3 Sheets--Sheet 1.

J. FREARSON.

Art of Manufacturing Wood-Screw Blanks.

No. 162,642. Patented April 27, 1875.

FIG. 11.

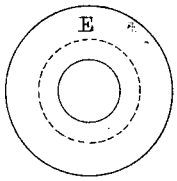


FIG. 1.

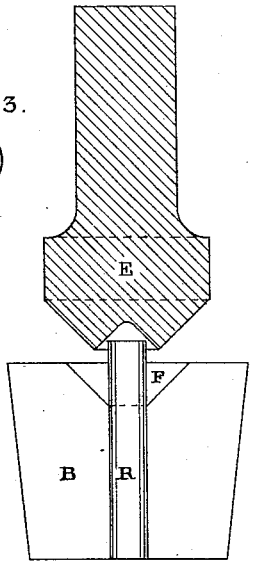


FIG. 2.

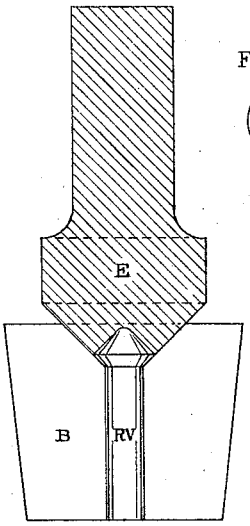


FIG. 13.

FIG. 9.

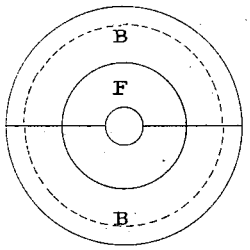


FIG. 16.

FIG. 3.

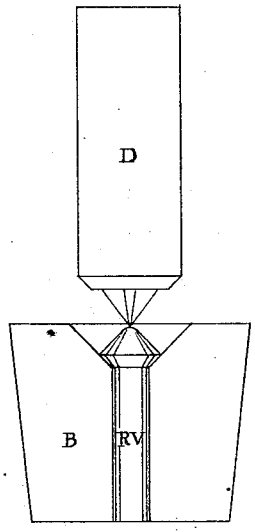


FIG. 21.

FIG. 22.

FIG. 4

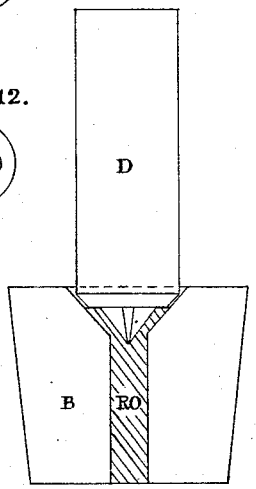


FIG. 5.

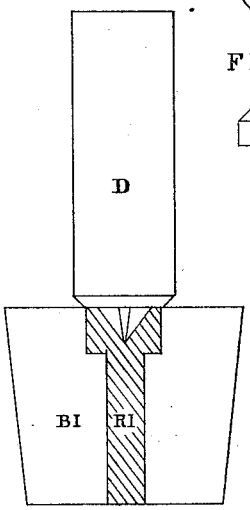


FIG. 14

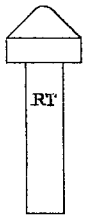
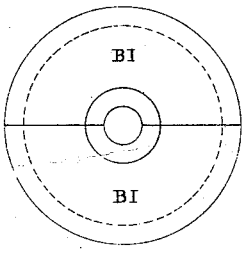


FIG. 12.

FIG. 10.



Witnesses;
John B. Gould
J. Prams.

Inventor;
John Frearson

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

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FIG. 8.

