(No Model.) 4 Sheets—Sheet 1.

D. E. KEMPSTER.

MANUFACTURE OF HORSESHOE NAILS AND NAIL BLANKS.

No. 427,030. Patented Apr. 29, 1890.

Fig. 1.

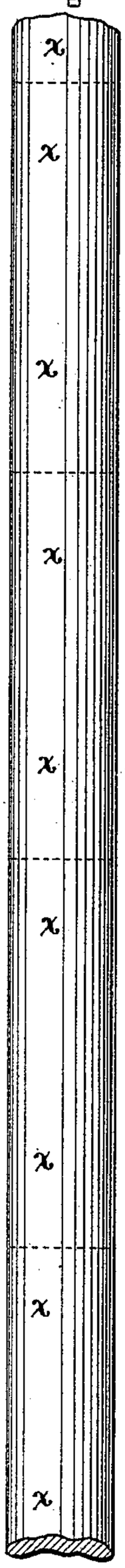


Fig. 2.

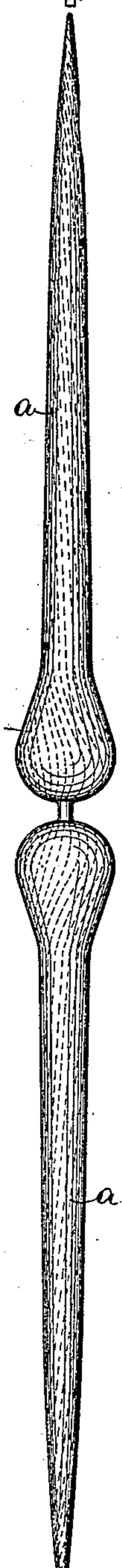


Fig. 3.

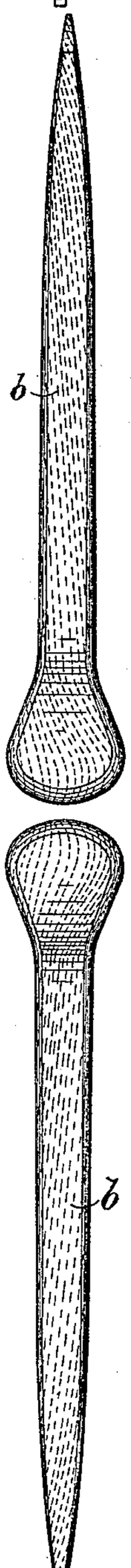


Fig. 4.

Fig. 5.

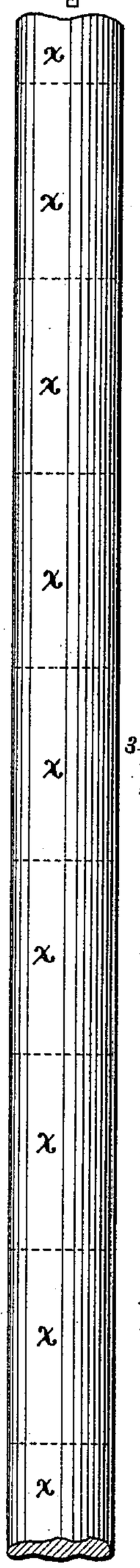


Fig. 6.

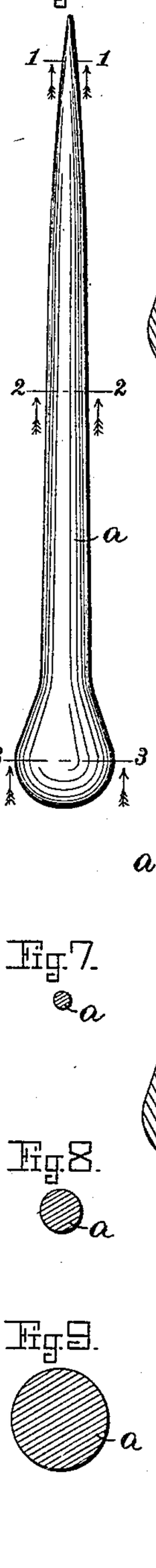


Fig. 10.

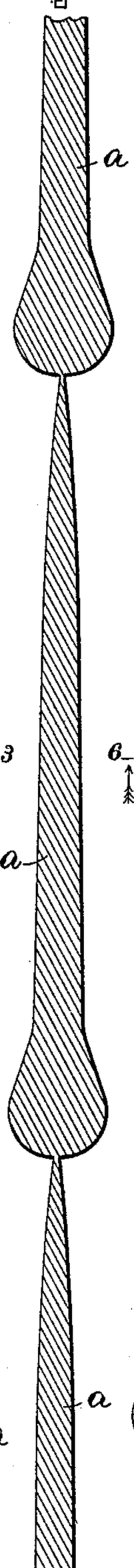


Fig. 11.

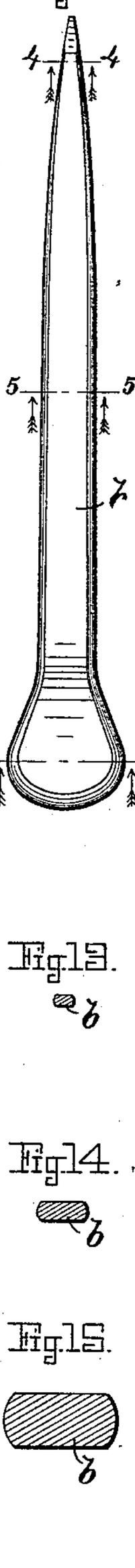


Fig. 12.

Fig. 7.

Fig. 13.

Fig. 8.

Fig. 14.

Fig. 9.

Fig. 15.

Witnesses

Henry Chadbourn.

Herbert L. Chapin.

Inventor

Daniel E. Kempster.

(No Model.) 4 Sheets—Sheet 2.

D. E. KEMPSTER.

MANUFACTURE OF HORSESHOE NAILS AND NAIL BLANKS.

No. 427,030. Patented Apr. 29, 1890.

Fig 16.

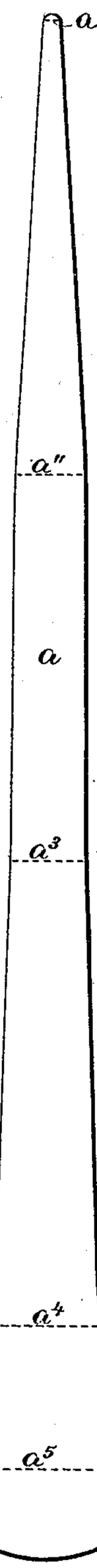


Fig 17.

Fig 19.

