

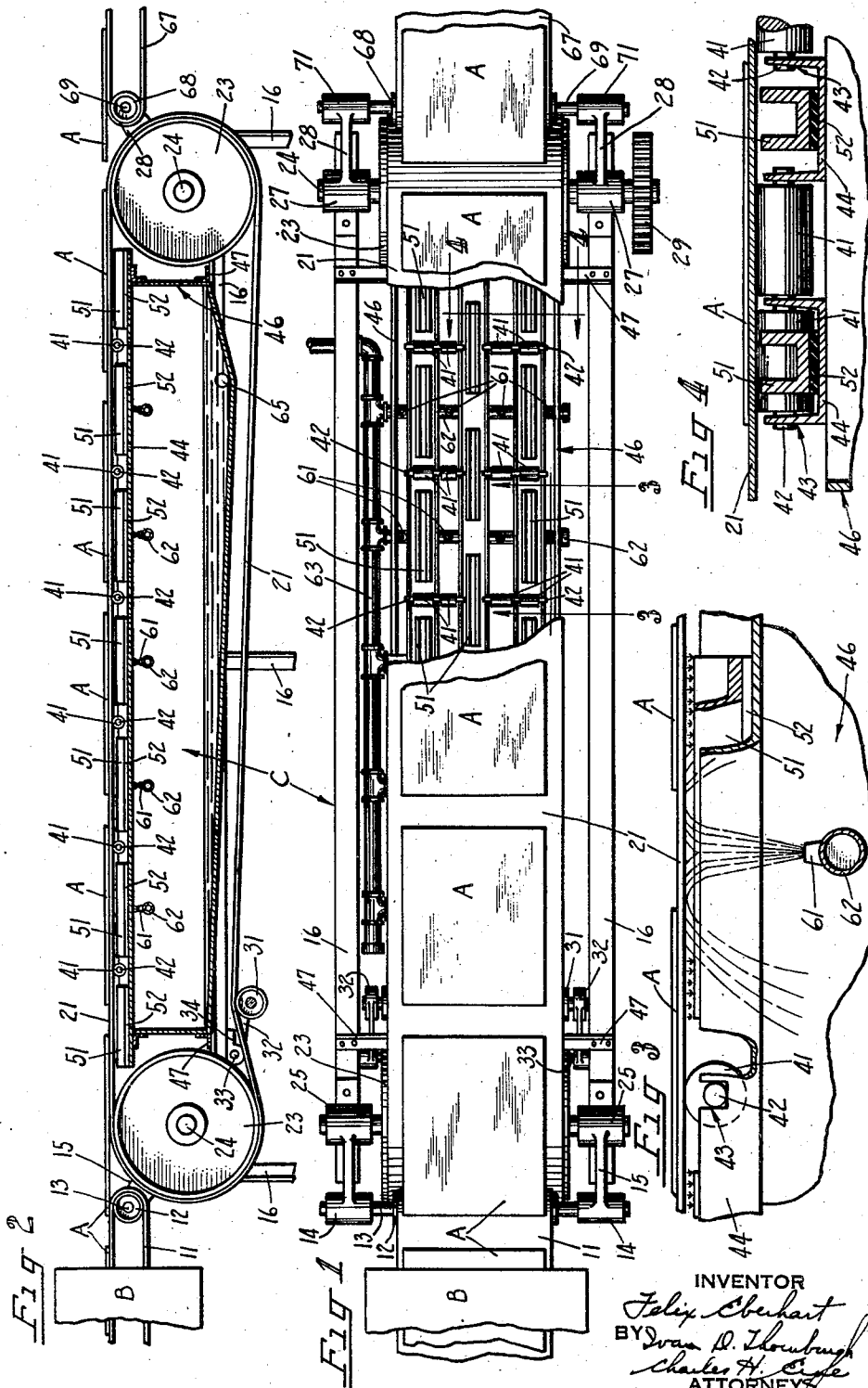
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METHOD OF CONVEYING AND TREATING METALLIC SHEETS

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METHOD OF CONVEYING AND TREATING  
METALLIC SHEETS

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The present invention relates to a method of conveying metallic sheets and the like and has particular reference to magnetically retaining the sheets in a predetermined flat position while conveying them along a predetermined path of travel for treatment of the sheets.

An object of the invention is the provision of a method of conveying flexible metallic sheets or the like wherein the sheets are moved along a predetermined path of travel through a magnetic field which holds them in a flat condition on a non-magnetic surface so that the sheets may be readily operated upon in such flat condition.

