No. 743,782. PATENTED NOV. 10, 1903.

H. F. WEINLAND.

TUBE CLEANER.

APPLICATION FILED JAN. 18, 1901.

NO MODEL.

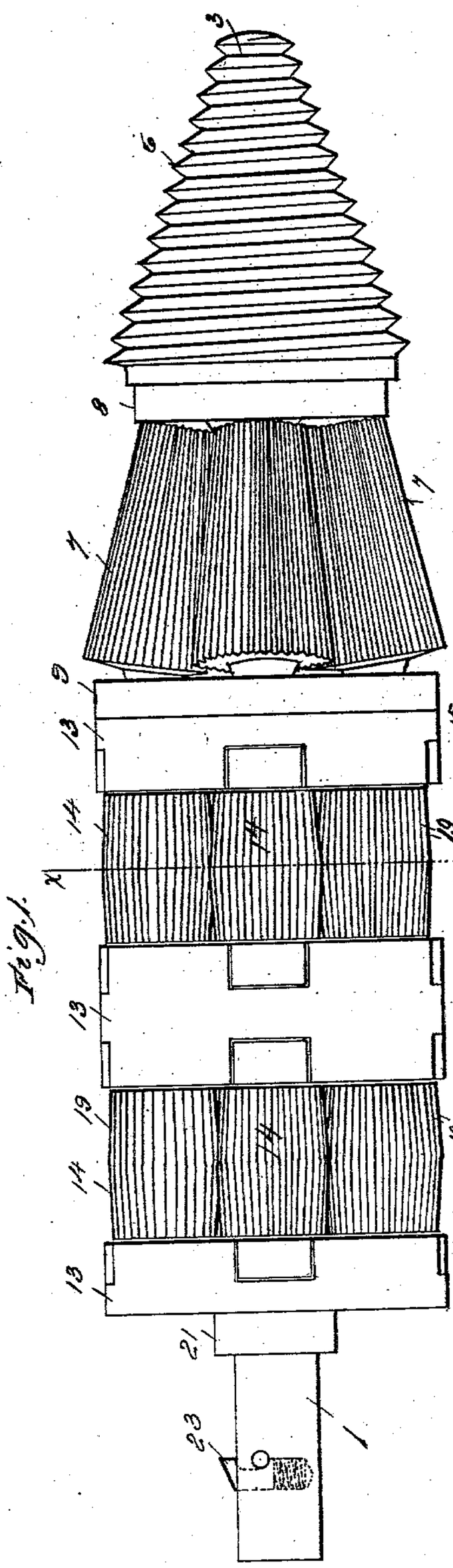

Fig. 1.

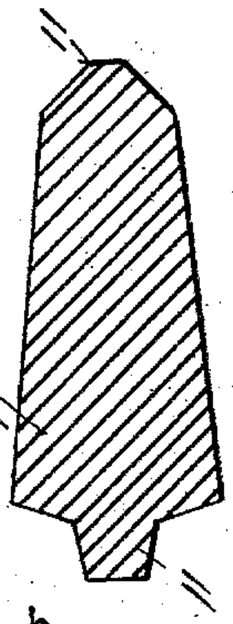

Fig. 5.

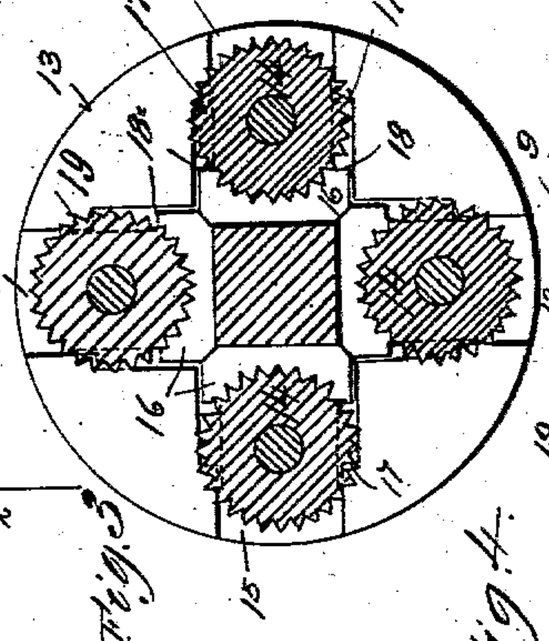

Fig. 3.