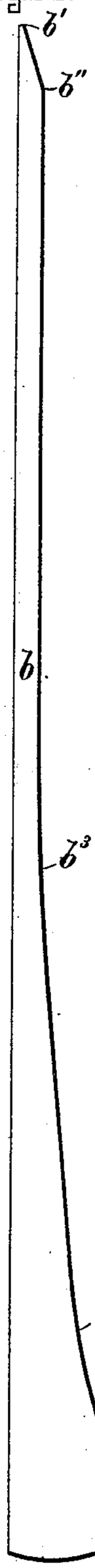
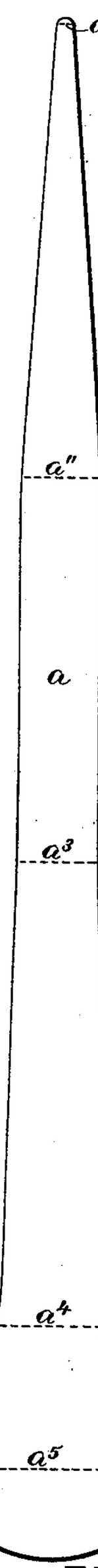


Fig 18.



Witnesses
Henry Chadbourn.
Herbert L. Chapin.

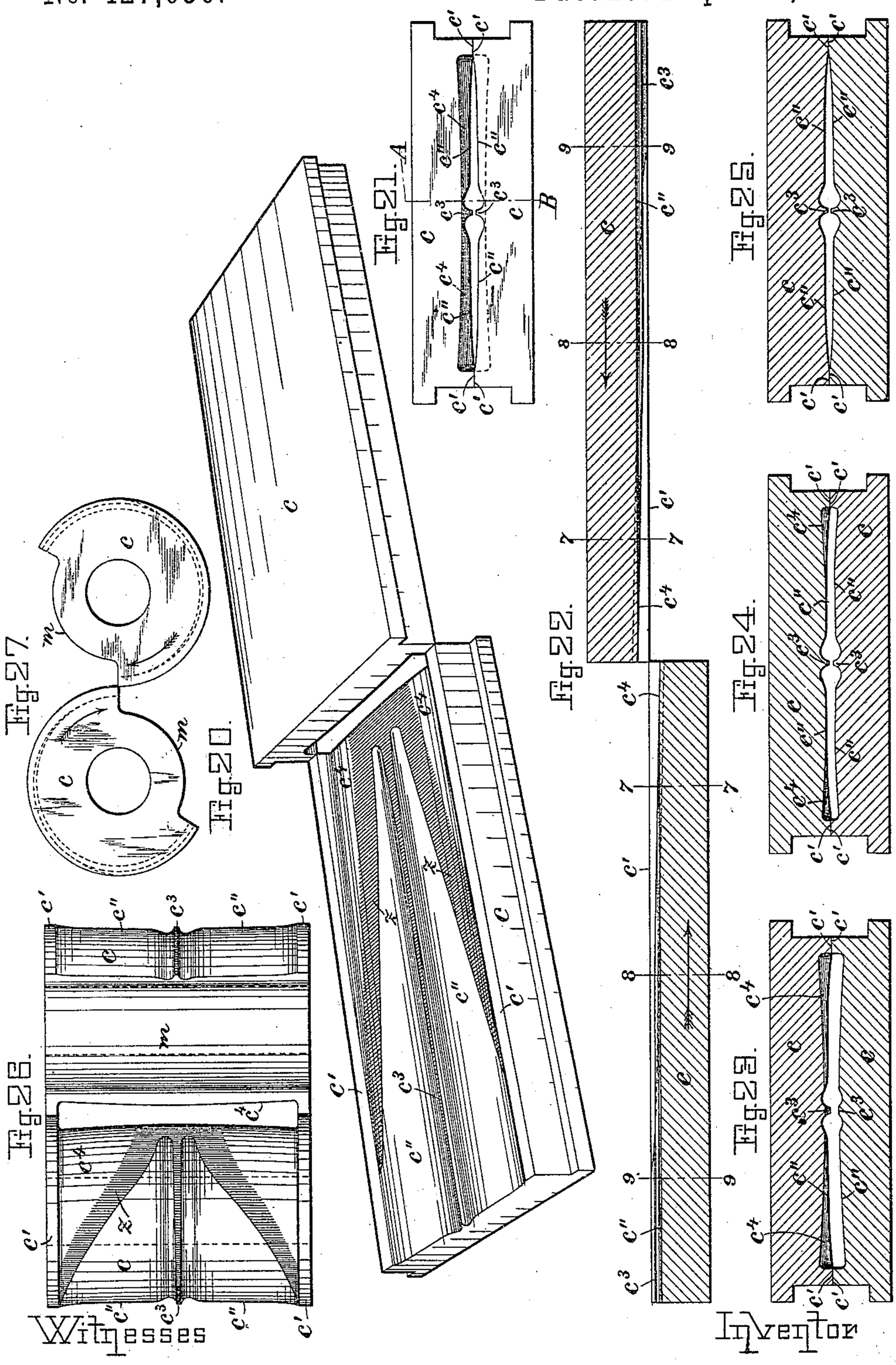
Inventor
Daniel E. Kempster.

(No Model.) 4 Sheets—Sheet 3.

D. E. KEMPSTER.

MANUFACTURE OF HORSESHOE NAILS AND NAIL BLANKS.

No. 427,030. Patented Apr. 29, 1890.



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MANUFACTURE OF HORSESHOE NAILS AND NAIL BLANKS.

No. 427,030. Patented Apr. 29, 1890.

Fig. 40.

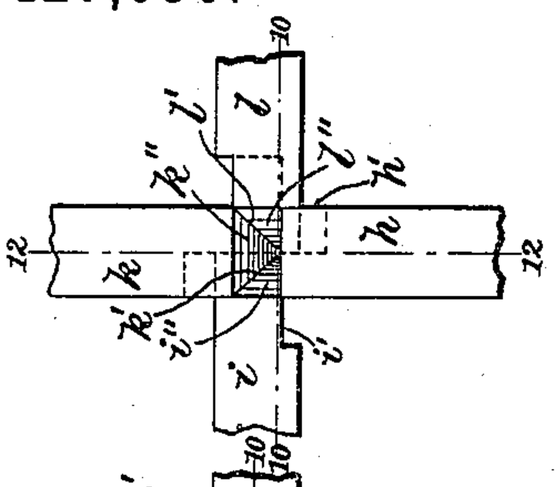


Fig. 41.

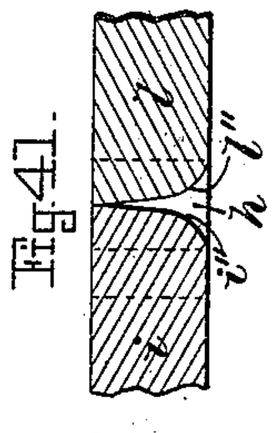


Fig. 42.

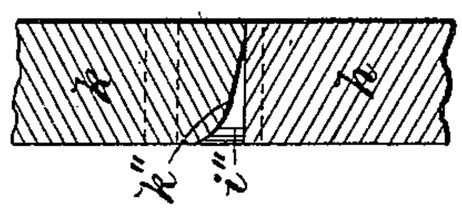


Fig. 37.

