(No Model.) 2 Sheets—Sheet 1.

H. A. HARVEY & C. S. CLARK.

STEEL DIE.

No. 327,262. Patented Sept. 29, 1885.

Fig. 1.

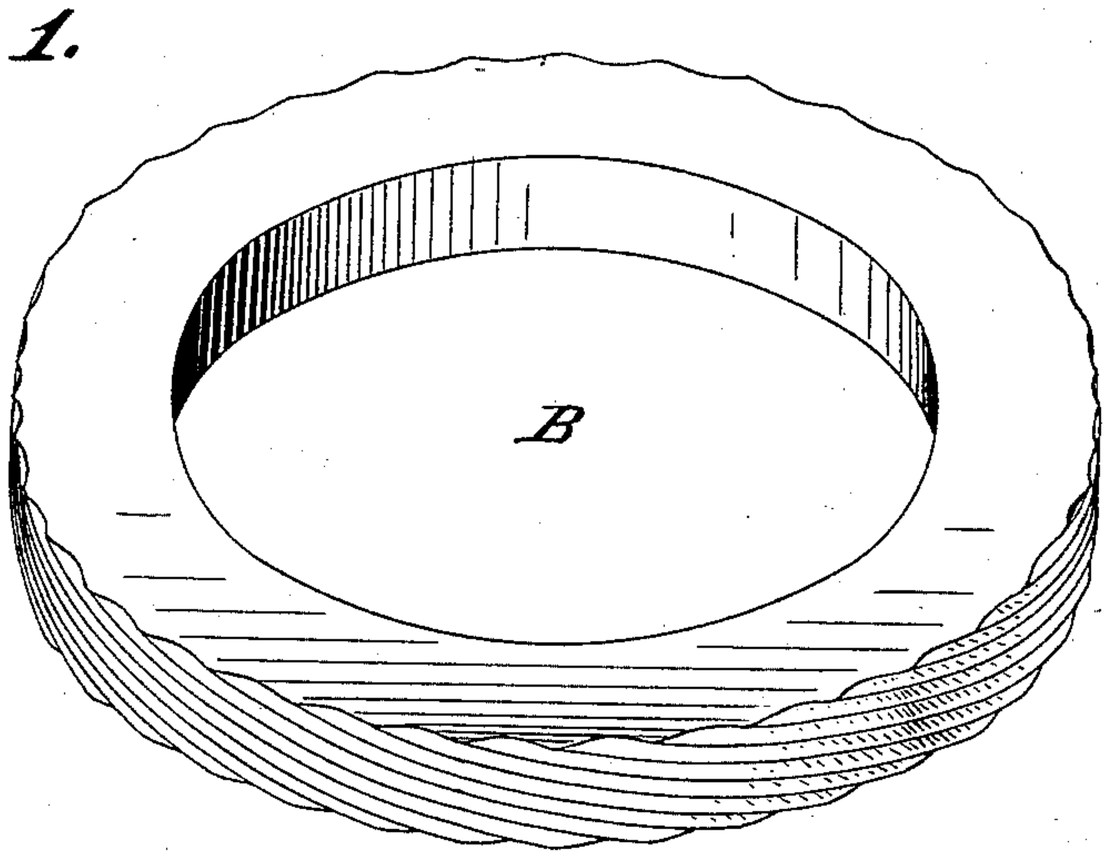


Fig. 2.