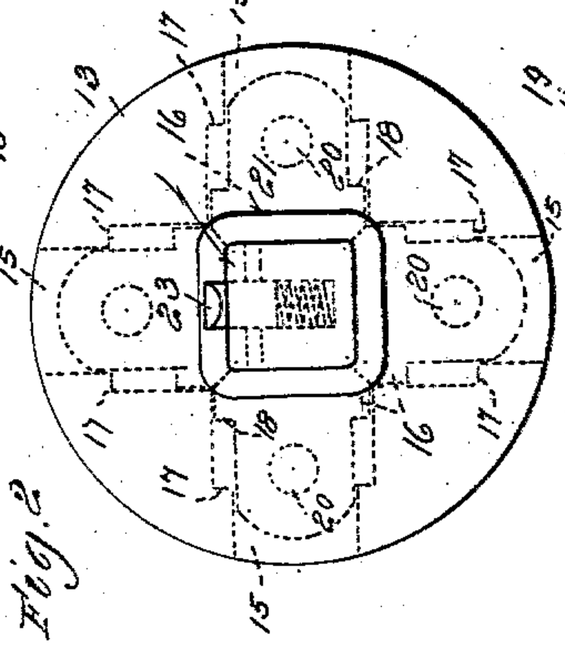

Fig. 2.

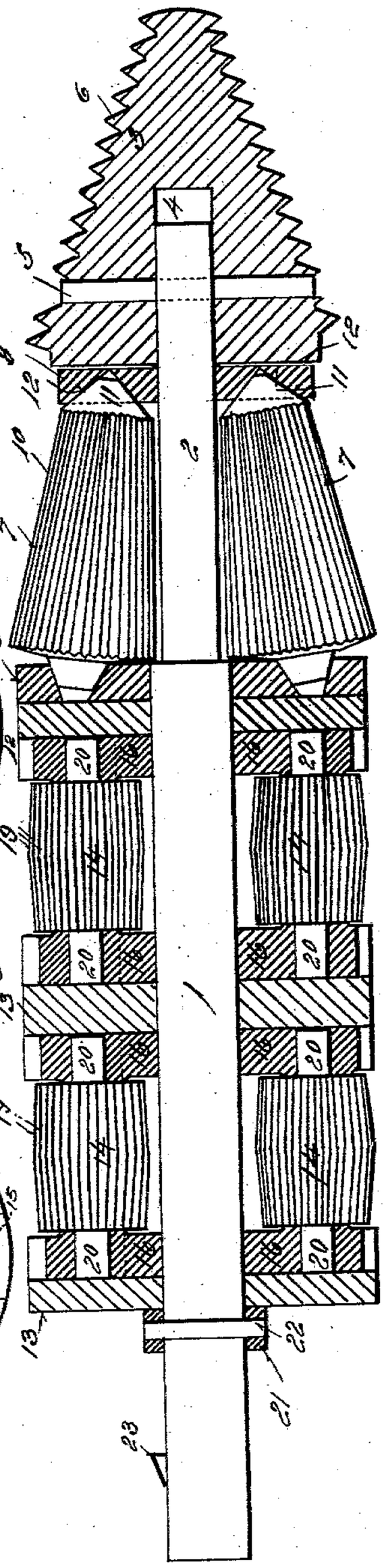

Fig. 4.

WITNESSES:

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By [illegible]

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No. 743,782. Patented November 10, 1903.

UNITED STATES PATENT OFFICE.

HENRY F. WEINLAND, OF SPRINGFIELD, OHIO, ASSIGNOR TO THE LAGONDA MANUFACTURING COMPANY, OF SPRINGFIELD, OHIO, A CORPORATION OF OHIO.