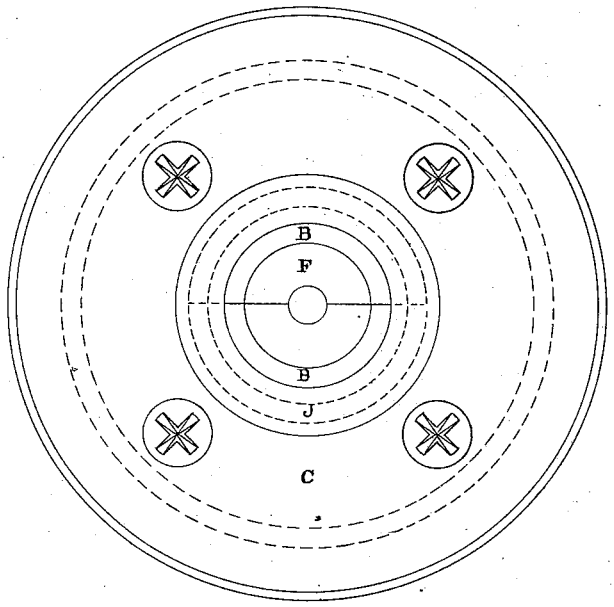
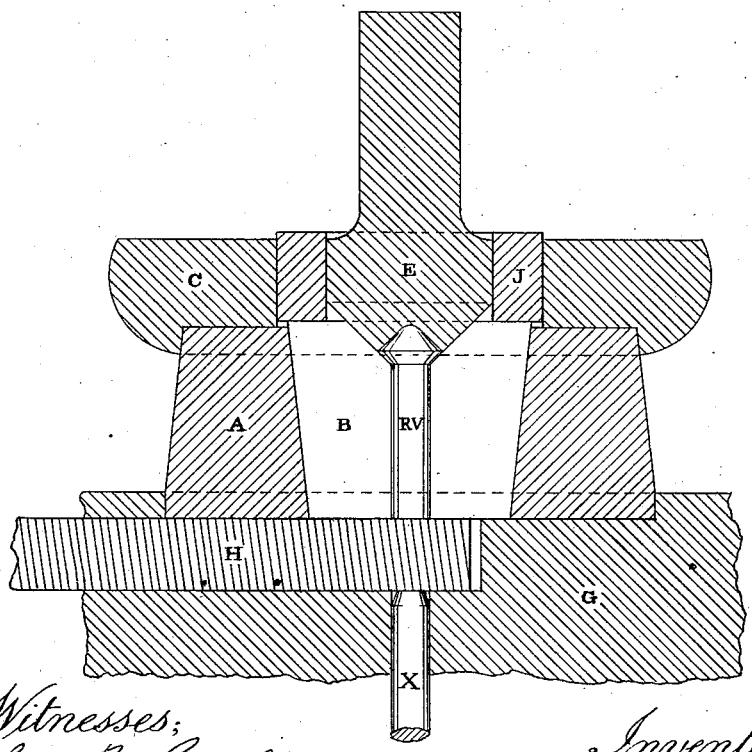


FIG. 6.



Witnesses;
John B Gould
J Praun.

Inventor;
John Frearson

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3 Sheets--Sheet 3.

J. FREARSON.

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FIG. 15.

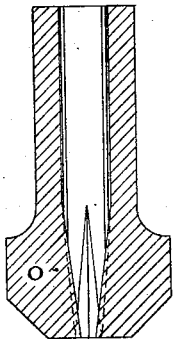


FIG. 19.

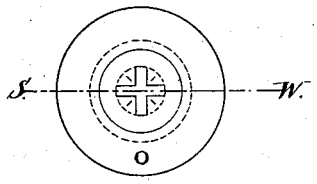


FIG. 20.

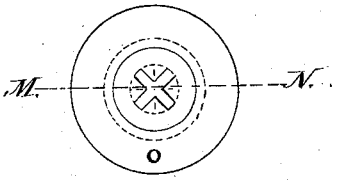


FIG. 18.

