New Inventions.

Improved Tubular Boiler.

The boiler represented in the accompanying illustrations is the invention of Mr. Frederic P. Dimpfel, and was patented by him some time ago. An engraving, as his boiler was then constructed, was presented on page 248, Vol. 7. It is capable of being used advantageously with any fuel, and is now in popular use on several locomotives as a coal burner. The degree of success which has attended its application for this purpose leads us to amplify somewhat on the difficulties to be overcome in coal burning.

Good dry wood is in many respects the best fuel yet known for locomotives. It lies loosely in the furnace, enabling the air to pass through its interstices freely, and it burns in such a manner that a portion of the fuel is decomposed, or changed into gas, to be burned as it escapes through the tubes, while another large portion is burned as it lies in the furnace, forming a glowing bed of soft, elastic, coherent, but not adhesive, fire. True, its combustion produces more or less smoke, which is very unpleasant in the nostrils or eyes, and it sometimes throws out sparks which destroy property, but these evils are trifling in comparison with those which usually attend the burning of pit coal.

All coals dug from the earth contain some volatile or gas-producing matter, and those which have but little we term anthracite. Now, whether we burn anthracite or coal containing more volatile matter or bitumen, the intensity of the heat cannot, as with wood fuel, be well controlled, and as a consequence some fuel and water are expended wastefully. Bituminous coal also makes much smoke, and the effluvia is such that coal-burning locomotives have been termed "stink-pots" by the people along some of the lines on which they are employed. Some coals melt and adhere together and stop the draught; the combustion of others tends to cover the grates with clinker, and all coal fires obstruct the passage of the air far more than do the large sticks of short wood generally employed in ordinary locomotives. This is a considerable evil, as the draught must be great and the fire intense in a locomotive, or the great amount of power required cannot be developed by a sufficiently small machine. Some coals, which are tolerably free from some of the above faults, crackle into fragments under the intense and sudden heat, and by the agitating motion of the locomotive are sifted through the grates to fill the ash pan, before they have an opportunity to become more than half or quarter consumed.

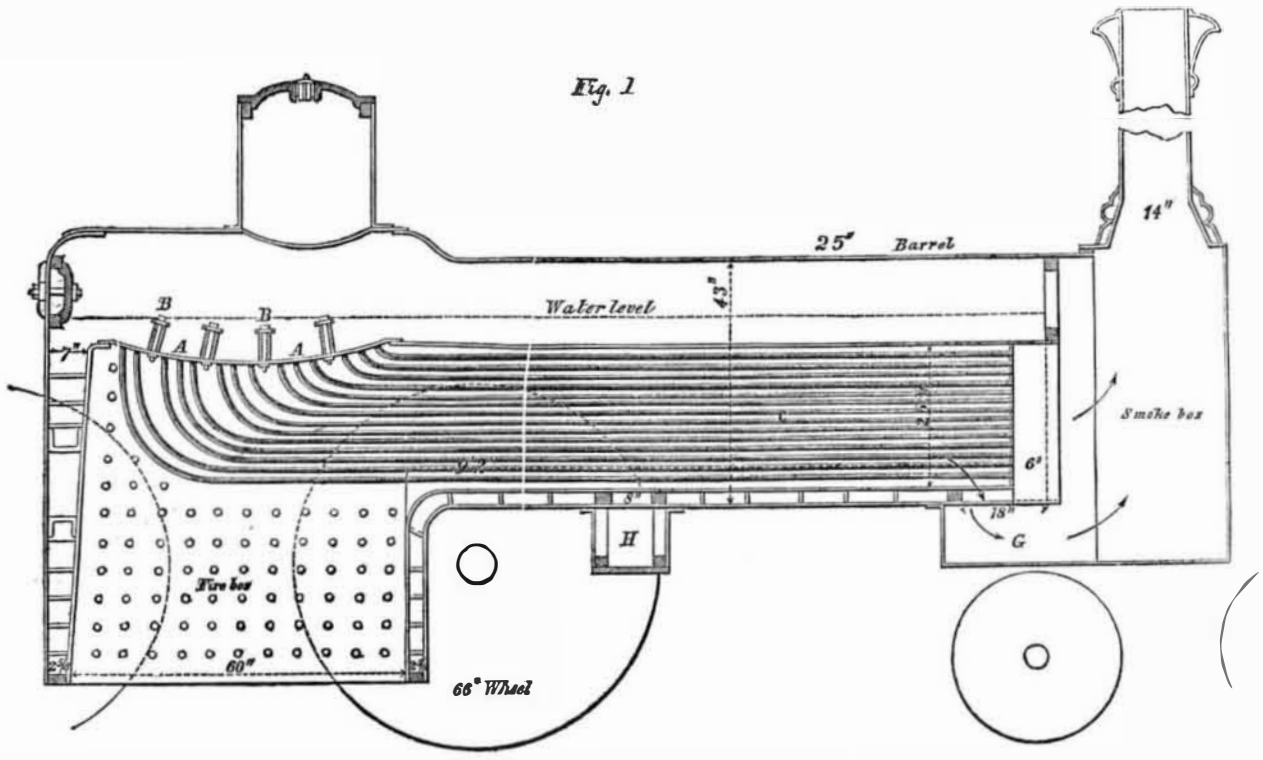
With the loss from the bad control of the heat, which involves a continuous great fire even though but little is wanted at times—with the loss of power in keeping up the draught, whether it be done by a fan blower, or by greatly contracting the blast nozzle through which the exhaust steam is discharged into the chimney—and with the loss of coal by dropping through the grates—it is sometimes found, even with locomotives adapted to the circumstances, that the actual cost of fuel is as great as with wood. Generally, however, it may be assumed that coal is sensibly the cheapest fuel, and the difference is becoming greater with each improvement in facilities for mining and transportation. Despite the evils, therefore, of sulphurous fumes, wasted coal, clogged fires, clinkered grates, and sundry additional ills of lesser magnitude, coal would come into very extensive use but for the existence of an evil which we have not yet alluded to.

