No. 659,962. Patented Oct. 16, 1900.

C. L. GOODRICH.

TURRET TOOL.

(Application filed Jan. 2, 1900.)

(No Model.) 3 Sheets—Sheet 1

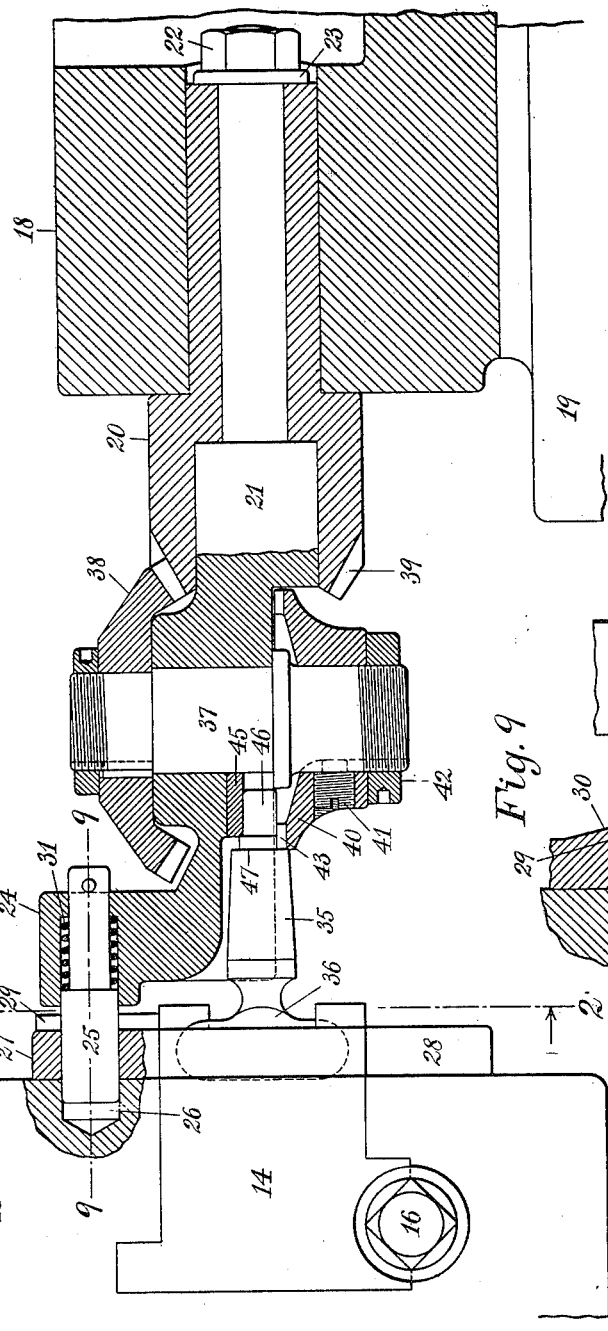

Fig. 1

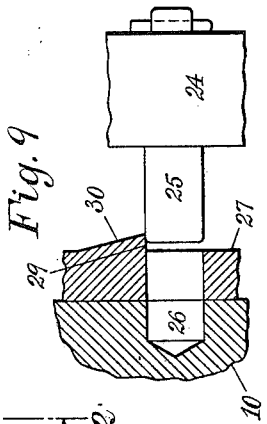

Fig. 9

Witnesses:

Jennie R. Case

H. Mallmer

Inventor

C. L. Goodrich

By W. H. Honiss Atty.

