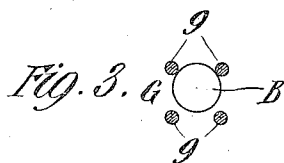
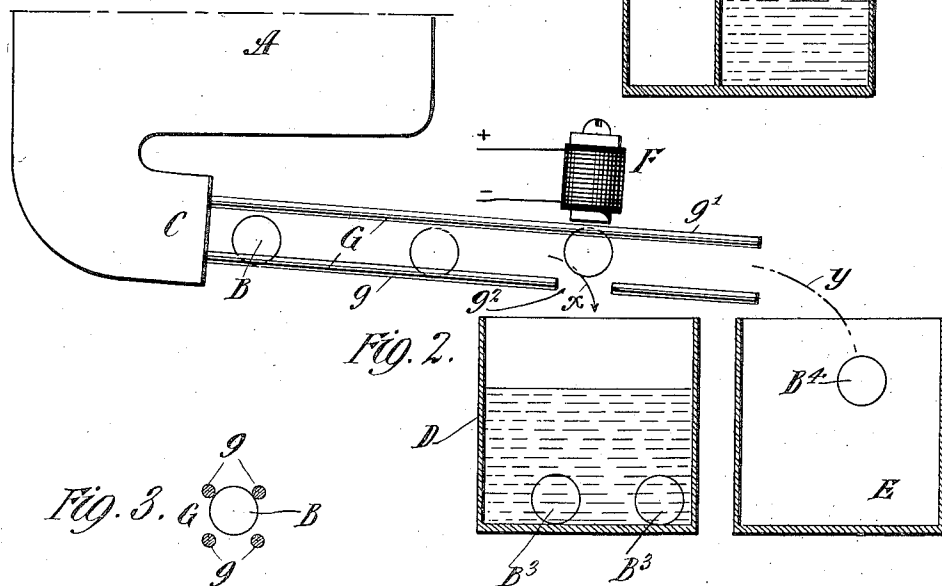
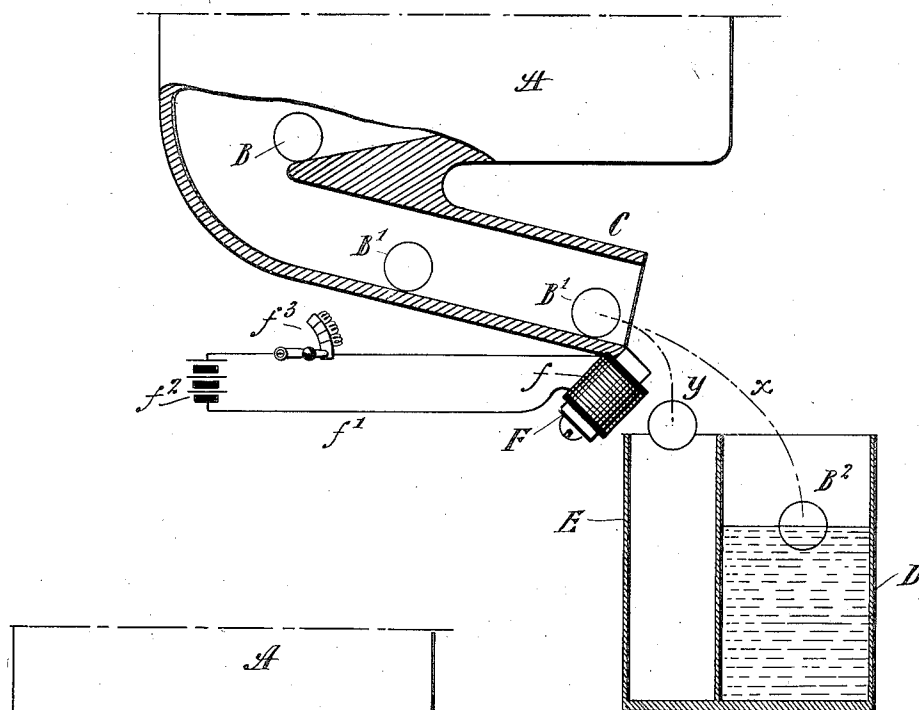


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METHOD OF AND APPARATUS FOR TEMPERING IRON AND STEEL ARTICLES.
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Fig. 1.



