

N<sup>o</sup> 28,026



A.D. 1896

*Date of Application, 8th Dec., 1896*

*Complete Specification Left, 18th Aug., 1897—Accepted, 2nd Oct., 1897*

PROVISIONAL SPECIFICATION.

**Improvements in Machinery or Apparatus for Flanging Metal Plates.**

I, JOHN AUDLEY FREDERICK ASPINALL of Horwich in the County of Lancaster, Chief Mechanical Engineer of the Lancashire and Yorkshire Railway, do hereby declare the nature of the said invention, to be as follows:—

My invention relates to a method or system of, and combination and arrangement of apparatus for flanging plates, more especially copper firebox plates and tube plates, but may be used for flanging plates or sheets of metals other than copper.

Heretofore copper plates have been flanged by means of hand tools, owing to the liability of the heated copper plates to tear when being flanged by means of the ordinary flanging blocks or dies commonly used with the hydraulic or other flanging press.

By this improved method I make use of clamping or fixing dies by means of which the plate to be operated upon is secured in position, each of these said dies having an external form corresponding and fitting therein to the form of the plate to be operated upon, or they may be made having an external form corresponding to the form to be imparted to the said plate.

The top clamping die or fixing plate is preferably fixed to the top or stationary table of the flanging press, the bottom die or clamping plate being fixed to, and raised and lowered by means of small rams or other apparatus commonly called vice rams and usually fitted to flanging presses, these vice rams work independently of the bottom or moving table. To this bottom or moving table, I fix the flanging dies or die.

The opening or internal form of this flanging or external die which is the one to receive motion, is made to correspond to the external form of the plate to be operated upon, and is made larger than the top clamping or internal die to such an extent that there remains between them a space or spaces corresponding in shape and in width to the thickness of the plate to be operated upon.

This said flanging or external die is preferably built up in separate pieces so as to form a sliding flanging die and a bed plate for the support of the same, this sliding or external die is arranged to slide on a series of anti-friction rollers by preference in the bed plate, and is guided thereon by means of guide slots situated at each side of the die, these guide slots allowing a limited lateral movement of the said sliding die.

At one end of the flanging die and fixed thereon are one or more inclined planes or wedge pieces which strike the stationary or internal die as the flanger rises, thereby causing the flanger to slide upon the anti-friction rollers and turn up the edge of the plate opposite the wedge piece or pieces.

As an example of one mode of carrying out my invention for blocking or flanging say the back plate of a copper fire box, I may further explain, that there is a bed plate or frame carried on suitable supports from the up and down moving bottom plate of the press, the upper face of this frame or bed has cavities formed in it on two sides, and one end for a series of anti-friction rollers.

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The lower side of the external die rests upon these rollers so that the die can move to and fro horizontally in one direction.

The internal die is secured to or suspended from the stationary head of the press.

The interior of the external die can pass over the internal block or die leaving at 5 the finish of the operation a space between the two, equal to the thickness of the metal of the plate to be flanged.

The inner face of the external die is curved and its upper face is inclined in one direction, and it is secured by guiding slots and screws to the vertically moving bed or frame, so as to slide in the long way of the plate. 10

There are inclines at one end of the external die which come opposite corresponding inclines secured to or formed upon the stationary internal die or block, and these inclines are or may be so formed that when the bottom table ascends the external die will at the same time move horizontally towards the internal die or block at that end opposite to that where the inclines are placed, and when the 15 bottom table descends the inclines will cause a movement of the external die horizontally in the opposite direction.

Within the frame or bed carrying the external die, there is a plate carried on rams which are worked independently of the other rams for moving the bottom press table, these rams forming the vice rams, and clamping the plate to be operated upon 20 firmly against the underside of the internal die or block.

The plate to be flanged is placed on the lower table or clamping plate which is then lifted to hold it firmly against the underside of the internal die, then the lower table is lifted, and the upper face of the external die comes against the margin of the plate extending beyond the edges of the internal die or block, at the same 25 time the external die is moved horizontally endways as above explained, and this gradually bends the flange on three sides of the plate to the required angle—the lower table then descends and the plate thus flanged is removed.

I wish it to be understood that I do not confine myself to the arrangement described, or to flanging three sides only of a plate, as the mechanism may be 30 varied without departing from its essential features, and flanges may be formed on four sides of a plate for instance, the external die may be formed in two, four or more parts for say a square or rectangular plate, and the two sides forming each angle may be in one piece and may be moved horizontally in a diagonal line by inclines on the moving parts of the external die or dies, and fixed inclines on the 35 internal die or block or parts from it, or from the stationary table of the press, or the lateral movements required to be imparted to the external dies may be given by other means.

The internal dies or blocks hereinbefore described as fixed may be made movable, and the external dies described as movable may be fixed, and the mechanism in 40 details may be varied and modified as required, without departing from my invention.

