Dec. 20, 1927. 1,653,152

J. C. DALEY

METHOD OF AND MEANS FOR MAKING CORE LAMINÆ

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Fig. 1.

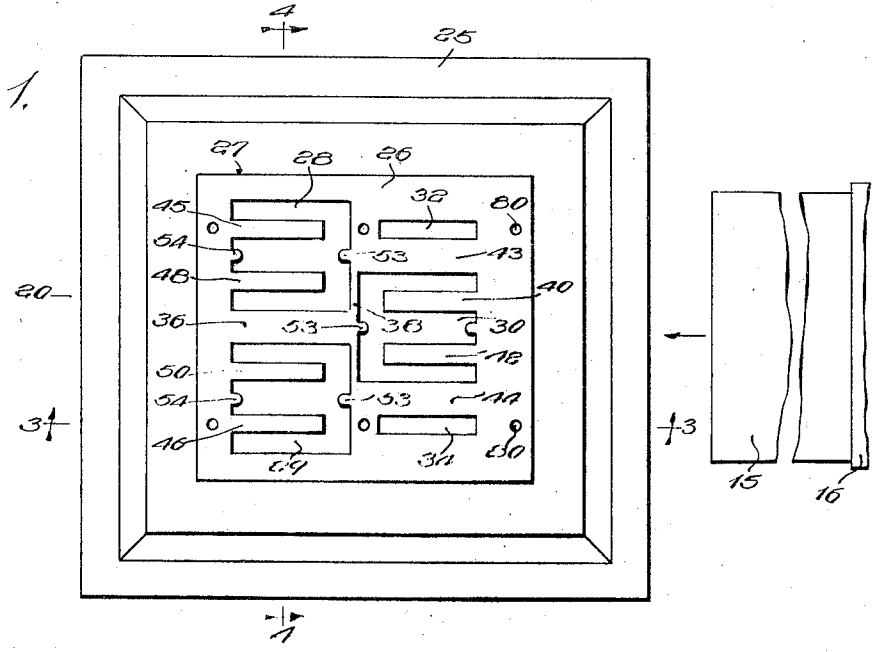
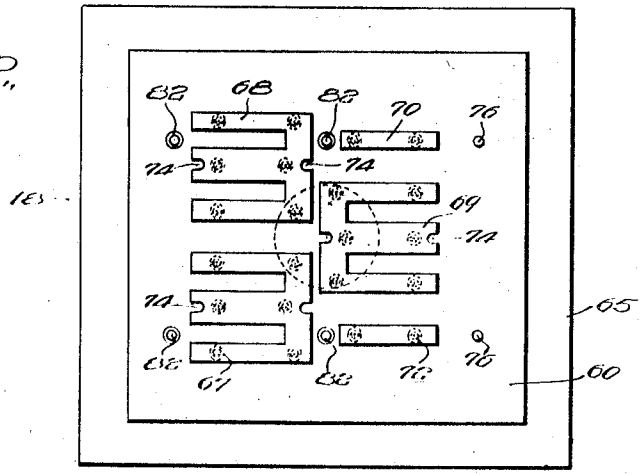


Fig. 2.



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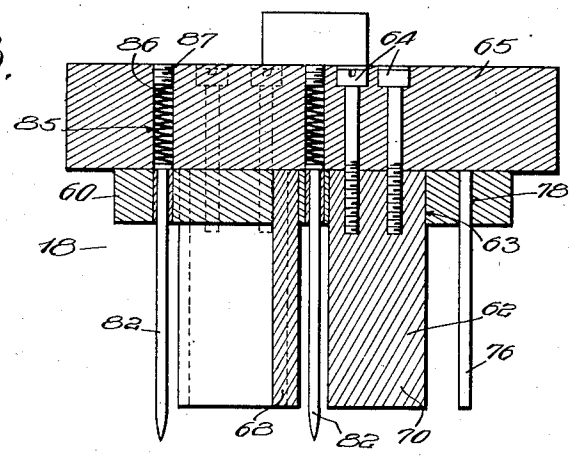
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METHOD OF AND MEANS FOR MAKING CORE LAMINÆ

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Fig. 3.