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METHOD OF AND APPARATUS FOR TEMPERING IRON AND STEEL ARTICLES.

1,103,358.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HENRY HESS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Methods of and Apparatus for Tempering Iron and Steel Articles, of which the following is a specification, reference being had therein to the accompanying drawing.

The present invention relates to method of and apparatus for tempering iron and steel articles of various kinds, for example, steel balls which have to be hardened for use in ball bearings and other well known uses.

As is well known there is a certain temperature at which iron and steel articles when heated will substantially lose their entire magnetic qualities; and it is true that this temperature, which may be termed the critical temperature, is for many purposes the proper temperature for heating iron and steel articles for hardening or tempering purposes, the heated article being thereafter quenched in water or other quenching medium.

It is an object of the present invention to take advantage of these facts to enable the employment of a magnet or magnetic force for controlling tempering operations and thereby avoiding the improper heating of the articles and securing uniformity in temper.

Other objects hereof will appear in the following description.

The present invention consists in the novel process and novel apparatus hereinafter described, and it contemplates the suitable heating of the articles to be tempered by a furnace, open flame or other heating means, afterward quenching the heated articles by a suitable water bath or other quenching means, and employing magnetic force acting upon the improperly or insufficiently heated articles so as to prevent them from being quenched, by constraining them either from leaving the place of heating or from entering the place of quenching.

Further and more specific features contemplated in the present invention will be more fully described; and so far as the features hereof are novel, they will be set forth in the claims.

There will now be described a method and one or more forms of apparatus embody-

ing and illustrating the principles of the present invention.

In the accompanying drawings, Figure 1 represents one illustrative form or embodiment of the apparatus contemplated in the present invention and capable of carrying out the process hereof. Fig. 2 represents a different form of embodiment. Fig. 3 is a detail of a part of Fig. 2 consisting of a transverse section, beneath the magnet, of the run-way.

A convenient manner of carrying out the method invention hereof consists in heating the balls or other articles in the furnace or by other means, and causing each of them normally to travel by a given route to the quenching bath or place where the quenching occurs, there being another possible route which the article can be caused to take if it be insufficiently heated, by the influence of a magnetic force serving to divert the ball from the normal route to the last mentioned route so that such insufficiently heated balls may pass to a place or receptacle other than the quenching bath and be returned to the furnace to be further heated. The magnetic force will be opposed by some other constant force, such as the action of gravity on the balls, or the action of any convenient mechanical device.

An apparatus for carrying out the method invention hereof and embodying the apparatus invention is illustrated in the drawings.

A source of heat will be understood and any suitable heating means may be employed whether a blow pipe, furnace or other means, and for convenience a portion A of a furnace or the like is indicated as representing a means of heating the balls or other articles to be tempered. The manner in which the balls are held or arranged within the furnace is immaterial, but it is preferred that the articles shall be caused to pass or travel gradually through the furnace while being heated, in a manner analogous to that of the so-called continuous furnace.

While cylinders or other articles might be treated in the described apparatus, it is shown as employed for the tempering of balls B, B¹, B², etc., these being bodies which are adapted to travel or pass from the furnace by the force of gravity. The exit C which may be termed the furnace mouth is properly arranged to permit the egress of

the successive balls after they have become heated to the approximate temperature required.