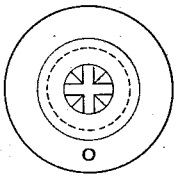
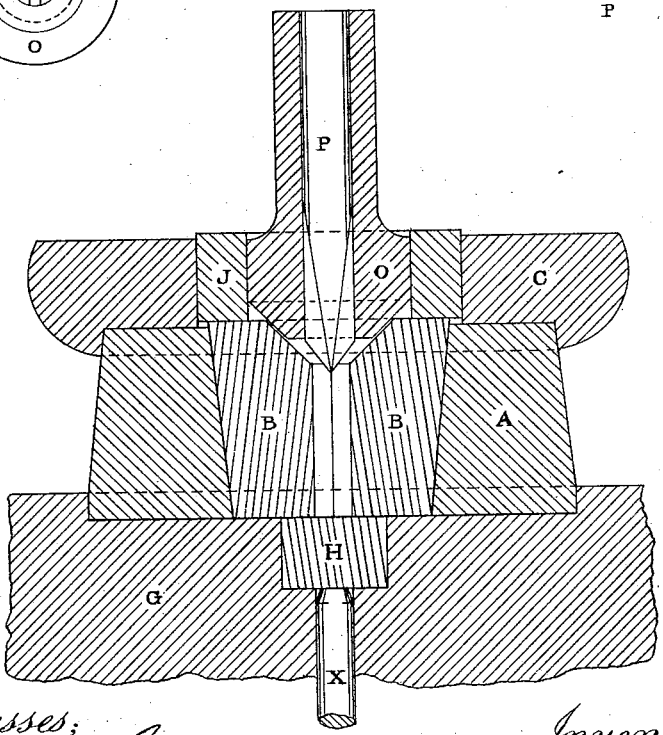


FIG. 17.

FIG. 7.



Witnesses:
John B. Gould
J. Prams.

Inventor:
John Frearson

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

UNITED STATES PATENT OFFICE.

JOHN FREARSON, OF BIRMINGHAM, ENGLAND.

IMPROVEMENT IN THE ART OF MANUFACTURING WOOD-SCREW BLANKS.

Specification forming part of Letters Patent No. **162,642**, dated April 27, 1875; application filed October 14, 1874.

To all whom it may concern:

Be it known that I, JOHN FREARSON, of 17 the Crescent, Birmingham, in the county of Warwick, England, mechanical engineer, have invented certain Improvements in the Manufacture of Screws or Screw-Blanks, and in the construction of tools and machinery for that purpose, of which the following is a specification:

My invention consists of the improvements hereinafter described, and illustrated in the accompanying drawings, in the manufacture of screws or screw-blanks, and in the construction of tools and machinery for that purpose.

To simplify the description, hereinafter the term screws will refer either to screws or screw-blanks, and the term screw-heads will refer either to screw-heads or to screw-blank heads.

My invention relates, first, to the manufacture of those screws which require cavities or nicks in their heads of the counter-shapes of the ends of screw-drivers by which they are driven, and especially to the manufacture of those screws described in the specification of Letters Patent granted to me for the United States of America on the 9th day of December, A. D. 1873, and numbered 145,411; secondly, to tools by which those screws are manufactured; and, thirdly, to parts of machinery to be used in connection with the said tools.

Iron screws, commonly termed "wood-screws," have been hitherto usually headed by means of flat-faced punches in dies having conical recesses therein of the depth of the heads of the screws, and, after being turned, then nicked by means of saws. By this system of heading screws by one operation, the iron becomes disintegrated before it fills the countersunk portion of the die, and so condensed when the die is filled that it is impossible, without fracture, to impress the cavities required in the heads of screws made according to the said patented invention; and if the iron wire used for making wood-screws is unsound before being headed it is made more unsound after being headed by the ordinary process, and after the deep nicks are made across the heads of the screws by means of sawing, the heads often part asunder during the operation of driving.