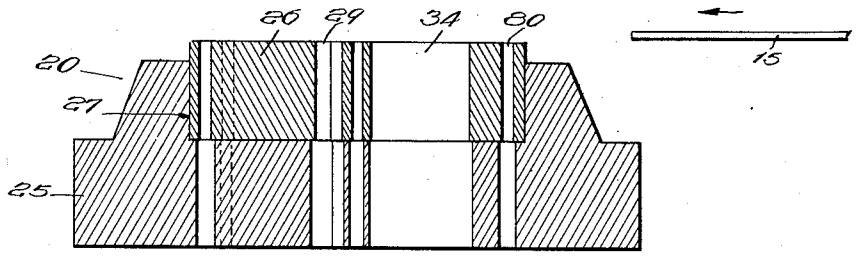
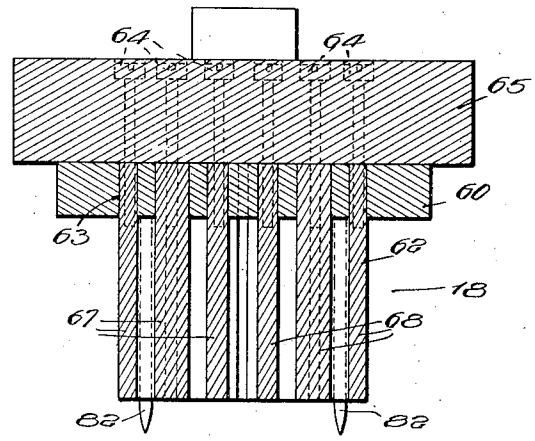
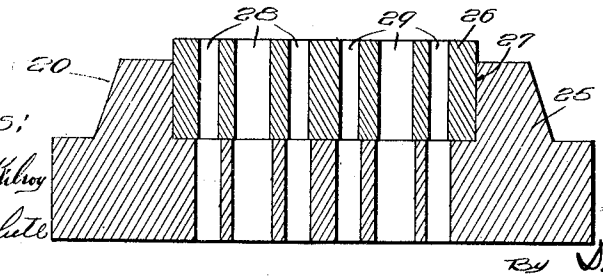


Fig. 4.





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Dec. 20, 1927. 1,653,152

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METHOD OF AND MEANS FOR MAKING CORE LAMIN E

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Fig. 5.

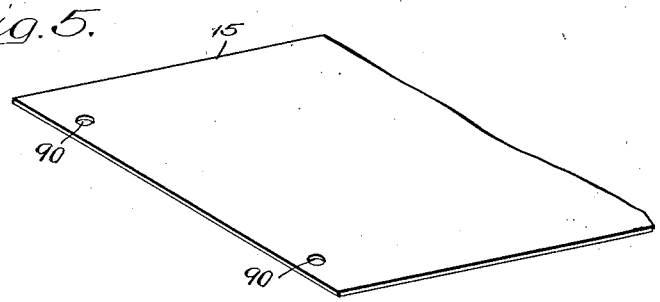


Fig. 6.

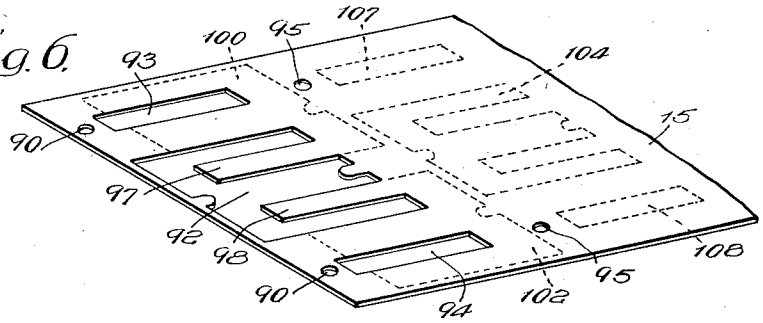


Fig. 7.

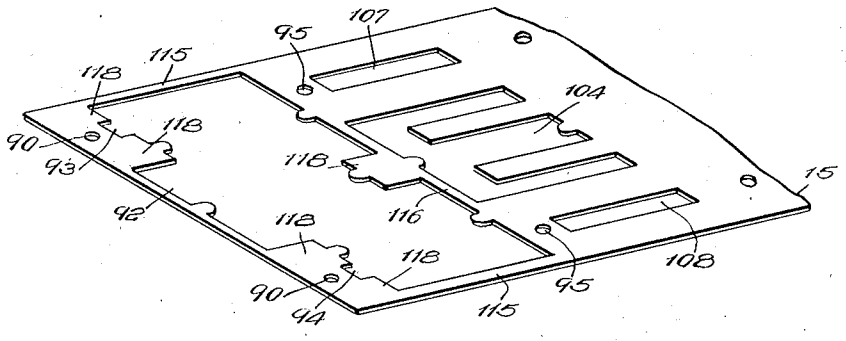
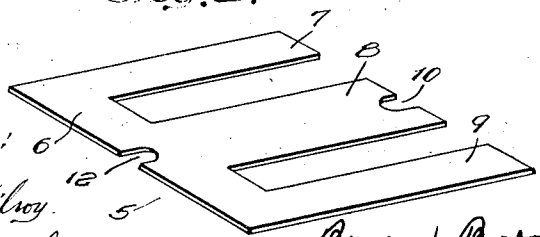


Fig. 8.



