AN INTERESTING PROCESS FOR AVOIDING SPONGINESS IN HEAVY STEEL CASTINGS.

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During the past fifty years, a period in which we have learned how to cast blocks or ingots of steel of great size and weight, it has been constantly sought to avoid the formation of air spaces in the interior of the ingots, caused when the molten metal is cooling in the molds. Up to the present time a number of ways of doing this has been discovered. One of the methods consists in strong pressure being brought to bear upon the inner or outer surface of the block while it is still in a liquid state in the mold, the top of which has first been closed. In another process the upper portion of the block is kept in a heated and liquid condition for so long a time that the hollow spaces formed in the lower portion can become filled with metal. These processes are used more especially in the case of blocks weighing over five tons, and the gain secured amounts to 25 to 35 per cent, if it be taken into consideration that the porous portion of the block must be cut off from the readily forged part, and is useful for scrap purposes only. In spite of this precaution, it often happens that the readily forged part also shows signs of blistering, so that the whole block is useless for this purpose.

The process described herewith is based upon the use of a deadhead or sullage piece, and it is employed successfully at the Gutehoffnungshütte works for castings weighing up to 60 tons. The assumption has been taken as a basis that, by using a deadhead, good results can be obtained only when the upper portion of the block is reheated, and to such an extent that the steel in the sullage piece is kept in a state of fusion till the block has set and the formation of the ingot is terminated. The heat required for this purpose is obtained by forcing cold atmospheric air through an incandescent bed of coke, as by regulating the force of the blast and the pressure of the gas, carbonic oxide is generated in the receptacle containing the layer of coke, and this is completely consumed and transformed to carbonic acid above the block. The process is carried out in the following manner: The heating apparatus is filled with pieces of hard, medium-sized coke. About one hour prior to the commencement of casting the coke is ignited, and brought to a cherry-red heat by means of a suitable air blast. The apparatus has meantime been moved along till it is over the plaster mold, and the flame is used to heat the mold, and more especially the fireproof crown or the fireproof lining thereof. Shortly before the beginning of the casting the apparatus is removed from the mold, and the blast is then allowed to act with full force. While the block is being cast—an operation which requires from 15 to 25 minutes, according to the size of the block—the whole of the coke filling acquires the cherry-red heat requisite for carrying through the process. Immediately the casting is terminated, the apparatus is moved back over the mold and the heating commences.

Fig. 1 shows two apparatus in use. As may be seen from the illustration, these are suspended from small trestle cranes in such a manner that the former, upon the termination of the casting, can be easily moved over the middle of the mold. As no preheating of the air is required, the Root's blower supplying the compressed air can be mounted in the immediate vicinity of the casting pit without necessitating the use of long piping. The whole plant thus presents little difficulty in supervision. The cost of installing an apparatus, including the trestle crane and the high-pressure blower, amounts to $1,200 to $1,500 abroad. The operating expenses, varying with the size of the block, amount to from 15 cents to 25 cents per ton without royalty. The total cost is constituted as follows:

Consumption of coal per ton	6 to 10 cents
Wages	6 to 10 cents
Upkeep (plant, etc.)	3 to 5 cents
	15 to 25 cents

Figs. 2 and 3 represent blocks which have been treated according to the process described above.

Fig. 2 is a block of 25,630 pounds net weight; the weight of the sound part amounts to 23,760 pounds, so that there is therefore a loss of 1,870 pounds, or 7.3 per cent. In another block weighing 37,510 pounds the loss in weight was 4.08 per cent. Fig. 3 is a longitudinal section of a block weighing 37,840 pounds. The weight of the sound portion amounts to 35,750 pounds, so that there is thus a wastage of 5.52 per cent. In the case of a block weighing 36,080 pounds, the waste weighed 26,950 pounds, of which 1,375 pounds are assumed to be sound, so that there is thus a loss of 1,320 pounds, or 3.6 per cent. Samples for analysis were taken from certain of the blocks, say at *a*, *b*, and *c*. The results of the analyses were as follows:

BLOCK 1.

	C	Mn	Si	P	S
Charge tests	0.13	0.80	0.14	0.042	0.034
Sample at *a*	0.15	0.82	0.15	0.052	0.052
Sample at *b*	0.17	0.84	0.12	0.066	0.060
Sample at *c*	0.16	0.84	0.20	0.050	0.036

BLOCK 2.

