No. 649,341. Patented May 8, 1900.

H. NEVILL.

DRIFT DIE AND MATRIX FOR FORMING GROOVES IN INNER SURFACES OF TUBES.

(Application filed Oct. 30, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

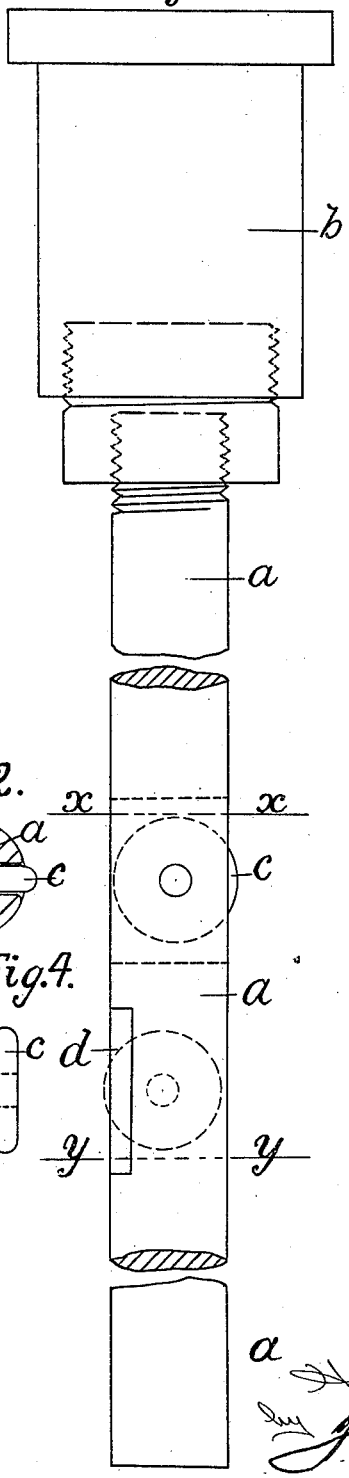


Fig. 10.

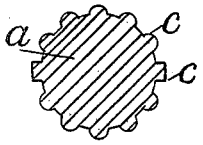


Fig. 9.

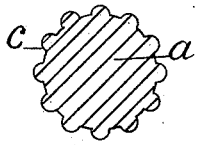


Fig. 8.

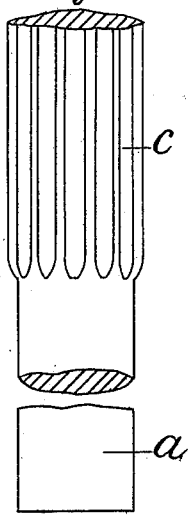


Fig. 3.

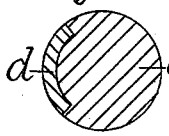


Fig. 2.

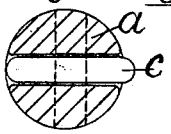
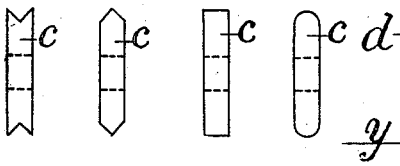


Fig. 7. Fig. 6. Fig. 5. Fig. 4.



Witnesses.

H. Lee Helms.

Inventor.

Henry Nevill

by James L. Norris.

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Fig. 11.