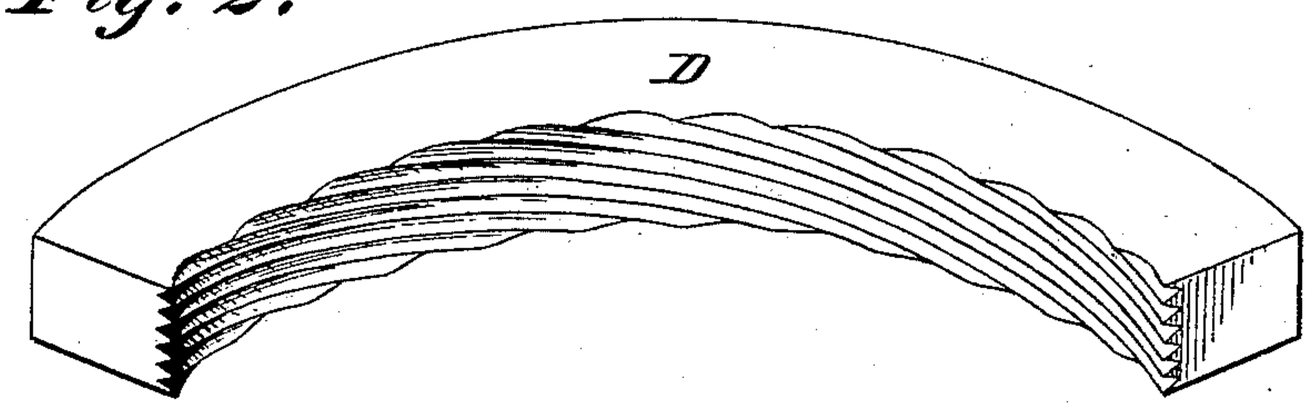
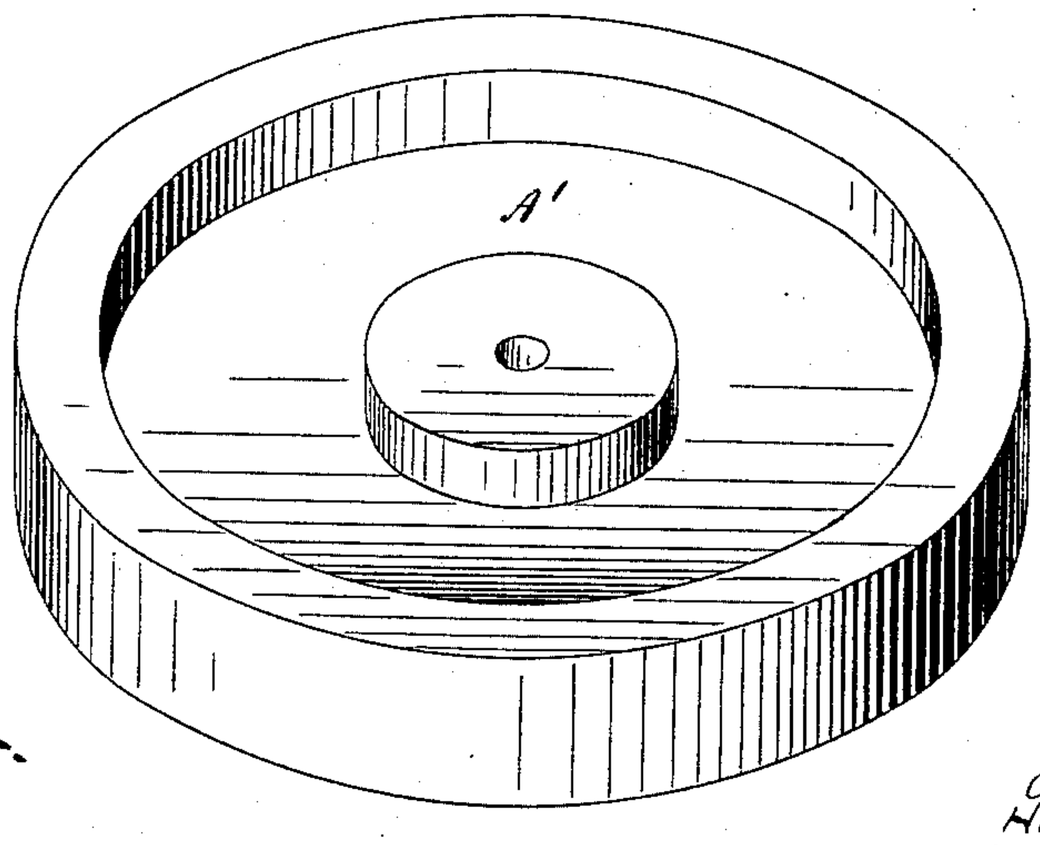


