obtain on the tube plates connections having double bosses, i.e. tube connections providing a neck, or boss on both sides of the tube plate. The tube to be fastened can then eventually pass through the tubular plate in which it is maintained, for instance, by hot shrinking, and welding of the ends of the double necks to the circumference of the tube.

Applicant has conceived a method for the manufacture of these connections, or double boss necks constituting the object of this invention as well as an improved tube plate provided with necks.

According to this invention, the tube plate is first pierced by means of a punch to create an ordinary unilateral tubular neck projecting from the tube plate from the pierced tube hole. Preferably this neck should have a high rim and be of conical, rather than pointed shape, i.e. that it shows at the top a relatively small end face; or even none, the outer wall of the neck merging with the inner wall at the end.

In the course of a second step of the method the tubular neck produced on one side of the plate is opened out in such manner that the diameter of the neck at its extremity becomes larger than that at its base, i.e. that of the opening formed in the plate. In the course of a third operation, by passing a punch of larger diameter than the tube hole in the opposite direction to that of the first operation, the bore of the widened neck is restored to a circular shape while the punch displaces part of the plate wall around the opening and causes a protrusion on the side opposite to that where the first neck was produced which produces an accumulation of metal which constitutes a second neck on the other side of the plate (having eventually the same diameter), and finally a cylindrical or non-cylindrical nozzle with double rims is obtained.

The following description when read in connection with the accompanying drawing will help to understand the manner in which the invention can be executed.

Figure 1 shows in cross section a tube plate on which a neck-like boss has been formed around a tube hole in accordance with the first step of the inventive method.

Figure 2 shows the neck of Figure 1 after being widened at its extremity.

Figure 3 shows in cross section the neck of Figure 2

2

at the time of introducing the punch which is to carry out the third operation.

Figure 4 shows in cross section the final tube connection with double bosses or necks as formed during the third operation.

Figure 5 shows in cross section a tube arranged in the double necked connection.

Figure 6 shows in cross section a variant for the execution of the double necked connection with another method of fastening the tube in the said nozzle.

As shown in the drawings, in order to obtain a double necked connection in accordance with this invention, one starts by forming on the tube plate 10 a tubular neck 12, for instance by pushing a punch in the direction of arrow A through the preheated plate, in cooperation with a die applied from the other side of the plate. A rather high neck 12 with relatively flat rims or end face 14 is thus obtained.

In the course of a second operation, the neck 12 of Figure 1, shown in dotted line in Figure 2, is opened or widened at its extremities, i.e. so that its rim 14 is spread so as to form a divergent cone 16, as shown in straight line in Figure 2, the circular opening 20 at the rim 14 attaining a diameter larger than that of the opening 22 pierced in plate 10. This operation can be executed in different ways. For instance, after heating the neck 12 a mandrel can be pivoted inside this protuberance in order to obtain its gradual widening by generating a conical surface.

In the course of a third operation, after the conical neck 16 has been suitably heated, especially in region D where it merges into plate 10, a punch 24 is pushed into the widened neck 16 in the direction B opposite to that of the punch which carried out the first operation to form the neck 12. The punch 24, as can be seen in Figure 3, is of a diameter larger than opening 22 but less than the diameter 20 of the extremity of the neck and hits the neck near circumference C and, in its driving movement displaces and carries along with it the metal of region D of the plate 10, which stretches out and forms, on the other side of the tube plate, a boss or neck 30 as shown in Figure 4.

Figure 4 shows in dotted line neck 16 before the final punching operation. It can be seen, that during the final operation the wall of the widened neck 16 folds back along punch 24, while the metal of region D of the neck and plate is constituting neck 30. In the course of this third operation, punch 24 can act in cooperation with a die 32 applied from the other side of tube plate 10, and which keeps the metal of tube plate 10 in the required position so as to obtain finally the double necked connection 30, 34 with cylindrical opening (Fig. 5).

In order to fasten a tube in the double necked connection thus obtained, one begins with heating necks 30, 34 and then introduces the cold tube 36 into the opening. During the cooling off period as the necks 30, 34 shrink a strong binding effect of tube 36 in necks 30, 34 takes place. The fastening can be completed by two seam welds 38 between plate 10 and the necks 30, 34 at their extremities.

As a variant, for fastening tube 36 in the double necked connection, the end faces or rims 40 of the necks 30, 34 can be pinched by outside pressure, so as to decrease the inlet openings of the connection from both sides, and to obtain in cross section a kind of bracket, as can be seen in Figure 6. The tube 36 can then be mounted in this bracket, the branches of which are eventually brought closer to the circumference of the tube, either hot or cold, so that they can adapt themselves to the diameter of the latter before being finally welded to the tube.

I claim:

1. The method of assembling a tube into a tube sheet which comprises; piercing a hole through the tube sheet from one side thereof; forming around the hole a frusto-conical tubular neck on the opposite side of the plate that is of relatively greater height than the diameter of the hole; widening the bore of said neck at its outer extremity and spreading the walls of the neck to form an inverted frusto-conical neck projecting from the plate beyond the tube hole; heating said neck and said plate at its junction with said neck; introducing into the convergent bore of the conical neck a punch of greater diameter than said hole and projecting said punch through said neck to a position beyond said one side of said plate to displace the material of said neck and plate adjacent said tube hole and thereby form a second neck projecting from said one side of said plate; heating both of said necks; seating the end portion of a tube in the cold state in both of said necks, said tube having an external diameter fitting the bore of said necks when the latter are heated and welding the distal end portions of said necks to the adjacent outer wall regions of said tube.

2. The method of assembling a tube into a tube sheet which comprises; piercing a hole through the tube sheet from one side thereof forming an upstanding tubular neck on the opposite side of the plate that is of sub-

stantially greater height than the diameter of the hole; widening the bore of said neck at its outer extremity and spreading the walls of the neck to form an inverted conical bore in the neck converging to the tube hole; heating said neck and said plate at its junction with said neck; introducing into the convergent bore of the neck a punch of greater diameter than said hole and projecting said punch through said neck to a position beyond the opposite side of said plate to displace the material of said neck and plate adjacent said tube hole thereby forming a second neck projecting from said one side of said plate; heating both of said necks; seating the end portion of a tube in the cold state in both of said necks, said tube having an external diameter approximating that of the bore of said necks when the latter are heated; and welding the distal end portions of said necks to the adjacent outer wall regions of said tube.

References Cited in the file of this patent

UNITED STATES PATENTS

1,101,084	McCarty	June 23, 1914
1,727,755	Dickinson	Sept. 10, 1929
1,744,932	Swank	Jan. 28, 1930
2,349,792	Rosenblad	May 23, 1944