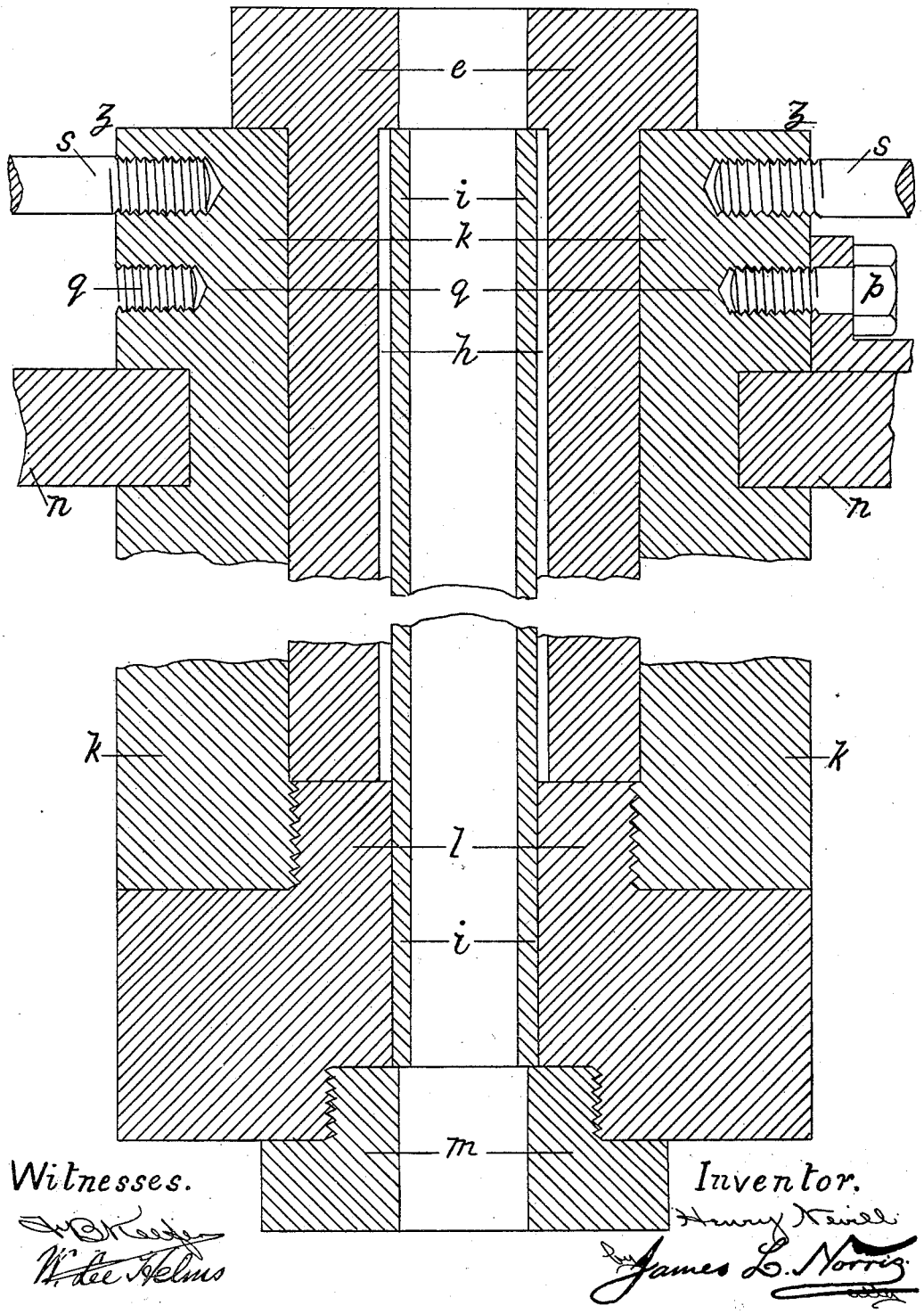

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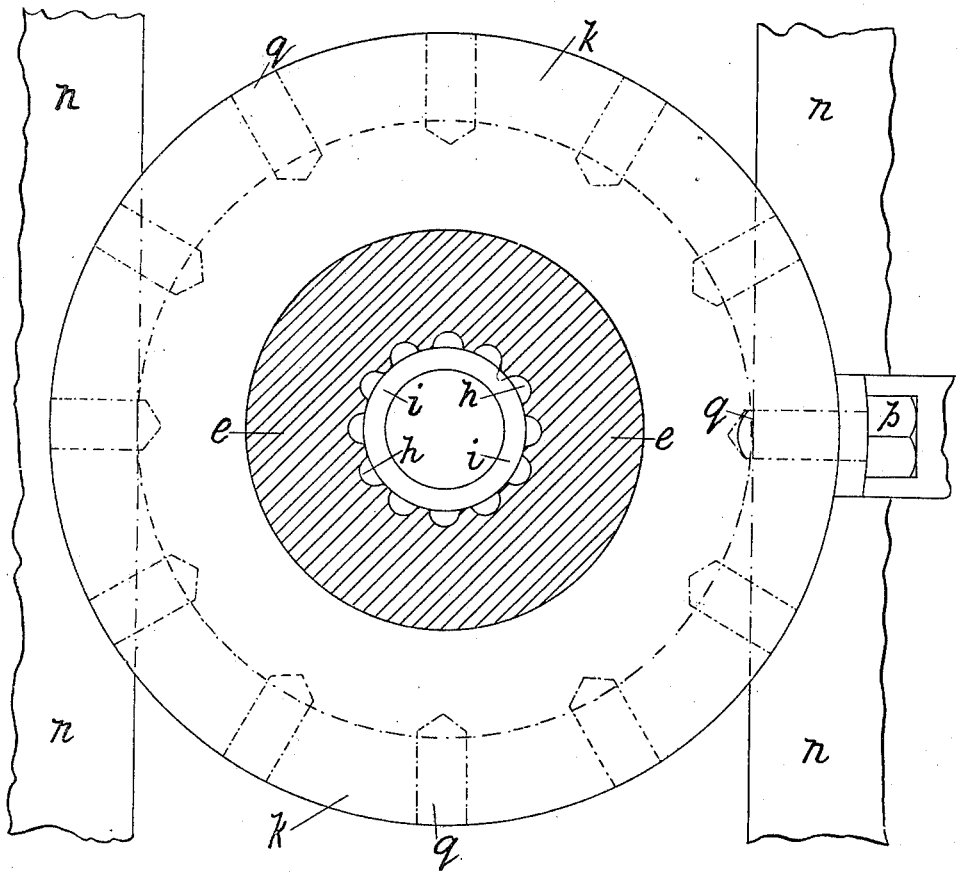
Fig. 12.



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UNITED STATES PATENT OFFICE.

HENRY NEVILL, OF SOUTHAMPTON, ENGLAND.

DRIFT-DIE AND MATRIX FOR FORMING GROOVES IN INNER SURFACES OF TUBES.

SPECIFICATION forming part of Letters Patent No. 649,341, dated May 8, 1900.

Application filed October 30, 1899. Serial No. 735,270. (No model.)

To all whom it may concern:

Be it known that I, HENRY NEVILL, manufacturing engineer, a subject of the Queen of Great Britain, residing at Aukerwyke, Shirley Warren, Southampton, England, have invented certain new and useful Improvements in Drift-Dies and Matrices for Forming Grooves in the Internal Surfaces of Tubes, of which the following is a specification.

My invention has reference to forming grooves or ways in the internal surfaces of malleable-metal or other malleable or ductile tubes, and has for its object to provide a tool whereby the grooves can be formed with great accuracy, speed, and economy of time as compared with the time occupied in cutting grooves in tubes with tools now in use. The tool consists of two parts—a drift-die and a matrix. I attain this object by the apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a vertical elevation of the drift-die. Fig. 2 is a sectional plan of the drift-die, taken at the line *x x*, Fig. 1. Fig. 3 is a sectional plan of the drift-die, taken at the line *y y*, Fig. 1. Figs. 4, 5, 6, and 7 are elevations of different rollers used in the drift-die to