Before my patent screws could be soundly manufactured there were many difficulties to be overcome. Those difficulties are now removed by my present invention, the object of which is to prepare and make screw-heads sounder than those which are made by the ordinary process of heading, and so render them fit, without being annealed, to receive cavities or nicks therein by pressure, and for this purpose, according to my invention, I operate upon the metal twice. The first operation is to make the head of suitable shape, so as to enable the second operation of simultaneously impressing the cavity, nick, or nicks, and finishing the shape of the head, to be properly performed. I therefore first compress between a suitably-formed die and punch a head on the metal which is to form the screw, the upper surface of this head being smaller in diameter at its summit than at its base, and the head of sufficient altitude to allow of its being opened and spread out without obstruction while the first part of the cavity is being impressed—the said punch having a recess of the counter-form to that of the said head, and the said die having a conical or cylindrical countersunk recess sufficiently deep for the die to support the entire head while the cavity or nick is being impressed.

Having thus formed the head, before removing it from the said die, or while it is in another die of similar construction, I impress the cavity, nick, or nicks in, and compress the shape of the surface of the screw-head by means of another punch, having on its lower end a central projection of the counter form to that of the cavity, nick, or nicks required in the screw-head, and a face or shoulder outside of the said projection of the counter shape to that required on the surface of the screw-head. That portion which immediately surrounds the said recess of the preparatory heading-punch I make to fit the upper part of the countersunk recess of the said die, or I make the body part of the said punch to fit and slide through a collar situated above the said die, for the purpose of making the prepara-

tory head and its shank concentric with each other; and I sometimes make the body part of the impressing-punch to fit and slide through a collar, for the purpose of insuring the cavity, nick, or nicks being impressed concentrically with the body part and head of the screw. The effect of the recess in the preparatory heading-punch upon the metal being smaller in diameter at its summit than at its base is to compress the ends of the fibers toward the center during the process of heading, and so prevent the disintegration or rupture of the metal, thereby leaving the metal in a more ductile or less condensed state than if more compressed for the second punch to impress the cavity and complete the screw-head. The prepared screw-head being seated in the die, the central projection of the impressing-punch is caused to enter the apex of the prepared head, and as this punch advances toward its destination it opens the upper portion of the head, which spreads out until the face or shoulder of the punch reaches it, when the punch compresses and expands the metal, which is so confined by the surface of the countersunk part of the die and by the face of the punch that the metal pinches the impressing projection of the punch, so that the upper edges of the cavity, nick, or nicks are brought up to a proper angle, and the cavity is impressed and the screw-head formed while in its cold state, without being annealed between the operations of compressing the preparatory head and impressing the cavity, nick, or nicks therein, and by holding the metal all round while the cavity or nick is formed, the head of the screw is not so liable to crack or be spoiled as by the process I formerly adopted in making my patent screws. When screw-heads are too large to be manufactured by the cold process, according to my invention, I make them while the metal is in a heated state.

To aid in a further description of the processes of manufacturing screw-heads, and in ascertaining the nature of my invention of improved tools and machinery, I will now refer to the accompanying three sheets of drawings.

Figures 3, 4, and 5 represent in elevation, and Figs. 1, 2, 6, 7, and 15 represent vertical sections of, the tools and parts of machinery for the manufacture of screws according to my invention. Figs. 8, 9, 10, 11, 17, 18, 19, 20, 21, and 22 represent in plan articles illustrated in elevation and section in the previously-recited figures of the drawings.

The same signs of reference in the accompanying drawings indicate the same articles or parts.

Figs. 1, 2, 3, and 4 represent the consecutive stages of the process of manufacturing screws according to my invention. R represents in elevation the cylindrical rod of metal which is to form the screw. R V is an elevation of the said metal, with a prepared head formed thereon of a conoidal shape; and R O is a vertical section, and Fig. 12 a plan, of the said metal with the completed screw-head and the cavity impressed therein.

E represents the punch, having a conoidal recess for compressing the conoid on the metal, as shown in Figs. 2, 3, 6, and 13. D represents the cavity-impressing punch. F represents the countersunk portion of the die B, for giving form to the under side of the conoidal and finished head of the screw, and for fitting the conical part of the preparing-punch E.

