W. J. COCHRAN.

Annealing Car Wheels.

No. 83,605. Patented Nov. 3, 1868.

Fig. 1.

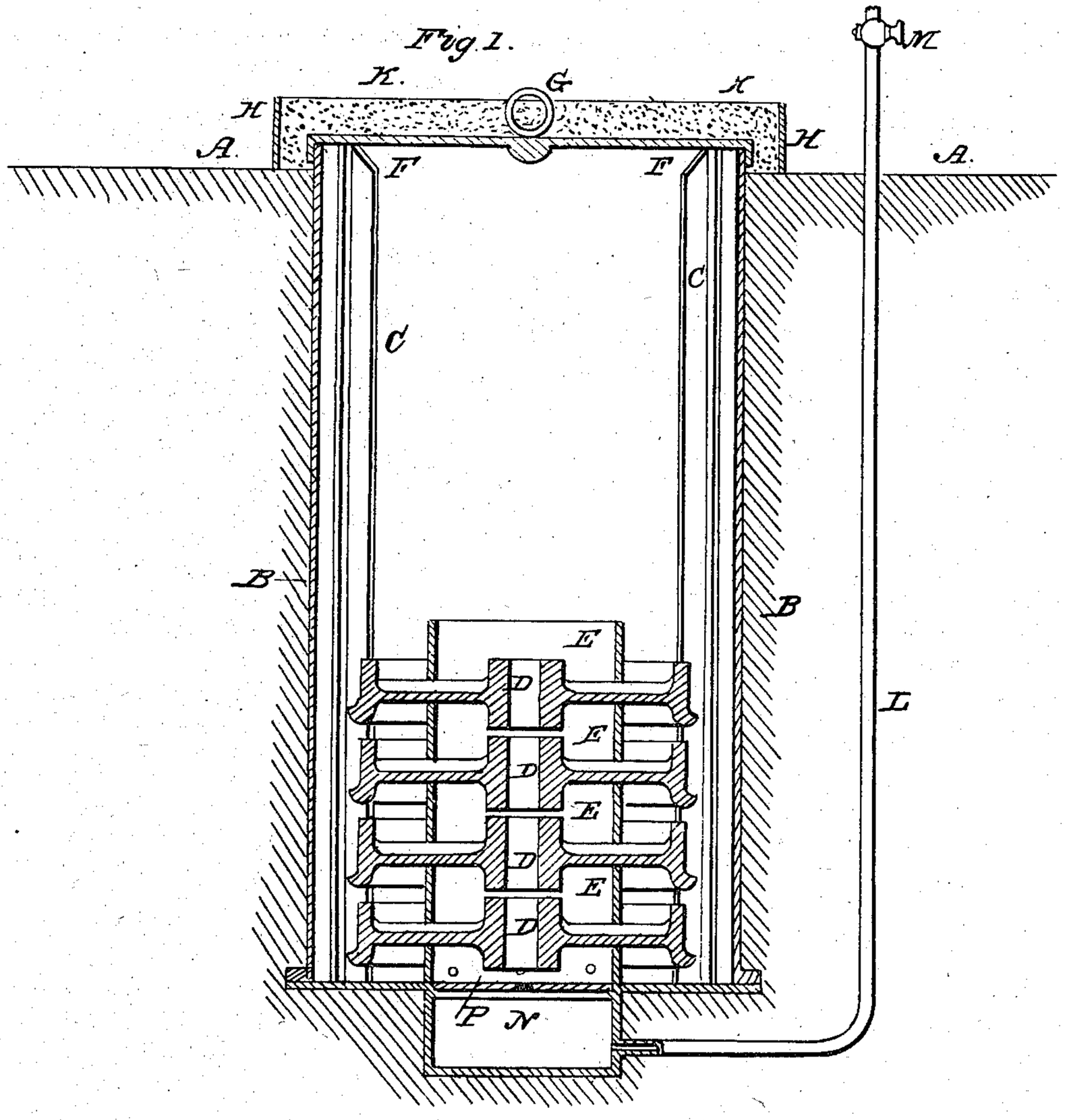
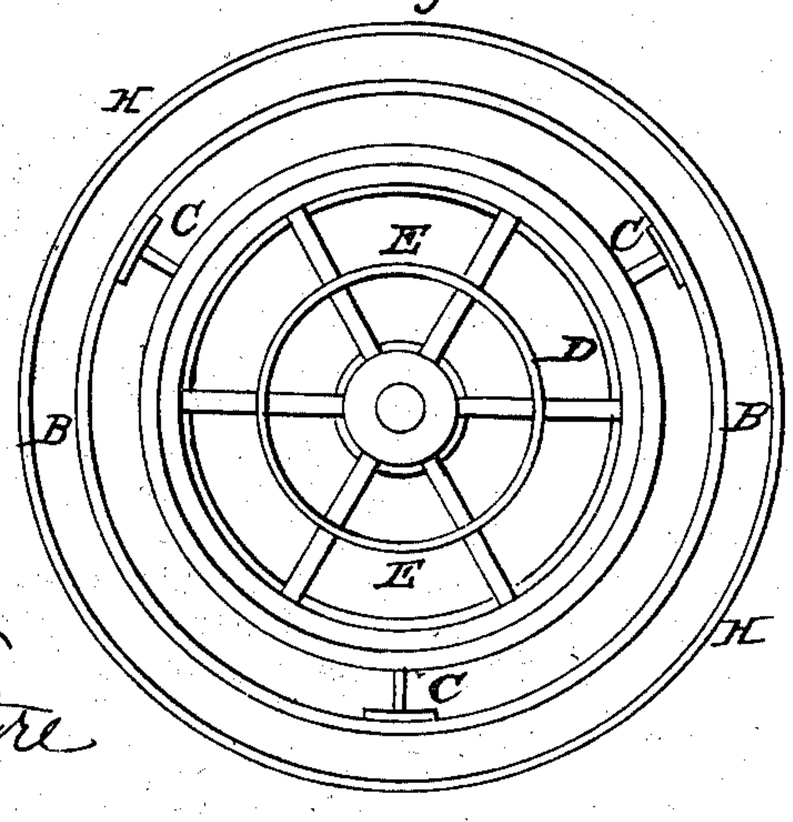


