

each of the revolving grooved rollers which is to be used according to this sixth part of my improvements has a portion of its circular ground circumference cut away at one place in that circumference so as to render the same deficient at one place in that circumference in order that when the deficient places in the circumferences of all the several rollers are opposite one to the other see Figure 1 sheet XII and the rollers are standing motionless that a sufficiently large aperture may then be left open between the rollers for allowing the turned up shelp to be pushed freely midway through the said large aperture in order to introduce one end or half (or other portion) of the length of the shelp into a suitable furnace which is situated as near to the revolving rollers as can conveniently be done and after the said end or portion has been heated to a welding heat it is withdrawn from the furnace by taking hold of the end which has not been heated and drawing the same by hand through between the said large aperture between the rollers until the commencement of that part of the shelp which is heated is brought within that large aperture and then the rollers are put in motion by the power of the millwork

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millwork and as they turn round the deficient places in their circumferences pass immediately away and then the grooves around those circumferences come into action to form by their concurrence an aperture of a proper size for compressing the heated iron and passing it through between the revolving rollers in a suitable manner for effecting the welding of the edges of the shelp. The length of grooves around the circumferences of the several rollers (without reckoning their deficient part) must exceed the length of the portion of the shelp which is heated at once in manner aforesaid when the rollers have completed one revolution they must then stop of themselves and then the said deficient parts will have come round again leaving the iron at liberty within the large aperture aforesaid either to be put back again into the furnace if it is intended to repeat the welding or else after the iron is turned end for end and cooled the other end or half is to be treated in the same manner (above described) as the first half was treated etc. This way rather more than half of the whole length must be heated at each time no mandrel is required to be used in this part of my improvements and for greater

greater facility of repeating the welding operation the revolving motion of the rollers may be reversed in its direction as soon as the iron has been carried through between the rollers in manner above described in a direction away from the furnace and nearly all but not the whole of the length of the heated portion of the iron has been passed through between the rollers and the extreme end of that portion has very nearly but not quite passed through - and on such reversal of the motion the iron will be re-passed through between the rollers in a direction towards the furnace so as to be again subjected to their compressing action and the heated end or portion of the iron will re-enter into the furnace during such re-passing and will receive fresh heat in preparation for being again drawn out and passed a third time through between the rollers by a repetition of the operation above first described - the reversing of the motion of the revolving rollers may be performed in several ways which are well known being in common use in other machinery particularly in planing machines where a very suitable mode of reversing is commonly used (videlicet) the machine may be put in mo-

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 motion by two endless straps around a large horizontal cylindrical drum which is continually turned rapidly round by power of mill-work the same two endless straps also acting around three pulleys in a horizontal axis which by a suitable connexion of toothed wheel-work gives the required motion to the revolving rollers. - The said three pulleys are disposed close together side by side on the said axis all three being of the same size the middlemost of the said three pulleys is fastened upon the axis so as to give motion thereto when it is turned round by either of the straps; the other two outside pulleys are fitted loosely upon the axis as to revolve freely thereon - one of the two endless straps aforesaid is crossed but the other strap is not crossed consequently which ever of the pulleys the two endless straps may operate upon these two pulleys will always be turned round in contrary directions; when the crossed is acting upon one of the side loose pulleys and the other open strap is acting upon the middlemost pulley then their axes will be turned round by the latter strap and pulley in one direction and by means of the wheelwork aforesaid the revolving rollers will be turned round in a direction to carry the heated iron straight towards them in a direction away from

from the furnace - and when the rollers have in that manner been turned round so far in that direction as that nearly but not quite the whole length of the heated portion of the Iron will have been passed through between them and their motion requires to be reversed, as already mentioned, then both the endleß straps are removed laterally on their drums and on their pulleys at once so that the crossed strap will pass from off the middlemost pulley to the adjacent side pulley which being loose will give no motion to their axes but the open strap being at the same time removed from that side loose pulley on which it had before acted and brought to act upon the middlemost pulley (as soon as the crossed strap quitted the same) the open strap will turn the middlemost pulley and the axes and wheelwork and consequently the rollers round in a contrary direction to that in which they were before turned, so as to re-pass the heated Iron through between them towards (and into) the furnace as already explained - when both straps are removed to the two side loose pulleys respectively so that neither will act on the middlemost pulley then no motion will be given to the

