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Machinery for the Manufacture of Nails.

CHURCH'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM CHURCH, of Bordesley Green, near Birmingham, in the County of Warwick, Gentleman, send greeting.

WHEREAS His present most Excellent Majesty King William the Fourth, by His Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Twenty-fifth day of February, in the second year of His reign, did, for Himself, His heirs and successors, give and grant unto me, the said William Church, my executors, administrators, and assigns, His special licence, full power, sole privilege and authority, that I, the said William Church, my executors, administrators, and assigns, and no others, for the term of fourteen years from the date thereof, should and lawfully might make, use, exercise, and vend, within that part of His Majesty's United Kingdom of Great Britain and Ireland called England, His Dominion of Wales, and Town of Berwick-upon-Tweed, my Invention of "CERTAIN IMPROVEMENTS IN MACHINERY FOR MAKING NAILS;" and in which said Letters Patent there is contained a proviso obliging me, the said William Church, by an instrument in writing under my hand and seal, fully to describe and ascertain the nature of my said Invention, and the manner in which the same is to be performed, and to cause the same to be inrolled in His Majesty's High Court of Chancery within six calendar months from the date of the said in part recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said William Church, do hereby declare the nature of my said Invention, and

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the manner in which the same is to be performed, is fully described and ascertained in and by the following description thereof, reference being had to the Drawings hereunto annexed, and the letters and figures of reference marked thereon, that is to say:—

My Invention of Certain Improvements in Machinery for Making Nails 5
consists,—

First, in making, forming, or preparing the nail rods from bars or plates of iron or other ductile metals or alloys of metals.

Secondly, in machinery or apparatus for converting such metal rods or rods otherwise prepared, into nails. 10

Thirdly, in machinery or apparatus for making that kind or description of nail for which a Patent was granted by His present Majesty to Richard Prosser, of Birmingham, on the Thirteenth day of July, One thousand eight hundred and thirty-one.

My method of making the rods from which the nails are to be formed, 15
consists in preparing bar or plate iron or other metal by passing it through pressing rollers having indentations upon the peripheries of one or both of them, so as to form the bar or plate of metal into the required shape for the rods, which plates or bars may afterwards be separated into rods of any desired width by common slitting rollers. 20

Figures 1 and 2, in Sheet I. of the accompanying Drawings, represent a pair of rollers which are of a similar construction to those ordinarily used for rolling flat bar iron, but having a part of the periphery of one of the rollers indented and formed into projections and curved surfaces *a, a*, whose radii or distances from the axis of the roller are unequal. 25

Figures 3 and 4 represent horizontal and side views of a piece of plate iron or other metal after it has been passed between the indented and cylindrical rollers.

The metallic plates or bars thus prepared are separated into nail rods, as shewn in Figure 3, where the plates is represented as being partly slit 30
by means of ordinary slitting rollers.

After the operations of rolling and slitting above described, it will be perceived the nail rods consist of a series of wedge-formed pieces *I, I, I*, as shewn in Figure 4, each wedge piece being intended to form a nail when finished. The principal object for rolling the rods into wedge-formed pieces 35
is to measure out a due quantity of metal proportioned to the required thickness or strength of the nail in its several parts, and which quantity depends upon the form that it may be thought expedient to give to the projections and indentations upon the peripheries of the roller or rollers.

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My machinery or apparatus for converting rods of metal into nails consists of three machines for effecting this object in different ways, and as each machine admits of variations in the arrangement or detail of its parts, I shall describe the machines separately, and state some different dispositions of
 5 the working or operative parts.

The first machine I shall describe is shewn in the several Figures in Sheet I. of the accompanying Drawings, and its improvements consist,—

First, in the manner of feeding the nail rod into the machine.

Second, in the manner or mode of effecting the pointing and cutting off
 10 from the rod the piece which is to form the nail.

Thirdly, in the manner of carrying the blanks or shanks when pointed and cut off to the dies, where it is to be finished in shape or moulded and headed.

