

respecting turned up plates or Skelps of wrought Iron the edges of which are to be welded together to form the longitudinal seam or joint of the tube when such a Skelp has been brought to a welding heat throughout all its length in a furnace and is to be withdrawn therefrom the iron will be in a softened state and as to that end of the said Skelp which is foremost when the Skelp is withdrawn from the Furnace (by a main taking hold of that end with tongs in the usual manner of proceeding) the said end being at a welding heat is liable to be bended and the edges of the plate or Skelp displaced from their proper intended contact by the force to which the said foremost end is then subjected. In order therefore to prevent such displacement of the edges at the said foremost end the said edges should be secured by one of the said devised cramps inlaid into the two edges near to the said end or two such cramps may be so inlaid near together in order to render the said foremost end very secure from separation or displacement of the edges when the said end is at a welding heat and is to be withdrawn from the Furnace - or both ends

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ends of the Skelp may be treated alike in manner aforesaid and a cramp being also laid in to the edges at the middlength of the tube will in most cases be sufficient for securing wedges together unless the length of tube or its size may render more security advisable and in such case more cramps may be inlaid. - and respecting the preparing of the two edges of the turned up plate or Skelp at that end of the tube which will be foremost when the tube is in the act of being withdrawn from the Furnace in order to secure those edges from displacement or separation when such end is afterwards heated to a welding heat instead of inlaying cramps into those edges at the said end in manner aforesaid those edges may be prepared by previously welding them together at the said end by hand hammering on the groove of a surge block with a plug or mandril inserted into the interior hollow of the tube in the usual and well known manner of welding Iron Tubes by hand labour. - The said meeting of the edges may extend about as much of the length of the tube from the said

said foremost end thereof as can be conveniently welded at one time of heating the end of the tube in a forge fire to a welding heat, and by such preparatory welding the said foremost end will be prepared for resisting the force to which it will be afterwards subjected when the whole or the greater part of the length of the tube (including the said foremost end) has become heated in the Furnace to a welding heat and is in that state to be withdrawn from the Furnace by taking hold of the said foremost end with Tongs, and whereas it has been the practice to weld together the edges of turned up plates or Skelps of wrought iron for short portions of the length at the two ends of such such skelp in cases when the remainder of the said edges are to be united together along all the rest of the said length by brazing therefore I make no claim to any such welding at the ends except when the same is done in substitution for the inlaying of double dovetailed cramps into the edges at the ends as hereinbefore described by way of a previous preparation for the whole or greater part of length of the turned up plate or Skelp of

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 of Iron being afterwards heated to a welding heat in a Furnace the end which is so prepared by welding partaking of such welding heat, and being the end which will be the foremost end of the Skelp when the same is to be withdrawn from the Furnace after having been heated to a welding heat therein. It is hitherto in the manufacture of Iron tubes by welding the edges together no means whatever have been used for securing those edges in their intended relative positions during the operation of heating the Iron to a welding heat in a Furnace and of afterwards withdrawing the Iron from the Furnace in that state. This third part of my improvements in preparing plates or Skelps of Iron (which have been turned up to a tubular form) by inlaying double dovetailed cramps into the edges of such plates or Skelps has the effect of securing those edges in their intended relative positions whilst they are undergoing the operation of heating to a welding heat in a Furnace as well as afterwards whilst the Iron is in the act of being withdrawn from the furnace in that state and likewise during the remainder of the operation of welding however that operation may be performed and

and the said securing of the edges being most wanted at that end of the turned up Shell or Tube which will be foremost and when it is in the act of being withdrawn from the furnace in that end at a welding heat the securing of the edges at the said foremost end may be performed either by inlaying of a cramp or cramps into the said edges in manner hereinbefore explained or otherwise by preparatory welding of the said edges in manner hereinbefore explained, and the same result will be obtained in either case by securing the said edges whilst heating and after being heated in a Furnace to a welding heat and no such result has been hitherto obtained by any means hitherto, or in use in the manufacture of welded Iron tubes whereof the whole of the length of the Tubes including the foremost end thereof is heated to a welding heat and respecting the welding of the edges at the ends of the Iron tubes whereof the remaining length of the same edges are afterwards to be brazed together (and which welding has been commonly practised as hereinbefore mentioned) the object of such welding has been to obtain greater strength at the ends of the tubes than can be obtained by brazing the edges together because such