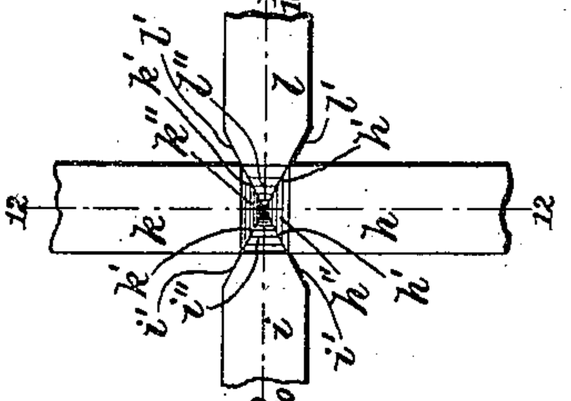


Fig. 38.

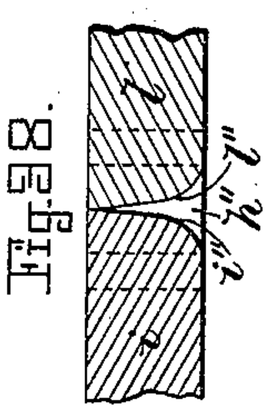


Fig. 39.

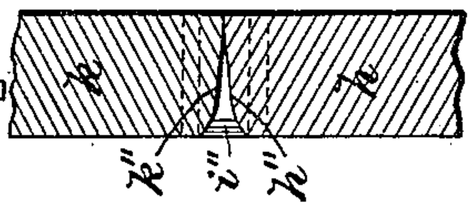


Fig. 34.

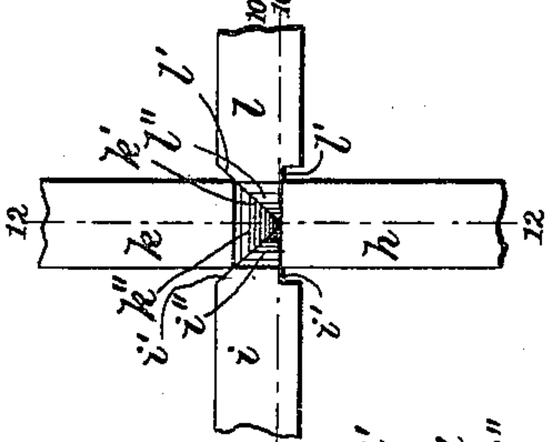


Fig. 35.

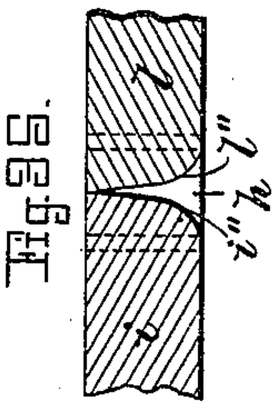


Fig. 36.

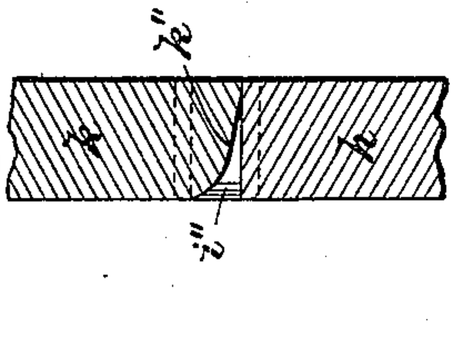


Fig. 30.

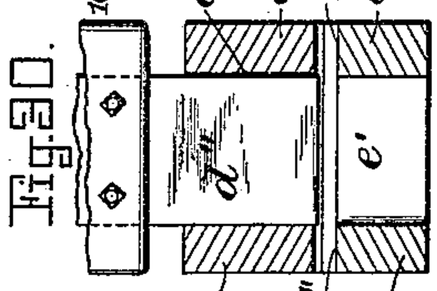


Fig. 32.

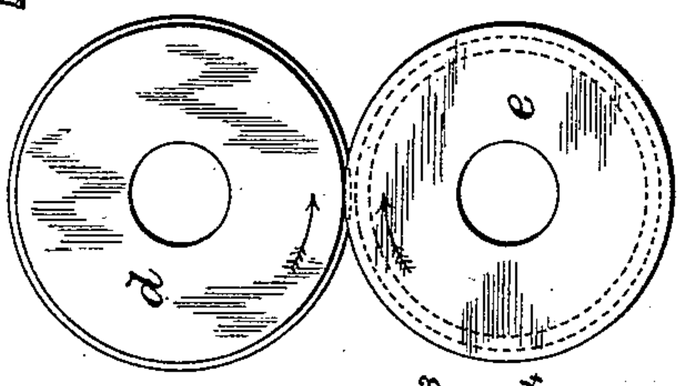


Fig. 28.

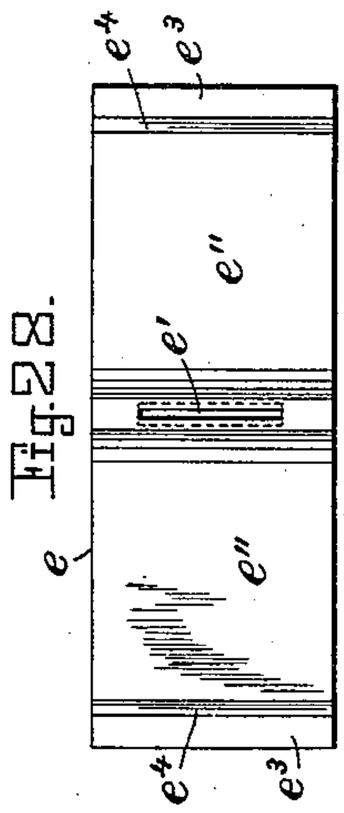


Fig. 29.

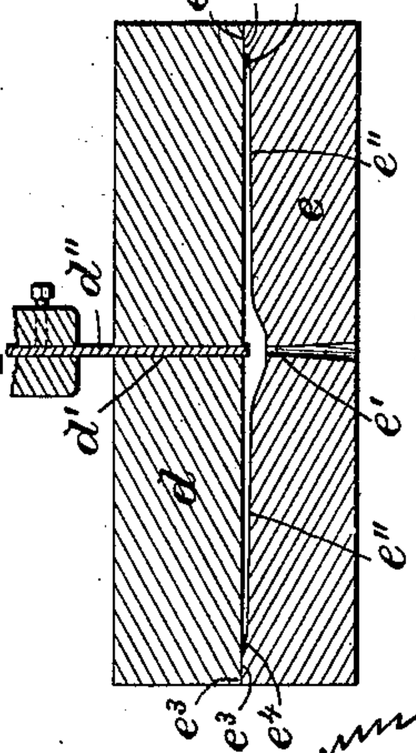


Fig. 31.

