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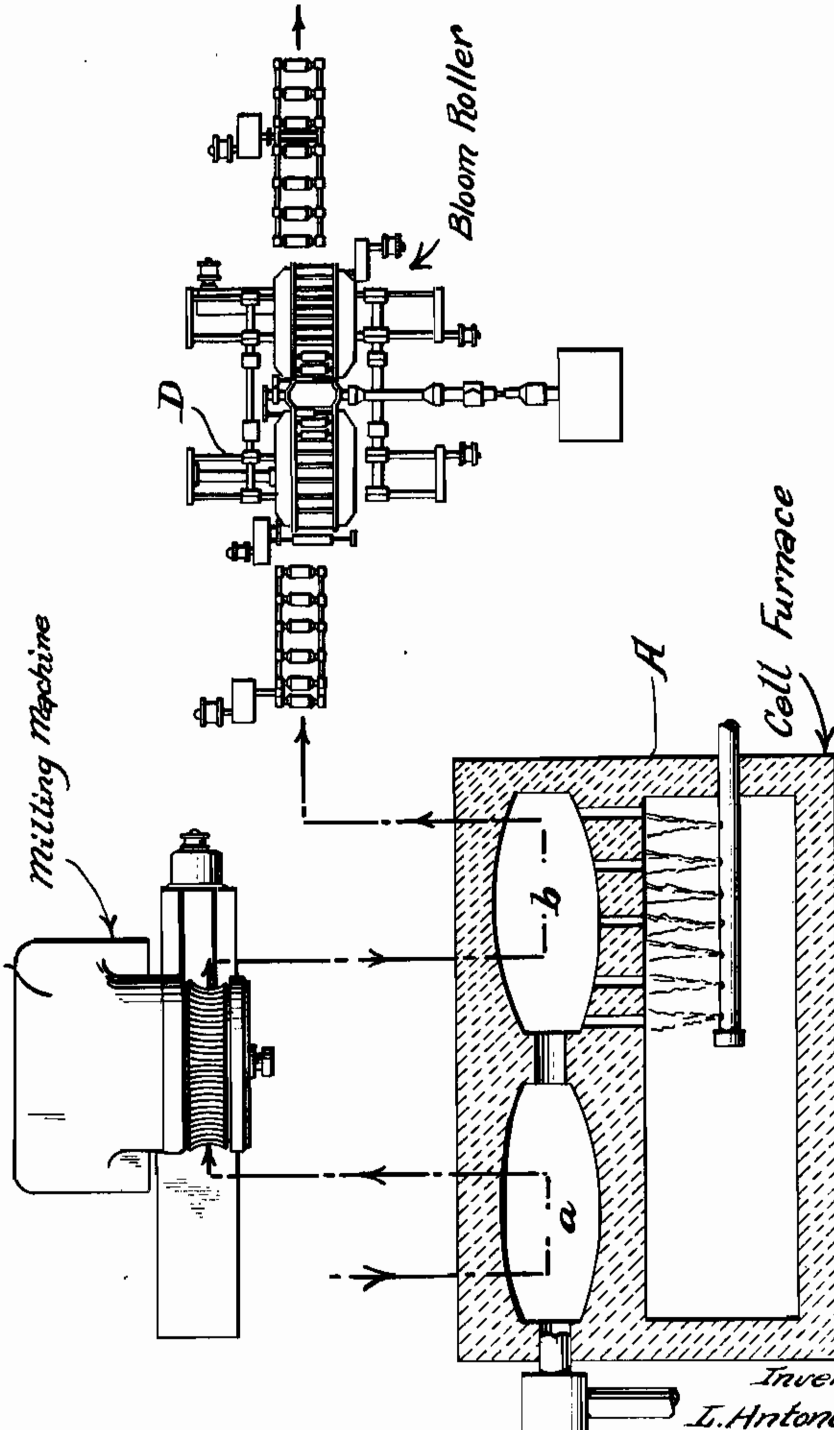

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ALIEN PROPERTY CUSTODIAN

SYSTEM OF HEAT MILLING FOR STEEL INGOTS

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The necessity now felt by constructors, of obtaining products from steel works without defect and particularly pure besides meeting with determined mechanical features, is of the greatest importance possible.

Steel works therefore have to look after the stages of transformation of the steel in order to cope with the ever increasing requirements of modern constructional technique.

It is known that starting from scraps or smelted pig iron as raw material, the chief stages of transforming steel are: smelting, casting in ingots, blooming the ingots in billets, rolling or forging. If these stages could follow each other without hindrance, the cycle itself would not be complicated, but unfortunately several negative factors contribute to make it more toilsome and slower, such as for instance: the necessity of cooling the ingots under ashes or in furnaces to avoid dangerous cracks; control of the fractures for structural examination of the steel; milling of the ingots or blooms to do away with superficial defects; intermediate heat treatments etc.

Modern steel works but particularly those producing special steel have to create special departments—called preparation departments—in which the products undergo some of the following operations in an intermediate stage of their transformation: machining, or milling, or planing disingotted and without milling the ingot is blooms, pickling, flatting with pneumatic hammers, sand blasting, moulding, etc. according to the quality, conditions and the purpose for which the steel is to be used.