Fig. 2



Witnesses

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IMPROVED ANNEALING-PIT FOR ANNEALING CAR-WHEELS.

Specification forming part of Letters Patent No. **83,605**, dated November 3, 1868.

To all whom it may concern:

Be it known that I, WILLIAM J. COCHRAN, of the city and county of Baltimore, and State of Maryland, have invented certain new and useful Improvements in the Pits or Chambers for Cooling or Annealing Railroad-Car-Wheel Castings, by means of which improvements unequal shrinkage in such castings is completely prevented; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the figures and letters marked thereon, and in which—

Figure 1 is a vertical section through the axis of the cooling-pit, and Fig. 2 a top view of the same.

In both figures the same parts are indicated by the same letters.

The deterioration in the strength of iron castings from unequal cooling and shrinkage—that is, from the cooling of the thin parts of the casting previous to the cooling of the thick parts of it—arises from the peculiar strains that are thrown upon the different parts of the casting by such unequal cooling. Those parts that cool first endeavor by their contraction to pull from or sever their connection with the hotter portions, thus producing not only incipient fracture at or near the line of junction of such thin and thick parts, but an enlargement also of the thinner portions of the casting by the consequent dragging out of the particles.

In railroad-wheels the central plate or disk, being the thinnest part of the casting, is the first to cool, and in so doing it pulls from the rim, causing a partial separation or dragging out of the particles of the iron or stretching of the substance, thereby making an incipient fracture at or near the line of junction within the rim, and in like manner the cooling of the hub causes it to pull from the central plate, thus making an incipient fracture at the line of junction around the hub. These strains give a permanent enlargement to the central plate of the wheel by the dragging out or partial separation of the particles of the iron, which enlargement of the central portion of the wheel in the next place resists the proper contraction of the rim which surrounds it, and thereby causes a number of incipient radial fractures to be formed in it or to be greatly and injuriously strained by its shrinkage on the central plate. The effect of these strains upon the wheel is to cause the rim, and also the junction between the hub and the central plate, to become very brittle from the disturbance or dislocation of the particles by the stretching of the metal, and therefore very liable to fracture; and it sometimes happens that such wheels will burst from these causes alone before leaving the foundry in which they were cast. To obviate these well-known evils a great variety of forms have been devised, so as to give that portion of the wheel which is between the rim and the hub some flexibility, in order that it might thereby compensate for the unequal cooling or contraction of the several parts, and in this manner a small advantage has been realized, inasmuch as some of these wheels will outlast others of more rigid construction that were cast from the same mixture of metal; but upon experimentally testing the ability to resist fracture in the best of such wheels it is found that they all come far short of the degree of strength which is due to the quantity and quality of the iron of which they were respectively composed. The form of the wheel proving an inadequate remedy for the evils of shrinkage, the annealing of the whole wheel has been resorted to as a means of equalizing the tension of all its parts; but as heretofore practised the evil consequences of unequal shrinkage have been inflicted upon the casting to a greater or lesser extent before being submitted to the annealing process. By my improvements and mode of treatment, however, this evil is effectually prevented by causing the wheel to cool slowly and equally in all its parts from the moment the casting is set in the mold till it may be handled with impunity, and the great heat of the casting in the first instance being long continued, the iron is thereby annealed and rendered very tough. Thus the common single-plate railroad-wheel, although it is one of the weakest products of the foundry if allowed to cool in the ordinary way, is made by my mode of treatment to possess the greatest possible strength that is due to the substance of the metal, while at the same time the cost of its manufacture is not increased.

The nature and object of my invention are accordingly to combine such improvements

with the common cooling-pit as will in the first place facilitate the handling and placing of the wheels in proper position within the pit at the greatest possible heat at which they can be moved after being cast; and, secondly, to cause the wheels to cool slowly and equally in all their parts and in all parts of the pit.

To enable others skilled in the art to make and use my invention, I will proceed to describe the same, and also the process or treatment by which the casting is made to shrink equally in all its parts.

I construct a cylindrical chamber or pit, below the level of the molding-floor A A, of masonry or of plate or cast iron, as shown at B B, allowing the top edge to project about one inch above the floor, for a purpose which will be presently explained. This chamber is some three or four inches larger in the clear than the diameter of the flange of the proposed wheels, and within it, at equal distances apart, I attach to it three vertical guide-strips, C C C, which have respectively sufficient projection to keep the wheels in the center of the pit as they are deposited within it. The pit should also have sufficient depth or capacity to hold about ten wheels, placed flatwise over each other at a little distance apart, as shown at D D D, for which purpose the spacers E E E are placed between them. These spacers are cast-iron rings having notches in the edge to clear the arms of the wheel, so that the bearing shall be upon the plates of the wheels only, and they should be of such diameter as would about equally divide the weight of the wheel, so that the portion of the wheel within the spacer may serve as a counterbalance to the exterior portion, the object being to insure such position to each wheel within the pit that it shall not be submitted to any strain that could alter its shape, as these castings are liable to warp if not properly bedded, owing to the great heat at which they are put into the pit. On the pit being filled with the newly-cast wheels it is immediately closed by placing upon it the iron top plate or cope, F F, for the convenience of handling which it is furnished with a staple or eye, G. Dry sand is spread over the plate to a depth of three or four inches, and to prevent the spreading of this sand over the floor I place upon the floor, around the top plate, F F, the portable ring H H, which I call the "cope-ring," and which should be about five inches greater diameter than the top plate. The covering sand being thus retained, as shown at K K, the pit is thereby hermetically sealed at top, for if the sand were not secured in this manner the heated air and gases would blow out at the top joint, and thus seriously impair the action of the pit, as the heat would soon be dissipated if allowed to escape at the top of the pit.

To relieve the pressure within the pit, and at the same time retain as much of the heat as possible, I attach to the lower part of the pit the vent-tube L, which rises above the floor A A, or may be conveyed to any convenient place. This tube is furnished with a stop-cock, M, so as to close the vent when the pressure is relieved. Sometimes I make these pits with a sub-chamber or air-space, N, below the bottom plate, P, of the pit, and communicating with the pit by means of one or more small holes passing through the said bottom plate.