the axes and the rollers will be left standing still - the requisite removing of the two endleß straps on the three pulleys for the above purpose is well known and may be performed by moving suitable strap guides by hand or such guides may be moved by the machinery itself in the same manner as is done in playing machines and is generally known - Note the writing grooved rollers which are most suitable to be used in this sixth part of my improvements are such as are combined to act three or four in concert by compressing the heated Iron which is passing through between them at as many sides at once; the grooves around their circumferences concurring together to form a truly circular aperture between the three or the four grooves for the heated Iron to be passed through and such combined revolving grooved rollers were formerly invented by me and letter patented but were granted to me therefore by her present Majesty on or about the Twenty seventh day of March One thousand eight hundred and forty and the same are fully described in my Specification thereof which stands enrolled in Chancery the Machine represented on Sheet XII although intended for a different purpose as heretofore explained will serve for a representation of one which

which is proper to be used in the sixth part of my Improvements and figure 1. thereon is a section to explain the deficient part of the circumference of the rollers hereinafore mentioned. The section representing the rollers when they are standing still. - The seventh part of my said Improvements is a new mode of preparing the extreme ends of the metal tubes which are to be united together end to end in prolongation of the length of one tube or piece or length of tube by another such tube or piece or length. - For this purpose the end of one piece is to be cut out with a vee groove in the edge of the thickness of metal of the tube all around the circumference of the said end - and the edge of the thickness of metal at the end of the other piece is to be cut to a double bevelled edge all around the circumference of the said end. The said double bevel must fit accurately into the said vee groove when the two pieces of tube are put together end to end as is shown in section by Figure 4. Sheet VII and requires very little further explanation. - The said vee groove and double bevelled ends are easily formed at the ends of the pieces by drawing in a lathe with slide rest in the usual manner practised by workmen in like cases and after the

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 the said ends have been so fitted one to the other and put together in close contact then double dovetail cramps are to be inserted into corresponding double dovetail notches cut out in the metal of the tube as is represented at w Figure 4 - which is a longitudinal section and the said cramps being inlaid into the notches will hold the two ends together until they can be permanently united by soldering, brazing or welding which operations are to be performed in the usual manner as commonly practised for uniting the ends of metal tubes together by one or other of those means respectively and requires no further explanation. - This seventh part of my Improvement being the aforesaid means of preparation of the end for being so united. - The cramps w are to be the same in every respect as already described in the third part of my Improvements and the manner of cutting out the double dovetailed notches and inlaying the cramps into them is the same as already described in reference to Figure 3. Sheet VII. By means of this seventh part of my Improvements the ends of pieces of welded show tubes may be very correctly and firmly welded one to another in order to obtain longer lengths of welded tubes than can be conveniently manufactured and in case of welded iron tubes which

which are required to be made very truly circular and of uniform thickness at their ends such would be easily done by turning the end ends in a lathe of metal could be spared for so turning without rendering the metal to them at the ends; but according to this part of my improvements short pieces cut from a tube which has been made with suitable thickness of metal for the purpose can be fitted in manner above described according to this seventh part of my Improvements to join to the ends of the intended tube so as when welded thereto to afford sufficient metal for afterwards turning the ends true in a lathe and yet after such turning that the ends shall be of the same thickness as the rest of the tube; or if the ends are required to be permanently thicker after such turning the thickness of the ends which are welded must be provided accordingly. The eighth part of my improvements is for cleaning and smoothing the surfaces of metal tubes by putting a number of them into a hollow cylinder which is mounted with its length horizontally on pivots at its two ends and is turned round by power of millwork in the manner of a barrel Churn in order that the tubes within it may roll round and rub one against another

so as to clean and smooth their exterior surfaces. See Sheet XI where in Figure 1. is a horizontal plan and Figure 2. an end elevation of four such cylinders AAAA mounted side by side on the frame BB. and turned round by bevil wheels a. on the end of the axis of each cylinder and other smaller bevil wheels b. b. on a horizontal cross axis D. The Tubes are introduced into the cylinders through two holes in the ends and when finished are taken out at doors in the said ends as is shown in Figure 2. In case of welded Iron tubes each tube may be put into the cylinder immediately after the welding whilst the tube continues red hot and the action of the other tubes therein will tend to straighten the tube and to keep it straight whilst it is cooling - and in case it is required to clean the interior surfaces of the tubes then a solid cylindrical rod of Iron may be inserted loosely into each tube and the weight of such rod rolling round within the interior of the tube by the rolling motion given thereto in the hollow revolving cylinder will operate to under the interior surface of the tube clean and smooth. The ninth part of my improvements is for finishing welded Iron tubes and rendering them