	C	Mn	Si	P	S
Charge tests	0.18	1.00	0.12	0.039	0.034
Sample at *a*	0.14	1.01	0.13	0.057	0.051
Sample at *b*	0.22	0.90	0.10	0.060	0.055
Sample at *c*	0.20	1.01	0.15	0.045	0.029

The economic advantage can easily be deduced from the following calculation: For a piece of wrought work or a heavy piece of warship armor there is required for example, a block of 33,000 pounds net weight, i. e., the block must have 33,000 pounds of sound material. With 25 per cent waste, *a*, the block used for the purpose must weigh 44,000 pounds; with 10 per cent waste, *b*, a weight of 36,665 pounds only is necessary. Taking the price of the block at $21.25 per ton, and the price of clippings at $15 per ton, we thus get, after crediting the clip waste at *a* of 11,000 pounds and of 36,665 pounds, the following price per ton of sound material:

According to *e*	$23.33
According to *b*	16.94
Or a saving of	$1.39 per ton.

An approximately similar economy supervenes with the working processes (pressing mills, hammer works, or rolling mills) as regards coal, motive power, and wages. If, therefore, the great advantages afforded by the heating of large blocks, with respect to safety in manufacture and saving in material and wages, be compared with the small cost of heating, the conviction will soon be acquired that a heating plant should be an accessory of every modern Martin works where heavy blocks of raw metal are cast.

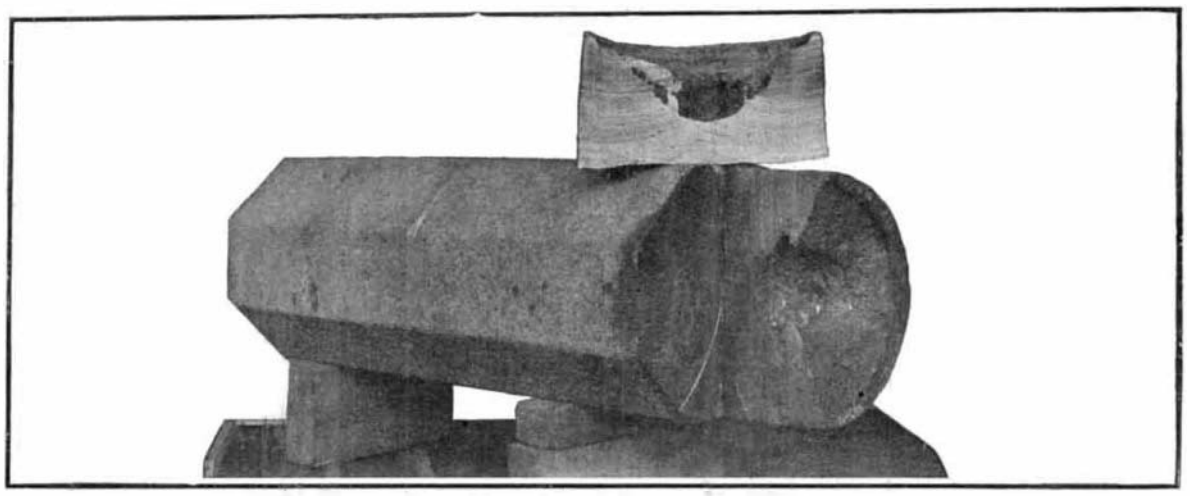

Fig. 2.—Block Weighing 25,630 Pounds, of Which 1,870 Pounds Are Lost.