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Fig. 2

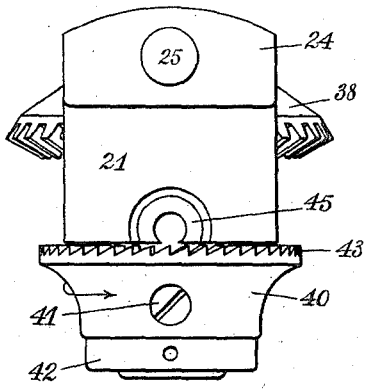
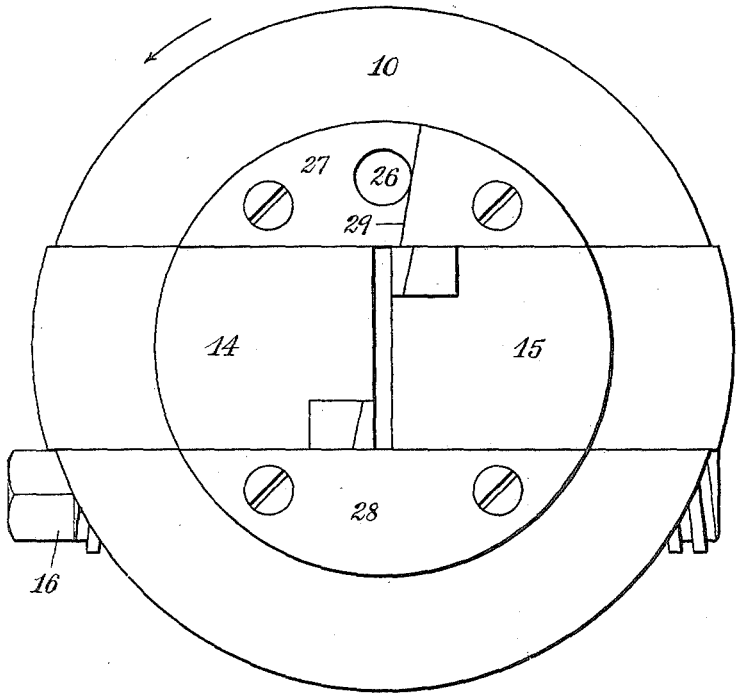


Fig. 3



Witnesses:
James N. Case.
H. Mallmer

Inventor
C. L. Goodrich
By W. H. Howiss Atty.

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Fig. 5

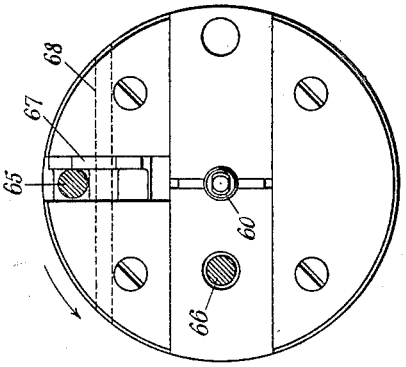


Fig. 8

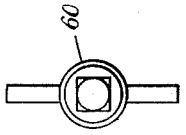


Fig. 6

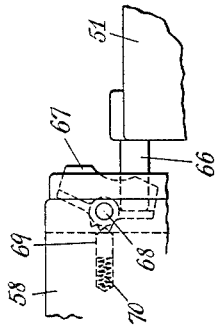


Fig. 4

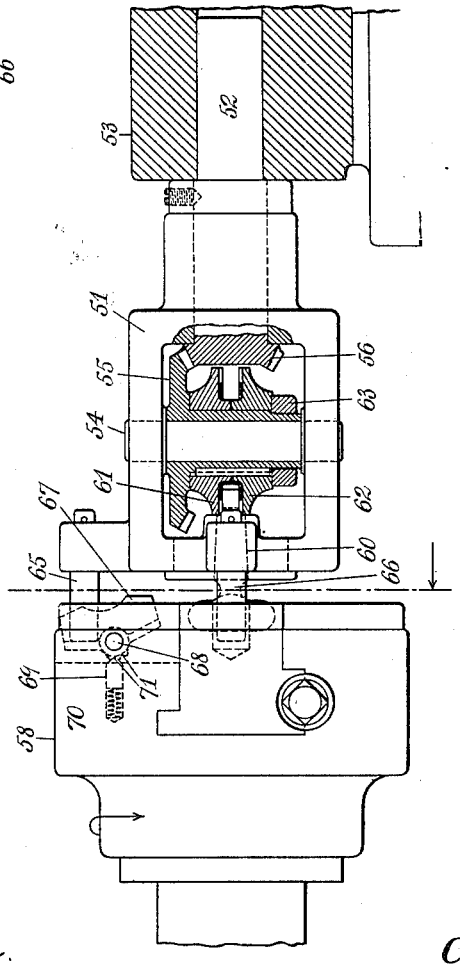
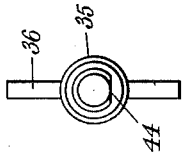


Fig. 7



Witnesses:
Jennie N. Case.
H. Mallner

Inventor
C. L. Goodrich
By W. H. Honiss. Atty.