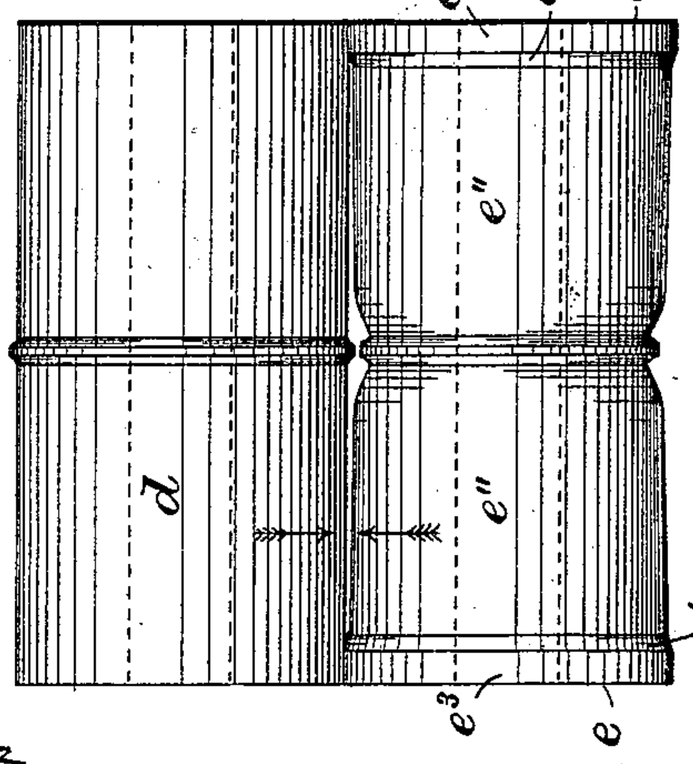
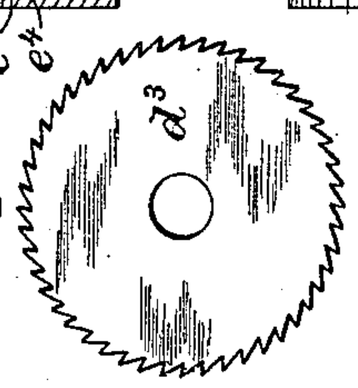


Fig. 33.



Witnesses

Henry Chadbourn.

Herbert L. Chapin.

Inventor

Daniel E. Kempster.

UNITED STATES PATENT OFFICE.

DANIEL E. KEMPSTER, OF BOSTON, MASSACHUSETTS.

MANUFACTURE OF HORSESHOE-NAILS AND NAIL-BLANKS.

SPECIFICATION forming part of Letters Patent No. 427,030, dated April 29, 1890.

Original application filed April 23, 1888, Serial No. 271,534. Divided and this application filed March 15, 1889. Serial No. 303,408. (No model.)

To all whom it may concern:

Be it known that I, DANIEL E. KEMPSTER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in the Process, Method, or Art of Manufacturing Horseshoe-Nails and Blanks Therefor; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to the manufacture of animal-shoe nails, especially to the improved nail which forms the subject of a separate application for Letters Patent, filed by me in the United States Patent Office April 23, 1888, and bearing Serial No. 271,534, and of which application the present application forms a division.

My invention has for its objects to manufacture animal-shoe nails more cheaply and economically than heretofore, and also to produce better nails, possessing properties peculiar to themselves by reason of their novel manufacture, which gives them superiority by combining therein the many special qualities essential in a perfect or ideal animal-shoe nail.

My invention consists in the novel process, method, or art of manufacturing animal-shoe nails herein described, and particularly pointed out in the claims.

In the drawings hereto annexed and forming a part of this specification similar letters of reference indicate corresponding parts wherever they occur thereon.

Figure 1 is a side view of a portion of a metal rod or bar, the dotted lines thereon indicating about the length of blank to be severed therefrom required for a double or "twin" nail-blank rolled forging. Fig. 2 is a side view of a double or twin nail-blank rolled forging. Fig. 3 is a face view of said forging after the flattening and pointing operations, which separate and produce two completely finished nails. Fig. 4 is a central longitudinal section of another form of double or twin nail-blank rolled forging, in which said blanks are joined at their points instead of at their heads. Fig. 5 is a side view of a portion of metal rod or bar, the dotted lines thereon indicating about the length of blank to be severed therefrom required for a single nail-blank rolled forging. Fig. 6 is a side view of a single nail-blank rolled forging. Figs. 7, 8, and 9 are cross-sections of nail-blank rolled forgings on the cross-lines 1, 2, and 3, respectively, in Fig. 6. Fig. 10 is a central longitudinal section of a rolled forged nail-rod, in which round nails are all joined in a rod or bar. Fig. 11 is a face view of a single nail-blank rolled forging after the flattening and pointing operations, which produce the finished nail. Fig. 12 is an edge view of a finished nail, shown in section. Figs. 13, 14, and 15 are cross-sections of a finished nail on the cross-lines 4, 5, and 6, respectively, in Fig. 11. Fig. 16 is an enlarged view of the nail shown in Fig. 6. Fig. 17 is an enlarged view of the nail shown in Fig. 12. Figs. 18 and 19 are similar views showing another form having straight and also different degrees of tapering portions within its length, as will be more fully explained hereinafter. Fig. 20 is a perspective view of two platen-dies for cross-rolling or roll-forging the double or twin nail-blanks, said dies being shown in about the position they occupy when first starting to roll the metal blank. Fig. 21 is an end view of said dies as seen from the left of Fig. 20. Fig. 22 is a longitudinal section of said dies on the line A B in Fig. 21. Fig. 23 is a cross-section of said dies on the cross-line 7 in Fig. 22. Fig. 24 is a cross-section of said dies on the cross-line 8 in Fig. 22. Fig. 25 is a cross-section of said dies on the cross-line 9 in Fig. 22. Figs. 26 and 27 are side and end views, respectively, of said dies when made in the form of rolls instead of platens, said die-rolls being shown in about the position they occupy when first starting to roll the metal blank, and being cut away at *m m* to permit the nail-blank to drop out when completely forged. Fig. 28 is a top view of a "female" die for flattening the double or twin nail-blank rolled forging thereon. Fig. 29 is a longitudinal section of

male and female flattening-dies. It shows also a punch and die for cutting apart and separating the double or twin nails. Fig. 30 is a central cross-section of said flattening-dies and also a side view of the nail-separating punch or die. Figs. 31 and 32 are side and end views, respectively, of said flattening-dies when made in the form of rolls instead of platens. Fig. 33 is a side view of a saw or cutter, which may be used for separating the double or twin nails instead of the punch and die shown in Figs. 29 and 30. Figs. 34, 37, and 40 are top or plan views of the nail-pointing dies, showing different ways of shaping their converging working ends, so that they may be able to all act simultaneously upon the four sides, or two sides and two edges, of the point of the nail. Figs. 35, 38, and 41 are respective sections of the same on the line 10 in Figs. 34, 37, and 40. Figs. 36, 39, and 42 are respective sections of the same on the line 12 in Figs. 34, 37, and 40.