form grooves of different section. Fig. 8 is an elevation of the drift-die which I use to finish the grooves after being formed by the drift-die shown in Fig. 1. Fig. 9 is a sectional plan of the drift-die shown in Fig. 8. Fig. 10 is a sectional plan of a modified form of the drift-die shown in Fig. 8. Fig. 11 is a vertical section of the matrix bolster and holder for use with the drift-die. Fig. 12 is a sectional plan of the matrix bolster and holder, taken at the line *z z*, Fig. 11.

Similar letters refer to similar parts throughout the several views.

According to this invention I provide the drift-die with a disk-shaped roller or a rib-former the edge of which corresponds in shape to the form of groove or flute required to be made in the tube and projects for the required distance beyond the surface of the shank of the drift-die. The drift-die may have one or more of these rollers or ribs. In the case of the rollers they are mounted on spindles and revolve in a slot or slots in the drift-die.

The drift-die works in a grooved cylindrical matrix-bolster of internal diameter to receive the tube to be grooved or fluted.

With reference to the drawings, *a* designates the shank of the drift-die, and *b* the head-piece by which it is driven or pressed by a suitable power or hydraulic press into the tube and matrix.

c denotes the roller or rib by which the groove or flute is formed in the tube. The roller *c* is mounted on a spindle and revolves in a slot in the shank *a*. The edge of the roller or rib is round or rectangular, as shown in Figs. 4 and 5, or shaped as shown in Figs. 6 and 7.