TUBE-CLEANER.

SPECIFICATION forming part of Letters Patent No. 743,782, dated November 10, 1903.

Application filed January 18, 1901. Serial No. 43,701. (No model.)

To all whom it may concern:

Be it known that I, HENRY F. WEINLAND, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Tube-Cleaners, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to tube-cleaners, and more particularly to that class of instruments employed in the removal of scale or incrustations from the interior of the tubes of water-tube steam-boilers.

The present invention relates more particularly to the construction of the cleaner proper or cutting instrument by means of which the scale is actually disintegrated and removed from the wall of the tube, and has for its object to provide an implement of this character having greater efficiency of operation combined with strength and simplicity of construction and which will serve to more effectually remove the scale or incrustation without damaging the tubes themselves.

To these ends the invention consists in certain novel features, which I will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is an elevation of a cleaner embodying my invention in one form. Fig. 2 is a rear view of the same. Fig. 3 is a transverse sectional view taken on the line $x\,x$ of Fig. 1. Fig. 4 is a longitudinal sectional view, and Fig. 5 is a longitudinal sectional view of one of the cutting-rollers detached.

Referring to the said drawings, 1 indicates a shaft preferably square in cross-section and also preferably reduced at its forward end, as indicated at 2, this reduced portion being also preferably square in cross-section. Upon the extreme forward end of this shaft there is mounted a conical tip 3, having a socket 4 to receive the forward end of the part 2 of the shaft 1 and being secured thereon by means of a pin 5 passing through the tip and shaft or in any other suitable manner. This tip is of increasing diameter from front to rear and is provided on its external surface with a spiral thread 6 of slow pitch, the edge of the thread forming a cutting edge extending entirely around the body of the tip and making the tip a spiral conical cutter of such a character that as the entire device is rotated the engagement of this spiral cutter with the material operated on tends to draw the implement forward, thereby materially aiding in the feeding forward of the device.

Immediately back of the tip 3 there is mounted a group of tapering cutting-rollers 7, supported in collars 8 and 9, mounted, respectively, on the reduced portion 2 of the shaft and on the main body of said shaft. Each of these rollers consists of a body portion tapering or diminishing in diameter from front to rear and provided with longitudinal cutting-teeth 10, said rollers being arranged so that their axes of revolution lie in planes radial with respect to the axis of revolution of the shaft 1. The axes of revolution of the rollers are, however, inclined in these planes downward and inward from rear to front, so that the innermost portions of the bodies of the rollers are substantially parallel with the axis of the shaft 1, while their outermost portions are at an angle thereto considerably greater than would exist if the axes of said rollers were parallel with that of the shaft or if said axes were arranged as shown and the bodies of the rollers were cylindrical. By reason of this construction a more effective cutting action is obtained.

In order to obtain a simple, strong, and effective support for these rollers, each roller is provided at its front and rear ends with an integral conical bearing-stud 11, and these studs fit in correspondingly-shaped bearing-seats 12, formed in the collars 8 and 9. In practice these rollers are cast and case-hardened, and the bearing-studs are then properly turned or ground to provide them with the necessary bearing-surfaces. Heretofore it has been customary to construct such rollers by casting the body portion upon a steel shaft or axle; but this results in the production of a structure which is liable to crack or warp—a difficulty which is obviated by the mode of construction just described.

Back of the group of rollers 7 and their supporting-collars 8 and 9 there is mounted on

the shaft 1 a series of collars 13, supporting between them groups of cutting-rollers 14. In the present instance I have shown three such collars and two such groups. Each collar is provided in one or both of its faces with a plurality of radial slots or grooves 15, forming ways in which the cutter-carrying blocks 16 are free to move radially. Each groove 15 is enlarged or widened at its inner portion, thereby forming shoulders 17, and each block 16 is similarly widened at its inner portion, thereby forming shoulders 18, the engagement of these shoulders serving to limit the outward movement of the bearing-blocks. As shown, the end collars 13 have ways in their inner faces only, while the intermediate collar is a double one, having ways in both faces. Each roller 14 comprises a body portion provided with longitudinal cutting-teeth 19, said body portion being of greatest diameter at the middle of the roller and tapering or diminishing in diameter toward each end. Each roller is also provided with bearing-studs 20, which fit in bearings in the supporting-blocks 16 at each end of the roller, so that the roller may be free to rotate and at the same time move in and out radially with respect to the shaft 1.