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Patented Dec. 20, 1927. 1,653,152

UNITED STATES PATENT OFFICE.

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METHOD OF AND MEANS FOR MAKING CORE LAMINÆ.

Application filed November 6, 1926. Serial No. 146,826.

This invention relates to the manufacture of laminated transformer cores and the like, and its object is to provide an improved method of and means for blanking or punching out the laminæ at an increased rate and with a minimum of waste.

The invention provides an improved method and improved die means for punching or blanking the laminæ and improved means for aligning the strip of material and holding it aligned as the laminæ are punched or blanked therefrom.

The laminæ may be made of sheet iron or any other suitable or preferred material, and the method and means which I provide enables producing same in large quantities expeditiously, quickly and economically and, as already pointed out, with little waste.

The invention is illustrated in the accompanying drawings in which

Fig. 1 is a top plan view of the lower die and die block;

Fig. 2 is a bottom view of the upper punch and punch holder;

Fig. 3 is a vertical longitudinal section through the upper and lower dies and die blocks, taken on the line 3—3 of Fig. 1;

Fig. 4 is a vertical transverse section through the upper and lower dies and die blocks taken on the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary perspective view of the end of the strip of material which is first presented to the die means, showing the aligning holes which are first punched therein;

Fig. 6 is a similar view showing the strip of material after the first laminæ punching step as it is initially fed between the dies of the press, the manner of punching the laminæ from the material by the next and succeeding punching and blanking steps being shown in dotted lines;

Fig. 7 is another similar view showing the strip of material after the punching and blanking steps shown in dotted lines in Fig. 6; and

Fig. 8 is a perspective view of one of the laminæ formed by the method and means of my present invention.

Referring to the drawings, each of the core pieces or laminæ 5 (Fig. 8) is of general E formation, having a base 6 and three parallel legs 7, 8 and 9 extending parallel with each other and at substantially right angles to the base 6. The laminæ or pieces 5 are identical and match each other in contour and dimensions. The intermediate legs 8 are disposed centrally between the legs 7 and 9 and are preferably wider than the end legs or tongues 7 and 9, and the bases 6 may be wider than the legs 7 and 9 and slightly narrower than the legs 8, although this may of course vary.

In making up a transformer, for example, the core pieces or laminæ are laid up or stacked upon each other with the legs 7, 8 and 9 upon each other and the bases 6 alternately at opposite ends. The coil is wound around the intermediate legs 8 and through the spaces between them and the outer legs 7 and 9, the central or intermediate legs 8 forming the core proper for carrying the flux through the coil while the outer legs 7 and 9 and bases 6 form the yoke about the coil. The free ends of the intermediate legs 8 are notched at 10 and the free edges of the bases 6 are similarly notched at 12 for purposes of assembly, the notches 12 being disposed centrally of the bases 6 and in longitudinal alignment with the notches 10.

In producing or making the core pieces or laminæ 5 I employ strips 15 of suitable material. Where the laminæ are to be used for making transformer cores, or the like, as herein disclosed, they are preferably formed from strips of suitable sheet iron, although of course any other suitable or preferred material may be employed. The strips 15 of material are preferably substantially flat and may, of course, be of any suitable or preferred gauge or thickness. They may in practice be punched cold.

For the purpose of punching or stamping the laminæ, the strip 15 is fed by suitable means designated diagrammatically at 16 in Fig. 1 between the upper and lower dies 18 and 20 of a suitable press, the strip 15 being suitably guided and fed over the lower die 20.