UNITED STATES PATENT OFFICE.

CLARENCE L. GOODRICH, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE PRATT & WHITNEY COMPANY, OF SAME PLACE.

TURRET-TOOL.

SPECIFICATION forming part of Letters Patent No. 659,962, dated October 16, 1900.

Application filed January 2, 1900. Serial No. 20. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE L. GOODRICH, a citizen of the United States of America, and a resident of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Turret-Tools, of which the following is a specification.

This invention relates to improved means for performing with certainty and accuracy various operations upon a rotating piece of work, and especially upon an unsymmetrical portion therewith, without arresting the rotation of the work.

This invention is herein illustrated as being embodied as an auxiliary to a turret-head screw-machine adapted to mill one or more flattened surfaces upon the side of an ordinary valve-plug, thus making either a D-shaped or a polygonal contour of that portion of the plug for the purpose of receiving a washer having a correspondingly-shaped opening, the object being to cause the washer to turn positively with the plug, this being the common practice, especially in the making of gas-cocks.

Figure 1 of the drawings is a side view, partly in central longitudinal section, of an embodiment of my invention shown in operative relation to the work and to the carrier, by means of which the work is gripped and the milling-cutter rotated. Fig. 2 is an end view of the milling-tool viewed from the plane of the line 2 2 of Fig. 1. Fig. 3 is an end view of the chuck or work-carrier also viewed from the plane of the line 2 2. Figs. 4 and 5 are a side and an end view, respectively, in reduced scale, of a modified arrangement of this device, showing also my arrangement for indexing the milling device from one position to another with relation to the chuck or work-carrier, so as to enable two or more sides of a polygon to be milled upon the work. In Fig. 4 the arrangement for supporting the gears and cutters is somewhat modified, those gears and cutters being here shown in cross-section taken substantially through their longitudinal center, like the corresponding parts of Fig. 1. Fig. 5 is a front end view of the chuck or work-carrier of Fig. 4 viewed from a plane represented by the line 5 5 and looking in the direction of the arrow adjacent thereto. Fig. 6 is a side view of a portion of the work-carrier, showing the indexing device in a different position from that of Fig. 1. Fig. 7 is an end view of a valve-cock, showing the flattened cut made thereon to form the D-shaped seat for the washer made by the apparatus of Fig. 1. Fig. 8 is a similar view of a valve-cock flattened or squared on four sides in a manner possible by the indexing arrangement of Figs. 4 and 5. Fig. 9 is a plan view showing the coengaging portions of the work-carrier and the milling device, the former being shown in section taken along the line 9 of Fig. 1.

The well-known turret-head lathes and screw-machines are ordinarily adapted only to the turning of circular surfaces or those which are concentric to the axis of rotation of the work or of the tool, as the case may be; but in the manufacture of many articles for which the functions of the well-known turret-head lathe or screw-machine are otherwise admirably adapted it is frequently necessary to drill a hole or mill a surface which is not thus concentric with the axis of rotation. For this reason it has hitherto been considered necessary to make a separate operation of these unsymmetrical cuts in another machine or to stop the work-carrying spindle while the cut is being made by an independently-operated tool mounted upon the cross-slide or elsewhere. This invention, however, avoids the necessity for many of these separate or independent operations and enables them to be performed upon the work by a tool held in the ordinary turret and without stopping the rotation of the machine. The principal difficulty in these operations which presents itself in the ordinary machine is that of transmitting rotative movement to the turret, and especially of transmitting a movement which shall coincide exactly with that of the rotating work-spindle, owing to the circumstance that the tool-holding turrets of such machines are mounted upon a slide which is moved longitudinally.

Referring to Figs. 1, 2, and 3, the numeral 10 represents an ordinary rotating chuck or work-carrier of a lathe or screw-machine. This chuck is provided with the jaws 14 and

15, which are operated by means of the screw 16 to grip them together upon the work, which is herein shown to be an ordinary valve-cock 35, the head 36 of which is gripped between the jaws.