Fourthly, in the mode or manner of finishing the shape of the shank, and of forming the head of the nail upon it; and

15 Fifth, in the manner of discharging the nail when finished.

Figures 5, 6, and 7 are elevations; Figures 8 and 9 are plan views; and Figure 10 is a horizontal section taken through the machine in the direction of the dotted lines A, B, in Figures 5 and 6; the same letters of reference being marked upon corresponding parts in all these Figures. The nail rods I, I,
 20 with the thin ends of the wedges foremost, are introduced into the machine through a guide of any convenient form, and placed in the situation between the cutters *b, b*, as shewn in Figures 5 and 10, after which it will be fed into the machine by the following means:—On the main shaft K is fixed the cam wheel S, which, as it revolves, raises the lever *t*, having its fulcrum in the ear
 25 *2*, and its under side resting upon the cam wheel. The lever *t*, as it rises, carries with it the other lever *u*, to which it is connected by an adjustable joint *3* moving in slots in the levers. The lever *u* is connected by its fulcrum rod *4* in the standard *5* to the lever *v*, fixed upon the other end of the rod *4*. To the lower end of the lever *v* is connected the piece *w*, its end being formed
 30 into a feeder or pusher, which, as it is moved backwards by the movement of the lever *v*, falls into the notches or recesses in the nail rod, and, on being moved the reverse way, pushes against the projections or shoulders of the wedge-formed parts of the nail rod, and causes them to move severally under the cutters *b, b*, to undergo the operation of pointing and cutting off. The extent
 35 of the movement of the pusher can be regulated through the joint *3* of the levers *t* and *u*, and after the feeder *w* has pushed one of the wedge-formed pieces under the cutters, a spring *6* draws down the levers *t* and *u* on to a smaller diameter of the cam S, and thereby causes the lever *v* to draw back the feeder *w* ready to push another portion of the rod under the cutters *b, b*.

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In order to form a point to the nail I cut a small piece 7 from one side of the thin end of the wedges I, I, I, as shewn in the enlarged Figure 12. The piece so cut off forms a shoe bill, and the operation of cutting off the shoe bill, which I call pointing, is performed in the following manner:—The rod being introduced through a guide and placed between the cutters *b b*, one of which 5 is fixed in the cutter head *c*, and the other in the bed *d*, the cutter *c* is mounted on the shaft *e*, and partakes of any motion given to it. At each end of the shaft *e*, on the side opposite to the cutter head, is fixed a short lever *f, f*, (see Figure 6), and between these levers *f, f*, is a sling *g*, connected to them by pivots *h, h*, (shewn in Figure 10); *i* is an antifriction roller on the small crank *j* 10 at the end of the main shaft K. This roller *i* works in a groove or opening in the sling *g*, by which means, as the main shaft K is made to revolve, the cutter head will rise and fall, and thus effect the operation, the lower cutter in the bed being stationary. These cutters *b, b*, stand obliquely to the rod, as shewn in Figure 12, in order that a triangular piece may be cut out of the 15 wedge piece of the rod, and at this operation the nail should not be entirely separated from the rod unless an extremely sharp point be required. On the side of the upper cutter *b* is another similar cutter *l* (see Figure 5), with its lower or cutting edge placed a little above it. When the cutter *b* has effected its operation, and has been carried down so that the 20 cutter *l* almost touches the nail, another small lower cutter *n* attached to a cylindrical slide *m*, situated in the bed *d*, is driven up by the lever *o*, which is connected to the before-mentioned *e* by the rod *p*, shewn by dotted lines in Figure 6. An adjusting screw 8 in the end of the lever *o* regulates the height to which the cutter *n* is moved in separating the nail 25 from the rod. The lower cutter *n* is stationary while the pointing cut is made. The slide *m*, which carries the lower cutter *n*, rests on a shoulder *q* in the cylinder bed-piece *d* (see Figure 11). The piece *m* is made in two parts, and furnished with a screw 10 for adjusting the height of the cutter *n*. After the nail has been separated from the rod by the cutter *n*, as above described, 30 it is thrust forward through the guide I, I, into the carrying plyers *r, r* (Figure 5), by means of the pusher *s* on the feeder *w* (which receives its motion, as before described, from the cam wheel S), another portion of the rod being at the same time brought forward to be pointed and separated as before. After the nail has been pushed into the carrying plyers *r, r*, it 35 is there held fast by means of springs *x, x, x*, pressing against a tailpiece 12 upon the moveable jaw of the plyers (see Figure 5). The carrying plyers are made to perform a portion of a revolution, that is, to move from the position of *r 1* to that of *r 2*, and so on by the following means:—On the main