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such Tubes have been made for the Boilers of Locomotive Steam Engines and require to be fastened by their ends into their places in such boilers and the longitudinal seam or joint of the edges of such Tubes when finished is a welded joint at each extreme end and a brazed joint along all the length intervening between those two extreme ends - and such Tubes are not heated throughout the whole or the greater part of their length to a welding heat in a Furnace but the heat to which the iron is subjected for brazing the joint is not such as to render the iron very soft as is the case in a welding heat now are those ends which are welded subjected to any action during the heating and brazing which requires the edges at those ends to be secured or which renders the ends liable to warp and the brazing of the edges from end to end of such tubes could be performed as well without any welding at the ends as with such welding if it were not required for the particular use for which such Tubes have been manufactured as aforesaid that the ends should be more strongly united than can be done by brazing - and another fourth part of my said Improvements is a new mode of introducing turned up plates or Shells

or tubes into the furnace where  
 in they are to be treated for  
 the purpose of soldering, brazing  
 or welding those edges of the metal  
 which are to be united together by  
 one or other of those means - ~~But~~  
 into the turned up Skelps for manu-  
 facturing welded iron tubes have  
 been merely thrown into the fur-  
 nace through the open door way  
 thereof by the strength of a man's arm  
 and allowed to fall heavily with an  
 endways motion by their whole weight  
 on the heated bottom or bed of the fur-  
 nace and in case the whole length  
 of a long Skelp cannot be so thrown  
 in at once then the end of it is  
 seized with a pair of Tongs and it  
 is pushed further into the furnace  
 by sliding it endways along the said  
 bed thereof until its whole length is  
 introduced. - On that way of intro-  
 ducing the tubes the foremost end  
 thereof is liable to cut up the surface  
 of the heated bed and get scoria or  
 dirt into the open end of the  
 Tube. - Most commonly the Skelps  
 have been thus thrown into the  
 furnace at the same door through  
 which the iron is afterwards to be  
 withdrawn after it has acquired  
 its welding heat. - But in some  
 cases the turned up Skelps have  
 been so thrown into the furnace  
 at another doorway at the opposite  
 end or side of the furnace so that  
 end thereof where the door at which  
 the

the heated iron is to be withdrawn  
 is situated - I prefer the latter  
 mode and my new mode of in-  
 troducing the turned up Skelp  
 into the furnace is to mount the  
 same upon a strong iron bar  
 which is longer than the tube and  
 one end of the bar extends into the  
 interior of the tube more than  
 half way through the length there-  
 of in order that the tube may  
 rest securely with its whole length  
 suspended upon the upper edge  
 of the said iron bar which is so  
 much smaller in its dimensions  
 than the interior of the tube as  
 not to touch the tube at any  
 other place than along the highest  
 part or summit of the circum-  
 ference of that interior. - The said  
 iron bar having the tube thus  
 suspended at one end of it is  
 kept in a horizontal position or  
 nearly so whilst it is moved with  
 an endways motion through the  
 door way of the furnace in order  
 to convey the tube into the interior  
 of the furnace without touching the  
 bed or sides or any part thereof  
 and when the whole length of the  
 tube is so introduced through the  
 door way the said bar is lowered  
 down so much as to allow the  
 tube to descend easily in order to  
 deposit it horizontally without  
 on the flat heated bed of the furnace  
 so that it may rest with its  
 weight

wright thereon and be supported throughout all its length and then the iron bar is withdrawn with an endway motion from the interior of the tube without disturbing the tube but leaving the same deposited on the heated bed of the furnace in the precise position it is intended to occupy therein by becoming heated. The height of the said iron bar and of the tube may be sustained during the above operation in a very simple manner by means of a pendulous rod or chain suspended from some fixed point as high up in the roof of the building as can be obtained the lower end of that rod or chain terminating in a ring large enough for the said iron bar to pass easily through and a notch may be made in the underside of the said bar for lodgement thereof in the said ring at such place in the length of bar as will cause the weight of the two ends thereof to be nearly balanced. The said pendulous rod or chain should hang vertically when the iron bar is at the midway of the whole extent of endway motion that must be given to the bar for withdrawing the end of it from the interior of the tube in order to leave the same deposited on the heated bed of the furnace in the manner already explained, and there should be some kind