Dated this Seventh day of December 1896.

PETER J. LIVSEY,  
Agent.

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## COMPLETE SPECIFICATION.

**Improvements in Machinery or Apparatus for Flanging Metal Plates.**

I, JOHN AUDLEY FREDERICK ASPINALL of Horwich in the County of Lancaster, Chief Mechanical Engineer of the Lancashire and Yorkshire Railway, do hereby 50 declare the nature of this invention and in what manner the same is to be

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performed, to be particularly described and ascertained in and by the following statement:—

My invention relates to a method or system of, and combination and arrangement of apparatus for flanging plates, more especially copper firebox plates and tube plates, but may be used for flanging plates or sheets of metals other than copper.

Heretofore copper plates have been flanged by means of hand tools, owing to the liability of the heated copper plates to tear when being flanged by means of the ordinary flanging blocks or dies commonly used with the hydraulic or other flanging press.

By this improved method I make use of clamping or fixing dies by means of which the plate to be operated upon is secured in position, each of these said dies having an external form corresponding and fitting therein to the form of the plate to be operated upon, or they may be made having an external form corresponding to the form to be imparted to the said plate.

The top clamping die or fixing plate is preferably fixed to the top or stationary table of the flanging press, the bottom die or clamping plate being fixed to, and raised and lowered by means of small rams or other apparatus commonly called vice rams and usually fitted to flanging presses, these vice rams work independently of the bottom or moving table. To this bottom or moving table I fix the flanging dies or die.

The opening or internal form of this flanging or external die which is the one to receive motion, is made to correspond to the external form of the plate to be operated upon, and is made larger than the top clamping or internal die to such an extent that there remains between them a space or spaces corresponding in shape and in width to the thickness of the plate to be operated upon.

This said flanging or external die is preferably built up in separate pieces so as to form a sliding flanging die and a bed plate for the support of the same, this sliding or external die is arranged to slide on a series of anti-friction rollers by preference in the bed plate, and is guided thereon by means of guide slots situated at each side of the die, these guide slots allowing a limited lateral movement of the said sliding die.

At one end of the flanging die and fixed thereon are one or more inclined planes or wedge pieces which strike the stationary or internal die as the flanger rises, thereby causing the flanger to slide upon the anti-friction rollers and turn up the edge of the plate opposite the wedge piece or pieces.

As an example of one mode of carrying out my invention for blocking or flanging say the back plate of a copper fire box, I may further explain, that there is a bed plate or frame carried on suitable supports from the up and down moving bottom plate of the press, the upper face of this frame or bed has cavities formed in it on two sides, and one end for a series of anti-friction rollers.

The lower side of the external die rests upon these rollers so that the die can move to and fro horizontally in one direction.

The internal die is secured to or suspended from the stationary head of the press.

The interior of the external die can pass over the internal block or die leaving at the finish of the operation a space between the two, equal to the thickness of the metal of the plate to be flanged.

The inner face of the external die is curved, and its upper face is inclined in one direction, and it is secured by guiding slots and screws to the vertically moving bed or frame, so as to slide in the long way of the plate.

There are inclines at one end of the external die which are or may be so formed that when the bottom table ascends the external die will at the same time move horizontally towards the internal die or block at that end opposite to that where the inclines are placed.

Within the frame or bed carrying the external die, there is a plate carried on rams which are worked independently of the other rams for moving the bottom press table, these rams forming the vice rams, and clamping the plate to be operated upon firmly against the underside of the internal die or block.

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The plate to be flanged is placed on the lower table or clamping plate which is then lifted to hold it firmly against the underside of the internal die, then the lower table is lifted, and the upper face of the external die comes against the margin of the plate extending beyond the edges of the internal die or block, at the same time the external die is moved horizontally endways as above explained, and this gradually bends the flange on three sides of the plate to the required angle, the lower table then descends and the plate thus flanged is removed. 5

I wish it to be understood that I do not confine myself to the arrangement described, or to flanging three sides only of a plate, as the mechanism may be varied without departing from its essential features, and flanges may be formed on four sides of a plate, for instance, the external die may be formed in two, four or more parts for say a square or rectangular plate, and the two sides forming each angle may be in one piece and may be moved horizontally in a diagonal line by inclines on the moving parts of the external die or dies, and fixed inclines on the internal die or block or parts from it, or from the stationary table of the press, or the lateral movements required to be imparted to the external dies may be given by other means. 10 15

The internal dies or blocks hereinbefore described as fixed may be made movable, and the external dies described as movable may be fixed, and the mechanism in details may be varied and modified as required, without departing from my invention. 20

In order that my invention may be clearly understood I shall now proceed more particularly to describe the same and for that purpose I shall refer to the annexed drawings which for the object of illustration shew the apparatus by means of which the back plate of a copper firebox may be flanged, but it must be distinctly understood that I do not confine myself to the flanging of copper firebox or tube plates, for it is evident that this combination and arrangement of apparatus may be modified without departing from the essential features of my invention, and further plates or sheets of metals other than copper may be operated upon in the manner specified herein. In the figures of the accompanying drawing like letters indicate like parts. 25 30

Figures 1, 2, 3 illustrate the apparatus used for flanging plates with straight sides. Figures 4, 5, 6 illustrate the apparatus used for flanging plates with shaped sides.