Fig. 14 represents, in elevation, the prepared conoidal head R T, which is to form the screw R I. Figs. 5 and 10 represent, in elevation and plan, respectively, the half part of the die B I, having a central cylindrical recess or countersink, in which is formed a cylindrical screw-head, with the cavity impressed therein by the punch D, as shown in vertical section, Fig. 5, and in plan, Fig. 16.

G, Figs. 6 and 7, represents a portion of the bed of a press or machine, in which is fitted the abutment-slide H, the discharging-ram X, and the die-holder A, which has through its center a conical hole, containing the split die B B, which rests upon G and H. Upon A is fitted the ring-cap C, in which is fitted the external part of the collar J, and the internal part of J is fitted to the punches E and O. The cap C and the die-holder A are securely held to the bed G by means of screws, as shown in Fig. 8.

Having properly annealed the punch D, and prepared its face and impressing-point, I form the flutes therein by pressure in a suitable matrix, or by means of cutting-tools.

I employ a punch composed of two parts—namely, a punch within a punch—the central part P for impressing the cavity, and the other part, O, for compressing the surface of the head of the screw.

Fig. 7 represents the punch O in vertical section, taken through the line S W, as shown in Fig. 19; and Fig. 15 is a vertical section taken through the line M N, Fig. 20. Fig. 18 is a plan, showing the top of the punch O, and Fig. 17 is a plan of the lower end of P. This compound punch may be employed in combination with the die B, or the die B I, for producing the cavities in, and shaping the surfaces of, flat-faced screw-heads.

Having drilled a hole in the center of O, of the size and depth of the plain part of P, and also a conical hole of the size of the core of the fluted part of P, I then drift the four radial grooves in O, as shown in Figs. 18, 19, and 20, and when the punch P is hardened and tempered I force it into the punch O until the cross V-point of P protrudes through O, as shown in Fig. 7. I then turn the body of O to fit J, and the shank to fit the ram or chuck of the press or machine, and the lower end of O I make to fit the countersink F of the die B, and when faced, hardened, and tem-

pered this compound punch is prepared for use.

The punch O has a double purpose—namely, to compress the face of the screw-head, and to hold the central punch P. The upper end of each of these punches, when at work, presses against a steel-hardened abutment-washer in the chuck or ram in which it is fixed. In some cases these compound punches will be found to be more advantageous than the single ones, and the central part P can easily be made of drawn steel wire, and fluted by means of a circular cutter, and when imperfect it can be withdrawn from O, and a new one inserted with facility.

I make each die of two parts, in such a manner that when placed face to face their internal central hole is of the form required for the screw-blank, and their external parts form a cone, and are fitted into a conical hole in a suitable holder or bolster, which secures them concentrically with the punch in a press or machine.

The half-dies B or B I, I forge of best iron in a suitable die, and well steel the parts which surround the screw-blank, and when the two surfaces which come together and their end surfaces are planed in suitable holders, I secure each half-die between a cramp and shoulder on an intermittent rotating mandrel, which has half of its diameter cut away for that purpose, and on which mandrel the conical part of the said half-die B or B I is planed or turned. When the two half-dies are planed or turned they are placed face to face and inserted in a conical chuck, and secured therein by means of clamps, where the central cylindrical hole is bored, and the die recessed as required, then properly hardened.

The circular cap C, the circular collar J, and the circular die-holder A are forged of coiled bar-iron, and when bored and turned as required they are case-hardened and finished for use.