In the drawings, Fig. 1, is shown in dotted lines the double blanks *x x* to be severed from the metal rod or bar and from which to produce the double or twin nail-blank rolled forging *a a* shown in Figs. 2 and 4. If preferred, the forging-dies *c c* may be so shaped as to entirely separate the nail-blanks *a a* (in Figs. 2 and 4) when forging them, thus producing two nail-blanks with the tops of their heads left round and smooth, similar to that shown in Fig. 6.

In Fig. 5 is shown in dotted lines the single blanks *x* to be severed from the metal rod or bar and from which to produce the single nail-blank rolled forging *a* shown in Fig. 6.

Fig. 10 is a metal rod or bar roll-forged into a nail-rod or continuous wire of connected animal-shoe-nail blanks *a a a*, &c. This form of nail-rod or continuous strip of round nails will be found useful for nails of other classes than the one herein described, and I desire to state that I have already made a continuous wire nail-rod having nails of suitable form and shape adapted for use in fastening leather and similar material, and therefore I reserve all rights thereto outside of the special class nail claimed in this application for another and separate application for a patent hereafter.

The nail-blanks *a* are circular in cross-section, and have tapering blades or shanks usually of varying degrees of taper throughout their length; but said nail-blanks may be formed of any shape longitudinally which may be desired by simply changing the shape of the working-faces of the forging-dies, as will, of course, be readily understood.

I prefer to forge the nail-blanks from hot metal, thus making them strong, tough, and durable, although, if preferred, said nail-blanks may be formed of cold metal, and the heat generated in them, by the rapid working of the dies while rolling, drawing, and forming the metal, is sufficient to anneal and prevent said nails from becoming hard and brittle. The use of hot metal, however, admits of running the forging-dies a greater length of time without reshaping, and also permits using a less expensive grade of iron in the manufacture of the nails without taking from said nails any of the essential qualities required therein. I then finish said forged nail-blanks when cold by flattening them and beveling their points, thus making smooth, stiff, and hardened nails, as will be more fully described hereinafter.

In practicing my invention the processes and methods made use of by me by means of my improved dies are substantially as follows: I would first state, however, that as machines for operating various forms of dies, both rotary and reciprocating, for making rolled forgings, and also machines for operating various forms of dies, both rotary and reciprocating, and for compressing and forming cold metal are old and well-known mechanical devices a detail description thereof is not deemed essential herewith, and consequently the following relates more especially to the progressive process and methods of manufacture, and to the construction and arrangement of the different dies employed therein.

In view of the foregoing, the forging-dies *c c* (shown in the drawings from Figs. 20 to 25, inclusive) are straight platens, and are assumed to be suitably mounted in the machine, (one or both dies being made to reciprocate,) with their working-faces adjacent to each other and adapted to travel, as indicated by the arrows shown in Fig. 22, and cross-roll or roll-forge metal introduced between their converging faces and produce the round, double, or twin nail-blank *a a* shown in Fig. 2. The dies *c c* have plane faces *c′ c′*, which lie parallel to each other when in position for work, and within said plane faces are sunk longitudinally the working-grooves *c″*, the working-surfaces of said grooves being shaped in cross-section corresponding to and the converse of the longitudinal configuration of one-half, more or less, of the round, double, or twin nail-blank *a a*, as shown in the drawings from Figs. 20 to 25. A central rib c^3 within the working-groove *c″* partly divides said double or twin nail-blank, as shown in said figure. If so desired, the center rib c^3 may rise flush with the plane faces *c′ c′*, and thus entirely divide said blank into two separate nail-blanks similar to that shown in Fig. 6, as before stated. The working-grooves *c″* are formed of equal width from end to end, but made tapering as to depth—that is to say, the die-grooves *c″* have tapering portions c^4, commencing about on the cross-line 9 in Fig. 22 and deepening toward their starting ends, where said grooves are a little deeper than one-half the diameter of the metal nail rod or blank *x x*, from which the round nail-blank is to be forged. This allows the metal blank when severed from the rod to freely enter between the tapering surfaces of the die-grooves. Said tapering surfaces may be milled or scored,

as at *z*, if so preferred, to aid in rotating the blank during the operation of the dies; or, if desired, said surfaces may be left smooth, excepting the central parting-rib c^3, which I prefer to mill or score its entire length, and also form far enough below the surfaces of the plane faces *c' c'* to leave a metal connection between the heads of the two nail-blanks *a a*, as shown in Fig. 2, as I find a considerable saving of time is effected in the subsequent operations on said blanks by thus handling them in duplex or twin form.

The tapering portions c^4 of the die-grooves *c''*, I denominate their "reducing" and "spreading" surfaces, and the balance or longitudinally straight portions of said grooves their "forming" or "finishing" surfaces. The reducing and spreading surfaces c^4 may be formed straight or slightly tapering in cross-section, or they may be formed crowning or convex, as shown in Figs. 20 and 26.

Figs. 23, 24, and 25 are cross-sections of the dies *c c* on the cross-lines 7 8 9, respectively, in Fig. 22, showing the different positions the dies occupy when in operation, and serve to illustrate the progression in change of form which would be given a metal blank being rolled between the converging faces of the die-grooves.

The dies *c c* are shown as adapted to forge a special shape of animal-shoe-nail blank; but it is evident that I may change or modify the shape of said blanks, if so preferred, to better adapt them for finishing and pointing in other ways and by other means than are herein shown and described, and I propose to make other and separate applications for patents embodying the rolled-forging process, combined with other and different processes of finishing and pointing the nails. I should also state that a machine having dies adapted to form round animal-shoe nails and then flatten and point them, all in one machine operating automatically and producing completely-finished nails, is already contemplated and in process of construction by me, and will form the subject of another application for patent hereafter.

The forging-dies *c c* (shown in Figs. 26 and 27) are substantially the same as the forging-dies just described, excepting that they are in the forms of rolls instead of platens; and it will be evident that said dies may also be formed segmental or curved, or one die may be concaved longitudinally and the other convexed longitudinally, or they may be made in any other of the well-known forms of construction, and they may either one or both be revolved or reciprocated, as preferred. It will also be evident to any mechanic that I may, if so preferred, form the working-grooves in any of the aforesaid dies without any tapering portions c^4 therein, and make them alike (straight longitudinally) from end to end, and by simply giving the dies a forward and backward movement to cause their working-faces to approach each other while rolling the metal the same result is obtained upon the forging as when the dies are tapered and operated as first described. This would require no invention, but simply an equivalent modification of the mechanical construction of the forging devices, as must be readily understood.