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of screw links on the rod or chain or other means of adjusting its length so that the ring will sustain the iron bar in a horizontal position whilst the end of it is withdrawn in manner aforesaid from the interior of the tube. A workman holding the extreme end of the said long bar in his hands when the whole weight thereof is suspended by the rod or chain (with the weight of the two ends of the bar nearly balanced) he can very easily withdraw the end of the bar from the interior of the tube without disturbing the tube as it lays horizontally on the bed of the furnace. And after the end of the bar has been so withdrawn from the interior of the tube and from the door of the furnace the workmen can then turn the direction of the long bar sufficiently aside for enabling him to insert the end of the bar into the interior of another tube which may be one of a heap laid in a convenient position near to the furnace for such insertion. When he may move the ring at the lower end of the pendulous rod or chain along the bar (towards the said tube) to another notch in the underside of the bar at a proper place therein for causing the weight of the two ends of the bar to be nearly balanced when the tube is mounted in place.

place upon one of those ends. after this preparation he can with ease take up the tube upon the end of the bar without feeling the weight thereof and after restoring the length way of the bar and the tube thereon to the proper direction of the doorway of the furnace he is ready for introducing the tube with promptitude and the interior of the furnace the instant after the door is opened - and after having quietly deposited the tube horizontally on the heated bed of the furnace as before explained he may then remove the ring of the pendulous chain back again along the bar to the first mentioned notch in the underside thereof where the ends of the two ends of the rod itself without any tube will be nearly balanced and then he can withdraw the end of the iron bar from the interior of the tube without disturbing the tube as already explained and the instant that the extreme end of the bar is withdrawn from the doorway of the furnace the door thereof may be closed to avoid unnecessary cooling of the interior of the furnace. The welding chamber (in which case it is important to avoid such cooling) the door may have a notch in it of sufficient size to allow the said bar to be withdrawn but no longer and then the

the door may be shut down the instant that the tube has been deposited on the heated bed of the furnace and the bar can be withdrawn at leisure through the said notch so as only to require the door way to be kept open during the very short time that is requisite for introducing and depositing the tube on the bed of the furnace in manner aforesaid and after the bar has been withdrawn the said notch is to be closed. By the adoption of this fourth part of my Improvements the bed of the furnace will not be disturbed or cut up from its proper flatness by the force of throwing the cold iron tubes down upon it and by afterwards pushing them endways further in with tongs and getting them to lay straight in the proper place whilst resting with their weight on the said said floor and the tubes will not be liable to get any scum or dirt of the floor into their open ends by moving them along the floor as is the case in the ordinary mode as already mentioned. and the bed of the furnace whilst the same is heating may be prepared to a true straight bed at the part the tubes are to lay upon it by balling and smoothing down the surface of the bed with a long

long heavy bar of iron which is suspended by the pendulous rod or chain before mentioned and the weight so much balanced as to be easily handled by mere holding the extreme end of the bar which is out of the furnace and thereby raising and letting fall the heavy end that is within the furnace in a suitable manner for beating flat on the bed of the furnace with heavy blows of the said heavy end of the iron bar which must be straight and broad and rubbing along the bed with a horizontal endways motion thereof till the bed when strongly heated and the materials softened is made very straight and true and smooth and with a proper surface by the Iron Tubes to lay upon in order that they may be properly supported along the whole of the length so that they cannot bend down or become crooked when they become softened by the heat - Or instead of the simple pendulous rod or chain for suspending the long bar upon which the tubes are to be introduced into the furnace as above described a carriage with four wheels to run upon a railway may be used for holding a similar (but shorter) bar horizontally and at the same time moving