The milling apparatus is carried in the turret 18, rotatably mounted upon the reciprocating turret-slide 19, this construction and arrangement being too well known to need further illustration or explanation herein. The collet 20 is clamped in the turret in the usual way, and in this collet is journaled the rotatable body or frame 21 of the tool, being held in place longitudinally by means of the nut 22 and washer 23. This washer may be of leather or be faced with leather, so as to impose a slight frictional resistance to the rotation of the frame 21 to prevent rebounding when it collides with the carrier. The axis of rotation of this body is concentric with that of the work-carrier or chuck 10 when the tool is brought into engaging relation thereto by the rotation of the turret. The work-carrier and the tool-frame are provided with coengaging abutments, so located as to bring the tool into the required relation to the work. The front end of the frame extends in the form of an arm 24 for receiving the coupling-pin 25, which is located in engaging relation to its seat or recess 26 in the face of the carrier 10. Inasmuch as these carriers are ordinarily made of cast-iron, they are preferably provided with steel facing-plates 27 and 28, the front faces of which are level with those of the jaws 14 and 15, these plates and the jaws being usually hardened in order to enable them to resist wear.

The arrangement shown in Figs. 1, 2, and 3 is adapted to mill only one side of the valve-cock, as shown in Fig. 6. It therefore requires no provision for indexing to different positions and contains but one coupling-pin 25 and its recess 26. As a means for engaging with the pin when the latter is brought forward by the turret the plate 27, containing the seat or recess for the pin, is provided with the projecting shoulder or abutment 29, located coincident with the rearward side of that recess, as best shown in Fig. 9, so as to locate the pin in alinement with its seat while the tool is being fed forward to its work.

On account of the fact that it is necessary for some pieces of work to change the direction of rotation of the carrier in order to perform the several required operations thereon the projecting shoulder 29 is inclined backwardly from its face at 30 to the plane of the facing-plate 27. For the same reason the coupling-pin 25 is mounted so as to yield longitudinally backward against the pressure of the spring 31. Thus if the pin should inadvertently be brought forward against the carrier while the latter is rotating rapidly in the wrong direction this arrangement of the pin will allow it to be forced backwardly by the incline 30, thus avoiding damage to the colliding parts. This is a desirable though not essential feature of the device, the other portions of which are not dependent thereon.

The spindle 37 is mounted to rotate in the body or frame 21 of the apparatus, being in this instance and for the purpose now under consideration mounted at right angles to the axis of rotation of that frame. As a means of rotating the spindle when its frame 21 is rotated the spindle is operatively connected with a non-rotating driver. The spindle has fixed upon it the bevel-gear 38, which meshes with an annular series of teeth 39, cut in the stationary collet 20, which serves as a driving-gear for rotating the spindle 37 when the body or frame 21 is rotated with relation to that collet. In the arrangement shown in Fig. 1 the milling-cutter 40 is mounted directly upon the spindle 37, being adjustably secured thereto by means of the set-screw 41 and the adjacent nut 42. The cutting edges of the teeth 43 of this cutter are thus adjusted to the plane of the cut 44 to be made upon the plug 35.

In the case herein illustrated and in all cases where possible some cylindrical portion, as 46 or 47, of the work adjacent to the cut is supported by means of a bushing 45, located in and carried by the frame 21 concentrically with the axis of rotation of the work. The form and arrangement of this bushing may be varied in many ways to suit the conditions of the work in hand.

The operation of this device is as follows: The plug-cock 35 is gripped between the jaws 14 and 15 of the rotating chuck or work-carrier 10, and where the work projects a considerable distance from the jaws some cylindrical portion thereof, as 46 or 47, should be turned by suitable tools in the turret, so that when this milling device is brought into alinement with the work the turned surfaces will enter and be supported by the bushing 45, thus steadying the rotating piece as closely as possible to the cut to be made, thereby avoiding the sidewise strain upon the work and its carrier of the cutting operation and enabling it to be done smoothly and without chattering. Where the work contains no such cylindrical portion, the bushing 45 may be recessed to receive the irregular or unsymmetrical end of the piece and to rotate in its own seat in the body or framing 21. After these preliminary operations this tool is swung by the rotation of the turret into alinement with the rotating work, and as it is advanced longitudinally by means of the turret-slide 19 the projecting end of the coupling-pin 25 is engaged by the rotating shoulder 29 of the carrier, which thereupon guides the still-advancing pin into its driving-recess 26. The tool and the work-carrier are now coupled together and rotated synchronously as one body. This rotation of the body 21 of the tool while the tool-spindle 37 is geared with the non-rotating driver or collet 20 causes that spindle and its milling-cutter 40 to be rotated at a suitable speed for the work

to be done, that rotative speed being determined by the diameter relations of the gearing. The continued forward movement of the rotating tool mills away the side of the cylindrical surface, thus forming the flattened surface 44. The length of the cut may be determined by means of a stop on the turret-slide or in any convenient and customary way. After the completion of this cut the turret-slide is moved backwardly, disengaging the tool from the work-carrier, whereupon the succeeding tools of the turret are brought into position for performing the remaining operations upon the work.