The flattening-dies *d e* (shown in Figs. 28, 29, and 30) are straight plate-dies, such as are commonly used in presses for stamping cold metal, and are assumed to be suitably mounted in the machine, (one or both dies being made to reciprocate,) so as to compress or flatten the metal nail-blank *a a* introduced between their adjacent faces. The male die *d* has a plane face provided with the opening *d'*, through which passes the nail-separating punch or male die *d''*, suitably mounted in the aforesaid machine, so as to reciprocate independent of the die *d* and enter its co-operating female die *e'*, formed in the female flattening-die *e*. In the face of the female die *e* is sunk a groove *e''*, the surface of said groove being formed in cross-section corresponding to and the converse of the longitudinal configuration of two flattened nails edgewise, substantially as shown in Fig. 29, and the plane faces e^3 e^3 on the female die *e* act as a stop for the male die *d* to strike against, thus admitting of great pressure being given the nail-blanks to bring them all to an exact thickness without danger of crushing them by the blow. It will be evident that part or all of the plane faces e^3 e^3 may be formed on the male die *d*, or said faces may be entirely dispensed with and other means employed for gaging or stopping the blow; also, the bevels e^4 e^4 on the female die *e* may be dispensed with and the nails entirely pointed and beveled by the simultaneously-acting pointing-dies before alluded to and which will be fully described hereinafter.

If preferred, the flattening-dies *d* and *e* may be made solid and unprovided with any nail-separating dies *d''* and *e'*, and the flattened and connected twin nails may be cut apart and separated by other means—as, for instance, the metal saw or toothed cutter d^3 may be suitably held in the flattening machine or press so as to be revolved, and the twin nails may be automatically fed across it and separated thereby, as will be readily understood by any mechanic.

The nail-flattening dies *d* and *e* (shown in Figs. 31 and 32) are substantially the same as those just described, excepting that they are in the form of rolls instead of flat dies, and said roller-dies are also without any nail-separating dies. It is evident that said flattening-dies may also be made in curved or segmental form and revolved or reciprocated, as preferred. I wish to state, also, that in practice the faces of the nail-flattening dies are formed with a suitable curve longitudinally, so as to bend as well as flatten the nails, and thus give them the usual and proper curvature or "set" required for driving, as will be readily under-

stood by those familiar with this class of nails, although they are shown here as straight, it being somewhat easier to so represent them in the drawings. I have also shown in the drawings the nail-forging and nail-flattening dies as made in the duplex form. This being a preferred form of construction, it is of course evident that said dies may be shaped for a single article or for any number desired.

The nail-pointing dies *h i k l* (shown in Figs. 34 to 42, inclusive) represent different ways of shaping the working ends of said dies, so that they may all be brought up together simultaneously to compress the nail upon all sides, and either set of said dies shown may be assumed to be properly mounted in a suitable machine, and being shaped or cut away as shown are all four adapted to act simultaneously upon the point of the nail and compress it upon all sides, or, rather, upon its two sides and two edges, and thus evenly condense the metal and bring it to a perfectly beveled and hardened point without any lateral displacement alternately in opposite direction of the fibers of metal composing the point of the nail as it is drawn to a point without spreading the metal laterally. Heretofore in the usual custom of beveling the points of the nails by compressing or hammering said nails when cold it has been found necessary, in order to operate upon the small blade or point of the nail and have the pointing dies or hammers clear each other while in operation, to act upon said points alternately, first upon two opposite sides and then upon two opposite edges, or vice versa. This lateral displacement alternately in opposite directions of the fibers of metal composing the delicate point of the nail necessarily fractures the minute crystals of metal and destroys the tenacity and cohesiveness of the fibers thereof, thus engendering laminations and minute cracks, and, although such nails seem apparently sound as far as any external appearance can denote, when they are driven into the hoof they develop slivers and split points, to the very great danger of disabling the animal being shod thereby. My improved dies above referred to effectually overcome the objections and defects mentioned, and also hasten the operation of pointing the nails. I prefer to use said dies constructed as shown in Figs. 34, 35, and 36, and, although they may all four reciprocate to and from a common center, I prefer to make the die *h* stationary to form an anvil for the back of the nail to rest against, and the dies *i k l*, I bevel and shape substantially as shown at *i' k' l'*, so as to permit their working ends or faces to come together simultaneously and compress the point of the nail against the anvil or die *h*, the four dies, when all brought together, forming a pocket or complete die of the exact shape of the finished and beveled nail-point. The dies *i k l* are flared or rounded on their upper corners, as shown at *i'' k'' l''*, to correspond with the size of the mouth of conductor or spout through which the nails pass automatically, point first, from the flattening-dies to and into the said pointing-dies. The upper or top corner of said dies being flared, as before stated, prevents the nails from lodging thereon and causes them to drop into proper position, where they are firmly held during the operation of pointing them.

The dies *i k l* are caused by a suitable cam or other mechanism to reciprocate simultaneously a certain number of times, generally about three compressions, to condense and bevel the point of the nail, and then said dies are caused to open apart wide enough to permit the finished nail when liberated to pass entirely through and then immediately close together sufficiently far to form a proper sized pocket or **V** to catch the next succeeding nail and allow it to settle far enough into said pocket to give the necessary metal stock when clamped or held in position for the dies to act upon and condense and bevel to a point. The die *k* is properly shaped on its face to impart the desired bevel to the point of the nail, and when reciprocated is forced against the plane or anvil-die *h*, and the dies *i l* are forced against each other and have their faces shaped the proper angle of the tapering side edges of the point of the nail, the working ends of the moving dies being beveled, substantially as shown, so as to all converge to a common center on the anvil-die *h*, and thus condense and bevel the point of the nail by acting simultaneously on all sides of it, and consequently without spreading the metal laterally, as hereinbefore stated.

The pointing-dies *h i k l* (shown in Figs. 37, 38, and 39) are substantially the same as those just described, excepting the die *h*, which is shown as also beveled and shaped as at *h' h''*, and the dies *i k l*, which are shaped to co-operate therewith.

The dies shown in Figs. 40, 41, and 42 are substantially the same as the two sets just described, they merely showing a little different manner of beveling and shaping the working ends of said dies, as at *h' h'' i' i'' k' k'' l' l''*, as will be readily understood by any mechanic on referring to the drawings without further description other than to state that in the operation of either set of the dies shown the round-edged nail-point is neatly and squarely drawn down to a perfectly beveled point without leaving any "fins" or seams thereon denoting the junction between the several dies.

Having described the several stages or progressive degrees of manufacture, and also the dies or mechanism by which they are carried out, I will now describe the general operation under my improved system, and briefly point out wherein superior qualities are imparted to the product thereof.