them straight and truly cylindrical which is done by heating them to redness within cast iron retorts which are set in a furnace some what in the manner of retorts used in making gas. The said retorts are cylindrical within - See description Figure 2, Sheet XII, and open at the ends for inserting and withdrawing the tubes which are to be finished according to this part of my Improvements and which are by that means heated uniformly at all parts of their length to a red heat and are taken out at a time in that state and laid in a long angle groove along a straight bar or trough of iron of an angular form which is horizontal and which lodges the hot tube in the exact line of the aperture between a set of combined revolving grooved rollers such as represented in Sheet XII and the said hot tube being pushed along sideways in the said straight groove is thereby presented to the said rollers and they pass it through between them and as it goes through on the other side it passes along into another like angle groove fixed there in exact continuation of the one first mentioned - In thus passing the tube is slightly compressed on all sides so as to make it take the form of the circular aperture between the grooved rollers and

and the tube is rendered straight 124
 by moving in the aforesaid angle grooves at each side of the rollers and when the tube has passed all its length through between the rollers in manner aforesaid then the revolving motion of the rollers is reversed in order to re-pass the tube through between them in a contrary direction but before the end of the tube is reentered into the aperture between the rollers for so re-passing it is turned partly round so as to bring a different side in contact with the angle grooves in which the tube rests - When the tube has re-passed all its length then the motion of the rollers is again reversed - and in this way the tube is passed and re-passed several times backwards and forwards all its length through between the rollers until it is rendered straight and true to its intended cylindrical form and size and until the iron is become so cool that it will preserve the said true form - The fourth part of my Improvements is for facilitating the using of machinery which is constructed with three or four revolving grooved rollers combined and consists in mounting the whole frame work containing the combination of such rollers on

on wheels which run upon the rails of a railway as represented in Sheet XII, so that the whole machine is rendered moveable in order that it may be put into complete order in a suitable workshop with the grooves around its rollers adjusted one to another and then it can be wheeled along the railway to the place where it is to be worked and at that place it is firmly fixed to a substantial base or foundation ready for work and the horizontal axes *v* and *w* of one or more of the rollers connected with the axes of *v* and *w* of the millwork by which the machine is to be put in motion - and in case of derangement or when the machine requires repair then it is unfastened from its foundation, disconnected from the millwork and wheeled away along the railway to the workshop and another machine which is in good order brought along the said railway to replace it. The said Railway must be provided with such turnplate and crossing places as the localities of the manufactory may require - and when different sizes of pipes are to be made the grooved rollers can in this way be changed

in the workshop and the machine with the proper rollers wheeled along the railway to the proper place for working the machine. The eleventh part of my improvement is for forming the grooves around the circumferences of rollers which are combined according to my said Patent of the twenty seventh of March One thousand eight hundred and forty - See sheet XIII wherein *EF* are the uppermost and lowermost of the combined rollers and *XY* part of the frame of the machine in which those rollers are mounted *DD* is a tube having a large circular flange *F* by which it is fastened to the frame *XX* and a shaft lining *cc* which is fixed into the tube *D* sustains a horizontal axis *K* and which has a steel cutter projecting from that end of it which is in the aperture between the combined rollers for cutting the grooves around the circumferences of the rollers when they are turned slowly round and at the same time the axis *K* is turned very much more slowly round by means of a worm wheel *W* on the end of it and an endless screw *V* which the workman turns as required by a handle *a* - The steel cutter is thereby carried round about with the axis *K* with a truly circular