The modified (or rather amplified) form of this invention shown in reduced scale in Figs. 4 and 5, inclusive, differs from that already described partly in the mounting and arrangement of the cutters and driving-gears, but chiefly in the addition of an indexing device for automatically changing the position of the tool with relation to that of the work-carrier, so as to enable the device to mill two or more sides or faces upon the work. In this modification the body or frame 51 is fitted to rotate upon the outside of the collet 52, clamped in the turret 53. The spindle 54 of this device is supported at its ends in the framing, and it may rotate therein, or the ends may be fixed in the framing, with the cutter-gear 55 rotating thereon. The gear 55 engages with the beveled gear 56, fixed to or integral with the collet 52, which thus forms the driver for rotating the gear 55 and its attached cutters when the framing 51 is rotated. This arrangement of the device is herein shown as adapted to mill the four flattened sides shown upon the valve-cock 60 in Fig. 7, and it is therefore provided with two cutters 61 and 62, which are carried by the gear 55, with their cutting-faces located upon the opposite sides of the valve-plug 60, being clamped to place by means of the nut 63. It is evident that these two cutters could at a single operation only mill two opposite faces upon the valve-cock 60, as shown in Fig. 5, and that in order to mill the other two flattened sides (shown in Fig. 7) the milling apparatus must be turned with relation to the carrier 58 at right angles to the position occupied by it while milling the first two sides. As a means to this end the apparatus is provided with two indexing coupling-pins 65 and 66, which are located at different radial distances from the center of rotation of the carrier and the tool and for the specific purposes here shown are ninety degrees apart. These pins are automatically brought in alternate succession to the driving position occupied by the pin 65 in these figures. The driving position of these pins and their alternate succession thereto is determined by means of the dog or driver 67, which is pivotally mounted in the carrier 56 upon the pin 68, upon which the dog is alternately rocked to the two positions shown in Figs. 4 and 6, respectively, by means of the alternate engagement therewith of the pins 65 and 66. The dog is yieldingly retained in each of these two positions by means of the plunger 69 and spring 70, entering the notches 71 in the driver at its alternate positions.

The operation of the device of Figs. 4 and 5 is exactly like that of the preceding figures already described so far as the milling of the two sides, as shown in Fig. 5, is accomplished, the remaining sides being brought into suitable relation to the cutters by means of the indexing device, which constitutes the chief and additional feature of this modified construction. The position of the dog 67 determines the selection of the driving-pieces 65 and 66. When in the position shown in Fig. 6, that dog will come in contact with the outermost driving-pin 65; but as the tool is advanced longitudinally in the performance of its function the end of the pin 65 comes in contact with the back or bottom of the dog 67, pushing its upper portion inwardly and swinging it upon its pin 68 to the position shown in Fig. 4. Upon the completion of this cut the tool is withdrawn far enough to disengage the pin 65 from the dog 67, whereupon the lower portion of that dog, which has thus been swung outwardly, collides with the innermost pin 66, and thus locates the tool with relation to the work-carrier at an angle of ninety degrees from its former position, the tool being advanced longitudinally, as before, until this second cut is completed, thus squaring the plug-cock, as shown in Fig. 8.

The tool-spindle may be adapted to receive and carry all kinds of cutting-tools—as cutters, drills, reamers, grinding-wheels, and all similar tools which operate by a rotative movement—and this tool-spindle may be arranged at any desired angle with the axis of the work or it may be parallel therewith, such modifications in the position of the spindle and the adaptation of the gearing to drive the tool at the proper speed and in the required direction being within the exercise of the ordinary skill of a mechanic. For some purposes the well-known frictional gearing may be substituted for the toothed gearing herein shown, these details being matters to be determined by the circumstances of each case.