Another object is the provision of such a method of conveying flexible metallic sheets wherein the sheets are carried in a flat position on a non-magnetic conveyor and while so moving the sheets pass through a magnetic field whereby the sheets are drawn into close contact with the conveyor to permit satisfactory operation on the sheets while moving with the conveyor.

Another object is the provision of a method of this character of conveying flexible sheets wherein an intimate contact between the conveyor and the sheets is maintained so that more ideal heat transfer conditions may be effected between the conveyor and the sheets.

Another object is the provision of such a method of conveying sheets wherein the sheets are carried on a non-magnetic belt which is wider than the sheets, the belt passing through a magnetic field which draws the sheets tightly against one side of the belt, and wherein a liquid cooling medium is projected against the opposite side of the belt so that the sheets will be quickly cooled by intimate contact with the belt and yet will be shielded from direct engagement with the cooling medium.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawing, discloses a preferred embodiment thereof.

Referring to the drawing:

Figure 1 is a top plan view of an apparatus for carrying out the steps of the instant method invention, with parts broken away;

Fig. 2 is a longitudinal section of the apparatus illustrated in Fig. 1;

Fig. 3 is an enlarged longitudinal section showing a detail of the apparatus, the view being taken substantially along the line 3—3 in Fig. 1; and

Fig. 4 is an enlarged transverse sectional detail taken substantially along the line 4—4 in Fig. 1.

As a preferred embodiment of the instant invention the drawing illustrates an apparatus for carrying out the method wherein sheets A, for example freshly lithographed and dried tinplate, are received in a heated condition as from a drying oven, indicated by the letter B, and are passed through a cooling mechanism C in which the temperature of the sheets is quickly reduced to a minimum so that further handling of the sheets or operations thereon, for example in the manufacture of tubular sheet metal can bodies, may be effected without undue delay. It will be understood however that the instant improved procedure is equally adapted to be carried out by means of apparatus other than that illustrated.

In the form of apparatus illustrated in the drawing, the hot dried lithographed sheets A are conveyed from the oven B in a flat or horizontal plane by way of a continuously moving endless belt 11 (Figs. 1 and 2). This belt takes over a pulley 12 mounted on a cross shaft 13 journaled in bearings 14 formed in brackets 15 secured to side frame 16 which constitutes the main frame of the cooling mechanism C. The belt 11 may be driven in any suitable manner in time with the moving parts of the cooling mechanism.

At the discharge end of the oven belt 11 the hot sheets A are delivered into the cooling mechanism C and are received on an endless belt cooling conveyor 21 which preferably extends the full length of the cooling mechanism. The conveyor carries the sheets along a predetermined path of travel, which process constitutes a step in the instant method.

This conveyor is made of non-magnetic material, preferably stainless steel suitably treated or alloyed to render the same non-magnetic, and is of sufficient width to accommodate the sheets in end-to-end arrangement without any portion of them extending beyond the edges of the conveyor. The top run of the conveyor 21 is in the same plane as the top run of the oven belt 11 and is arranged in end-to-end relation to the oven belt so that the sheets may be readily delivered onto the conveyor.

The non-magnetic conveyor 21 takes over a pair of large pulleys 23 which are located one at each end of the cooling mechanism C and are disposed between the side frames 16. These pulleys are respectively mounted on cross-shafts 24, one disposed at each end of the conveyor 21. At the entrance end of the conveyor one of these pulley shafts is journaled in bearings 25 (Fig. 1)

formed in the brackets 15. At the opposite or discharge end of the mechanism the pulley shaft 24 is mounted in bearings 27 (Fig. 1) formed in brackets 28 which are secured to the side frames 16. This latter mentioned shaft 24 at the discharge end of the conveyor, is preferably the driving shaft and for this purpose is provided with a gear 29 (Fig. 1) which may be rotated from any suitable source of power, such as an electric motor or other prime mover.

The conveyor 21 is maintained in a taut condition by a belt tightener pulley 31 disposed in a pair of spring held side arms 32 mounted on a cross shaft 33 carried in bearing brackets 34 secured to the side frames 16. This belt tightener engages against the lower run of the conveyor and thus pulls the upper run straight and taut.

In order to prevent sagging of the upper run of the conveyor 21 the latter is supported on a plurality of spaced rollers 41 which are disposed transversely of the cooling mechanism. These rollers are mounted on short cross shafts 42 carried in notches 43 formed in the sides of a plurality of channel beams 44 which extend the full length of the mechanism between the conveyor pulleys 23. The rollers are preferably mounted in pairs on each shaft 42. One roller of each pair is disposed in the channel and the other roller extends across the open space between adjacent channels.

