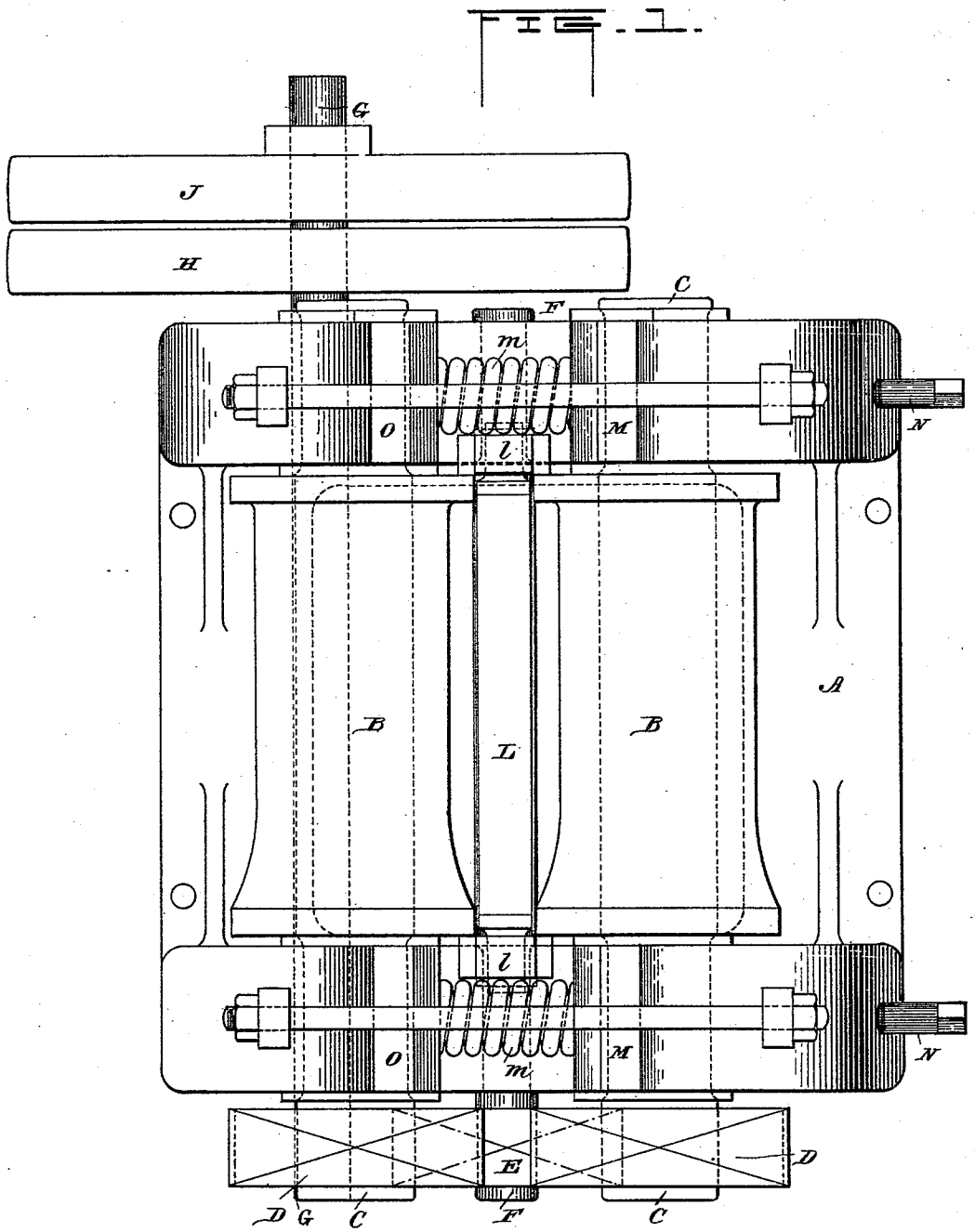
(No Model.) 2 Sheets—Sheet 1.

R. A. HADFIELD.

PROCESS OF MANUFACTURING SHELLS.

No. 458,165. Patented Aug. 25, 1891.



WITNESSES

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FIG. 2.