The several collars and rollers abut against each other, being held in position at one end by the tip 3 and at the other end by a collar 21, secured on the shaft 1 by means of a pin 22. The shaft 1 is provided with a spring-detent 23 or other suitable means, by which it may be readily engaged with and disengaged from its actuating mechanism.

The cutting apparatus hereinbefore described is designed more particularly for use in connection with an operating mechanism such as is set forth in Letters Patent No. 660,828, granted October 30, 1900, to the Lagonda Manufacturing Company as my assignee; but it may, however, be used in connection with any suitable means for imparting to it a rotary and a longitudinal motion. When thus operated, the spiral cutter on the tip acts upon the larger accumulations of scale and serves not only to cut loose the greater portion thereof, but also to aid in advancing the cutter as the work is done. The first group of rollers—to wit, the rollers 7, which are both inclined and tapering and which are not so mounted as to yield—serve to positively remove the greater portion of the scale remaining after the spiral cutter of the tip has passed a given point in its operation, and it will be observed that the path of the widest portion of these rollers is a circle of considerably greater radius than the path of the widest portion of the spiral tip-cutter. The device being rotated at a high rate of speed, the rollers 14 are forced out by centrifugal action, and when in their outermost position these groups of rollers describe circles of a radius still greater than that described by the widest portions of the rollers 7, so that these groups of rollers 14 operate upon the remaining portions of the scale adhering closely to the walls of the tubes and not reached by the rollers 7. These rollers 14 being held in place by centrifugal force only are capable of yielding inward when any obstruction is met—such, for example, as an inequality on the inner surface of the tube, arising from a weld or from other causes—so that while these rollers are adapted to clean the inner surface of the tube they will not injure or burst the same. By relying upon centrifugal force to hold these rollers in position I am enabled to dispense with the use of springs for this purpose, which springs I have found to be objectionable by reason of their liability to crack and break, thereby becoming inoperative and preventing free movement of the rollers.

It is obvious that the precise embodiment of my invention chosen for purposes of illustration may be modified without departing from the principle of said invention. For instance, under certain circumstances the spiral tip-cutter may be dispensed with, and its work, as well as their own, may be accomplished by the rollers 7. Again, the number of groups of rollers 14 and the number of rollers in each group may be varied according to the character of the work and other circumstances. I therefore do not wish to be understood as limiting myself to the precise details of construction hereinbefore described, and shown in the accompanying drawings.

It will be understood, of course, that the several collars mounted on the shaft 1, between the tip 3 and the collar 21, are loosely mounted on said shaft, being free to move thereon when the collar 21 is released by driving out the pin 22, and it will also be noted that the groups of rollers are loosely mounted between the collars, so that by freeing the collar 21 the several elements may be separated to remove and replace any of the rollers.

In the claims I have used the term "planes radial to the axis of the shaft" to indicate planes passing through the axis of the shaft in a direction radial thereto and in which planes at their intersections the axis of the shaft wholly lies. It will be observed that the first group of cutting-rollers are so arranged that their axes lie in these respective radial planes and are inclined inward and forward therein.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A cutting implement for boiler-tube cleaners, comprising a shaft adapted for rotary and longitudinal movement, a group of cutting-rollers mounted to rotate along with said shaft, each roller being also independently rotatable on its own axis in fixed bearings, said rollers being arranged with their axes in planes radial to the axis of the shaft and inclined inward and forward in said planes, the body of each roller being tapering or of diminishing diameter from rear to front, and

being provided with an uninterrupted cutting-face, and a second group of cutting-rollers carried by said shaft in the rear of said first-mentioned group and adapted to rotate along with the shaft, each roller being also independently rotatable on its own axis, which is normally parallel with that of the shaft, and being free to move radially relatively to the shaft by centrifugal action, said group of rollers having a minimum working path of less diameter and a maximum working path of greater diameter than the maximum diameter of the working path of the first group, substantially as described.