circular motion of its own so as to cut successively in the grooves of the rollers all around for rendering the aperture that is formed between the said grooves truly circular. - The principal part of my said improvements is for cutting off the ends of cylindrical metal tubes to an exact length by the machine represented in Sheet XIV wherein the tube A is fixed fast in a horizontal position with its two ends passing through the hollows of two hollow axes B B which are mounted in bearings b b and turned round by gullets b b and endless bands. On the end of each hollow axis a flat circular plate d is fastened and revolves with it the circumference of the plate d has teeth around it like a spur cog wheel as is shown in the end view, and against the flat surface of the said plate d a slider i is applied to carry a tool e, the cutting edge of which is towards the centre and is carried round about the fixed tube A with the said cutting edge in contact with the outside of the tube so as to cut the same and by a slow motion of the slider i the tool e is advanced towards the centre so as to cut into the metal of the tube until it is cut quite through. The slow advancing motion of the slider i and tool e is given hereto

hereto by an eccentric circular groove l formed in the flat surface of a circular cog wheel k which is fitted loose on against the back of the wheel or plate d so as to be carried round therewith but the cog wheels k and d have a different number of teeth as is shown by the figures and the teeth of both wheels are geared into a fission in which revolves on a fixed stud or pin but owing to the different numbers of teeth in the two wheels and wheel k acquires a very slow relative or differential motion from the wheel d and that motion by means of the eccentric groove l advances the slider i and the cutting tool e towards the tube for cutting the same. The slider i having a pin which enters into the said eccentric groove l - a bearing pin r is also applied to the face of the wheel d to sustain the tube at the opposite side thereof to that which is at the time of cutting by the tool e. - Both ends of the tube are cut off at once in manner aforesaid. The bearings B B can be set nearer together or further apart to suit for cutting tubes of different lengths. The thirteenth part of my said improvements is for a new kind of head for a mandril to be used in the welding of Iron tubes between

between revolving grooved rollers the head of which mandril is to remain stationary with the interior of the tube whilst the tube is passing through between the revolving rollers, on the stationary mandril in the usual and well known manner of rolling such a mandril. As such mandrils have been hitherto used they are liable at times to stick to the tube which is passing over them - Sheet IV represents the new kind of head for a mandril which is formed on a circular steel plate A Figure 1 cut with notches in its circumference and then bended into the form of a hollow cup B - Figure 2 which is applied as shown in the section - Figure 3 on the end of the stem E of the mandril in the manner of a nut upon a screw formed at the end of the stem. The sides of the hollow cup B form the piston or bulb end of the mandril which is to be within the tube that is rolling and opposite to the place of greatest compression by the revolving grooved rollers at the outside of the tube - and in case of the heated iron of the tube sticking fast so as to clog up the aperture between the rollers then the sides of the hollow cup B will yield and collapse towards the

and fastened by screwing on the pointed end of extremity F of the mandril

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the stem E so as to avoid causing such a strain upon the axis or what work of the revolving rollers as would break any of the parts as is sometimes the case when that part of the mandril for which the hollow cup B is the substitute is a solid piece of metal. My improved apparatus for fastening tubes in their intended place in Steam Boilers and other vessels is shown on Sheet 16. Figure 1 is an elevation of the apparatus the part C being inserted within the tube which requires fastening a section of this apparatus is shown at Figure 2 and the like parts are marked with the same letters in the different figures wherever they occur D Figure 1 and 2 is a hardened steel plug screwed at one end hexagonal and truncated at the other. The screwed end of the steel plug D passes freely through a hexagonal hole in the metal block E a recess is also sunk in the face of the block E the depth of which determines the distance the tube is to stand out or project from the face of the end plate of the Boiler or other vessel into which the tubes are to be fastened - the end of the steel plug which is hexagonal and truncated has six hardened steel dies 1, 1, 1, 1, 1, 1 shown in

in plan Figure 10, and side elevation Figure 9. These dies are shown in section at A. A. Figure 2, one on each side of the steel plug D-Z. Figure 10 exhibits the hexagonal space enclosed by the six dies when in their proper relative positions in the machine and they are kept together by means of a steel spring inserted in a groove Y figure 9, so as to allow the dies to expand or rather to separate from each other a little when operated upon by the steel plug D Figure 2 - Y Figure 2 is a small handle for the purpose of screwing the nut B either on or off the steel plug D more rapidly than can be done by means of the ratchet lever X. W is a short lever shown separately at Figure 3. this lever is fitted on to the block B and is for the purpose of preventing it being turned round by the motion of either the handle Y or the ratchet lever X and this is effected by passing the pin V through a hole in the lever W and into a hole in the end plate of the Boiler or other vessel or into one of the tubes - the block B has a key fixed into it, and this key fills the holes 1, 2, in the lever - Figure 3 the key in the block B is first passed into