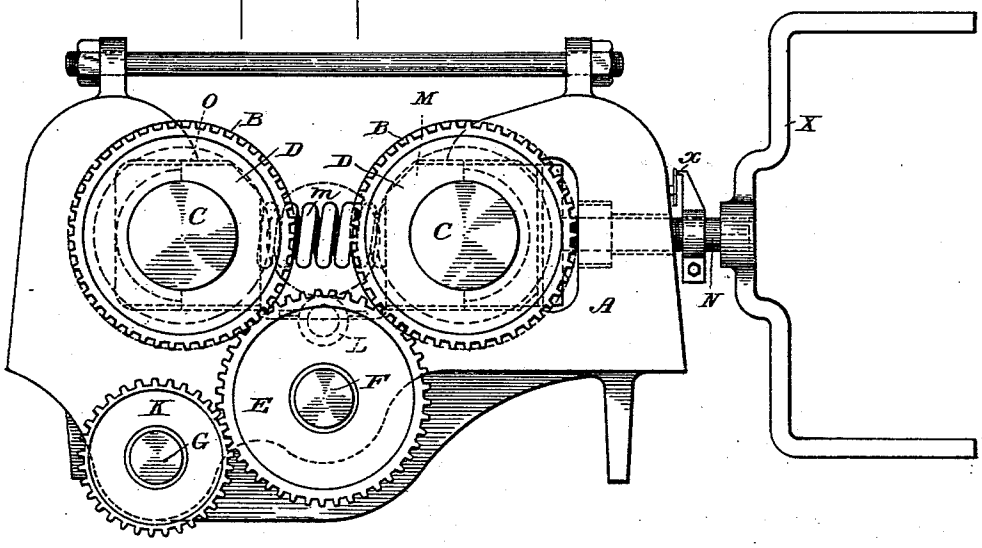
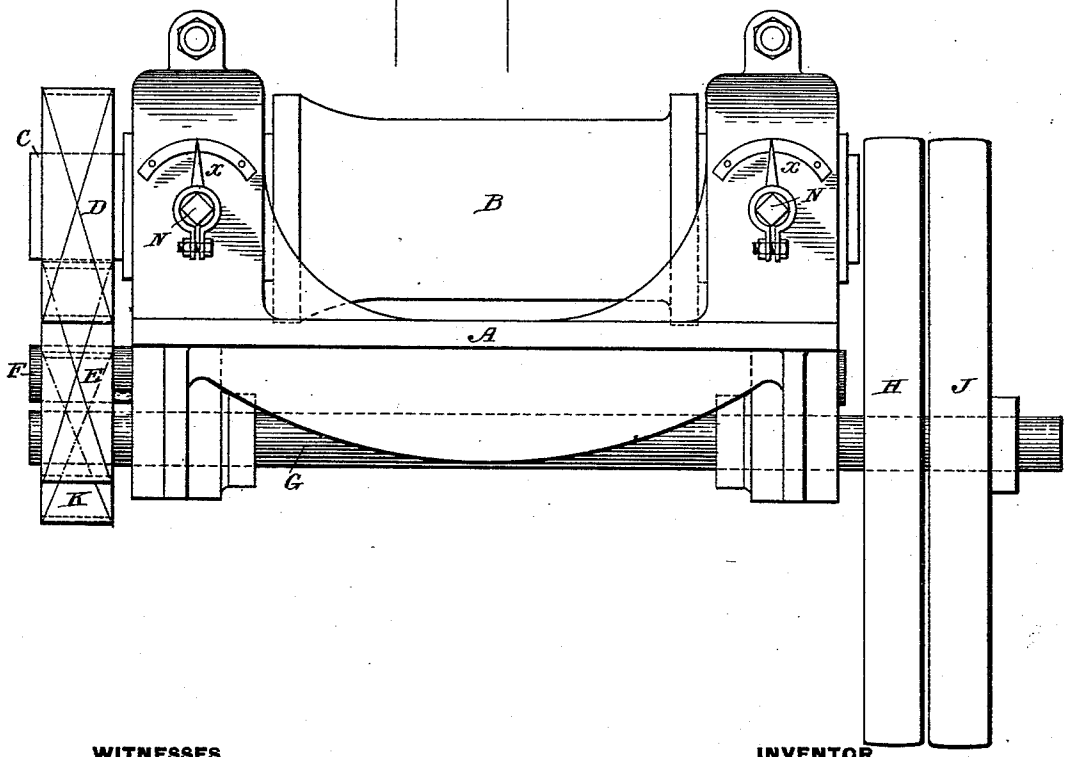


FIG. 3.



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UNITED STATES PATENT OFFICE.