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

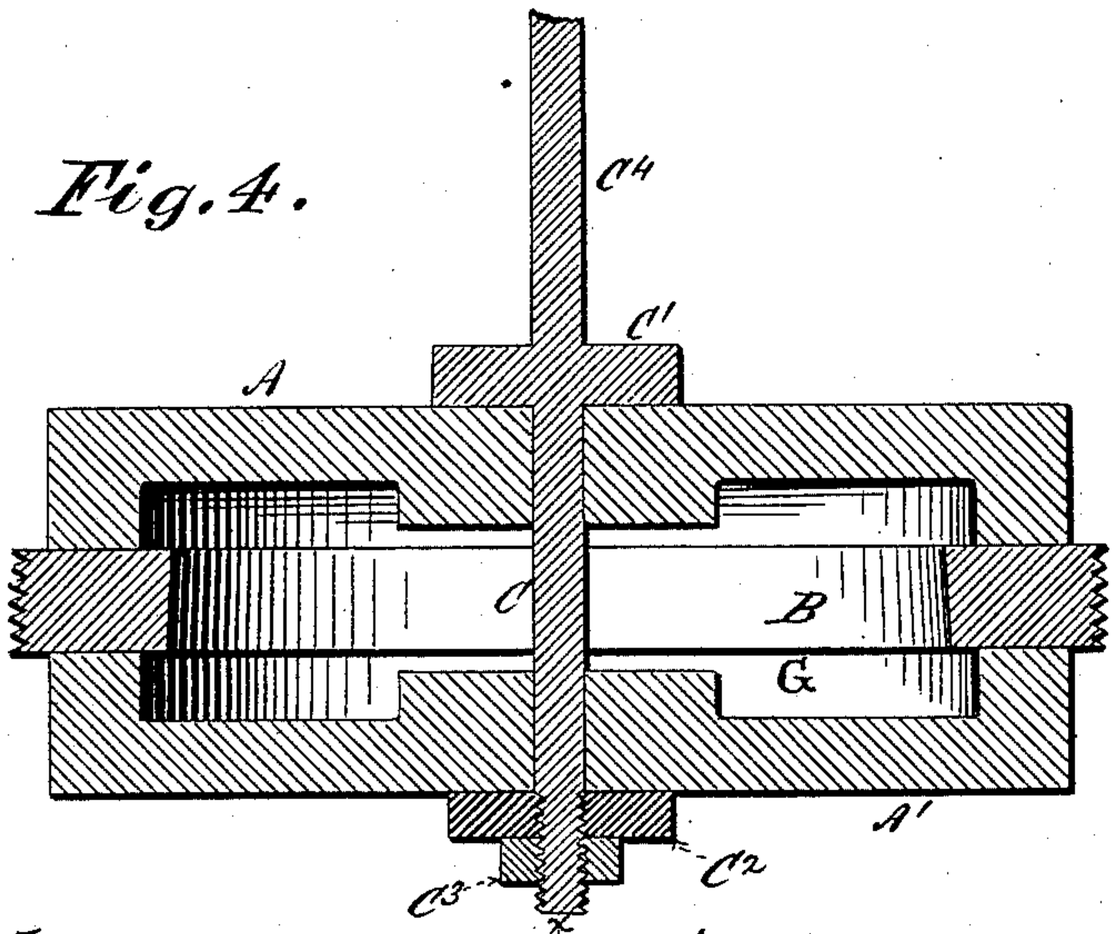


Fig. 5.