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shaft K is fixed a toothed wheel A, gearing with the wheel B, attached to the driving wheel C, as seen in Figure 7. The driving wheel C has a short arm D, carrying a roller Z, which roller is situated in that part of the wheel where a portion of it has been removed, as seen in the Figures. The carrying

5. plyers are mounted upon one end of the shaft E. Upon the other end is fixed what I call the star wheel F. By the motion of the wheel A on the main shaft K the driving wheel C is made to revolve, and the roller Z entering one of the grooves 13, in the star wheel F, turns it one fourth round, where it is securely held throughout the remainder of the revolution of the driving

10 wheel by the part between the grooves 13 being in contact with the periphery of the driving wheel C; and thus while the carrying plyers only perform a portion, the main shaft K performs an entire revolution, and thereby the pointed wedge-form pieces or shanks of the nails, are carried successively between the moulding dies G, H, and there held while the operation of

15 moulding and heading is performed, these dies being furnished with adjusting screws 14, 14, by which their proper position may be determined. The parts of the apparatus for moulding and heading will be best seen in the section in Figure 10, where a blank is represented in a position to be operated upon. By the revolution of the main shaft K the crank J, through the medium of

20 the connecting rod L, pulls towards it the lever M, which being connected by the bars N to the moveable die block O, the dies are brought together with sufficient force to shape or finish the shank part of the nail, at the same time holding it firmly while the heading pin P is forced up by the lever M, and compressing a part of the shank forms the head, the heading pin P being

25 furnished with an adjusting screw 20. On the further progress of the crank J the dies recede from each other, and the carrying plyers are again brought into motion by the means before described, and the finishing nail carried out of the heading dies, and another taken into its place. On the end of the lever M is mounted the antifriction roller 15, moving upon a short axle 16, and

30 running upon the rail 17, by which means the lever M will be made to move freely and in proper position to the heading dies. In passing from the station where the nail is headed to the lower station where it is discharged, a tail-piece 18, on the jointed end of the moveable jaw of the carrying plyers r, r, comes into contact with the fixed pin 19, and, moving it outwards, opens the

35 plyers, when the nail is allowed to fall away below. It should here be remarked, that, altho the carrying plyers should be made thinner than the nail where they rest between the dies while the heading is performed, they should be strengthened on each outer edge.

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The second machine for converting rods of metal into nails is shewn in the several Figures in Sheet 2.

Figure 1 is a plan view of the working parts of the machine, for effecting the moulding, heading, and cutting off.

Figure 2 is a front view, and Figure 3 a vertical section. 5

Figures 4 and 5 are plan views of the dies in different positions, the same letters of reference being remarked upon corresponding parts in all the Figures.