In making the round nail-blanks *a* the metal rod may be first cut up into short pieces or blanks containing just sufficient metal stock

to be forged into a single or duplex nail-blank, as desired, and said blanks may then be automatically fed either hot or cold into the forging-dies, where they are quickly rolled and formed into shape. I prefer, however, to make use of a system or automatic metal-rolling mill similar to those shown in patents granted to me April 10 and August 28, 1888, and numbered 380,759 and 388,565, respectively. In that case the coil of wire nail-rod is supported upon a suitable reel and passes off through a furnace, which heats it nearly to a welding heat, and passing thence through feed-rolls which intermittently feed it into the forging-machine, where suitable blanks are intermittently severed therefrom and passed into the forging-dies, where they are rapidly rolled or forged into shape, said shape in its preferred form being the duplex or twin nail-blanks *a a*, connected by a metal connection at their heads, as shown in Fig. 2. The entire operation of the nail-forging mill being continuous and automatic is therefore capable of great speed. The round nail-blanks when cold, and after having the usual oxide or scale removed therefrom, are next placed in suitable bulk in the hopper of the combined nail feeding, flattening, and pointing machine, where they automatically feed down into and between the flattening-dies, where they are compressed or stamped and flattened into the desired thickness, taper, and curvature edgewise of the nails, and partly beveled on their points or not, as preferred, by the descent of the upper or male die *d*, and while the double nail-blank is thus compressed and firmly held between said flattening-dies the die *d''* descends and severs the metal connection between them, and as the flattening-dies are separating the two nails are caused to drop and enter point first into two separate conductors, which guide them down into two sets of pointing or beveling dies, where they are quickly given the necessary finished and beveled point required and are then dropped into suitable receptacles provided therefor. The entire operation of the combined nail feeding, flattening, and pointing machine being continuous and automatic is therefore also, like the forging-mill, capable of great speed, and this machine, and also a special form of forging-machine, both of which are designed especially for the manufacture of animal-shoe nails, will form subjects for other applications for patents hereafter.

As I have in my former application, Serial No. 271,534, hereinbefore referred to, fully described and pointed out the imperfections existing in different classes of animal-shoe nails as heretofore manufactured, and also set forth the essential qualities desirable in a perfect or ideal nail for this purpose, I will not therefore enter into these matters very minutely herein, but will simply state that in order to have the nails drive properly, and when driven fill the holes in the shoe and hoof tightly, it is very essential to have the finished nail blade or shank largest in cross-section in the neck under the head and tapering longitudinally smaller toward the point, substantially as shown in Figs. 11 and 12, and in order to illustrate and plainly set forth how I accomplish this object I have presented Figs. 16, 17, 18, and 19 as greatly enlarged views of the round nail-blanks *a* and the flattened and pointed nails *b*.

It will of course be understood that in practice the dies are formed so as to shape the round nail shown in Figs. 16 and 18 without any abrupt angles, the junction between the several angles or different tapering portions of the nail being filled in or rounded over to make the nail of symmetrical shape, substantially as shown in Figs. 2 and 6.

Fig. 16 represents an enlarged view of the nail shown in Fig. 6, the exaggerated size thereof bringing out more plainly the different tapering portions within its length, which consists of four distinct portions having different degrees of taper, as shown from a' to a'', from a'' to a^3, from a^3 to a^4, from a^4 to a^5, and from a^5 rounded over to form the top of the head.

Fig. 17 represents an enlarged view of the nail shown in Fig. 12, which consists of four distinct portions having different degrees of taper, as shown from b' to b'', from b'' to b^3, from b^3 to b^4, from b^4 to b^5, and from b^5 rounded over to form the top of the head.

Fig. 18 represents a round nail-blank *a*, having a tapering portion from a' to a'', a straight portion from a'' to a^3, a tapering portion from a^3 to a^4, a tapering portion from a^4 to a^5, and from a^5 rounded over to form the top of the head.

Fig. 19 represents a longitudinal central section of a finished nail having a tapering portion from b' to b'', a straight portion from b'' to b^3, a tapering portion from b^3 to b^4, a tapering portion from b^4 to b^5, and from b^5 rounded over to form the top of the head.

I have shown in Figs. 17 and 19 two of the most common and desirable ways of tapering the nails edgewise; but it should also be understood that said nails may be differently shaped, if so preferred, and in any case the face form or tapering shape of the side edges of the flattened nails, as in Figs. 3 and 11, may be predetermined by simply distributing the metal properly within the round nail-blanks—as, for instance, when it is desirable to produce a finished nail having the proper tapering face form, as in Figs. 3 or 11, and its blade or shank tapering edgewise, as shown in Figs. 12 or 17, it is accomplished by forming the round nail-blank with the series of tapering portions, substantially as shown in Fig. 16, the metal forming said blank being of varying tapers longitudinally, thus properly distributing the metal therein, so that when flattened and finished the nail necessarily assumes the form shown in Figs. 3 or 11 and 12 or 17, as before stated. If the nail is to

be flattened partly straight and partly tapering edgewise, as shown in Fig. 19, then the round nail-blank should be formed partly straight and partly tapering, substantially as shown in Fig. 18. This distribution of the metal composing the round nail-blank is absolutely necessary in order to insure the face form of the flattened nail assuming the desired width or symmetrical or tapering shape, substantially as shown in Figs. 3 or 11, without the liability of said nails, when being flattened, bulging or swelling out broader across the middle portion or point of the blade or shank, which would then require the usual and additional operation of side swaging or clipping of the side edges of the nails to bring them to a proper finished shape suitable for driving. Now, therefore, it must be clearly understood that I produce animal-shoe nails having their blades or shanks tapering smaller toward their points, or having the blade formed largest in cross-section, in the neck under the head, as above described, without swaging the side edges of said blade or removing any superfluous metal therefrom, but by simply giving the round nail-blank the necessary longitudinal configuration by properly distributing the metal therein, so that when said blank is flattened to the proper thickness and taper edgewise of the finished nail it will also necessarily cause said nail-blank to assume the proper width or tapering or desired face form of a finished nail, thus making strong and durable nails with their fibers uncut and intact from head to point, and furthermore, if so desired, the fibers of metal composing the nails may be caused to assume an anomalous or spiral form, as will now be plainly described.