into the hole 1 and then by turning the handle Y the nut B is screwed upon the pin D, a reciprocating motion is given to the ratchet lever X until the dies A. A. Figure 2 are expanded against the inside of the tube and stretch the tube so as to fill the hole in the plate and become thereby fastened therein to which this has been done a reverse motion is given to the screwed nut B by holding the end a of the ratchet in one of the notches of the screwed nut and communicating a reverse motion to the ratchet lever X for the purpose of loosening the dies A. A. a more rapid motion and a greater extent of motion is given to the nut B by the handle Y the end of the steel plug is driven inwards by a blow so as to loosen the apparatus - the key which was inserted into the key way or hole 1 of the lever W is then taken out and inserted in the key way 2 - these keyways are placed at such a distance apart as to allow the apparatus and dies A. A. to be moved through one twelfth of their circumference (the pin V being placed in the same hole as before) by this arrangement the middle of the dies A. A. A. A. Figure 10 are brought against those parts of the tube opposite the spaces which were formed between the dies when they were in their expanded

expanded or extended state as above mentioned, the dies when in their new positions are again expanded by moving first the handle Y and then the ratchet lever X until the dies are again expanded so as to press or force the outside of the tube firmly into contact with the inside of the hole in the steam boiler or other vessel into which the tube is placed - any desired form may be given to the dies and the end of the block D may have the necks so made so to allow any portion near the end of the same tube to stand out or project from the end plate or the tube may be flush, or even with that surface, but I prefer that the tube should project a little from the end plate and that part which projects should be enlarged by the apparatus so as to prevent the end plates being forced over the tubes by the pressure from within the steam boilers or other vessels into which, tubes may be expeditiously fastened - without the expense of furnaces and with less injury to the tubes than when taper mandrills are driven into the ends of the tubes with a view to expand or stretch the tube until it fills the hole and becomes fast and thrown without a ferrule - taper mandrills are very likely to open the ends of the tube.

tubes may be fastened by this apparatus

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tube in the operation of fastening thereby spreading the tube - Figure 4 is an end view of Figure 2 through the line z z - Figure 5 is an end view of Figure 1 showing part of the lever X - Figure 6 is an end view of Figure 2 showing the handle Y and part of the lever X - Figure 7 is a view of part of the end plate of a steam boiler or other vessel into which a tube which is fastened into it - Figure 8 is a section through the end plate of a boiler or other vessel and also through a part of a tube - C Figures 1 and 2 is a screw to counterpoise the end D of the apparatus - Figure 11 is a spring which brings the end e of the ratchet into the grooves or notches in the nut A when the lever X is worked in a backward direction - Having now described my said improvements - I the said Richard Prosser do hereby declare that the new Invention, whereof the exclusive use is granted to me by the Letters Patent, hereinbefore recited consists in the following Improvements - Firstly, in the Improvement hereinbefore described and represented in Figure 1, sheet 1 of the drawings already annexed of preparing the edges of flat plates or sheets of metal which are afterwards to be turned up into tubular forms with a web groove along one edge and

and a double bevel along the other edge of each such plate or shell which are grooved and double bevelled edges will fit one to the other when the prepared plate is afterwards turned up into a tubular form - or otherwise preparing the said edges with rabbets in the manner hereinafore described and represented in Figure 2, Sheet 1. one such rabbet being formed at one side or surface of the flat plate and the other rabbet at the contrary side or surface; and which rabbets will fit one to the other when the prepared plate is afterwards turned up to a tubular form - Also the improvement hereinbefore described and represented in figure 2, 3. and 4. Sheet II. of combining two pairs of circular wheels e. f. and g. h. together for the purpose of operating at the two edges of flat plates or shells of metal at once in the manner of circular shears for paring, or cutting off narrow strips from those two edges leaving the same smooth straight and parallel - Likewise of combining three such pairs of circular wheels together in manner hereinbefore explained for the purpose of cutting along the middle and at the same time cutting along the two edges of a broad plate so as to divide the same into two flat plates or shells each