In this machine the moulding and finishing of the shank of the nail is obtained by a reciprocating rotatory motion of the moulding dies, instead of 10 the direct pressure in the foregoing machine. The nail rods may be prepared in the manner described under the first head of this Specification, or they may be passed through a pair of rollers, as shewn in Figures 6 and 7. The indentations upon the peripheries of these rollers will cause the rod to take the form shewn at *a, a, a*, Figures 6, that is, with an enlargement on the ends of 15 the wedge-formed pieces, which will assist the operation of heading. The moulding dies *a, b*, are mounted in the ends of levers *c, d*, turning upon axles *e, f*, as their fulcrums, and are moved by connecting rods *g, g*, and cam wheels *h, h*, upon the main shaft *i, i*, and in order to open the dies (as shewn in Figure 4) so as to admit the rod of metal between them, the axle *f* is 20 mounted in a sliding piece *j* (shewn by dots in Figure 2), moving in guides in the framework of the machine. To the axle *f* is connected one of the toggle-pointed levers *k, k*, and the other to a pin *l* fixed in the framework. The manner of constructing these toggle-joint levers is shewn best in Figure 2, they being partly removed in the other Figures to expose the other parts of 25 the machine. To these toggle levers is connected a bar *m*, actuated by a cam *n* on the main shaft, which draws the bar *m* and levers *k, k*, towards it to open the dies; and on the nail rod being brought between the dies (as shewn in Figure 4) by a proper feeder or any other convenient means, the cam *n* pushes back the bar *m* and the levers *k, k*, into the position shewn in 30 Figure 1, and cause the dies *a, b*, to hold the nail rod firmly while the heading is performed. The heading die *o* is mounted on the end of the short arm of the lever *p*, which turns on an axle at *q*. The other end of this lever *p* is connected by the coupling piece *r* to the crank *s* upon the main shaft *i*. By the rotation of this crank the heading die is brought up against the moulding 35 dies *a, b*, (as shewn in Figures 1 and 2), with sufficient force to form the head of the nail, which being completed, the heading die *o* recedes from out of the way of the dies *a, b*, as they proceed to mould or finish the shaft, which is effected

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by the cam *h, h*, pushing forward the bars *g, g*, thereby moving the levers *c, d*, into the position shewn in Figure 5, and at the same time pressing or moulding the nail rod into the required form, and completing the shaft of the nail, which may be separated from the rod by the cutter *t*, mounted in the lever *c*, and sliding in a grove in it, and is made to cut off the nail from the rod by the cam wheel *u* pushing forward the bar *v*, which is connected to the bent lever *w*, having an adjusting screw *x* pressing upon the vertical arm *y* of the cutter *t*. After the nail is separated from the rod, the bar *m* and cam *n* cause the toggle levers *k, k*; to open the dies, when the nail will be at liberty to fall away, the bar *g, g*, and cams *h, h*, bringing the levers *c, d*, and moulding dies *a, b*, into the position shewn in Figure 4, and the cam *u* drawing back the bar *v* and lever *x*, allows the cutter *t* to be brought back into its former position by a spring or any other convenient means. The manner of constructing the moulding dies is shewn on an enlarged scale in the sectional Figure 8, where it will be perceived that they overlap each other so as to give the nail the required form; but I do not mean to confine myself to that particular construction, as in some cases the dies may be used without the overlapping parts. An adjusting screw is placed behind the heading die *o* and wedge-formed pieces *Z* in the lever *d* to adjust the moulding dies, or they may be adjusted in any other convenient manner.

The third machine for making nails from rods of metal is shewn in the several Figures in Sheet 3. The operation of moulding a pressing the shank of the nail into the required form in this machine is obtained by an interrupted rotatory motion of a series of dies placed in a wheel, instead of the reciprocating rotatory motion described in Sheet 2.

Figure 1 is a plan view of the working parts of the machine, with the moulding dies *a, b*, shewn in their position when holding the nail rod while the heading is performed. Figure 2 is a vertical section of the same. Figure 3 is a similar view to Figure 1, with the dies in the position after the heading and moulding of the shank is performed, and the nail ready to be separated from the rod. Figure 4 is a section of the same.

Figure 5 is a section taken in the direction of the dotted lines *A, B*, in Figure 1, and shewing the manner of constructing the moulding dies *a, b*, which are mounted in strong plates or wheels *c, d*, fixed upon the shafts *e, f*, and are brought together for holding the nail rod while the heading is performed, and for pressing or moulding the shank by means of the toggle-jointed levers *k, k*, and cam wheel *n* and rod *m*, as described in the foregoing machine. The heading die *o* is mounted in the end of the sliding bar *p*, moving in bearings in the cross pieces *g, g*, of the framework, and is actuated by a cam wheel *s*,