This invention, especially when used in conjunction with devices for feeding the separate pieces of work successively to the carrier without stopping the rotations thereof, is admirably adapted for embodiment in the various types of turret-head machines now so largely used for the manufacture of small parts of machinery, the scope of such machines being very greatly extended by the embodiment therein of the devices of this invention.

I claim as my invention—

1. The combination of a rotatable tool-carrying frame, a rotatable cutting-tool journaled thereon, and operatively connected with a non-rotating driver.

2. The combination of a rotatable tool-frame, a non-rotating driver located concentrically therewith, a rotatable tool mounted in the frame and operatively geared with the non-rotating driver.

3. The combination of a rotatable tool-frame, a fixed gear located concentric therewith, a rotatable tool-spindle journaled in the frame and operatively connected with the fixed gear, and a milling-cutter mounted upon the tool-spindle.

4. In combination with a rotating work-carrier, a rotatable tool-carrying frame adapted to be engaged by and be rotated synchronously with and by the work-carrier.

5. In combination with a rotating work-carrier, a rotatable tool-carrying frame adapted to be engaged by and be rotated synchronously with the work-carrier, a tool-spindle rotatably journaled in the frame, and a non-rotating driver connected with the rotatable spindle.

6. In combination with a rotating work-carrier, a rotatable tool-carrying frame, a rotatable cutting-tool journaled thereon, and operatively connected with a non-rotating driver, with means for automatically coupling the work-carrier and the tool-frame, whereby the tool-frame is rotated synchronously with and by the carrier.

7. In combination with a rotatable work-carrier and a tool-holding turret, a tool-frame rotatably journaled on the turret, and arranged to be brought by the operation of the turret into concentric relation with the work-carrier, a tool-spindle journaled on the frame, and operatively connected with a non-rotating driver on the turret.

8. In combination with a rotating work-carrier, and with a tool-holding turret, a tool-carrying frame rotatably journaled on the turret and arranged to be brought by the operation thereof into concentric relation to and rotative engagement by the work-carrier, a tool-spindle rotatably journaled upon the frame, and a non-rotating driver fixed upon the turret and operatively connected with the tool-spindle for rotating the latter when the frame is rotated by the work-carrier.

9. The combination of a rotating work-carrier, and a rotatable tool-carrying frame, provided with coengaging abutments whereby one is rotated synchronously with and by the other.

10. In combination with a rotating work-carrier and a rotatable tool-carrying frame, a coupling-pin located on the frame and a projecting abutment on the carrier for engaging with the pin and rotating the frame synchronously with the carrier.

11. In combination with a rotating work-carrier, and a rotatable tool-frame, a coupling projection carried by the frame, a driving-seat therefor on the work-carrier and a projecting abutment for engaging with and guiding the coupling projection into its driving-seat in the carrier.

12. In combination with a rotating work-carrier, and a rotatable tool-frame, a coupling-pin resiliently mounted for longitudinal movement upon the frame, and a projecting abutment upon the carrier, the abutment being beveled back from its face for the purpose specified.

13. In combination with a rotating work-carrier and with a rotatable tool-carrying frame, a plurality of driving and indexing abutments upon the tool-frame, the carrier being provided with means for engaging alternately with the abutments of the frame for indexing it into different positions relative to the work-carrier.

14. In combination with a rotating work-carrier, and with a rotatable tool-carrying frame, a plurality of driving and indexing abutments located in coengaging pairs upon the carrier and the tool-frame respectively at different radial distances from their common axis of rotation, the abutments upon one of the rotatable members being operatively connected, whereby the coengagement of one pair of abutments brings another pair of abutments into engaging relation.

15. In combination with a rotating work-carrier and with a rotatable tool-carrying frame, a plurality of indexing-abutments located upon the tool-frame at different radial distances from its axis of rotation, and a dog pivotally mounted upon the carrier, having its ends located in engaging relation to the abutments upon the tool-frame, whereby the engagement of one indexing-abutment with its end of the dog brings the other end of the dog into engaging relation to the other indexing-abutment.

Signed at Hartford, Connecticut, this 12th day of December, 1899.

CLARENCE L. GOODRICH.

Witnesses:
W. LINCOLN BARNARD,
W. H. MILLER.