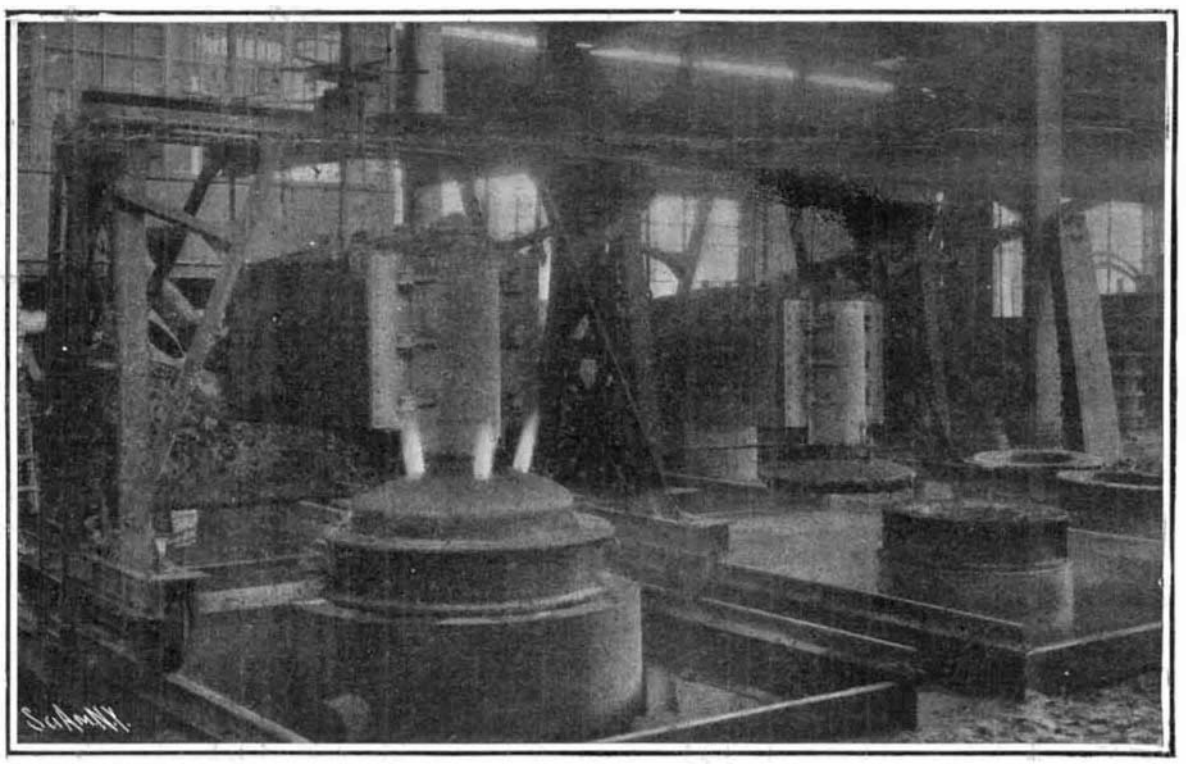

Fig. 1.—Two Apparatus in Operation.

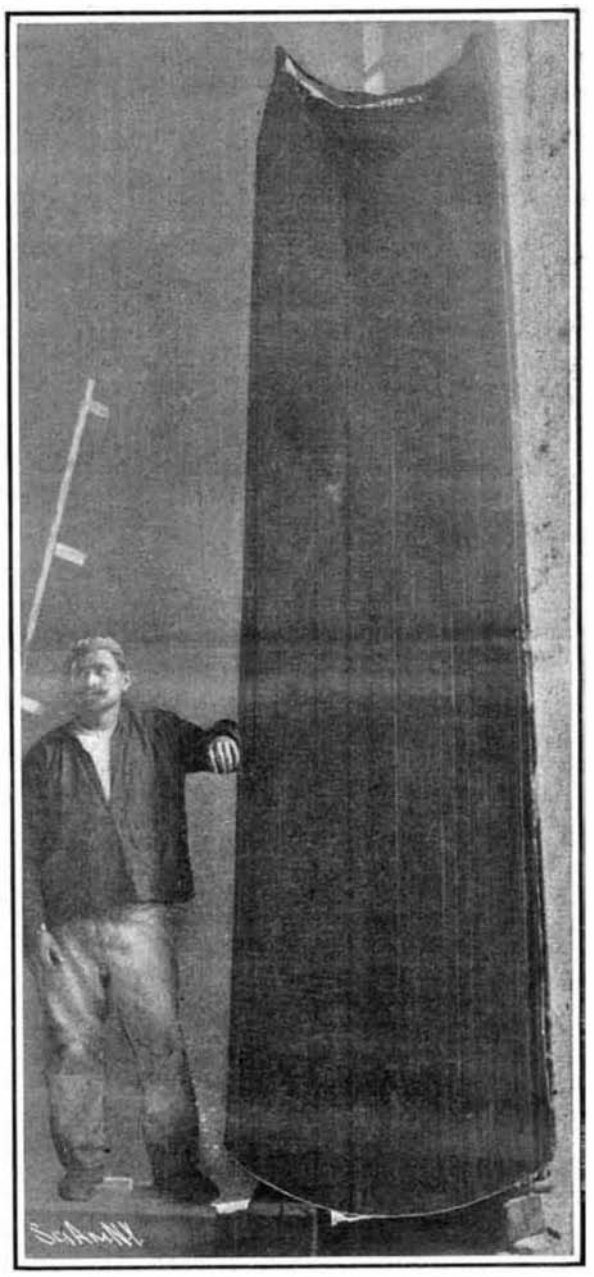

Fig. 3.—Longitudinal Section of a Block Weighing 37,840 Pounds.

The first-class cruiser "Pallada" was launched at the new Russian Admiralty shipbuilding yards on Saturday last. She is of 7,887 tons, and will have a speed of 21 knots. Her armament will consist of thirty-eight guns, the heaviest of which will be of 8-inch caliber, and two torpedo tubes.