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on the main shaft *i*, pressing against a friction roller *r* on the end of the sliding bar *p*. This manner of working the heading die *o* shews another mode of performing the heading of the nail, but a lever and crank may be used instead, as in the foregoing machine. The cutter *t*, for separating the nail from the rod, is placed vertically in the framing of the machine, and is actuated by a 5 lever *v*, turning on its fulcrum *w* on the cross bearer *q*; the short end of this lever is connected to the cutter *t*, its other end having a friction roller *x* against which the cam *u* acts, depressing this end of the lever *v* and raising the short end, and with it the cutter *t*, thereby separating the nail at the time the moulding dies have finished the shank of the nail, after which, the cam *u*, 10 ceasing to act upon the friction roller, allows the lever *v* to be brought into its former position by a spring or weight. It will be seen that the moulding dies *a*, *b*, are mounted radially in the plates or wheels *c*, *d*, and, on one pair of dies completing a nail, they must move round a part of a revolution to allow of the next pair of dies coming into operation. To effect this movement I 15 give them an interrupted rotatory motion by means of the star wheel 1, mounted upon a shaft *e*, and which receives its motion from the driving wheel 2, as before described. The driving wheel is actuated by the toothed wheel 3, which takes its motion from another wheel 4 upon the shaft 5 of the bevel wheel 6, which gears into another bevel wheel 7 upon the main shaft *i*. The 20 shaft *e* gives the interrupted rotatory motion to the other to shaft *f*, by means of the pair of toothed wheels 8 and 9, the teeth of which should gear sufficiently deep one within the other so as to allow of the shaft *f* and dies *b* sliding to open them without throwing the wheels quite out of gear.

It will be observed that the two last-described machines are not constructed 25 to make any but what are called chisel-pointed nails, from the moulding dies giving pressure only on two sides of the nail rod. It will also be observed, that if the nail rod was passed through a pair of dies where a portion of the point was removed, as described in the first machine, then these machines would be capable of finishing the nail shank into a point, but as it is not always 30 desirable to remove a portion of the rod, the nail, as soon as formed by these machines, may be carried away to another pair of moulding dies, where the nail may undergo a second pressure on the other two sides to those pressed by the moulding dies, and the point thereby completed. As there are many ways of conveying the nail from the moulding dies to a second pair of dies, 35 by carrying fingers, spring clips, &c., either sliding or rotating, I have not thought it necessary to describe any particular method, but have shewn in Figure 6, Sheet 3, one mode of effecting this object. In this Figure the moulding dies *a*, *b*, are shewn open, and the nail rod in the situation for them

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to close upon it to form another nail. The cutting off, under these circumstances, is not effected until it is placed as there shewn, when the cutter *t* may effect the operation in any convenient way. 1, 2, are a pair of carrying fingers or spring clips, mounted in a bar 3, sliding between the guide arms 4, 5 fixed upon the axle 5. This axle has an interrupted rotatory motion communicated to it by a star wheel, or any other convenient manner, by which it will bring the carrying finger 1, 2, alternately opposite the nail as it is delivered from the moulding dies *a, b*. Upon the back of the bar 3 are two studs or pins 6, 6, which are also brought by the motion of the shaft 5 between the 10 forked end of the lever 7; at this time a projection upon the cam wheel 8, fixed upon the shaft 5, causes the lever 7 to move outward, and slide the bar with the pair of fingers 10 into the nail just before it is cut off from the rod, and by the motion of the shaft carry it over into the second pair of moulding dies 9, when another projection upon the cam 8 will move the lever 7 away, and the bar 3, 15 and with it the spring clips 1, leaving the nail in the second moulding dies which have previously taken fast hold of it; the second pair of moulding dies may give their pressure to the nail by means of any of the different motions of the moulding dies *a, b*, as described under Sheets 1, 2, or 3, or in any other convenient means, which it is not necessary here to describe. It 20 will be observed by all competent mechanics that the moving parts of these machines may be altered considerably in the arrangements; for instance, the lever *c* and *d*, in Sheet 2, may be connected together by toothed wheels fixed upon the axle *e, f*, as described in Sheet 3, so that these movements may be simultaneous, and only one rod *g* and cam wheel *h* be necessary. Also that 25 the heading dies may be mounted upon sliding bars actuated by cam wheels, or in levers moved by cranks upon the main shaft, and that the moulding dies be made to open and shut otherwise than by toggle-jointed levers and bars, and yet the motion and effect of the dies remain the same; for instance, they may be connected together by a strap, loop, or bar, which may be placed upon 30 either of the axles *e, f*, and upon the other an excentric or cam working in the connecting strap or bar, which will bring the dies together at the time the heading or moulding of the shank is performed, which will assist that operation, and also be made to open them when necessary.