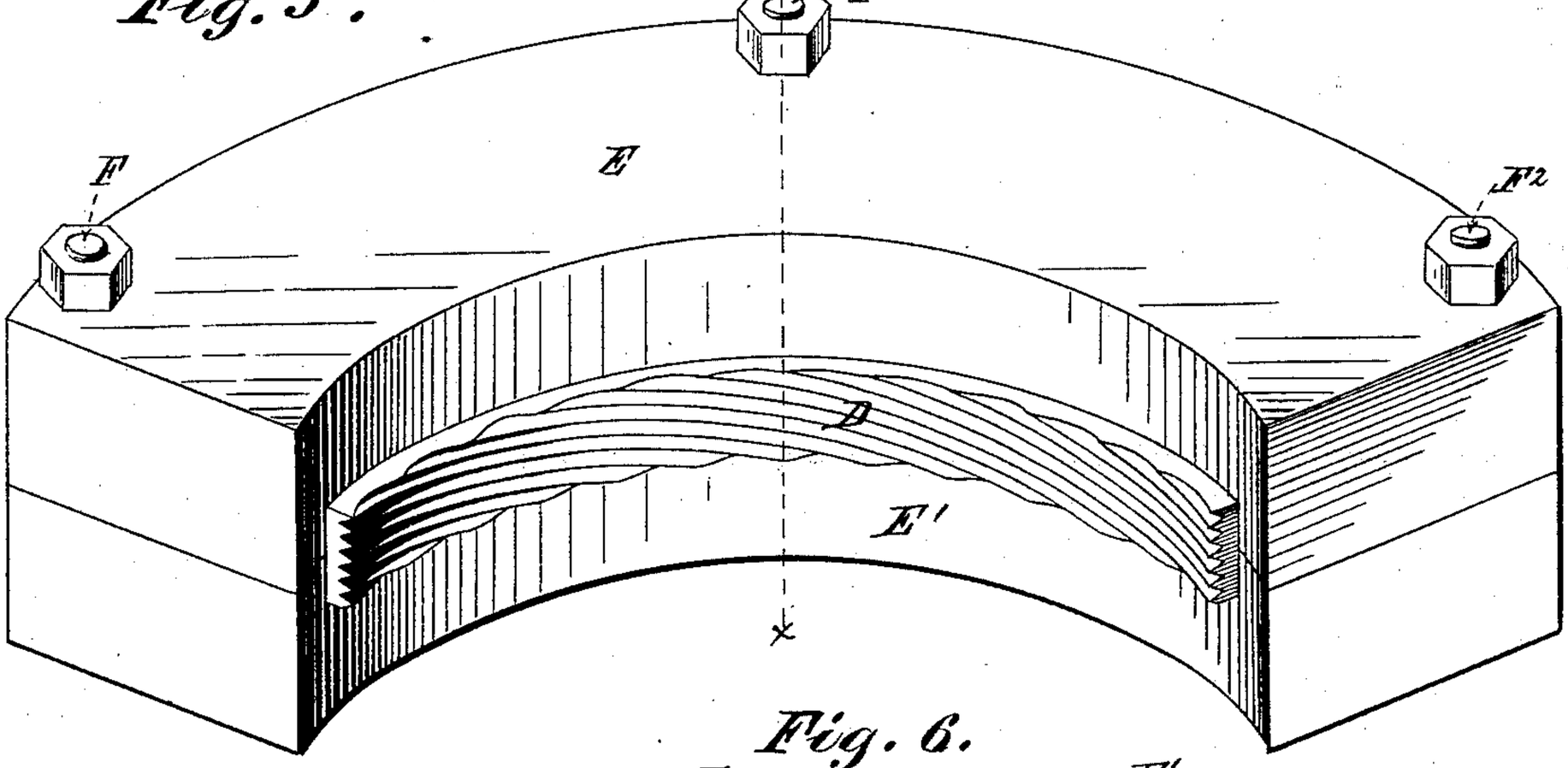
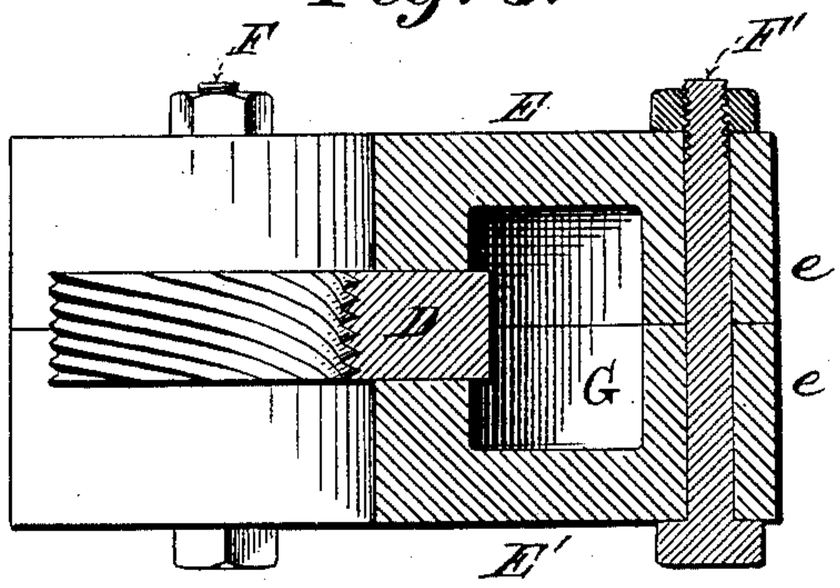