Fig. 1, is a sectional elevation of the fixing and flanging dies secured to the table of a hydraulic flanging press.

Fig. 2, is a combined plan of the bed plate and the flanging die. 35

Fig. 3, is a half end sectional elevation of the flanging die and the bed plate.

These drawings illustrate the relative positions of the various apparatus after the plates have been flanged.

A, indicates the face of the top of stationary table of the flanging press.

B, the face of the bottom or rising and falling table of the flanging press. 40

C, C<sup>1</sup>, are small rams usually fitted to flanging presses, and are raised and lowered independently of the bottom table B.

D, is the male die around which the plate is flanged, this die is secured to the top stationary table A, by packing pieces Y, and is made having a shape corresponding to the form of the plate or to the form to be imparted to the plate that is to be operated upon. 45

E, is the fixing or clamping die which is secured to the vice rams C, C<sup>1</sup>, and is raised and lowered thereby and is made to have a form similar to the form hereinbefore described for the male die D.

In Figures 1, 2, 3—F, is the female or flanging die which is arranged to slide upon the antifricition rollers G, which are fitted on the upper face of the bed plate H. 50

This die F, is or may be made in two halves secured together by flanges and a bolt at F<sup>x</sup>, and the ends of the two halves are secured to a bar N<sup>2</sup>, by flanges and bolts N<sup>3</sup>, and set screws N<sup>4</sup>. 55

This said flanging die F, has its internal form made larger than the male die D, to such an extent that there remains between them a space or spaces corresponding

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in shape and in width to the thickness of the form to be imparted to the plate that is being operated upon. The sides of this die F, are made having a certain amount of curvature shewn at F, in Fig. 3, and also the top surface of the sides are inclined longitudinally with the horizontal plane as shewn at F in Fig. 1, this inclination  
5 gives the flanging die a certain amount of lead, *i.e.*, when the flanging die is making its upstroke, it strikes the overlapping plate that is being operated upon, and as the stroke of the die is continued the said plate has its edges gradually turned up or flanged. At one end of this die F, and fixed thereto are one or more inclined planes or wedge pieces J.

10 In Figs. 1, 2—these inclined planes during the upstroke, strike on the male die D, thereby causing the flanging die F, to move in the direction indicated by the arrow Fig. 1, so that when the upstroke is completed, the flanging die F, will have travelled horizontally to such an extent that the space at that end of the dies opposite that which the wedge pieces formed between the male die D and  
15 flanging die F, will be equal to the thickness to be imparted to the plate P.

K, K<sup>1</sup>, (Fig. 2) are guide bolts fitted to the bed plate H, and secured thereto, to hold down the die F, but permit it to slide or move on the rollers G, the slots L, L<sup>1</sup>, in the flanging die F, guide it when being moved by the wedge pieces J. The process or method of flanging the firebox backplate as hereinbefore described by my  
20 invention, is as follows:—

In the first instance in Figs. 1, 2, 3, the bottom or moving table B, of the flanging press, is in its lowest position with the upper face of the die F, a little below the level of the upper face of the clamping plate E, when in its lowest position, and fixed to the table B, by packing pieces Z, is the bed plate H, carrying the flanging die F; the  
25 vice rams C, C<sup>1</sup>, are also placed in their lowest position and fixed thereon is the clamping or fixing die E. The plate P, to be operated upon, which has previously had the mouthpiece or fire hole M, made therein is laid upon the clamping die E, the said mouthpiece fitting into a recess made in the die E, this recess being of a similar shape to be imparted to the plate or to the shape previously made in the said plate.

30 When the backplate P, is thus laid in position there will be a certain amount of plate overlapping the edge of the clamping plate E, this overlap depending on the amount of flange that the backplate has to receive, or the amount the edge has to be turned up.

The vice rams carrying die E, and the plate P, are then raised by hydraulic or other  
35 means until the plate P, is jammed against the male die D and held securely thereto.

The flanging die F, being in its lower position is moved over in a reverse direction to the arrow Fig. 1, by hand or other means, the bottom table B, carrying this said die is then raised by hydraulic or other means and during its upward stroke the  
40 highest point of the flanging die F first strikes the projecting plate (due to the angularity given to the sides of the said die) and it gradually turns up the edges of the overlapping plate, and at the same time the wedge piece J, strikes on the end of the stationary or male line D, and the stroke being continued the flanging die F, is caused to slide on the antifriction rollers G, in the direction indicated by the  
45 arrow Fig. 1, thereby turning up the top edge (or the edge opposite to that at which the inclined planes are formed) and jamming it to the end of the male die D, the plate P, will then have had three of its edges turned up or flanged.