All the foregoing weighs on the cycle of production which requires much more time than the greater stages of transformation and makes it considerably burdensome on account of the really imposing mass of machinery and men required for the aforesaid auxiliary operations.

Among these auxiliary operations or preparation operations, the most important, both for improvement of the quality as well as for the notable amount of steel that has to undergo it, is the superficial milling of ingots or blooms (peeling on all the surfaces without heat and with a lathe, or a plane, or a milling machine is meant by milling).

This milling on the ingots is done in the beginning of the cycle of transformation and it makes it possible to proceed in the other stages with a relative certainty of arriving at the finished product without further costly interventions of preparation. After cooling the ingots go on to the Preparation Department for lathe machining or milling with special machines built for this purpose.

Sometimes on the other hand, the red steel is distinguished and without milling the ingot is sent on to the heating hearth for the following rolling in billets at the bloom rolling mill.

In this case the milling always takes place without heat on the billets and it is harder because the total surface to be milled is considerably more.

Ingot milling without heat.—Ingot milling is being dealt with here since that of billets is less convenient.

As mentioned before ingot milling now takes place by lathe machining or planing work. The troubles of this system are many:

1. Most of the ingots have to be cooled slowly as soon as they are taken from the moulds to avoid serious structure defects or cracks taking place in the mass; steel works with large productions therefore have to put up large ash houses or covered pits in which the ingots are left to cool for several days (cooling of large ingots last 1–15 days); the work cycle hence lasts much longer and the pit service calls for means of carriage and hoisting as well as a total of operations which on the production.

2. Cooling of the ingots for the following mechanical workmanship means the loss of a good part of the smelting calories. When it is borne in mind that after milling the ingots must be brought up to about 1200° for the following blooming mill work and this temperature is arrived at by degrees (slow heating up to 650° at least has to be provided for with some kinds of steel), it will be readily understood that interruption of the work cycle is all the more harmful on account of the production having to be stopped, as well as the forethought required for cooling and the following reheating as mentioned hereinbefore.

3. The machines required for milling without heat of ingots are costly, complicated and with a low yield.

Various models of lathes for square turning have been studied and constructed, but they never settle the kinematic problem fully and much less do they reach the economic factor required.

The worked ingot is hardly ever like the rough ingot and the tool, which constructors planned as being oscillating to keep the cutting angle constant, had to be fixed afterwards because its movement caused constructional complications and harmful vibrations, and the yield of the machine dropped again by about 30%. In this regard it is advisable to remember that the surfaces (crusts) of rough ingots are coarse and gather foreign bodies, slag, etc.; therefore the strain on the machines and tools in workmanship is very strong.

A type of plane studied during a few years especially for planing ingots is likewise complicated, slow and unsuitable for the heavy work of milling.

It can be stated that the best machine for milling without heat now in the market only peels a 1500 kg. ingot in an hour with difficulty.

System of heat milling of ingots.—The system which the applicants intend to put into practice soon and for which they are applying for letters-patent, completely does away with the defects and incongruities of the system listed hereinbefore.

Specification of the system which is the subject-matter of this invention indicated schematically in the plan of the annexed drawing.

From the steel works the ingots removed when they are still red from the moulds, are sent with a bridge crane or carriages to the cell furnace A and put in cell *a* which keeps them hot from red hot to more than 900°. From this cell and at regular intervals, the ingots are taken with a tong crane to a special milling machine C and milled with a large mill having blades brought back (This machine is the subject-matter of another patent application of the applicants.) After milling the ingots whose temperature owing to the rapidity of the system, has not gone down during the work below 700°–850°, are put in cell *b* with the aforesaid crane and here brought up to the temperature required for the following rolling in the bloom roller D. Furnace A is a gas furnace, usually of a gas generator or of a blast furnace, in which cell *b* only is heated with gas burners and hot air, whereas cell *a* is heated solely by exhaust gas of cell *b* of which the temperature is more than sufficient for the purpose.

Advantages of the system.

The advantages of this system are evident:

1. The slow cooling now required in the ingots after they are taken from the moulds is avoided and with this the danger of cracks.

2. There are no more stops in the stage of transformation and the cycle is made much quicker.

3. No ash houses or covered pits for cooling, or bridge cranes for service of the same are required. The operations are fully simplified.

4. A large part of the smelting calories is utilised with considerable saving of fuel.

5. The preheating stage is completely done away with in bringing the ingots up to the rolling temperature, because they are taken from the moulds when they are still red and put in cell *a* which acts as a feed bag for the milling machine, and which is kept hot without wasting heat, solely by the exhaust gases of cell *b*.

6. The heat milling machine could not be simpler than it is. Neither special cams nor complicated movements are required, since it works with a simple movement of rotation of the cutter and copies the ingot in its primary form by means of shaped blades brought back.

7. The production is increased enormously in comparison with cold milling. As a matter of fact at the temperature of about 850° the resistance of the steel is lessened to such an extent that the cutting speed as well as the feeds can be multiplied on a large scale.

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