Fig. 6.



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UNITED STATES PATENT OFFICE.

HAYWARD A. HARVEY, OF ORANGE, NEW JERSEY, AND CHARLES S. CLARK, OF PROVIDENCE, RHODE ISLAND; SAID CLARK ASSIGNOR TO THE HARVEY SCREW AND BOLT COMPANY, OF CONNECTICUT.

STEEL DIE.

SPECIFICATION forming part of Letters Patent No. 327,262, dated September 29, 1885.

Application filed February 3, 1885. (No model.)

To all whom it may concern:

Be it known that we, HAYWARD A. HARVEY, of Orange, New Jersey, and CHARLES S. CLARK, of Providence, Rhode Island, have invented a certain Improvement in the Construction of Hardened Steel Dies having Curved Working-Faces, of which the following is a specification.

Our invention relates to the production of suitably-hardened steel dies having curved working-faces.

Our object is to harden a comparatively thin stratum of metal upon the working-face of the die without unduly hardening the metal composing the remainder of the die. To effect this object, in the case of a die in the form of a cylinder, we make such cylindrical die hollow, and thus give the die the form of a tube. We then apply to the opposite ends of such tube cheeks or disks of cast-iron or other suitable material, which are firmly bolted together, so as to confine the tube between them. We thus provide in the interior of the tubular die what, for convenience, we call an "annealing-chamber," and expose in position to acquire contact with the cooling-liquid only that portion of the die which we desire to harden—to wit, the stratum of metal upon its periphery. When a tubular die thus shielded is heated to the customary temperature, and with its shield is immersed bodily in water or other cooling-liquid, the exterior surface of the die, by reason of its direct contact with the water, is quickly chilled and hardened. The interior surface of the die, by reason of its protection from direct contact with the water, and its exposure only to the heated air or steam contained in the annealing-chamber, cools more slowly, and is thus hardened to a less degree. It is not necessary that the joint made between the protecting-shields and the ends of the tubular die be perfectly water-tight, as the leakage into the annealing-chamber of a small amount of water does no harm, because such water is instantly converted into steam, the pressure of which serves for the time being to prevent the entrance of any considerable quantity of water into the annealing-chamber.

If it should be desired to harden the interior or concave face of the tubular die only, the die would then be inclosed between the lips of a circular trough composed, for example, of two suitably-flanged rings bolted together, thus establishing the annealing-chamber upon the outside of the tubular die. Similarly, if the working-face of the die be the concave face of a segment of a hollow cylinder, such a segment would be inclosed between the lips of a segment of a circular trough.

It will thus be seen that there are two conditions necessary to the carrying out of our invention—first, the construction of the die in such form that the piece of steel of which it is composed is comparatively thin in a direction perpendicular to the working-face of the die, and, secondly, the protection or shielding of all that portion of the die which it is desired shall not be excessively hardened, so that such portion, instead of being exposed to direct contact with the cooling-fluid, is exposed to contact only with the hot air or hot air and steam contained in the annealing chamber or space between the inner walls of the shield-pieces and the protected part of the die.