In Figs. 4, 5, 6,—F<sup>1</sup> and F<sup>11</sup>, are the female dies, these dies are made in two halves or pieces one end of each being hinged or pivotted respectively on pins at R, R<sup>1</sup>, in  
50 the bar N, the opposite ends being inclined as at O (Fig. 5) so that when the plate is being flanged the opening in the dies will not cause the plate to be marked. These female dies have inclined pieces cast on them at S, S<sup>1</sup>, which strike on the block T, secured to the table A, during the upstroke of the dies thereby closing the dies at O (being pivotted at R, R<sup>1</sup>) and at the same time the inclined piece S<sup>1</sup>, and wedge  
55 pieces J<sup>1</sup>, move the dies in the direction of the arrow Fig. 4, as herein explained in reference to Figs. 1, 2, 3.

Although I have herein described the flanging of the back plate of a copper firebox

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having only three of its edges flanged or turned up, it must be understood that I do not limit myself to the flanging of such or similar plates flanged on three sides, as it is obvious that the arrangement of apparatus may be modified to flange plates on any number of sides, and further the dies may be so arranged that the male die D may be raised and lowered whilst the flanging die be stationary or *vice versa* to the method 5 hereinbefore described, which modification would not depart from the spirit of my invention and it will evidently be seen that the form and size of the said dies will depend on the form and size to be imparted to the plate that is being operated upon.

Having now particularly described and ascertained the nature of my said 10 invention, and in what manner the same is to be performed, I declare that what I claim is:—

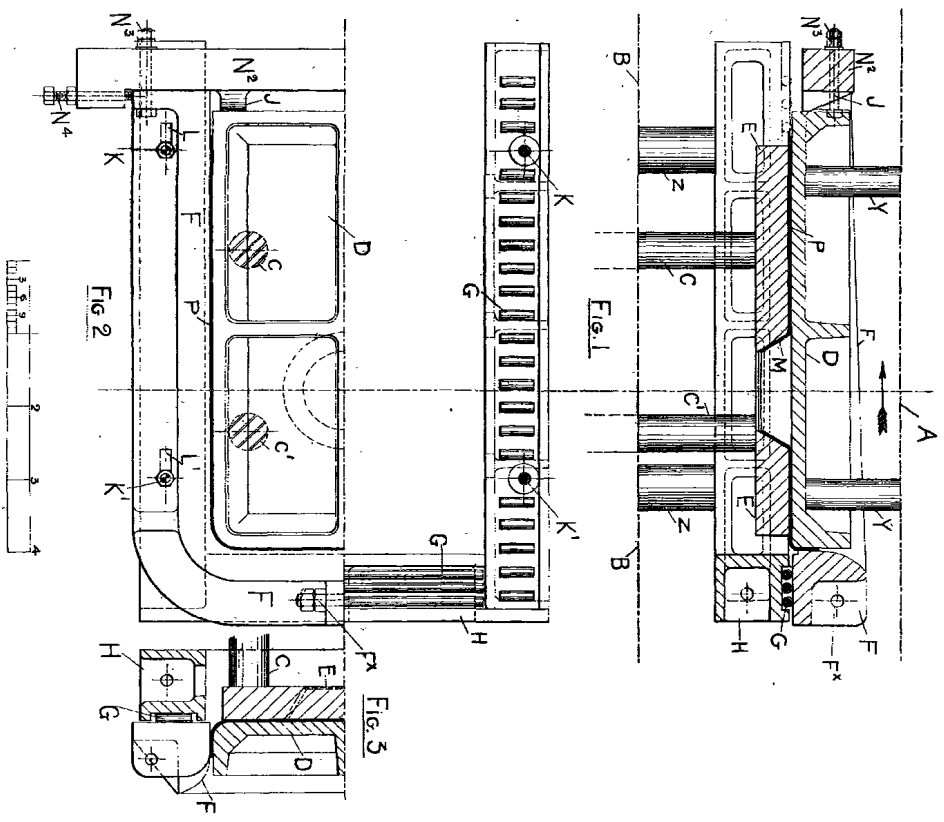
1. The combination of apparatus constructed, arranged and operating substantially as hereinbefore described and illustrated by the drawings for the manufacture or 15 formation of flanged plates.
2. In the manufacture or formation of flanged plates, the combination of a flanging die F, and bed plate H, having antifriction rollers interposed between them substantially as hereinbefore described and illustrated by the drawings.
3. In the manufacture or formation of flanged plates, the combination of a flanging die and inclined planes or wedge pieces J, substantially as hereinbefore described and 20 illustrated by the drawings.
4. In the manufacture and formation of flanged plates, the combination of the flanging dies F<sup>1</sup>, F<sup>11</sup>, and inclined planes S, S<sup>1</sup>, substantially as hereinbefore described and illustrated with reference to Figs. 4, 5, 6 of the drawings.