108.  
moving it endways with the tube upon it in order to convey the same into the furnace through the open door way thereof; and with means of then lowering the said bar just so much as is requisite for depositing of the tube gently upon the flat bed of the furnace, but still keeping the said bar horizontal and afterwards withdrawing it with an endways motion horizontally from the interior of the tube without touching that interior but leaving the tube deposited on the flat bed of the furnace. See sheet VIII wherein Figure 1 is a longitudinal elevation - Figure 2 an end elevation and Figure 3 a horizontal plan AA. Figures 1 and 2 and 3 are two railway bars laid horizontally on the ground opposite to the door of the furnace and conformably to the direction in which the tubes are to be laid in the furnace on the flat bed thereof. BBBB. are the four wheels of the carriage to run upon the rails AA and DD is the carriage which rests with four bearings upon the two axes of the said four wheels. EE are four upright pillars which stand up from the carriage D being firmly fastened thereto at their lower ends and

and having screw threads around their upper ends for nuts *a. a.* to screw upon and there by enabling the pillars *E E* to sustain a horizontal platform *F F* which by turning the nuts *a. a.* can be set higher or lower as may be required and with the surface of the platform *F F* horizontal and it can then be made fast by screwing down other nuts *e. e.* on the pillar above the platform *F F*. *C* is a broad bar or trough which is moveable and is sustained above the platform *F F* by means of four inclining parallel levers *g. g. g. g.* which are fastened at their lower ends upon two horizontal axes *w. w.* which extend across the width of the platform *F F* and the upper ends of the said levers *g. g.* sustain four joint pins which project out horizontally from the sides of the moveable trough *C* all those four parallel levers *g.* being of equal length and inclining alike they can be made to act with motion similar to that of a parallel ruler (as is apparent in Figure 1) for raising or lowering the trough *C*, a small quantity but it will preserve its horizontal position in so rising or lowering *H* is one end of the bar of iron whereon the tube is to be mounted as already mentioned

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mentioned. The said end *H* is fastened upon the trough *C* in a horizontal position and projects forwards over the end thereof in a direction parallel to that of the rails *A A* but the drawing only shows a portion of that end of the bar *H* whereon the tube is to be mounted for introducing it into the furnace. *J* is a balance weight at the lower end of a lever *I* which descends from one of the axes *w. w.* of the parallel levers *g. g.* It balances a portion through not the whole of the weight of the trough *C* with the bar *H* but without the weight of the tube upon it so that those parts have a decided tendency to descend by their own weight by motion of the four parallel levers *g. g. g. g.* about their horizontal cross axis *w. w.* and joint pins before mentioned until such descent is limited by a stop *K* which is fastened to the trough *C* and strikes against the end of a stop screw *n* which screws horizontally through a part of the platform *F F* and therefore by turning the handle at the end of the screw *n* the height can be regulated at which the trough *C* and the bar *H* will rest when their further descent is stopped by the stop screw *n*, but they will continue horizontal. When the parallel levers *g. g.* are in a vertical position the



the trough C and the bar H with the tube thereon will be at their highest position but still horizontal and when the lever I with its balance weight J is in a vertical position the parallel levers G G will have passed a little way beyond the vertical as is shown by the dotted lines Z Z, and when the trough C and bar H with the tube which is mounted on the end of it will remain at their highest position which is suitable for introducing the tube into the furnace. - which being done then by the parallel levers G G being moved from the direction Z Z to the direction Y Y. Figure 1 the trough C with the bar H and the tube thereon will be lowered down as much as is requisite for depositing the tube upon the flat bed of the furnace and the stop K which limits the further descent of the parts retains the bar H at the proper height for being withdrawn from the interior of the tube after the same has been deposited on the flat bed of the furnace - and the said screw R must be regulated according to the height of the flat bed of the furnace so as that when the stop K comes in contact with the end of the screw R, the bar H will not then touch the interior of the deposited tube during the withdrawing of the bar H with an endway motion