By this construction and arrangement the heat and gases evolved from the mass of incandescent metal within the pit are made to pass downward into the sub-chamber N, and from thence outward by the vent-tube L, which may be closed by the stop-cock when the heated air and gases cease to escape with force, thereby causing the heat to be the same in all parts of the pit, and consequently all the wheels within the pit will be equally annealed and tempered in all their parts, as I have experimentally ascertained; and I have also experimentally ascertained that in those pits which are not vented from the bottom the wheels in the bottom of such pits are not as well annealed and tempered as those at the top, and that such bottom wheels have not more than half the strength of the top wheels of such pits. The wheel-molds being poured with iron at a proper degree of heat, the wheels can be lifted from the sand and placed within the pit in about five minutes after being cast. I usually cast ten wheels from a vessel holding sufficient metal for this purpose, lift them from the molds, place them in the pit, and cover them with the top plate and sand in eight minutes, taking up the wheels in the same order in which they are cast. The pit and contents should then remain undisturbed for about four days, in which time the wheels will be sufficiently cooled to be removed with safety.

It is of the utmost importance that the wheels should be got into the pit and covered up before shrinkage commences, for, the wheels being closed up at that high heat within a chamber from which radiation or escape of the heat is very slow, all the parts of such wheels immediately acquire the same degree of heat, and as the heat diminishes it passes from every portion of them alike, thus causing all the parts of such wheels to shrink uniformly while cooling without being influenced in any way by the thickness or thinness of such parts, thereby retaining the particles of the metal in their normal position in the casting, and consequently in the full exercise of their cohesive attraction or tensile strength, and not only have such wheels the greatest possible strength, due to the metal of which they are composed, but the long-continued action of the high heat at which they are placed in the pit has the effect of greatly toughening the metal, thus permitting the use of a large quantity of wheel-scrap in the mixture, and thereby reducing the cost of production, especially in those localities where such scrap is not required for other purposes; wheels thus treated containing sixty or seventy per cent. of such scrap being found equal to those made from mixtures of the best pig metal; and although

such wheels, if cooled in the mold, are liable to fly apart, (and have actually done so from the derangement of the particles of the metal by unequal shrinkage,) yet the same form of wheel and mixture of metal, when cooled in my improved pit, has required three hundred and fifteen blows of twenty-two pound sledges, plied with full swing by two men of over average strength, to merely punch a hole through the central plate between the arms without cracking either the arms or rim, showing that such wheels can be used with perfect safety under all conditions and for all purposes of railroad travel or transportation.

I do not claim the cooling of wheels in pits or chambers, as that has long been practiced; but such pits or chambers were not arranged or fitted like mine, being either open at top or connecting by means of a flue with a chimney, and being destitute of the means by which the wheels may be accurately and expeditiously arranged within such pits. The thin parts of the wheels were injuriously cooled before that could be accomplished; and such pits being vented at the top, any benefit that might be derived from their use was confined to the top wheels only. Such pits or chambers could not produce the same effects upon the castings which are obtained by my improvements, these being so arranged as to permit the greatest possible expedition in securing the newly-cast wheels within the pit; and whereas in the common pits the wheels are usually piled in upon each other without system or order, in my pits they are placed in such a manner that they cannot be subjected to any strain or change of form, either from their individual weight or from the aggregated weight of those that may be placed upon them, which is particularly important, for to secure the full benefit of the pit the wheels must be placed within it in an almost semi-plastic condition, the heat being such that they would yield by their own weight to any unevenness in the bearing upon which they may be placed, which is effectually prevented by their being truly placed and bedded upon each other by means of the guide-strips and spacers; and being hermetically inclosed at the high heat described with a covering that prevents the escape of the heat in an upward direction it is retained within the pit till the iron of the wheels is thoroughly tempered, and as the cooling of the inclosed castings proceeds slowly and uniformly in all their parts, unequal shrinkage is effectually prevented and the greatest possible strength due to the quality of the metal secured to the casting.

Having thus described the nature, construction, and operation of my improvements in pits or chambers for cooling or annealing wheel-castings, what I claim therein as my own invention, and desire to secure by Letters Patent, is—

1. The cooling or annealing pit herein described with a top covering and bottom vent, arranged for the purpose set forth.

2. The arrangement of the cope-ring with the top plate, substantially as described.

3. The cooling or annealing pit, in combination with the guide-strips, or their equivalents, arranged and operating substantially as described.

WM. J. COCHRAN.

Witnesses:
JOHN COCHRANE,
JOHN MCINTYRE.