The heat of fiercely glowing anthracite is frequently too intense to be endured by iron plates, even if they be cooled by the constant presence of water on the inside. The metal therefore warps, cracks, leaks, and "loses its life," in short, is *burned* under its influence, and it is found that the cost of supplying a new boiler or furnace, after a few months or years, according to circumstances, is alarming. The effect is especially severe on the tube-sheet, the part in which the ends of the tubes are presented to the furnace, and several devices have been patented with a view to protect this part from destruction.

The device represented in the accompanying figures provides not only for the quite thorough protection of the tube-sheet from the radiant heat of the fire, but ensures a very energetic circulation of the water in contact with that part, and also allows very completely for any inequalities of contraction and expansion of the parts. It frequently happens that owing either to a difference in the metals or to a difference in temperature, the tubes of an ordinary tubular or locomotive boiler are very much strained in their positions within the boiler. The tubes being copper or brass, for example, expand faster than the iron of the shell as the boiler becomes heated, and endeavor to lengthen themselves more than the increase of length of the shell will allow, an effect which is increased by the fact that the shell is only warmed by the heated water, and that by contact only on one side, or its interior surface, while the tube has the heated water on one side, (its exterior) and the far more heated products of combustion circulating within, so that both the nature of the metal and the higher temperature tend to make the tubes longer in proportion to the other parts than was the case when they were fitted to each other. The strain thus induced tends to loosen the tubes in their fastenings, as also does the opposite one when the fires are suddenly drawn, as under such circumstances the shell remains heated while cold air is allowed to be drawn through and cool the tubes.

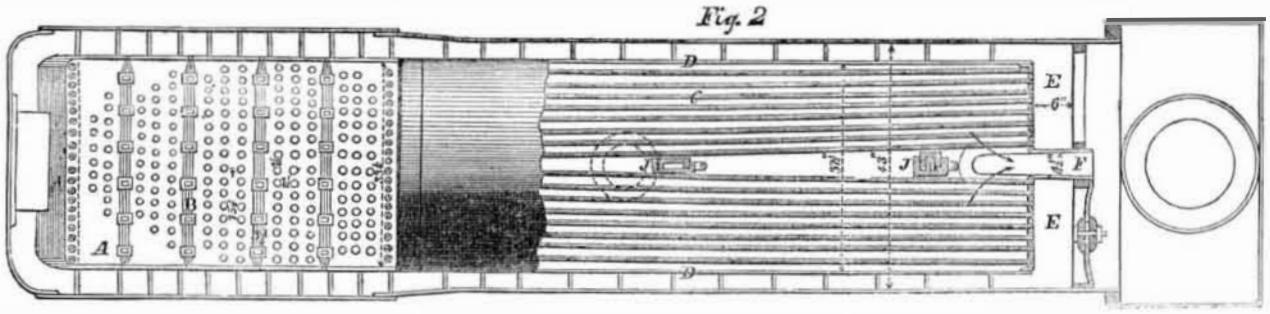
DIMPFEL'S TUBULAR BOILER.