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 motion from that interior. The manner of using this apparatus. The whole carriage is run back along the rails A A so as to remove it from the furnace to any convenient place where prepared plates or Skelps turned up into a tubular form are laid up in readiness - and the trough C and bar H being raised to their highest position by the workman pushing the trough C endways into the parallel levers G G pass beyond a vertical position as already explained. then a tube is put horizontally over the projecting end of the bar H the extreme end of which bar must reach more than half way through the length of the tube in order that the latter may by its weight hang steadily on the bar H and there should be some stop on the bar H to determine the proper place to which the tube is to be brought along the bar from the extreme end thereof. Then the carriage with the tube on the bar H is to be run forwards along the rails A towards the furnace until the end of the tube approaches close to the door which being opened the tube is without any delay introduced with a horizontal endway motion into the furnace through the open doorway by running the carriage steadily forwards along its rails A A until

until the further endway motion of the tube in that direction is stopped by the end of the trough C coming in contact with a fixed stop m. Figure 1. and thereby the parallel levers E & F are removed from beyond a vertical position on the other side thereof whereupon the weight of the trough C and the bar H with that of the tube thereon causes those parts to descend in opposition to the balance weight J but in an easy manner by motion of the parallel levers E & F which keep the trough and the bar H and the tube horizontal in so descending and thereby the tube is gently deposited in its intended position on the flat bed of the furnace but the descent of the trough C and the bar H continues a little further until the stop screw n prevents any more descent and leaves the end of the bar H which is within the interior of the tube quite free from all contact with that interior when the said end of the bar H is withdrawn from the interior of the tube by motion of the whole carriage backwards along the rails A away from the furnace leaving the tube properly deposited within the furnace; and the door thereon may be closed the instant after the end of the bar H has been so withdrawn - and note the horizontal

horizontal endway motion where  
 by the tube is introduced into the furnace will be so correctly prepared with the said carriage that it will not be requisite to open the usual large door of the furnace for introducing the tube therein but only a notch or small arch at the lower part of that door which arch may be only as much larger than the tube as to just admit the same to be introduced without touching but leaving only very little open space at which cold air can gain admission so as to cool the furnace and the opening of the said small arch may be closed the instant after the extreme end of the bar H is withdrawn - and in order that the motion of the carriage along its rails A may be performed with regularity when introducing the tube into the furnace and when withdrawing the bar H from the interior of the deposited tube an endless rope or chain W Figure 1. whereof one part is attached to the carriage may be extended over two pulley wheels V. V. and one of those pulleys being turned round either by hand or by connection with millwork the carriage will be moved with a very steady motion avoiding jabs and this fourth part of my improvements

improvements also includes the following mode of facilitating the withdrawing of the heated tube from the furnace - after the tube has acquired a welded heat within the furnace and requires to be withdrawn therefrom it is usually seized at one end with a pair of tongs and dragged all its length along the bed of the furnace through the opened door thereof but the iron being in a softened state by the heat the tube is liable to become bent in being so drawn out at the door and is also liable to carry out scoria and dirt with it from the bed of the furnace. In order to facilitate the withdrawing of the tube when at a welding heat I apply a ground roller on a horizontal axis beneath that door way of the furnace through which the heated tube is to be withdrawn so that the tube will rest on the groove of the said roller whilst the tube is in the act of being drawn out; and a revolving motion may be given to the roller in order to assist in withdrawing the tube when it is resting in the said groove and the said revolving motion if sufficiently rapid will cause the surface of the roller with which the heated tube is in contact to rub with the surface of the tubes with

with a tendency to remove loose scoria and dirt which the tube may carry out with it from the bed of the furnace. The groove in the said roller being in conformity with the direction in which the tube lays on the bed of the furnace the tubes will be kept straight in coming out - the horizontal axis of the said roller may be turned round by any suitable means which will give it a revolving motion and the roller should be situated as near to the furnace as it can be and part of the wall of the furnace beneath the fire door may be cut away to leave room for the roller. - And in order to facilitate the moving of the heated tube endways along the bed of the furnace when it is first pulled at the foremost end by a pair of tongs in the usual manner the hinder end of the heated tube may at the same time be gently pushed onwards by a man with an iron rod introduced through the open door of the furnace so as to assist the ordinary motion of the tube - and in cases where my improvements is adopted for introducing the tubes into the furnace as hereinbefore described the same long iron bar which is provided for so introducing the tubes may be used for pushing