My improvements in machinery for making or forming that kind or description of nail for which a Patent was granted by His present Majesty to Richard 35 Prosser, of Birmingham, on the Thirteenth day of July, One thousand eight hundred and thirty-one, a description of which will be found in the Specification of that Patent, consists in the peculiar formation or construction of the dies, punches, or tools for effecting the different required operations, and as

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they may be worked to good effect in several different ways I have shewn in Sheets 4, 5, 6, 7, and 8, several different machines or methods of using them. In Sheet 4, Figure 1 represents an elevation of one of the machines for forming the blanks or parts which constitute the head of the nail. The tool or punch which cuts out the piece to form the head of the nail, from rolled sheet metal of any description proper for the purpose, is shewn at A, and the bed or counter die, against which the tool or punch cuts, is shewn at B, both being shewn in section at Figure 2. The tube or punch is made to descend until it enters the bed or counter die, which is stationary. The punch is hollow, and equal in internal diameter to the head of the nail intended to be made. The part C, which is fixed into the bed B, is of a diameter somewhat smaller than the inside diameter of the tube or punch A, and of the same form which is intended to be given to the head of the nail. The end of the punch A is made conical on the inside, so as to bring it to a cutting edge all round its circumference, the sheet of metal being placed between the punch A and counter die B, and motion given to the machine by any convenient means (such as the crank shaft E, connecting rod F, and lever H). A circular tisk or blank will be cut out of the sheet of metal equal in diameter to the outside of the punch. The blank so cut would pass down into the bed but for the interposition of the piece of metal C, which obstructs the passage of the blank. The punch A continuing to move downward, after having cut out the blank, presses it on to the head of the piece C, and obliges it to take the same form, while its edges are forced down by the inside of the tube or punch A into the space between the piece C and the inside of the die B into the form shewn in section at a, Figure 3, and in plan Figure 4. The blank G in consequence being equal in diameter to the inside of the tube or punch A, on its receding from the bed, carries the blank just formed with it. A few of the blanks a, a, so formed are exhibited in the tube A, Figure 2, and are pushed upwards in succession by each succeeding blank until they arrive at the top D, when they are allowed to fall into a receiver. The piece C, in the dies B, may be made to move upwards and meet the punch A, after it has cut out the disk of metal, by a lever worked from the crank shaft forcing up the sliding piece K, in which the piece C is mounted, shewn in the section Figure 5, thereby producing the same effect upon the disk, and forming the same shaped blank. The blank C may be removed out of the punch A without its having to travel up it by the rod L being pressed down by a lever connected to the crank shaft, or any other convenient means which will push the blank out of the punch, and allow of its being removed out of the way. Another mode of forming these blanks is exhibited in Sheet 5, where Figure 1 is an elevation of

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a machine, having the piece C, which forms the hollow or cup of the blank, placed within the punch A, as shewn in the detached sections Figures 2 and 3, and another lever I to work it. On the punch A descending and cutting out the disk of metal as before described, the lever I, through the crank shaft, 5 causes the the piece C to descend and force the disk of metal into the dies B, and on its meeting with a smaller diameter of the hollow of the die the disk is forced down by the piece C, (as shewn in the section Figure 3), and out through the die B, thereby producing the same formed blank as before described.