Dated this Seventeenth day of August 1897.

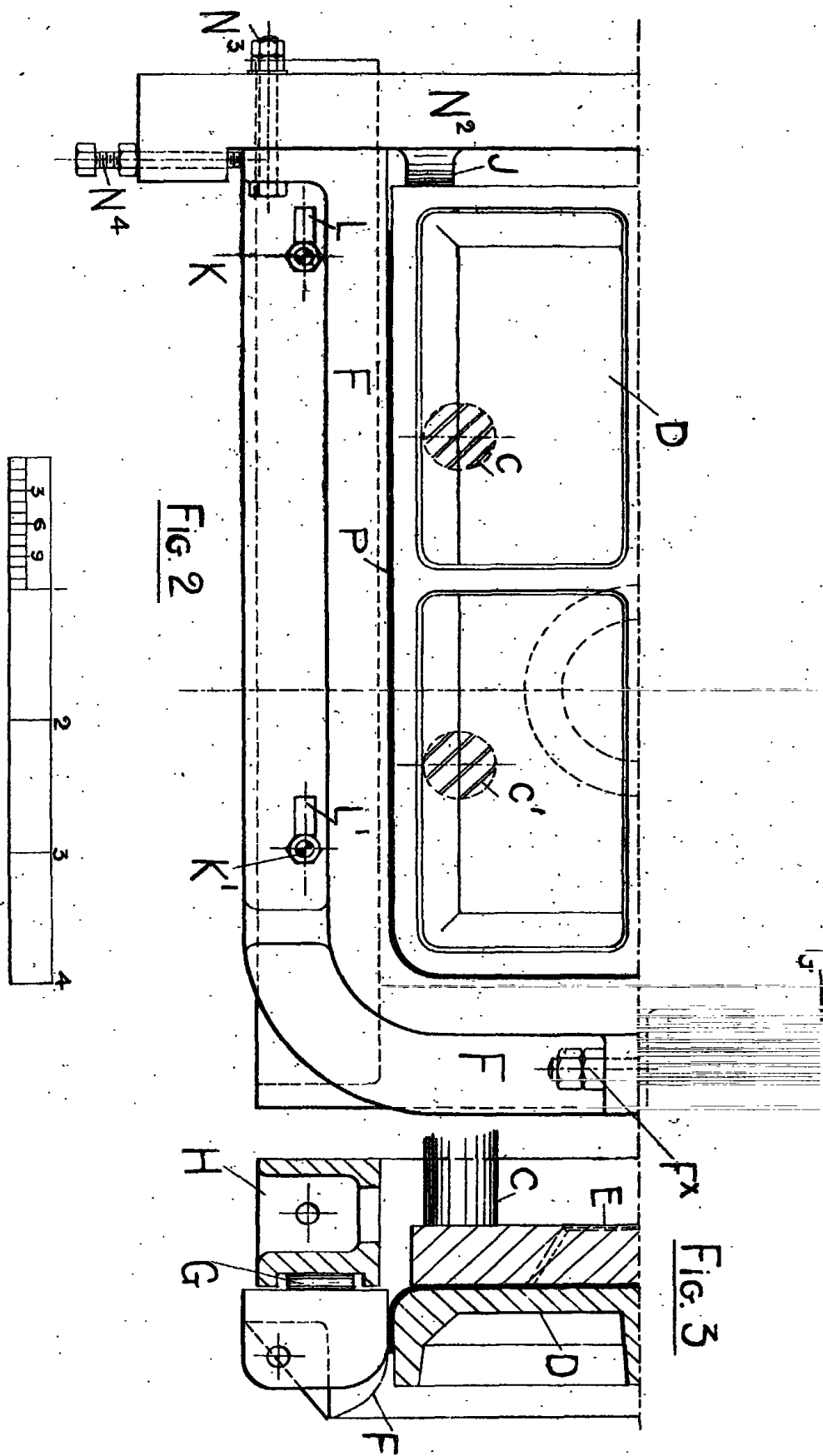
PETER J. LIVSEY,  
Agent.