pushing gently at the hinder end of the heated tube as it lays on the bed of the furnace a cap with a flat end being first fastened on the extreme end of that bar suitable for applying to the end of the heated tube; but note the force wherewith the end of the heated tube is so pushed onwards must be moderate or the iron of the tube in its softened state might be bended from its proper form. - The principal force must be given by the man at the foremost end dragging forward that end of the tube with his clings in the usual manner but a gentle pushing behind at the other end will afford some assistance in first moving the tube endway along the bed of the furnace until the foremost end of the tube is advanced sufficiently toward through the door way to begin to lean in the groove of the revolving roller before mentioned and then the action thereof will begin to assist in the further endway motion of the tube for withdrawing it from the furnace and whereas it will be the foremost end of the heated tube upon which will have to endure the principal part of the force which the man must exert with tongs for dragging the tube endway along the bed of the furnace and

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and the said foremost end is liable to be bended and the two edges of the plate or sheet disappointed from their proper contact by that force the double dovetail cramps which are to be inlaid into the said edges according to the third part of my invention as hereinbefore described will be extremely useful for securing the said edges against such separation - and accordingly one or more of the said cramps should be inlaid into the said edges near to each end of the tube in order to enable those ends when they become softened by the heat to sustain the force to which they must be subjected in the act of withdrawing the tube from the furnace by dragging it endway at the foremost end with tongs in the usual manner and pushing it endway at the hindmost end - Or instead of inlaying such a cramp into the said edges at the foremost end those edges may be firmly welded together by hand hammering or otherwise before the tube is introduced into the furnace so as to complete the foremost end of the pipe for a short portion of its length in the manner hereinbefore described and when the tube so prepared is heated to a welding heat in the furnace, the foremost

foremost end will be better quali-  
 fied for resisting the force to which  
 it will be subjected for withdraw-  
 ing it from the furnace - and  
 other parts of my Improvements  
 in the manufacture of metal tubes  
 relates to the welding together of  
 the edges of plates or skelps of  
 wrought iron which have been  
 turned up to a tubular form -  
 The fifth part of my said im-  
 provements is for welding the edges  
 of plates or skelps of wrought iron  
 which have been turned up to  
 a cylindrical tubular form by pass-  
 ing such skelps when heated to  
 a welding heat - throughout the  
 whole of their length between a pair  
 of revolving grooved rollers whose  
 grooves are formed to operate  
 upon one fourth part of the  
 circumference of the said tubular  
 form by each roller one at the high-  
 est end the other at the lowest part  
 of such circumference and with  
 a pair of grooved guiding cheeks  
 applied between the said rollers  
 to operate laterally against the  
 other fourth part of the circum-  
 ference of the said tubular form  
 at each side of that circumference  
 see sheet IX wherein Figure 1  
 is a front elevation and Figure 2  
 a horizontal plan of a machine for  
 the above purpose &c &c are the stand  
 arms of the frame for sustaining  
 the bearings for the two horizontal  
 axes

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 AA and BB wherein the revolving  
 grooved rollers E and F are fasten-  
 ed and are turned round with  
 a continuous revolving motion by  
 the power of millwork applied  
 to the said axes AB in the usual  
 manner of a pair of revolving rollers  
 for operating upon metal but the  
 circumferences of the two rollers E  
 and F do not touch one another  
 in order that space may be left for  
 a pair of grooved guiding cheeks R  
 and S to be fixed to the frame &c  
 so as to be interposed between  
 those circumferences at the places  
 where those circumferences are  
 nearest one to the other as is  
 shown in Figure 1. which also  
 shows that the grooves around  
 the circumferences of the two re-  
 volving rollers E and F and the  
 grooves in the two fixed guiding  
 cheeks R and S conform one  
 groove with the other so as to leave  
 between the four a circular aper-  
 ture of a proper size for the  
 heated skelps to be passed through  
 and receive as much compression  
 in so passing as will effect the  
 welding of the edges of the iron  
 together - The propulsion by which  
 the heated iron is carried on-  
 wards through between the  
 rollers will be only operative  
 at the upper and lower parts  
 of the circumference of the heat-  
 ed iron to which parts of the  
 grooves