I will now describe the action of the said tools and parts of the machinery required in the process of manufacturing screws according to my invention. A piece of metal, R, Fig. 1, of suitable length and diameter, being placed in the die B B, Figs. 6 and 8, the punch E descends and compresses upon it the conoidal head R V. The punch E then ascends out of the way, and the abutment-slide H recedes to make way for the discharging-ram X, which, as it ascends, raises R V, B B, and J about one-third of an inch, when J and B B are stopped by a two-branched lever (not shown in the drawing) pressing upon two opposite sides of the upper surface of the collar J, and as the die B B is relieved from the gripe of the holder A the two halves B B open, and X discharges the conoidal screw-blank from the press or machine. X being withdrawn and H reinserted, another rod of metal is placed in B B, and the said two-branched lever, pressing upon J, forces the die B B to its seat again, when the tools are in position for the operations of these parts of the machinery to be repeated. The conoidal-headed screw-blanks thus prepared are then fed into another press or machine, Fig. 7, which contains the tools for impressing the cavities in the prepared heads, where they are completed according to my invention. However, as the motions of this press or machine are precisely the same as those described for making the prepared conoidal heads, it is not necessary to repeat the description.

In order that my invention might be easily understood, I have described the tools for making the prepared head as being in a separate press or machine to that in which the tools impress the cavity and complete the head of the screw; but as the edges of the split die B B, when worn, will produce a fin-like projection on two sides of the shank, and on the under surface of the conoidal head, which fin-like projection may prevent the conoidal head from being firmly seated in the second die, and thereby endanger the breakage of the punch P or D, I prefer to make the prepared conoidal head and impress the cavity therein before being removed from the die in which the conoid was formed, and therefore I have constructed a self-acting machine for this purpose, in which the two punches E and O P, or D, are placed in slides parallel to each other, the proper distance apart, and four sets of dies are placed at an equal distance apart, in an intermittent rotating table, which moves the dies from the preparing-punch to the nicking-punch, and each time the table is at rest the two punches operate simultaneously, E making the prepared head, while D or P produces the cavity in the one previously prepared. However, as circular intermittent rotating tables containing dies for the manufacture of other kinds of articles are in use, and the actuating parts in such machinery are applicable to my invention, any competent machinist can supply the actuating apparatus to each part described, and illustrated in the accompanying drawings, and any competent toolmaker can make the tools according to my invention, without further description or illustration.

Although, for convenience of description, I have described the said parts of the press or machine as being placed in vertical position, I prefer to place them horizontally.

Whatever shape the finished head of the screw may be, in all cases I prefer to make the preparatory head of a conoidal or conical shape, and of sufficient altitude to prepare it for the complete formation of the cavity or nick, and of the finished head by the second punch.

Having described the nature of my invention, and the manner in which the same is to be performed, I wish it to be understood that I do not limit myself to the precise details

herein described, and illustrated in the accompanying drawings, as the same may be varied without departing from the nature of my invention; but

I claim as my invention of improvements in the manufacture of screws or screw-blanks, and in the construction of tools and machinery for that purpose—

1. As an improvement in the art of forming heads upon screws and screw-blanks, first upsetting the end of the wire rod or blank in a flaring or cone-shaped recess or cavity in the face of the die-block by means of a punch chamfered externally to correspond to the wall of the said recess, and having at its extremity a flaring, conical, or conoidal cavity, and then subjecting the upset head, while still in the die in which it was formed, or in another die like it, to the action of another punch, that, entering by its point into the apex of the conical or conoidal head, shall, at the same time, force the metal laterally outwardly all around, to, and against the wall of the flaring or conical die-block recess, produce the cavity, nick or nicks, and flatten or shape the extremity or outer surface of the screw-head, substantially as described.

2. The combination of the punch D and die B B, constructed and arranged as shown in Fig. 3.

3. The combination, substantially illustrated in Fig. 7, of the parts marked P, O, J, C, A, B, H, G, and X, arranged for joint operation, as and for the purposes set forth.

4. In combination with the herein-described parts marked C, J, A, B, H, G, and X, the punch E, constructed substantially as and for the purposes set forth.

JOHN FREARSON.

Witnesses:

JOSEPH SAMUEL ORTON,

ALBERT DANCASTER.