The lower die 20 comprises a die block or plate 25 which may be suitably fastened down upon the bed of the press or other support. Suitably secured as by a pressed fit or otherwise in the opening 27 in the die block 25, is the lower die proper 26. The die 26 is provided with the E-shaped die openings 28, 29 and 30 and with two oblong openings 32 and 34, all preferably bounded

by relatively sharp cutting or shearing edges, as well understood in the art. The die 26 is, for the purpose of clarity, shown as made up in one or an integral piece, but it may of course, in practice, be made up of a plurality of strips and blocks assembled in block 25 to form the openings 28, 29, 30, 32 and 34. In practice it is usually desirable to avoid angular pieces in making up the die proper and to make the die up at least as completely as possible of oblong pieces, so that angular cutting edges and corners are avoided.

The strip of material 15 is fed between the die members 18 and 20 in the direction indicated by the arrow in Figs. 1 and 3. The E-shaped die openings 28, 29 and 30 are identical with each other and with the E-shaped laminæ which it is desired to punch, the opening 30 being inverted with respect to the openings 28 and 29 with its base disposed centrally adjacent the bases of the openings 28 and 29. The opening 30 is disposed centrally of the openings 28 and 29 on the side of the die over which the strip of material 15 travels first in its movement between the dies. The bases of the openings 28 and 29 are in alignment and extend transversely across the path of travel of the strip 15 and the legs of these openings 28 and 29 are all parallel with each other and extend in the direction of feed or travel of the strip 15. The space 36 between the inner legs of the openings 28 and 29 is of a width equal to the width of the middle legs 8 of the laminæ 5 and the base of the opening 30 extends transversely across the path of travel of the stock 5 parallel with and adjacent the bases of the openings 28 and 29, but spaced therefrom slightly at 38 to allow a slight transverse retention therebetween as the laminæ are punched from the material.

The middle leg of the die opening 30 is aligned with the strip of material 36 between the openings 28 and 29 and is of the same width as the strip of material 36, extending from the base of the opening 30 in a direction opposite the direction of movement of the strip 15 between the dies. The legs of the openings 28, 29 and 30 are all parallel with each other and with the path of travel of the strip 15, and they extend longitudinally thereof and longitudinally of the die members. The strips of material 40 and 42 between the legs of the opening 30 (Fig. 1) are aligned longitudinally one with each of the inner legs of the openings 28 and 29, and their width is the same as the width of the inner legs of the openings 28 and 29.

The oblong openings 32 and 34 are also parallel with the legs of the openings 28, 29 and 30 and with the direction of movement of the strip 15, and they terminate at one end in alignment with the ends of the legs of the opening 30 transversely of the die. The openings 32 and 34 are spaced at 43 and 44 from the outer legs of the opening 30 a distance equal, on each side to the width of the central legs 8 of the laminæ, the strips of material forming these spaces 43 and 44 being equal in width with the central leg portions of the openings 28 and 29 and aligned longitudinally therewith. The ends of the openings 32 and 34 toward the openings 28 and 29 extend slightly past the bases of the spaces between the legs of the opening 30 as viewed transversely across the die. The width of each of the openings 32 and 34 is equal to the width of the spaces 45 and 46 between the central and outer legs of the openings 28 and 29, respectively, and are aligned longitudinally therewith.

The outer legs of the opening 30 are each of the same width as the strips of material forming the spaces 48 and 50 between the central and inner legs of the openings 28 and 29 and are aligned longitudinally therewith. The outer legs of each of the laminæ are, in the embodiment of the invention shown, of the same width and the spaces between the central and outer legs are of substantially of the same width as these outer legs. The bases of the openings 28, 29 and 30 have lips or tongues 53 and the outer ends of the central legs of these openings have tongues 54 for forming the notches 12 in the bases and outer ends of the central legs of the laminæ 5 as already referred to.

The cooperating upper die 18 or punch is reciprocable up and down and into and out of the lower die openings 28, 29, 30, 32 and 34. It comprises a block 60 in which the upper ends of the upper die member 62 are suitably secured at 63, and this block 60 is, in turn, secured by screws 64 to a block or head member 65 which may be mounted in a suitable punch head or holder for vertical reciprocation. The die 62 comprises the three E-shaped die parts 67, 68 and 69 which fit in the die openings 28, 29 and 30 of the lower die for up and down movement into and out of said openings and the oblong die parts 70 and 72 which fit in the lower die openings 32 and 34 for up and down movement into and out of the openings 32 and 34. The die parts 67, 68 and 69 have notches 74 for cooperation with the tongues or lips 53 and 54 of the openings 28, 29 and 30 of the lower die.