Below the roller *c* and on the opposite side of the drift there is provided an antifriction-roller *d*, as shown in dotted lines, or a steel plate *d* may be let into the shank *a*. This roller or plate *d* bears on the side of the tube opposite to that on which the groove is being formed.

e denotes the matrix-bolster, and *h* the grooves therein. These grooves correspond to the extreme number and depth of the grooves or flutes to be formed in the tube.

i denotes the tube in which the grooves are to be formed.

The matrix-bolster *e* has an internal flange at the top, which projects partly over the metal of the tube, and an external flange by which it is held in an adjustable block *k*, which is provided with a screw-block *l*, which secures the bolster, and with a screw-block *m*, which holds and secures the tube *i*. The block *k* is carried or supported in the press by the bars *n*, which are provided with a stop-bolt *p*, which takes into holes *q*, formed in the block *k*, which holes correspond with the grooves *h* in the matrix-bolster.

s denotes handle-bolts by which the block *k* and matrix *e* can be moved around to bring the tube *i* into position for the roller *c* of the drift-die *a* to form the successive grooves in the tube *i*.

In operation the tube *i* to be grooved or fluted is placed in the matrix-bolster *e*, which has first been secured in the block *k* by the screw-block *l*. The block *k* is then placed in a power or hydraulic press, in which it is supported by the bars *n*. The drift-die *a* is then fixed to the plunger of the press and inserted

into the top of the matrix-bolster *e*, and upon pressure being applied the drift-die is driven into the tube *i*, and by means of the roller *c* the metal of the tube *i* is rolled or pressed into the groove *h* of the matrix *e*, which is in line with the roller *c*, and a groove corresponding in shape to the edge of the roller is formed in the tube. After the groove has been formed in the tube *i* the drift-die is withdrawn, and the block *k*, with the matrix *e*, is turned to bring another groove *h* opposite the roller *c*, and a second groove is formed in the tube, and the operation is repeated until the required number of grooves have been formed in the tube *i*. After all the grooves have been formed the roller drift-die is removed from the press, and a drift-die having a number of ribs corresponding to the number of grooves is forced by the press into the tube *i*. This operation trues and finishes the grooves made by the roller *c*.

The grooves or flutes are formed in the tube one at a time when the drift-die has one disk roller-tool, and when the drift-die has two or more disk roller-tools a corresponding number of grooves or flutes are formed at one stroke. Also the groove or grooves may extend only partly through or entirely through the tube, and the operation may be performed with the tube either in a cold or hot state.

A drift-die and matrix according to my invention is particularly applicable for forming multiple grooves on the inner surface of tubes to form longitudinal ball-races for ball-bearings, also for forming keyways in the inner surfaces of tubes, and the use of the tool enables the groove to be formed with great accuracy and economy of time as compared with the time occupied in cutting grooves with tools now in use.

My drift-die is adapted to operate upon the interior surface of the tube, the roller or rollers forcing the metal outward into the grooves *h* in the matrix and to that extent increasing the cross-sectional area of the tube. Heretofore and prior to my invention tubes have been grooved by external rolling corrugators which pressed the metal inward toward the center of the tube, thereby reducing the interior area of the tube. I make no claim to any such construction.

What I claim, and desire to secure by Letters Patent, is—

1. In the manufacture of metallic tubing, the combination with a drift-die consisting of a shank having one or more rolls, each journaled in a slot in the shank and projecting from said slot at a single point, of a matrix having a cylindrical opening to receive the tube, said opening being provided with grooves in its internal face, which grooves receive the outwardly-forced metal of the tube which is driven into them by the drift-die, substantially as described.

2. In the manufacture of metallic tubing the combination with a drift-die, consisting of a shank having one or more rolls, each journaled in a separate diametrical slot and projecting therefrom upon one side of the shank, an antifriction-plate being secured to the opposite side, of a matrix having a cylindrical opening provided with one or more longitudinal grooves to receive the metal of the tube forced outward by the drift-die acting in the interior of the tube, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

HENRY NEVILL.

Witnesses:
FREDERICK J. CHEESBROUGH,
ARTHUR JAMES LEA.