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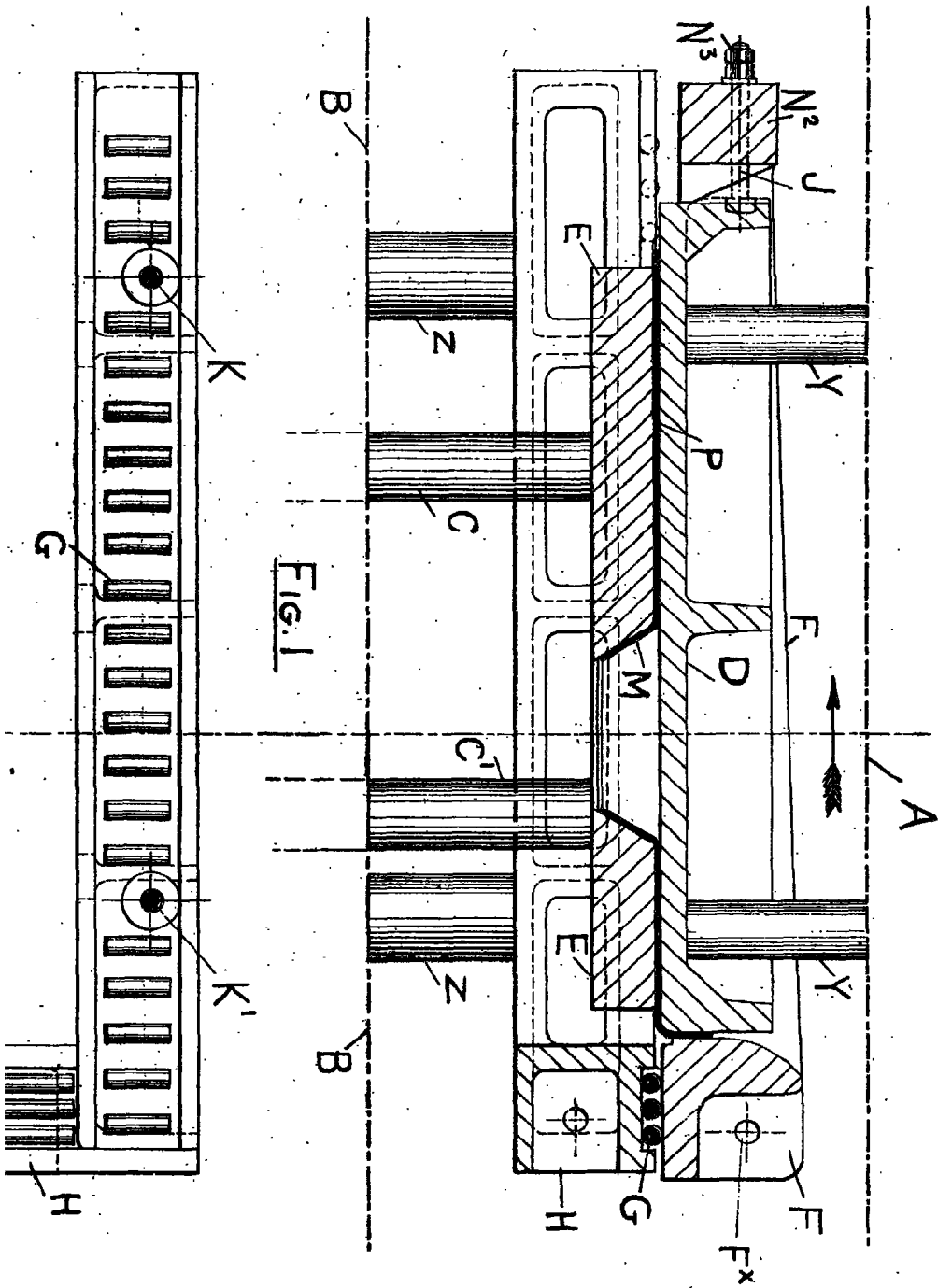


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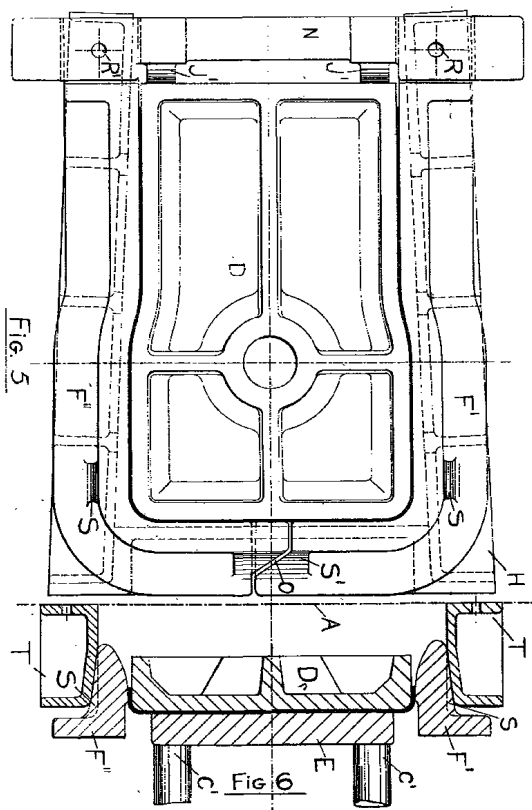
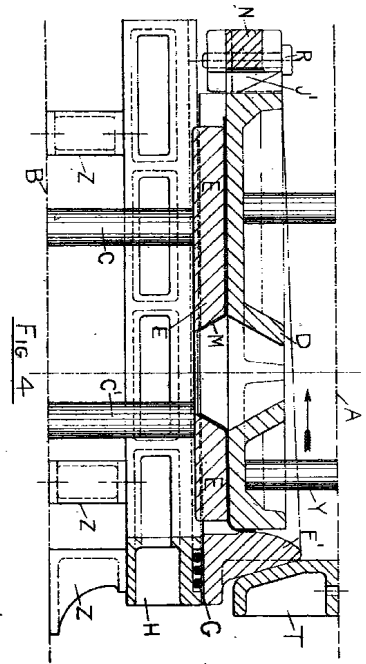