grooves of the revolving rollers, as we must necessarily be the case when only one pair of rollers is used, but in respect to compression of the heated iron by the rollers, or its passing through between them, the guiding checks R & S will operate at each side to prevent the iron from spreading laterally beyond the intended cylindrical form by the compression which the rollers exert upon the upper and lower parts of the circumference of the said cylindrical form, and by such operation of the said checks the compression will be sufficient to effect the welding provided that the edges of the iron of the plates or Skelps have been previously prepared and turned up with care so that the said edges will fit correctly together with close contact and then carefully treated in the furnace for heating the iron to an uniform welding heat throughout all its length and for withdrawing it from the furnace when at a welding heat without displacement of the edges from their said contact all which may be done by Skelps and attentive management of the usual and well known modes of preparing the edges turning up and heating the iron without adopting any of the parts of my improvements for those purposes. But if the edges of the plates or Skelps

of iron are prepared with one groove and double bevels or with bevelled edges according to the first part of my improvements and then turned up to a correctly cylindrical tubular form according to the second part and the edges finished together according to the third part and the turned up Skelps so prepared are introduced into the furnace and withdrawn therefrom when at a welding heat according to the fourth part of my improvements as hereinbefore described the edges will be kept so correctly and closely in contact when at a welding heat that a slight degree of compressing force will be sufficient for effecting the welding and by aid of the pair of grooved guiding checks R and S fixed and applied between the pair of revolving grooved rollers E and F the requisite compression may be given for effecting the welding. Each of the guiding checks R and S is affixed to the middle part of a flat plate of steel r and s which is disposed in a vertical plane parallel to the adjacent standard v and firmly fastened thereto at the upper end and at the lower ends by supporting bolts z z. v. v. by which means the guiding pieces R and S are firmly held in their proper places between the circumference of the rollers E and F as is shown in the

the Figures 1 and 2. The upper and lower surfaces of the guiding pieces R and S which apply to the circumferences of the rollers may be curved to suit those circumferences with close contact thereto. The grooves in the guiding cheeks R and S may be curved in the direction in which the heated iron is to pass endways through between them as is shown in Figure 2. The plates of steel r and s will bend and yield to allow the guiding cheeks R and S to recede a little laterally in case of necessity and from each guiding cheek R and S a strong screw bolt w or x passes horizontally through the plate of steel r or s and through the standard V with a nut y or z screwed on the end of the screw and acting to draw the guiding piece R or S away from its place as part of the circular aperture a and the steel plate r or s is set on a spring so as to urge the guiding piece towards the said aperture with considerable force which is resisted by the bolt w or x but the bolt will not prevent the aforesaid receding of the guiding piece in case of necessity. A stationary mandril may be applied in the aperture a between the rollers EF and guiding cheek R and S with a long stem for sustaining such mandril in the usual

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usual and well known manner of using a mandril in the manufacture of welded tubes by revolving grooved rollers or the tubes may be welded by passing them through the said aperture a without any such mandril then in as may be preferred and note the edges of the turned up sheet which are to form the joint or seam along the tube should be uppermost when the foremost end of the heated sheet is presented to the aperture a and it will continue to be uppermost whilst the whole length of the heated sheet is passing through between the revolving grooved rollers E and F and grooved guiding cheeks R and S and if the turned up sheet has been introduced into the furnace on the end of a bar moved horizontally endways and the same sheet has been withdrawn therefrom when at a welding heat by aid of a grooved bearing roller under the doorway of the furnace according to the fourth part of my improvements the edges or sides may be kept uppermost when it is presented to and passed through between the revolving grooved rollers EF and grooved guiding cheeks R and S and after the grooved rollers EF have passed nearly all but not quite the whole length of the heated sheet through between them by their rotation in a forwards direction