2. A cutting implement for boiler-tube cleaners, comprising a shaft adapted for rotary and longitudinal movement, a conical tip mounted on the front end of said shaft and having a spiral cutting-thread thereon, a group of cutting-rollers mounted on said shaft back of said conical tip, so as to rotate along with said shaft, each roller being also independently rotatable on its own axis in fixed bearings, said rollers being each provided with an uninterrupted cutting-face, and being arranged with their axes in planes radial to the axis of the shaft, and inclined inward and forward in said planes, with their forward ends within the maximum working path of the conical tip and having a portion to the rear of their front ends projecting beyond said maximum working path, the body of each roller being tapering or of diminishing diameter from front to rear, and a second group of cutting-rollers carried by said shaft in the rear of said first-mentioned group and adapted to rotate along with the shaft, each roller being also independently rotatable on its own axis, which is normally parallel with that of the shaft, and being free to move radially relatively to the shaft by centrifugal action, substantially as described.

3. A cutting implement for boiler-tube cleaners, comprising a shaft adapted for rotary and longitudinal movement, a group of cutting-rollers mounted to rotate along with said shaft, each roller being also independently rotatable on its own axis in fixed bearings, said rollers being arranged with their axes in planes radial to the axis of the shaft, and inclined inward and forward in said planes, the body of each roller being tapering or of diminishing diameter from rear to front and being provided with an uninterrupted cutting-face, and a second group of cutting-rollers carried by said shaft in the rear of said first-mentioned group and adapted to rotate along with the shaft, each roller having a body portion tapering in each direction from the middle and being independently rotatable on its own axis, which is normally parallel with that of the shaft, and being free to move radially relatively to the shaft by centrifugal action, said second group of rollers having a minimum working path of less diameter than the maximum diameter of the working path of the first group, substantially as described.

4. In a cutting implement of the character described, the combination, with a shaft adapted for rotary and longitudinal movement, of a plurality of collars through which said shaft passes and on which they are removably secured, their opposite faces being provided with radial grooves or ways, blocks mounted to slide in said grooves or ways, stops for limiting the outward movement of said blocks, and cutting-rollers having end bearings in said blocks, substantially as described.

5. A tube-cleaning tool comprising a frame adapted to be rotated, a toothed cutter fixed centrally to the forward end thereof, and one or more rotary implements to the rear of said fixed cutter with their forward ends within the circumference of the fixed cutter and a portion to the rear of their front ends projecting beyond the periphery of said fixed cutter.

6. A tube-cleaning tool comprising a frame adapted to be rotated, a toothed cutter fixed centrally to the forward end thereof, and one or more radially-immovable rotary cutters to the rear of said fixed cutter with their forward ends within the circumference of the fixed cutter and a portion to the rear of their front ends projecting beyond the periphery of said fixed cutter.

7. A tube-cleaning tool comprising a frame adapted to be rotated, a conical toothed cutter fixed centrally to the forward end thereof, and one or more toothed cutters rotatably mounted on said frame to the rear of the fixed cutter with their forward ends within the circumference of the fixed cutter, and a portion to the rear of their forward ends projecting beyond the periphery thereof.

8. A tube-cleaning tool comprising a frame adapted to be rotated, a conical toothed cutter fixed centrally to the forward end thereof, two implements rotatably mounted in said frame to the rear of the fixed cutter, one of said implements on either side of the axis of the frame, and having their forward ends within the circumference of the fixed cutter and a portion to the rear of the forward ends projecting beyond the periphery of the fixed cutter.

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

HENRY F. WEINLAND.

Witnesses:
R. W. LEIBERT,
JNO. H. KRESSLER.