In reducing or forging metal by compressing and rotating it between adjacent die-faces in the usual and well-known manner of making rolled forgings, the surface movement or rotation of the metal blank when work is being performed, if there is no slip, is the same as the rate of linear movement of the dies or the length of the working-surfaces on said dies which have acted upon and forced said metal blank to revolve. Consequently in roll-forging any small tapering cylinders or spindles similar to the blade or shank of the round nail-blank, as the work progresses and the blank becomes tapering and variable in size, being prevented from slipping by the hot plastic metal engaging the milled or scored surfaces of the dies, the smaller diameters of said blank are compelled to rotate faster than the larger, as must be readily perceived, and thus the fibers of the metal composing the blank are spun or twisted somewhat as represented by the dotted lines in Figs. 2 and 3. The degree of pitch or twist given the fibers of metal depend upon the degree of taper given the blank and to whether the smaller portions of said blank are permitted to slip past the die-surfaces without being rotated thereby, as by relieving the die-faces, so as to reduce the friction on the blank and dispensing with the milled or scored surfaces other than that on the central parting-rib c^3, the blank may be rolled into form without materially twisting the metal, as shown in Figs. 6 and 11, it slipping in the dies, so that the smaller portions are not revolved any faster than the approximate speed of the largest diameter of the blank. This spinning or twisting of the fibers of the hot metal during the formation of the nail is especially desirable when using an inferior or low-cost grade of iron, as it tends to close up and weld or knit together any seams or imperfections existing in the metal and materially adds to the homogeneity, strength, and durability of the nails, as will be readily understood and appreciated by those acquainted with the art of working metal, and most especially with the art of forging and pointing animal-shoe nails, wherein at the present time, with the nail-forging and nail-pointing machines in use, and which have rolls, dies, or hammers adapted to forge or draw out the metal by compression or by percussive blows alternately applied upon two opposite sides or edges of the blank, it has been found exceedingly difficult and with many grades of iron absolutely impossible to act upon the slender nail in this manner and draw it out, or even point it, without rupturing the metal, as the portion of metal being acted upon either when forging the hot nail or when pointing it cold is so small and delicate that it will only stand a limited amount of compression or blow, and which, if exceeded, will result in crushing the metal and spreading it laterally, instead of drawing it down and extending its length, as required for the blade and point of the nail. Now, therefore, it must be readily seen that the rapidity with which nails can be forged and pointed in the manner just described is necessarily limited, and owing to the tendency of the fibers of the metal to disintegrate while being so forged or pointed, the use of high-cost grades of imported iron is necessitated, and I desire to state in this connection that I have demonstrated the fact that there are many grades of comparatively low-cost domestic iron which possess the essential qualities requisite in metal composing animal-shoe nails—such as toughness, tensile strength, and ductility; but they are lacking in that quality of cohesiveness of fibers characteristic of Swedish and Norway irons, and consequently are incapable of being practicably forged and pointed into merchantable nails by any of the machines heretofore used for the purpose, and I believe myself to be the first to invent a process and methods and appliances for carrying it out, whereby this grade of metal may be manufactured into good and serviceable animal-shoe nails possessing superior qualities and at a cost very much less than this class of nails have ever before been produced.

I have described the nails as having rounded

side edges and as being beveled by simultaneously-acting pointing-dies; but it is plainly evident that the side edges of the nails may be compressed or flattened, if so preferred, and also that the pointing-dies may act in pairs alternately, if so desired, both of which changes could be made without evading the essential spirit of my invention

I do not limit myself to the particular order of the steps of progression, nor to the particular form of nail made, nor to the special form or construction of the appliances or dies used in carrying out my invention, as these things may all be changed within the scope of mechanical skill without departing from the fundamental spirit of my invention—as, for instance, the round nail-blanks, if so preferred, may be beveled or pointed prior to their being flattened; and, furthermore, the round nail-blanks may be formed and flattened by rolling the metal lengthwise instead of cross-rolling, and it is also plainly evident that various other modifications in the details of the invention may be made without evading the essential principle thereof, which consists in the novel process, method, or art of manufacturing animal-shoe nails herein described.

It will be readily seen that the shape and form of the round roll-forged nail-blank may be varied so as to adapt it without further manipulation to be used as a nail and for other purposes.

I do not in this application claim the round roll-forged nail-blank, nor a nail or nail-blank having the fibers of its metal twisted, nor a nail or nail-blank having other improvements herein described, as these features are already claimed in my application for Letters Patent filed in the United States Patent Office April 23, 1888, Serial No. 271,534. Neither do I claim in this application a round duplex or twin animal-shoe-nail blank, as I have claimed it in my application for Letters Patent filed in the United States Patent Office October 10, 1889, Serial No. 326,593. Neither do I claim in this application the appliances or dies described for carrying out my invention, as I have claimed said appliances or dies in my application for Letters Patent filed in the United States Patent Office October 21, 1889, Serial No. 327,625.

I would also state herein that when making the nails of steel, instead of iron, I prefer to connect and operate the flattening-dies in connection with the forging-dies, thereby forging and flattening the nails in one and the same machine while the metal is hot, and then, after the nails are cold, finishing and pointing them, as desired.

When making the nails of soft ductile metal—such as Swedish or Norway irons—I prefer to connect and operate the forging, flattening, and pointing dies all in one combined machine, without the necessity of heating the metal, and the heat generated by the friction of the rapidly-working dies is sufficient to anneal said metal, thus preventing the nails from becoming hard and brittle and giving them just the proper amount of temper required for driving and wearing qualities. By this method of operating the expense of heating the metal and the expense of part of the subsequent handling of the same are saved.

For any further information in regard to the general manufacture of animal-shoe nails or regarding the particular nail shown and described herein, I would refer to the companion application before alluded to as containing a more minute and specific description of these matters.

Having thus fully described the nature, construction, and operation of my invention, I wish to secure by Letters Patent and claim—

1. The described process or method of making animal-shoe nails from rods or bars of metal, which consists in first cutting blanks of suitable length therefrom, then feeding said blanks into suitable forging or forming dies to reduce them into approximate shape, having circular cross-sectional area and the metal taperingly distributed, as required, to form the nails, then flattening or hammering said blanks into the desired tapering shape, thickness, and curvature edgewise, and finally finishing the nails by compressing the points on all sides between dies which draw, condense, and bevel the points of the nails, substantially as described.

2. The improved process or method of making animal-shoe nails from rods or bars of metal, which consists in first cutting said rods or bars into suitable lengths for double blanks, then feeding said blanks into suitable forging or forming dies to reduce them into approximate shape, then flattening or hammering said blanks into the desired tapering shape, thickness, and curvature edgewise, then severing the double blanks into two single blanks, and finally finishing the nails by compressing the points on all sides between dies which draw, condense, and bevel the points of the nails, substantially as described.

3. In the manufacture of animal-shoe nails, that improvement in the art or method of forming nail-blanks which comprehends rolling or forming said blanks circular in cross-section throughout and tapering so that the requisite quantity of metal for the formation of the nail is distributed through the head and body, so that said blanks will assume the proper width or face form of a finished nail, with the body or shank largest in cross-sectional area in the neck under the head and tapering smaller toward the point, substantially as described, when they are flattened on two opposite sides to the required thickness of a finished nail, substantially as set forth.

4. In the manufacture of animal-shoe nails, the described subprocess or method of making nail-blanks from rods or bars of metal, which consists in first cutting blanks of suit-

able length therefrom, then feeding said blanks into suitable forging or forming dies, which roll, condense, and form them into approximate shape, having circular cross-sectional area throughout and tapering so that they will assume the proper width or tapering face form of a finished nail having a blade or shank largest in cross-sectional area in the neck under the head, substantially as described, when they are flattened on two opposite sides to the required thickness, substantially as set forth.

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

DANIEL E. KEMPSTER.

Witnesses:

HENRY CHADBOURN,

HERBERT L. CHAPIN.