For holding the strip aligned between the dies and punching aligning holes in the strip as it is fed therebetween, the upper die 18 has a pair of transversely aligned punch pins or posts 76 transversely aligned at its forward end with one in longitudinal alignment with each of the oblong openings 32 and 34. These pins 76 are secured at their upper ends at 78 in the block 60 and the lower die 26 has registering holes 80 for re-

ceiving the punch pins 76 as the upper die is depressed into punching cooperation with the lower die. Between the upper die parts 68 and 70 and 67 and 72 and rearwardly of the die parts 67 and 68, are four aligning and holding pins 82 aligned transversely in pairs with two in longitudinal alignment with each of the punch pins 76. The lower ends of the aligning and holding pins 82 are preferably tapered as shown in Figs. 3 and 4, and these pins are mounted at their upper ends in the blocks 60 and 65 to yield vertically therein. For this purpose they may be passed through sleeves in the block 70 with their upper headed ends disposed in the openings 85 in the block 65 and springs 86 interposed between the upper headed ends and suitable plugs 87 and normally forcing or urging the pins 82 downwardly.

In punching the laminæ the strip 15 is first fed in just sufficiently to dispose its inner end between the punch pins 76 and cooperating punch openings 80, whereupon the upper die is depressed into cooperation with the lower die and the pins 76 punch the two openings 90, as shown in Fig. 5. The dies are thereupon separated and the feeding mechanism 16 then functions to feed the strip 15 a distance equal to the distance from the vertical axes of the punch pin 76 to the vertical axes of the forward aligning and holding pins 82, this distance being equal to the distance between the axes of the forward pins 82 and the axes of the rear pins 82.

This movement of the strip 15 registers the openings 90 with the forward aligning and holding pins 82 and upon the next successive operation of the dies or stroke of the press the pins 82, by depending below the upper die parts, first engage in the openings 90 and align the strip and hold it aligned and as the upper die is brought into cooperation with the lower die, the E-shaped opening 92 and oblong side openings 93 and 94 are stamped from the strip as shown in Fig. 6.

The following separation of the die members releases the strip and it is again fed an equal distance, registering the openings 90 with the rear aligning and holding pins 82 and the openings 95 which are punched with the openings 92, 93 and 94 are registered with the front aligning and holding pins 82. The material stamped from the opening 92 forms one of the E-shaped laminæ and the material 96 and 97 between the central and side legs of the opening 92 forms the inner legs of the laminæ designated in dotted lines at 100 and 102 in Fig. 6 which are punched upon the succeeding stroke of the press. As the initial aligning openings 90 reach the rear aligning and holding pins 82, the next and all succeeding operations of the press upon the particular strip 15 punch the three laminæ 100, 102 and 104 (Fig. 6) and the openings 107 and 108 together with the aligning openings 95 from the strip of material.

Thus, as soon as the strip is completely between the dies, there is produced on each operation of the press three complete core laminæ substantially identical in contour, not only with each other, but also with the core laminæ produced on the succeeding operations of the machine. The inner legs of the laminæ 100 and 102 interlock transversely between the legs of the previously punched laminæ from the opening 92, and the material 97 and 98 left between the legs of the opening 92 on the preceding punching forms the inner legs of the laminæ 100 and 102 on the succeeding punching. The openings 93 and 94 remove the material between the outer legs of the laminæ 100 and 102. The material between the opposite sides of the opening 92 and the openings 93 and 94 forms the center tongues of the laminæ 100 and 102 and the material outwardly of the openings 93 and 94 forms the outer tongues or legs of these laminæ.

The strips of material 15 employed are preferably of a width slightly greater than the transverse distance from the outer edge of the die opening 28 to the outer edge of the die opening 29 so that as the laminæ are punched or stamped from the material narrow longitudinal retention margins 115 are left as shown in Fig. 7, these margins 115 and the transverse strips 116 and the slightly enlarged square portions 118 formed at the end of the central leg of the central opening 92 and at the ends of the central and outer legs of the laminæ 100 and 102, together with the oblong strips from the openings 32 and 34 constituting the only waste material in the production of the laminæ from the strip 15. The present invention lends itself to the production of the laminæ in large quantities, expeditiously, quickly and economically and with little waste, and such little waste as there is forms retention for holding the strip together after the laminæ have been stamped therefrom so that it may be fed from the machine and removed from between the dies by its feeding movement therebetween.

I claim:—

1. The method of producing substantially similar E-shaped core laminæ which comprises feeding a metallic strip between the dies of a press, simultaneously punching upon the successive strokes of the press three E-shaped laminæ with their bases across the path of movement of the strip and their legs parallel with said path of movement and with the legs of two of the laminæ interlocking transversely with the legs of the opening formed in punching the third lamination on the preceding stroke of the press.