direction they may then be turned round in a backward direction in order to re-pass the heated Skelp through between them again for repetition of their compressing and welding action whilst the iron retains its welding heat; and whilst the Skelp is so re-passing it may return with part of its length into the furnace to adjust in keeping up its welding heat and after nearly but not quite the whole length of the heated Skelp has been so re-passed then the motion of the revolving rollers is reversed and they are again turned round in a forward direction to pass the tube through again - and such passing and re-passing alternately in contrary directions may be repeated as often as may be requisite for completing the welding of the edges of the Iron together with a proper seam or joint - In so turning the rollers alternately backwards and forwards their motion in each direction must not be continued so far before it is reversed as would cause the extreme end of the heated iron to be passed quite through the aperture *a*, but the end of the heated iron continuing between the rollers when their motion is reversed the iron cannot fail to be carried backwards and forwards in a proper manner - The revolving rollers may be thus turned round

round first in one direction and then in the contrary direction by the same kind of wheel work or pulley and endless strap work as is commonly used in spinning machines for the like purpose of turning the wheels or spindles thus of alternately backwards and forwards (as hereinbefore more particularly explained) and with the same means of reversing the direction of the motion when some exact extent of motion is may be required has been performed. Or if preferred the revolving grooved rollers *E F* may be turned round in a forward direction for performing the welding by motion in one direction without reversing or re-passing as aforesaid - and the sixth part of my improvements is a new mode of welding together the edges of turned up plates or Skelps of Iron whereof only one end or half or other portion of the length of each Skelp is heated to a welding heat at the same time - The said welding being performed by passing such heated portion through between the circumferences of revolving grooved rollers that end or portion of the Skelp which is not heated is used for handling the whole Skelp when required in order in the first instance to introduce the other end or portion which is to be heated into



into a proper furnace for that pur-  
 pose and afterwards to withdraw  
 the said portion from the furnace  
 as soon as that portion has acquired  
 its proper welding heat therein  
 and to present the said heated  
 portion to the revolving grooved  
 rollers for being passed through  
 between them so as to perform  
 the welding by their agency and  
 note it has been the usual practice  
 to heat only one end or half of  
 the length of such Skelps at a time  
 in manner aforesaid in case of the  
 welding thereof being performed  
 by drawing the heated portion of  
 the Skelp by power of a Draw-  
 bench with an indway motion  
 through bell mouthed or conical  
 staves in tongs or dies for welding  
 by the compression so caused. But  
 in all cases of the welding of such  
 Skelps being performed between  
 revolving grooved rollers the whole  
 length of the Skelp has been  
 heated to a welding heat at the  
 same time and the extremity of  
 the foremost end which is first en-  
 tered between the said revolving groo-  
 ved rollers being at a welding heat  
 and in a soft state is liable to  
 become bended or deformed from  
 its proper tubular form and the  
 edges which are to be welded to  
 become separated from their proper  
 contact by the force to which such  
 foremost end must be subjected  
 by

110.  
 by the tongs wherewith it is  
 withdrawn from the furnace and  
 presented to the revolving grooved  
 rollers for being caught and taken  
 in between them. All which has  
 been heretofore mentioned and  
 it has been explained how such  
 separation of the edges at the  
 foremost end may be prevented  
 by previous fastening of those edges  
 together either by inslaying of cramps  
 or by preparatory welding of the  
 edges at the extremity of the  
 Skelp foremost end of the Skelp  
 according to the third part of my  
 improvements. - But according  
 to the sixth part of my im-  
 provements now about to be de-  
 scribed the action of the revolving  
 grooved rollers to begin to compress  
 the Skelp between them does not  
 commence at either extremity of the  
 Skelp but commences at some middle  
 part of the length thereof and in  
 such manner as that the said  
 commencement of the welding action  
 of the rollers will take place with  
 greater certainty of being correctly  
 commenced than can be the case  
 when an extremity which is in  
 a heated and softened state is pre-  
 sented to the rollers for being caught  
 and taken in between them in  
 order to commence their welding  
 action as has been hitherto the case  
 in the manufacture of welded Iron  
 tubes by revolving grooved rollers.  
 Each