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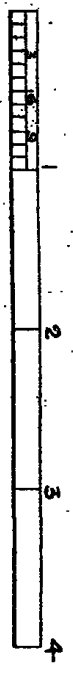
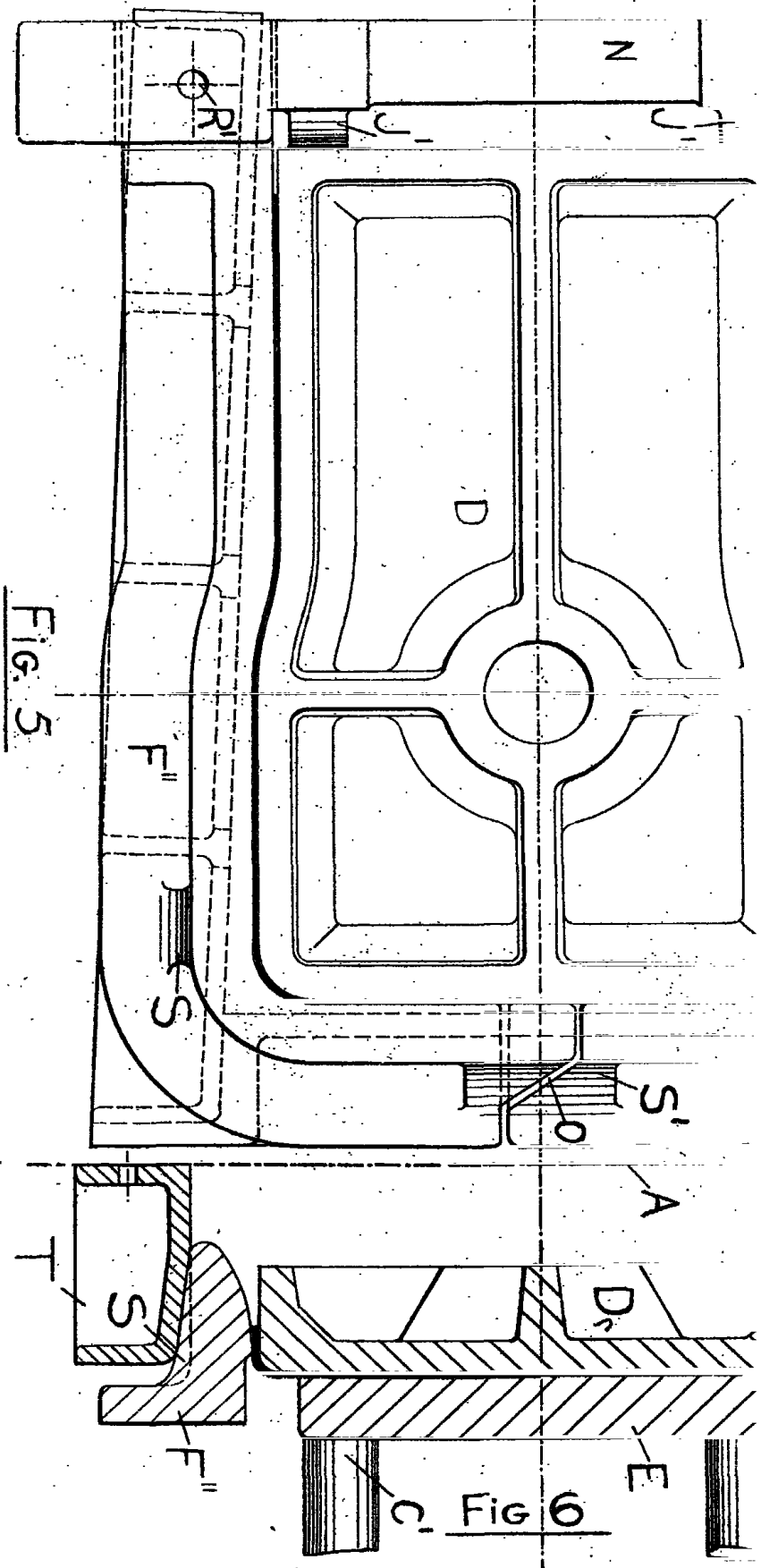


Fig 5

Fig 6

[This Drawing is a reproduction of the Original on a reduced scale.]