Fig. 1



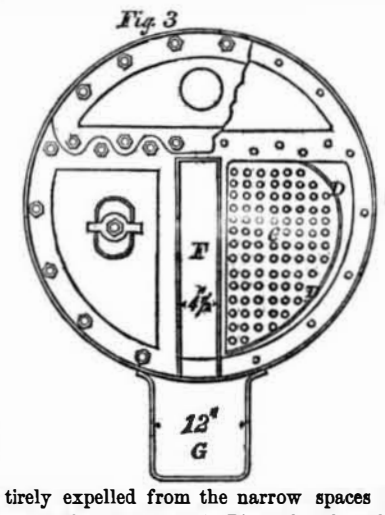
The Dimpfel boiler has a large flue, D D, (Fig. 2) in the location where the tubes of an ordinary boiler are arranged, and this flue is filled with tubes, arranged as represented, so that water circulates within, while the heated gases flow along through the spaces between them. The large flue is not continued quite through the barrel of the boiler, except in a quite narrow space, F, and the products of combustion principally escape by descending through a suitable box G (Figs. 1 and 2) below. The tubes are so arranged as to receive the water from a water-space, E, (Fig. 2,) at the end of the flue next the smoke-box, and allow it freely to escape at the other, which enters the fire-box in the manner represented, and bends upward into the crown sheet, which thus becomes, in fact, the tube-sheet of the boiler. The water in the tubes is rapidly changed to steam, which, by reason of its levity, tends very powerfully to ascend and to drag with it the water with which it is mingled, so that there is always quite a rapid current through the tubes, water flowing in at the smoke-box, and water mingled with steam escaping through the upturned ends in the furnace or fire-box.

Fig. 2



Externally the boiler resembles ordinary locomotive boilers, and the principal parts are denominated by the same terms. The crown sheet, A, is supported by stay bars, B, as usual, but the sheet is depressed in the center, so that the section forms a portion of a circle. This form allows a less number of stay bars to suffice for its support. The active circulation due the rising of the water through the tubes, C, prevents the collection of any non-conducting deposits in the hollow top of the crown sheet. The flue, D, in which the tubes are enclosed, is itself very efficient heating or steam-generating surface, and as the tubes are equally small, numerous and closely packed, and project considerably into what is usually the empty open space in the top of the furnace or fire-box, it follows that the heating surface is not only more efficient in consequence of the free and rapid circulation of the water, but is considerably greater in a given volume of boiler than when the tubes are arranged in the ordinary manner. It is by no means extraordinary to find in the common tubular boilers strong indications that the water has been at times almost entirely expelled from the narrow spaces between the tubes, but the Dimpfel boiler allows no possibility of such an effect being produced, as a clear space always exists for the water to flow freely in at the front end, and to escape from the upturned ends at A, with great rapidity, whether in the form of water or steam. The current through these tubes has in some instances been so active as to carry a half-inch bolt through, and deliver it on the top of the crown sheet.

Fig. 3



E represents the narrow space referred to as that from which the tubes receive their supply. F is the vertical opening therein, through which a portion of the products of combustion flow to the smoke box, but this is insufficient to discharge the whole, and the remainder is compelled to descend and escape through the box G. H is a small chamber designed to catch any small coals or cinders which may be drawn along the flue, D, by the draught, and by removing a simple plate at its bottom, it may be emptied at each trip; but it is not deemed very essential in practice, and is omitted in some. The presence of the space, F, necessitates a corresponding division of the tubes, C, and to prevent the draught from flowing through this space without heating the tubes, it is usual to insert the dampers, J, which are so made as to be closed up, and readily inserted through F, and subsequently to be expanded to the condition represented.

The boiler presents a very extensive and efficient heating surface, so arranged as to but slightly retard the draught. A very powerful large engine of this style built by the Taunton Locomotive Manufacturing Company, and running on the New York and Erie Railroad with anthracite alone, runs the express train at the ordinary speed, with a blast opening five inches in diameter, showing that a less powerful blast is required than is usually necessary with wood burners. We have before us a number of certificates from master mechanics and superintendents, showing that little or no trouble has been experienced in practice from leaks or other difficulties.

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