10 In Sheet 6, Figure 1 represents a machine for combining the different parts of these kind of nails, so as to constitute a complete nail. The pieces *b, b*, which form the back or under side of the head of the nails may be formed by any convenient machine, and placed on to the beds A, A, fixed on to the revolving bed plate E, shewn detached in Figure 6. A shank, formed by 15 the machinery above described, or by other means, is put through the hole in the centre of the back piece *b*, and the blank or part which forms the head *a* (and which has been prepared as described in the machine under Sheets 4 and 5) is then placed over the shank *c* and back piece, as shewn in section in Figures 2 and 3, and carried under the punch or tool B, remaining stationary 20 while the punch descends to unite the parts to form the nail, which is done by the peculiar formation of the tools or punch B and dies A, as shewn in section, Figure 2; the nail, when finished, being shewn in section at Figure 4, and in elevation at Figure 5. As the punch B descends, it first comes in contact with the head of the nail *a*, placed upon the piece *d* (see Figure 2), which 25 piece is supported by a spring *e* in the socket piece *f*, resting upon shoulders in the bed A, and as the punch descends it carries with it the parts of the nail and the piece *d*, and enters the recess *g* in the bed A, the peculiar form of which recess causes the edges of the head piece *a* to turn in under the back piece, and thereby firmly unite the whole of the parts of the nail 30 together. The punch B now ascends; the nail and bed containing the nail with the bed plate move a part of a revolution, according to the number of dies placed upon the bed plate E, and another die is brought under the punch B, the parts forming the nail being placed in the revolving beds during the time they remain stationary, so as to be operated upon in 35 succession. It will be perceived these beds must have an interrupted revolving motion, which I communicate by the star wheels C and driving wheel D, already described, the bed plate E being placed upon the upper end of the shaft G of the star wheel C, the driving wheel D receiving its motion through the toothed wheel H on its axis I. This wheel receives motion from

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a toothed wheel J upon the back of the mitre wheel K, which takes into another mitre wheel L. Upon the back of the wheel L is another toothed wheel M, receiving motion from the driving wheel N fixed upon the crank shaft. The punch or tool B is actuated in the same way as that described under Sheets 4 and 5. 5

Figures 7 and 8 are sections of the dies A and B, where the socket piece *f* is made capable of being moved upwards, so that its upper part may assist in turning in the edges of the head piece *a* under the back piece *b*, shewn in Figure 8, which may be effected by a lever, placed in any convenient part of the machine, pressing upon the adjusting screw *h*. 10

I must here observe that the parts of the machines for making these peculiar kind of nails, as described under Sheets 4, 5, or 6, admit of a variety of different arrangements, and, although here described as separate machines, may be placed upon one framing, receiving motion from one crank shaft, or the parts may be changed in position, as shewn in the elevation, Sheet 7, 15 where the dies A, A, are placed upon the periphery of a strong wheel or revolving plate E, which receives an interrupted rotatory motion through the star wheel C, driving wheel D, and bevell wheels K, L, as before described; or, instead of a rotatory bed plate or wheel, a bed plate or bar C may be used, as shewn in the elevation Figure 1, Sheet 8, and plan view, 20 Figure 2, and moved backwards and forwards, bringing the die A under the punch B in succession by a lever D, actuated by any convenient means, as the step-formed cam wheel E upon the main shaft F.

In conclusion, I must remark that the same effect as produced by the second pair of moulding dies, for finishing and pointing the nails formed by 25 the machine described under Sheets 2 and 3, may be obtained from one pair of moulding dies, by the nail having a motion given to it by which it will be turned over and its different sides presented to the pair of dies for pressure. This may be done by causing a pair of plyers or spring clips to take fast hold of the nail shank, and, by giving them a recipro- 30 cating rotatory or interrupted rotatory motion, they may be made to turn the nail one quarter of a revolution, by which the other sides of the nail shank to those first operated upon will be presented to the dies. In machines where this is effected it is obvious the heading die must be made to move sufficiently out of the way to allow of the necessary parts 35 being introduced, and in some cases it would be desirable to remove the heading operation away from the moulding dies *a*, *b*, and perform it in some other part of the machine where another pair of dies may be made to hold the nail shank while the heading is performed. Fig. 1, Sheet 9, represents