Referring more particularly to the embodiment in Fig. 1, the exit C will be seen to constitute a support or run-way affording a portion of the path or route of the balls from the heating place (in the furnace) to the quenching place or vessel D containing water. A portion of the path of the ball from the furnace to the water is through the air as indicated by the dotted line x . It will be understood that the momentum of each ball when it is unconstrained will carry it forward so as to fall beyond the termination of the runway C, and the quenching bath D is so located as to receive the balls which in their normal unconstrained operation travel along the path x . As some of the balls may be insufficiently or improperly heated, and therefore not in a condition to be quenched, it is desired to segregate them from the properly heated balls. To this end another route is provided including the runway C and including also a path y through the air sufficiently removed from the path x to enable a separate receptacle E to be located to receive the improperly heated balls. Each ball leaving the furnace will travel on one of the two routes, x or y , and as stated normally each ball being unconstrained would take route x and pass to the quenching bath. In order to cause insufficiently heated balls to take route y this invention contemplates the employment of magnetic force which constrains each ball, in this instance by exerting an attraction upon it so as to divert it from path x to substantially path y .

As representative of means which may be employed to exert magnetic force, a magnet F is shown, and this for convenience is indicated as an electro-magnet having a coil f of wire around the core and a circuit f' extending to a source of electricity f^2 and a rheostat or controller f^3 for properly regulating the strength of the current so that the diversion of the balls will take place to the desired degree.

The operation of the apparatus above described may be as follows: The balls B passing preferably one at a time out of the furnace A, roll down the runway C, as indicated at B', B'. Assuming a ball to have been heated to the proper temperature, it will have lost its magnetic qualities as previously explained, and the presence of the magnet cannot have any effect upon it, so that undiverted it will pass by its momentum along the route marked x so as to fall in the water of the quenching bath, as seen at B². Insufficiently heated balls, however, not having lost their magnetic qualities will be diverted by the magnet F and pulled out of the normal path into the path y so as to

fall in the receptacle E which is not a quenching bath but which may either hold the balls or allow them to pass to a suitable place from whence they may be returned to the furnace to be re-heated. In this way any given article which is insufficiently heated on one operation will not be quenched but will be passed again through the furnace until finally when it has become properly heated it will on the next operation pass to the quenching bath; so that entire uniformity in temperature and in tempering results is attained.

Referring now to the embodiment of Fig. 2, a run-way G is seen exterior to the furnace mouth and along which the heated balls pass on their way either to the quenching bath or to such receptacle as will enable them to be returned for re-heating. This run-way, while its construction might be varied, is shown as consisting of lower supporting means or wires g and upper supporting means or wires g' , within which lower and upper supporting means the ball B passes. A break is indicated at g^2 in the run-way G, it being of such size and nature as to admit a ball dropping from the run-way, and directly therebeneath is located the quenching tank D, so that normally the path of a heated ball will be from the furnace along the run-way members g as far as the break g^2 and therethrough into the quenching bath, as indicated at B². An arrow x is for convenience placed on this drawing to show the normal route of a properly heated ball, corresponding to the route x of Fig. 1.

In the embodiment of Fig. 2 the magnet F is differently placed, namely closely adjacent to the upper members g' of the run-way G, and directly or nearly directly above the break or aperture g^2 . A insufficiently heated ball would be attracted by the magnet and, as it were, lifted over the aperture g^2 and allowed to pass along the path marked y , whence at the end of the run-way it will drop into a receptacle E as indicated by the ball B⁴.

The operation of this device may be as follows. The successive balls rolling out of the furnace and along the run-way G will normally be non-magnetic and will consequently drop through the aperture g^2 into the quenching tank; but on the contrary if insufficiently heated the magnet F will exert an attraction so as to divert the ball from the path x , namely so as to roll along the upper support g' of the run-way as indicated in Fig. 3, rather than along the lower support. This enables the ball to bridge over the aperture g^2 and to reach the lower run-way portion beyond said aperture before being released from the attraction of the magnet with the consequence that the ball in its further movement passes to the

end of the run-way and by the path *γ* drops into the receptacle E whence as before explained, it may be restored to the furnace for reheating.

It will be understood from the hereinabove description that the magnet, that is to say the magnetic force, is in a broad sense to be located at any point short of the quenching place, in the article's normal route from heating place to quenching place; while in a narrower sense there is a forked path or route for each article with the magnet located at the fork to divert the article to the abnormal from the normal path of travel.