each having two smooth, straight and parallel edges - Note no claim is made to the application of one pair of such circular wheels for cutting along one edge at a time but only to the aforesaid combination of two pairs for cutting along two edges at once and of three pairs for cutting along the middle as well as along the two edges of a broad plate at one operation nor is any claim made to the application of the aforesaid combinations of two pairs and of three pairs of circular wheels to any other purpose than that of cutting the edges of plates or shells of metal which are afterwards to be turned up into tubular forms - Secondly in the improvement hereinafore described and represented in Figures 1, 2, 3. and 4. 5 6. - Sheets IV V VI of turning up flat plates or shells of metal to tubular forms by pressing the flat plates into the hollows of suitable moulds so as to bend the plates by degrees to the required tubular forms - Thirdly in the improvement hereinbefore described and represented in Figures 1, 2, and 3 Sheet VII for fastening together the edges of plates or shells of metal which have been turned up to tubular forms by inlaying double dovetailed cramps into corresponding double dovetailed notches cut out in the two edges of the turned up plate or shell - also for securing the edges of

of plates or Skelps of Iron which have been turned up to a tubular form by preparatory welding of the edges together in manner hereinbefore described for a short portion of the length of each turned up plate or Skelp: at that end more of which will be foremost when such turned up plate or Skelp is to be withdrawn from the furnace wherein it has been heated to a welding heat the said foremost end which is so secured by preparatory welding partaking of that welding heat - But no claim is made to any preparatory welding together the edges at the end or ends of any turned up plate or Skelp whereof the other parts of the edges which have not undergone such preparatory welding are to be afterwards united by bridging the only preparatory welding together of the edges at the end which is claimed being for such turned up plates or Skelps of Iron as are afterwards to be welded along all the other parts of the edges which have not undergone such preparatory welding - Fourthly in the Improvements hereinbefore described and represented in Sheet VIII for introducing turned up Skelps of Iron into a furnace wherein they are to be heated to a welding heat - also for facilitat-

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 facilitating the withdrawing of such turned up Skelps from the furnace after they have been heated to a welding heat therein by the application of a revolving groove bearing roller beneath the door of the furnace as hereinbefore described together with the application of a preparatory welding of the edges of the turned up plate or Skelp at that end thereof which goes foremost in so withdrawing and which end is at a welding heat and must endure the force of pulling with tongs for withdrawing as already mentioned - Fifthly in the improvement hereinbefore described and represented in Sheet IX for welding the edges of turned up plates or Skelps of wrought Iron which have been heated throughout the whole length to a welding heat by passing such heated Skelp through between a pair of revolving grooved rollers having a pair of grooved guiding cheeks fixed so as to enter between the circumferences of the two grooved rollers in such manner as that the grooves in the said two guiding cheeks and the grooves around the circumference of the two rollers will conform one groove to the other in order to produce a circular aperture for the heated Skelp

Sheet to be passed through the upper and lower portions of the circumference of the said aperture being formed by the grooves around the two rollers and the two side portions of the same circumference being formed by the grooves in the two guiding cheeks R and S, and the said guiding cheeks being capable of yielding laterally in case of necessity - also the aforesaid revolving grooved rollers being if preferred turned round first in a forward and then in a backward direction alternately for the purpose of first passing and then re-passing the heated Sheet through between the grooved circumferences of the revolving roller and between the aforesaid grooved guiding cheeks in order to repeat the compressing action by which the welding is to be performed - Sixthly in the improvement hereinbefore described and represented in part in Figure 1 Sheet XII for welding the edges of turned plates or Sheets of Iron whereof only one end or half (or other portion) of the length is heated to a welding heat at the same time; the said welding heat being performed between revolving grooved rollers having deficient places in their circumferences

circumferences for permitting the Iron to be put through between the rollers whilst they are standing motionless in order to introduce that end or portion which is to be heated into the furnace and to withdraw the same after it has become heated. The said revolving grooved rollers being turned once round for passing the heated part of the sheet through between them and they may if preferred be so turned once round first in a forward and then in a backward direction alternately for passing and then re-passing the heated iron through between them in alternate directions for repeating the compressing action by which the welding is to be performed - Seventhly in the improvement hereinbefore described and represented in Figure 4 Sheet VII for preparing the ends of welded iron tubes for being welded together end to end in continuation of length by forming a vee groove around one of the two ends which are to be welded together and forming a double bevel around the other of those ends which the groove and double bevel will fit true one into the other and then fastening together the two ends which are so fitted by interlaying double dove tailed clamps into corresponding notches cut out in the two ends and