2. The method of producing substantially similar E-shaped core laminæ which comprises feeding a metallic strip between the dies of a press, simultaneously punching upon the successive strokes of the press three E-shaped laminæ with their bases across the path of movement of the strip, their legs parallel with said path of movement and one inverted relative the other two and the legs of the other two laminæ interlocking transversely with the legs of the opening formed in punching the other inverted laminæ on the preceding stroke of the press.

3. The method of producing substantially similar E-shaped core laminæ which comprises feeding a metallic strip between the dies of a press, simultaneously punching upon the successive strokes of the press three E-shaped laminæ with one inverted and base to base with the other two and with their legs parallel the direction of feed of the strip and between the strokes of the press advancing the strip to position the material left between the legs of the one inverted lamination in position to form one of the legs of each of the other two laminæ upon the succeeding stroke of the press.

4. The method of producing substantially similar E-shaped core laminæ which comprises feeding a metallic strip between the dies of a press, simultaneously punching upon the successive strokes of the press three E-shaped laminæ with one inverted and base to base with the other two and two oblong openings, one on each of the opposite sides of the one inverted lamination and between the strokes of the press, advancing the strip to position the material left between the legs of the one inverted lamination in position to form one of the legs of each of the other two laminæ, and the material on opposite sides of the oblong opening forming the other two legs of each of the other two laminæ upon the succeeding stroke of the press.

5. The method of making core laminæ which comprises feeding a metallic strip between the dies of a press and simultaneously punching upon the successive strokes of the press three laminæ with one having two spaces forming one of the tongues of each of the other two laminæ punched on the succeeding stroke of the press.

6. The method of making core laminæ which comprises feeding a metallic strip between the dies of a press and simultaneously punching upon the successive strokes of the press three laminæ with one having two spaces forming one of the tongues of each of the other two and three legs forming one of the spaces between the legs of each of the other two laminæ and the space between the other two laminæ punched on the succeeding stroke of the press.

7. The method of making core laminæ which comprises feeding a metallic strip between the dies of a press and punching upon the successive strokes of the press three laminæ with one having two spaces forming one of the tongues of each of the other two and three legs forming one of the spaces between the legs of each of the other two laminæ, and the space between the other two laminæ punched on the succeeding stroke of the press, and simultaneously punching oblong openings on opposite sides of one of the laminæ for forming the other space between the legs of each of the other two laminæ.

8. The method of making core laminæ which comprises feeding a metallic strip between the dies of a press and simultaneously punching three E-shaped laminæ with their bases extending transversely across the strip and their legs extending longitudinally of the strip.

9. The method of making core laminæ which comprises feeding a metallic strip between the dies of a press and simultaneously punching three E-shaped laminæ with their legs spaced transversely across the strip and with one inverted with respect to the other two.

10. The method of making core laminæ which comprises feeding a metallic strip between the dies of a press and simultaneously punching upon the successive strokes of the press three E-shaped laminæ with one in inverted central position with respect to the other two and with an oblong opening on each side of the opening formed by the punching of the inverted lamination and parallel with the legs thereof.

11. In combination, a die having three E-shaped die openings, one inverted relative to the other and having its base parallel with and adjacent the bases of the other two and its outer legs of widths equal to the widths of the spaces between the central and inner legs of the other two die openings and aligned therewith and its central leg of a width equal to the width of the space between the inner legs of the other two die openings and aligned therewith and a cooperating die having complementary die portions movable into and out of the die openings of said first die.

12. In combination, a die having three E-shaped die openings, one inverted relative the other and having its base parallel with and adjacent the bases of the other two and its outer legs of widths equal to the widths of the spaces between the central and inner legs of the other two die openings and aligned therewith and its central leg of a width equal to the width of the space between the inner legs of the other two die openings and aligned therewith, a cooperating die having complementary die portions movable into and out of the die open-

ings of said first die, aligning means for aligning and holding the stock in place between the dies and punch means for forming an opening cooperable with said aligning means upon cooperation of said dies.

13. In combination, a first die having a die opening, a second die having a die portion movable into and out of said opening, means for feeding a metallic strip between said dies, aligning means for aligning and holding said strip in place and punch means aligned with said aligning means in the path of travel of said strip for punching openings in the strip for cooperation with said aligning means.

In witness whereof, I hereunto subscribe my name this 10th day of October, 1926.

JAMES C. DALEY.