It will have been understood from the specification that the process and apparatus hereof are in principle not limited to the particular details described and set forth, but that on the contrary the same may be indefinitely varied; and no limitations to the invention are intended except such as are set forth in the appended claims.

What I claim and desire to secure by Letters Patent is:

1. The method of tempering iron and steel articles consisting in heating the articles and causing each of them to normally travel one of two routes and employing magnetic force to selectively divert to the other route the improperly heated articles, quenching the articles taking the first route, and treating the articles taking the latter route by further heating, travel selection and quenching.

2. The method of tempering iron and steel articles consisting in heating the articles while giving them mechanical support in heating location, and causing each article to normally travel from heating to quenching location, and employing magnetic force to selectively prevent each improperly heated article from traveling to quenching location.

3. The method of tempering iron and steel spheres consisting in heating the spheres while giving them mechanical support in heating location, and causing each sphere to normally roll along a runway from heating to quenching location, and employing magnetic force to selectively prevent each improperly heated sphere from traveling to quenching location.

4. The method of tempering iron and steel spheres consisting in heating the spheres while giving them mechanical support in heating location, and causing each sphere to normally roll along a runway from heating to quenching location, and employing magnetic force to selectively prevent each improperly heated sphere from traveling to quenching location by diverting it during its travel from heating to quenching location.

5. An apparatus for tempering iron and steel articles comprising in combination, a means for raising the articles to a high temperature, means for mechanically support-

ing the articles during heating and permitting them to travel normally to a quenching means after heating, a quenching means, and a magnet arranged and located to act selectively upon the articles to prevent improperly heated articles from traveling to said quenching means.

6. An apparatus for tempering iron and steel spheres comprising in combination, a means for raising the spheres to a high temperature, means for mechanically supporting the spheres during heating, a runway along which the heated spheres may roll normally to a quenching means, a quenching means, and a magnet arranged and located to act selectively upon the spheres to prevent improperly heated spheres from traveling to said quenching means.

7. An apparatus for tempering iron and steel spheres comprising, in combination, a means for raising the spheres to a high temperature, means for mechanically supporting the spheres during heating, a runway along which the heated spheres may roll normally to a quenching means, a quenching means, and a magnet arranged and located to act selectively upon the spheres to prevent improperly heated spheres from traveling to said quenching means by diverting them during their travel from heating to quenching location.

8. An apparatus for tempering iron and steel articles comprising, in combination, a means for raising the articles to a high temperature, a quenching means, a support along which the articles may pass from the place of heating toward the quencher, and a magnet located intermediate the heating place and quencher for selectively controlling the articles by constraining insufficiently heated articles from passing to the quencher.

9. An apparatus for tempering iron and steel articles comprising, in combination, a means for raising the articles to a high temperature, a quenching means, a support along which the articles may pass from the place of heating toward the quencher, and a magnet located intermediate the heating place and quencher for selectively controlling the articles by constraining insufficiently heated articles from passing to the quencher by diverting them to a place other than the quencher.

10. An apparatus for tempering iron and steel articles comprising, in combination, a means for raising the articles to a high temperature, a quenching means, a support or run-way arranged to afford alternate paths of travel whereby the articles may normally pass along one path to the quencher, and a magnet adapted to selectively control the articles by diverting insufficiently heated articles to the other path.

11. An apparatus for tempering iron and steel articles comprising, in combination, a

means for raising the articles to a high temperature, a quenching means, a support or run-way along which the articles may pass from the heating place to issue therefrom
5 and pass by gravity to the quencher, and a magnet adapted to selectively control the articles located to divert insufficiently heated articles to a receptacle other than the
10 quencher.

12. An apparatus for tempering iron and steel articles comprising, in combination, a means for heating the articles, a quenching means, a support or run-way having a gap

or aperture through which heated articles may pass to the quencher, and a magnet 15 located opposite said gap or aperture for causing the insufficiently heated articles to travel past the same so as to divert them to a receptacle other than the quencher.

In testimony whereof I affix my signature 20 in presence of two witnesses.

HENRY HESS.

Witnesses:

MARY M'CALLA,
NETTIE L. HAHN.