and after being so prepared the joint to be heated and welded by hammering or otherwise as may be preferred - also the application of such mode of joining tubes end to end for adding and welding on ends of thicker metal to tubes which require to be turned true in a lathe at the ends such thicker metal allowing for the waste occasioned by such turning & rightly in the improvement hereinbefore described and represented in Sheet VI for cleaning and smoothing the surfaces of metal tubes by putting a number thereof into a hollow cylinder with the axis thereof horizontal and which is turned round in the manner of a revolving churn in order to cause the tubes which are within it to be rolled round and rubbed one against another so as to clean and smooth their surfaces and a cylindrical metal rod may be inserted into the interior hollow of each tube when it is so put into the said hollow cylinder for the purpose of cleaning and smoothing the interior of the surface of the tube by the rolling and rubbing action of the said rod therein - Ninthly in the use of machinery represented in Sheet V for straightening and rounding

rounding tubes by pressing them between tools with a semicylindrical groove in each tool so as to form when they come together a long straight and circular hole. Tenthly in the improvement hereinbefore described and represented in Sheet XII of mounting the whole frame work of machines containing revolving grooved rollers to be used in the manufacture of metal tubes upon wheels adapted to run upon horizontal rails like those of a railway in such manner as that such machinery may be put into complete order in a suitable workshop and then wheeled along the rails to its proper place for working and there fixed for working or may be removed therefrom again when repair is required and replaced by another complete machine which has previously been put into complete order - also for changing a machine containing grooved rollers suited for one size of tubes for another machine containing grooved rollers suited for a different size of tubes - Eleventhly in the improvement hereinbefore described and represented in Sheet XIII for cutting the grooves around the circumferences of combined revolving grooved rollers so that the aperture formed between the several rollers

rollers by their said grooves will
be a truly circular aperture -
Twelfthly the improvements here-
inbefore described and represented
in sheet XIV for cutting off the
ends of cylindrical metal tubes
to any exact length by cutting
tools which are carried circularly
round ~~round~~ about those ends of
the tube which are to be cut off
whilst the same is held fast in
a horizontal position for cutting
both ends at once - The said
tools cutting deeper and deeper
into the metal of the tube at
each revolution until they make
around the tube until they cut
quite through the thickness of the
metal - Thirteenthly in the Im-
provement hereinbefore described
and represented in Figures 1,
2, 3, Sheet XV for a mandril
to be used in the manufacture
of metal tubes which will collapse
in case of accident so as to avoid
breaking the machinery - Four-
teenthly in the improvement
hereinbefore described and represented
on sheet XVI for fastening tubes
in their intended places in Steam
Boilers or other vessels - In
Witness whereof I the said Richard
Prosser have hereunto set my
hand and seal this fourteenth
day of March in the year of
our Lord one thousand eight
hundred

hundred and forty six. (signed) 134.
Richard Prosser - Taken
and acknowledged by Richard
Prosser party hereto the fourteenth
day of March 1846 at Dumfries
him in that part of the United in the County
Kingdom of Great Britain and of Manxwick
Ireland called England before
me (signed) Frederick Mills -
a Master extraordinary in Chancery
Edinburgh the sixteenth day of
March One thousand eight hundred
and forty six years This Specification
is enrolled in the records of Her
Majesty's Chancery in Scotland
by me Archibald McNeill Director
of said Chancery - signed) 16 March 1846
McNeill C. D. -

Specification of Moses Poole

To all to whom these presents shall Moses Poole
come I Moses Poole of the Patent
Office Seale Street in the County
of Middlesex Gentleman Send greet-
ing whereas Her present most
Excellent Majesty Queen Victoria
by Her said Majesty's Letters Patent under
the Great Seal appointed by the Treaty of
Amity to be used in place of
the Great Seal of Scotland bearing
date at Edinburgh the nineteenth
day of November in the ninth year
of Her said Majesty's said Majesty's
said Majesty's

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