ROBERT A. HADFIELD, OF SHEFFIELD, ENGLAND.

PROCESS OF MANUFACTURING SHELLS.

SPECIFICATION forming part of Letters Patent No. 458,165, dated August 25, 1891.

Application filed February 11, 1890. Serial No. 340,066. (No model.) Patented in England December 18, 1888, No. 18,506.

To all whom it may concern:

Be it known that I, ROBERT A. HADFIELD, of Sheffield, in the county of York, England, have invented a new and useful Improvement in the Manufacture of Shells, &c., of which the following is a full, clear, and exact description.

This invention has for its object to greatly facilitate the manufacture of cast hollow steel and other cast-steel shells by entirely dispensing with the operations of grinding and turning, as heretofore practiced, and instead thereof mechanically reeling or rolling the same, thus effecting a considerable economy in time, labor, and expense. This I effect by casting a hollow steel or other shell and then placing it while hot between two rolls, a suitable bed being provided to support the shell during the operation, and reeling or rolling the shell between such rolls. These latter may be of any suitable form and dimensions and operated in any convenient manner, so that the shell operated upon may be either wholly or partially reeled or rolled, as desired.

In the accompanying drawings, Figure 1 is a plan view of a reeling or rolling machine constructed according to my invention. Fig. 2 is an end elevation, and Fig. 3 a front elevation, thereof.

To carry out my invention, I construct a machine which consists of a suitable frame A, whereon two rolls B are mounted. Such rolls are of surface form, corresponding to the form of the projectiles to be treated, and are each carried on a shaft C, fitted at one end with a spur-pinion D. These spur-pinions are driven by a central pinion E, which is keyed on a shaft F.

G, Fig. 3, is a shaft having fast and loose pulleys H J fitted at one end and a spur-pinion K at the other end. These fast and loose pulleys receive motion from any suitable motor, while the pinion K transfers such motion to the pinion E.

A convenient space is left between the rolls B wherein to place the shell, which is supported on a revolving roller L, carried in bearings *l*. When the shell has been placed upon the supporting-roller L between the rolls B, the latter are adjusted in position by means of sliding bearings M, which are regulated by screw-spindles N, furnished with handles X, Fig. 2, by which they are operated.

O are fixed bearings which carry the roller-shafts C. In order to facilitate the accurate adjustment of the rolls, suitable indicators or pointers X, Fig. 3, are fitted to the machine, which serve to assist the operator in accurately adjusting the same. Strong spiral springs *m*, Figs. 1 and 2, are fitted between the bearings M and O, by the operation of which springs the sliding bearings M are caused to return to their normal position when the screw-spindles are retracted. The rolls may correspond in size with each other, or they may be made of a different diameter, so as to vary the speed at which the shell is reeled or rolled.

The operation of the apparatus is as follows: After the steel shell has been cast in a mold it is placed while in a heated state between the rolls B B upon the roller L, and by means of the spindles N these rolls are moved against the interposed shell and by their rotation in contact therewith finish and polish it, reducing it accurately to proper dimensions and dispensing with the necessity for subsequent grinding and polishing. When the shell has been finished, the rolls are retracted and the shell removed.

I am aware of the following United States Letters Patent Nos. 365,980, 412,626, and 384,878, and Reissue No. 10,928, and do not claim what is therein shown and described.

The advantage of my invention is in the improved quality of the shells produced by its use. In making forged common shells they must be drawn of mild steel, the use of hard steel being impracticable on account of the impossibility of drawing the shells. To draw the steel easily, it must be so mild that these forged shells are liable to set up in the gun—a most serious defect. This is also apt to occur in the use of cast shells, which may be too soft. By use of my invention, however, I am enabled to produce a cast-steel shell with a fine, hard, and close grain on the surface to the depth of several millimeters, thus stiffening and hardening the exterior and preventing the setting up of the shell in the gun when fired. Such hard surface and fine grain is produced by the rolling process, and a shell of better quality than heretofore

known is made without necessity for the usual and expensive grinding and turning.

Having thus particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

In the art of making hollow steel projectiles, the improvement which consists in casting such projectile in substantially finished form in a mold, and then finishing and compacting its surface by axial rolling, substantially as described.

In testimony whereof I have hereunto set my hand this 27th day of December, A. D. 1889.

R. A. HADFIELD.

Witnesses:
S. ERNEST BRANSON,
FRANK M. CLARK.