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Church's Improvements in Machinery for Making Nails.

a horizontal section of part of a machine where these two operations are effected; *a, b*, are the moulding dies mounted in the wheels *c, d*, turning upon the axles *e, f*, as before described. The nail shank in this machine is separated from the rod before it is headed, but, previously to this being effected, a
5 pair of spring clips or carrying fingers *g, g*, are made to take hold of the shank. These spring clips are mounted in the tube *h*, which slides in the carrier piece *i, i*, connected by arms *j, j*, to the shaft or axle *k, k*, which has an interrupted rotatory motion, as that described under Fig. 6, Sheet 3, by which means the spring clips will alternately be brought into the position at A, and take fast
10 hold of the end of the nail rod, the dies *a, b*, having also taken hold of it to effect the moulding; and as they proceed to form the shank it is with the spring clips *g, g*, pushed back into the position shewn in the Figure at A, and in the cutter *l* separating the nail shaft from the rod, and the dies *a, b*, opening the spring *m* placed within the hollow *n* of the carrier piece *i, i*, (by acting
15 between the shoulder *o* on the tube *p* and the back of the hollow *n*) will push the spring clips and nail shank into their former positions, and, on being turned over one fourth of a revolution, will be ready to receive a second pressure from the next pair of dies *a 2, b 2*. This turning over of the nail shank is effected by the following means:—Upon the end of the tube *h* are fixed the
20 arms *p, p*, (see the detached sections of the tube Figs. 2 and 3). These arms are alternately acted upon by a pin *q* fixed in a small lever *r* attached by a joint to the bar *s* sliding between the grooves *t, t*. On the motion of this sliding bar upwards the pin *q* comes in contact with one of the arms *p*, as represented in Figure 2, and forces it upwards into the position shewn in Figure 3,
25 thereby moving the tube *h* one quarter of a revolution, and consequently with it the spring clips *g, g*, and nail shank, which will be thereby be made to present its other two sides to the dies *a 2, b 2*, to be operated upon. As the sliding bar *s* descends to effect the turning of the next nail shank, the pin *q* passes over the arm *p* below it without disturbing it, the small spring *l, l*,
30 which presses against the tailpiece of the lever *r*, allowing it to move outwards to pass the arm *p*. After receiving a second pressure the shank will be ready to be carried to the heading dies *v*, which is effected by the movement of the shaft *k*, and will then be in the position at B, that is, within the dies, they being open to receive the shank, and on their closing upon it by means of the lever
35 *w* (which carries one of the dies), the heading bar or lever *x* is forced forward by any of the means before described, pushing the heading pin or die *y* (mounted within the tube *h*) up against the dies *v*, compressing the end of the shank, and forming the head. The inclined plane parts of the spring clips causes them to open and make way for the heading pin as it is pushed forward.

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On the nail being completed, the heading bar or leaver *x* is drawn back, and the leaver *w* moved outwards, opening the dies *v*, when the nail is allowed to fall away below, the dies *v* then being ready to receive another nail shaft to be brought into them by the next pair of spring clips *g, g*. And I verily believe that this my Specification does, in all and every respect, comply with the 5 proviso contained in the above in part recited Letters Patent to me granted.

In witness whereof, I, the said William Church, have hereunto set my hand and seal, this Twenty-fourth day of August, in the year of our Lord One thousand eight hundred and thirty-two.

WM. (L.S.) CHURCH. 10

Griffiths, Extra.

AND BE IT REMEMBERED, that on the Twenty-fourth day of August, in the third year of the reign of His present Majesty King William the Fourth, the said William Church came before our Lord the King in His Chancery, and acknowledged the Instrument aforesaid, and all and every thing therein contained and specified, in form above written. And also the Instrument 15 aforesaid was stamped according to the tenor of the Statute made in the fifty-fifth year of the reign of His late Majesty King George the Third.

Inrolled the Twenty-fifth day of August, One thousand eight hundred and thirty-two.

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