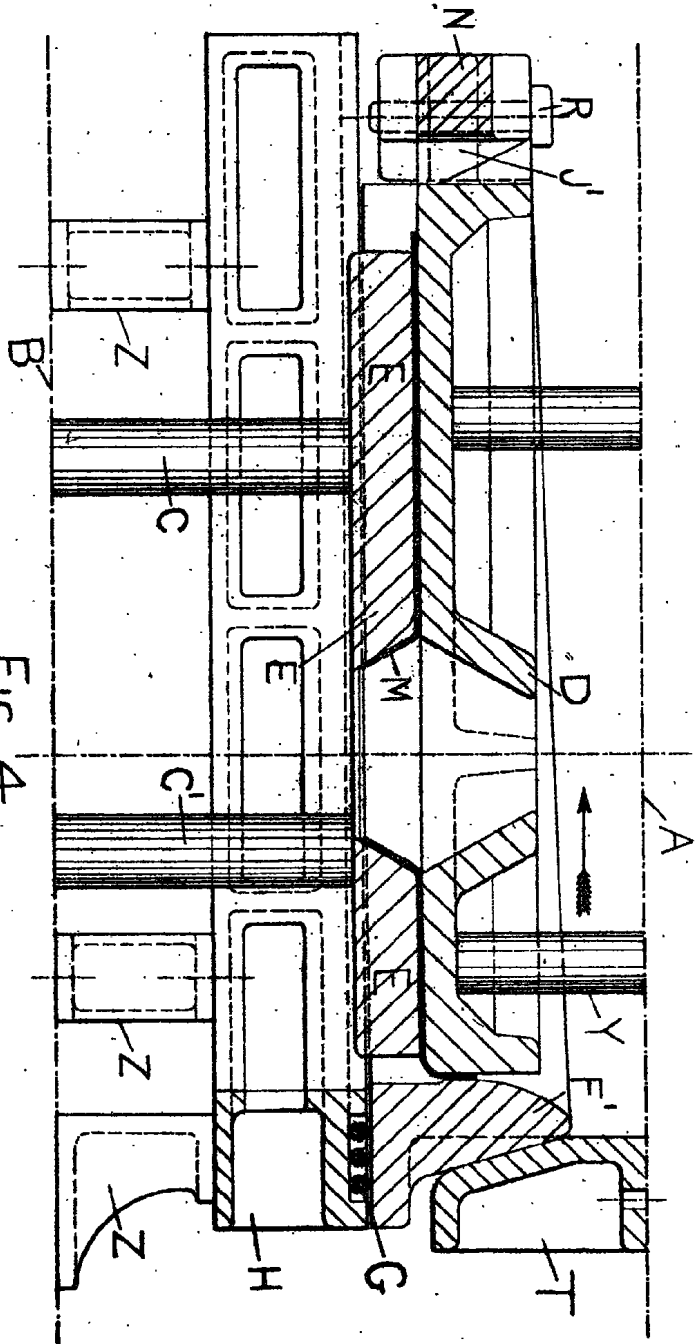
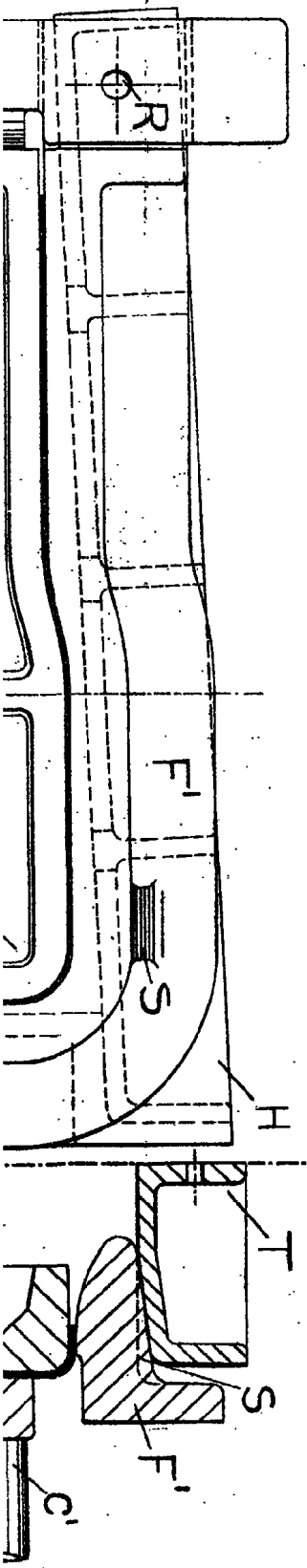


Fig. 4.



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