The accompanying drawings illustrate the mode of applying our invention in the construction of the diagonally-ribbed rotating die and the similarly-ribbed stationary concave die employed in rolling screw-threads upon screw-blanks.

Our rotating die is made in the form of a hollow cylinder, and when finished and hardened is mounted upon a mandrel. Our concave die is made in the form of a segment of a hollow cylinder.

The drawings are as follows: Figure 1 is an isometrical perspective of our hollow cylindrical or tubular die. Fig. 2 is an isometrical perspective of our segmental concave die. Fig. 3 is an isometrical perspective of one of the flanged shields for the tubular die. Fig. 4 is a central axial section of the tubular die and of its shields bolted in place. Fig. 5 is an isometrical perspective of the segmental concave die with its shields bolted in place. Fig. 6 is a transverse section taken through the line *x x* on Fig. 5.

It will be understood that the shape and dimensions of the protecting-shields will in all cases be governed by the shape and dimensions of the object which is to be hardened. Thus the shields A A′ for the tubular die B are circular, and are of slightly less diameter than the outside diameter of the tubular die. The shields A A′, placed, respectively, against the opposite sides of the tubular die, are secured in position by the transverse bolt C, provided with a head or with the collar C′ and the tightening-nut C^2 and jam-nut C^3. Thus the entire convex working-face of the tubular die projects slightly from the shields in position to acquire direct contact with the cooling-liquid, in which, after being properly heated, the whole structure is immersed.

If desired, the bolt C may be provided with the elongation C^4, which will serve as a handle by which the die, when clamped between the shields, may be conveniently lifted.

The space within the tubular die and between the shields constitutes the annealing-chamber G.

The stationary curved die D is in the form of a segment of a hollow cylinder, and is confined between the opposite walls of a shield in the form of a suitably-curved trough composed of two parts, E E′, either or both of which may be provided upon their convex side with the transverse flange *e*. The two members of the shield are placed upon opposite sides of the segmental die, and are secured in position by several transverse bolts—as, for example, F F′ F^2. In this case the space within the trough outside the convex surface of the segmental die constitutes the annealing-chamber G′. In this case the concave cylindrical surfaces of the shields are formed upon radii slightly greater than the radius of the curved working-face of the die, leaving a sufficient portion of the die projecting, as in the case of the tubular die, for direct contact with the cooling-fluid. The width of the flange *e*, or, if both members of the shield are flanged, then the sum of the width of the two flanges, is made to conform to the thickness of the die.

If desired, the flanges may be extended around the ends of one or both of the members of the shield, in order to protect the inner portion of the ends of the curved die from direct contact with the cooling-fluid. By this means only the concave working-face of the die will be hardened when suddenly chilled by immersion in the cooling-fluid, while the remainder of the metal composing the die will cool more slowly, and be less hard.

It will be understood that if the circumference of the object to be cooled be polygonal instead of circular the shield-pieces will be made correspondingly polygonal, in order that there may be a uniform projection outside the edges of the shields of the portion or portions of the object which it is desired to harden.

In operation the die and the shields which partially inclose it are heated to a cherry-red, or to such other temperature as is found to be best adapted to the kind of steel of which the die is made, and then plunged bodily into water or other cooling-fluid. The exterior projecting portion of the die being thus brought into direct contact with the cooling-fluid, which is of comparatively low temperature, is at once chilled and hardened. The inclosed portion of the die is less suddenly chilled and is hardened to a less degree, because it is exposed to contact only with the hot air or with the hot air and steam contained in the annealing-chamber.

We claim as our invention—

A steel die in the form of a hollow cylinder or of a segment thereof, having its working-face formed upon one of its curved surfaces and hardened to a comparatively shallow depth only, substantially as herein set forth.

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CHARLES S. CLARK.

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