There are preferably three of these channel beams shown in the drawing and they are supported on the top edges of an open top drain tank 46 which is located under the upper run of the conveyor. The drain tank in turn is supported on cross-beams 47 which are secured to the side frames 16 of the cooling mechanism.

As a step in the instant invention the sheets on the conveyor are carried over a magnetic field which draws the sheets into close contact with the conveyor. This magnetic field is located adjacent the rollers 41 and is created by a plurality of stationary permanent magnets 51 which are disposed in the channel beams 44 and which are insulated from the beams by insulating spacer blocks 52. These magnets are preferably of an elongated rectangular shape of U-shaped cross section as best seen in Figures 1 and 4. They are placed in staggered positions throughout the entire area between the conveyor pulleys 23 and are just high enough so that their tops are adjacent but not touching the stainless steel conveyor continuously moving above them.

Hence when a sheet A to be cooled is delivered onto the conveyor 21, it is carried along with the conveyor over its path of travel. The conveyor being of a non-magnetic nature has no attracting properties to make the sheet adhere to it but just as soon as the sheet reaches the region of the magnets 51 the latter draw it down tight and retain it in a predetermined position against the top surface of the conveyor so that the entire sheet is perfectly flat against the conveyor. This magnetic force drawing the sheet is indicated by short arrows shown in Fig. 3. Thus an ideal condition for heat transfer by conduction between the conveyor and the sheet obtains as the conveyor carries the sheet forward.

While the sheet is so held and as a further step of the invention, a cooling medium is projected against the bottom of the upper run of the conveyor to initially keep the conveyor cool and through it to cool the sheets. Such a method of cooling the sheets has a double advantage. First the intimate surface contact of the entire

sheet with the conveyor surface tends to promote effectual and rapid heat exchange, thereby providing for efficient cooling of the sheet, and second, the wide conveyor acts as a shield to protect the sheets from coming into direct contact with the cooling medium.

In the illustrated preferred embodiment of the invention a liquid cooling medium, such as water, is used and this cooling medium is projected from a plurality of nozzles 61 which extend up between the channel beams 44. These nozzles are arranged in spaced transverse rows and are connected with short transverse pipes 62. Along one side of the cooling mechanism, the ends of these pipes are closed with caps while along the opposite side of the mechanism the pipes communicate with a main supply pipe 63. This main pipe leads to any suitable source of supply of cooling medium such as a pump or a tank.

The cooling medium projected against the conveyor spreads over its entire bottom surface and falls back into the drain tank 46 from which it is drained off as desired or returned to the main supply source for re-circulation. For this purpose there is provided a drain pipe 65 (Fig. 2) which is threaded into the tank wall near its bottom.

At the discharge end of the conveyor 21 the cooled sheet is carried out of the region of the permanent magnets and hence it is no longer held attracted to the conveyor but rather is again free and ready to be discharged. The discharge of the sheet is effected by an endless belt 67 which is disposed adjacent the end of the conveyor with its upper run in the same plane as the upper run of the conveyor. Hence a sheet on the conveyor readily travels forward onto the discharge belt 67 and is carried away to any suitable place of deposit.

This discharge belt 67 takes over a pulley 68 mounted on a cross shaft 69 carried in bearings 71 formed in the conveyor brackets 28. The belt is actuated in any suitable manner in time with the conveyor 21 so that the sheets may be carried away in regular order without interfering with the following sheets.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the steps of the process described and their order of accomplishment without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the process hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. The method of cooling flexible metallic sheets having exposed heat treated surfaces, which consists in supporting the sheets while moving the same in processional order in a predetermined path of travel through a magnetic field, subjecting said sheets in such field to a magnetic pull exerted in a direction normal to the plane of each sheet to draw and hold the same firmly and intimately against one side of the supporting means, and projecting a cooling medium against the opposite side of said supporting means while the heated sheets are intimately and magnetically held thereagainst by said magnetic pull, whereby to effect efficient heat transfer by conduction from said sheets to said cooled supporting means.

2. The method of cooling flexible metallic sheets having exposed heat dried lithographed

surfaces, which consists in moving the sheets in processional order in a predetermined path of travel through a magnetic field while supporting the sheets by means of a non-magnetic medium moving therewith, subjecting a said sheet in such field to a magnetic pull exerted in a direction normal to the plane of said sheet to draw and hold the same firmly and intimately against one side of the supporting medium, and projecting spaced sprays of cooling medium against the op-

posite side of said supporting medium while the heated sheets are intimately and magnetically held thereagainst by said magnetic pull and while shielding the sheets by said supporting medium from direct contact with the cooling medium, whereby to effect efficient heat transfer by conduction from said heated sheets to said cooled supporting medium.

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