June 25, 1957 S. F. WILBUR 2,797,075

HUMP TYPE FURNACE BELT DRIVE

Filed Oct. 22, 1954 2 Sheets-Sheet 1

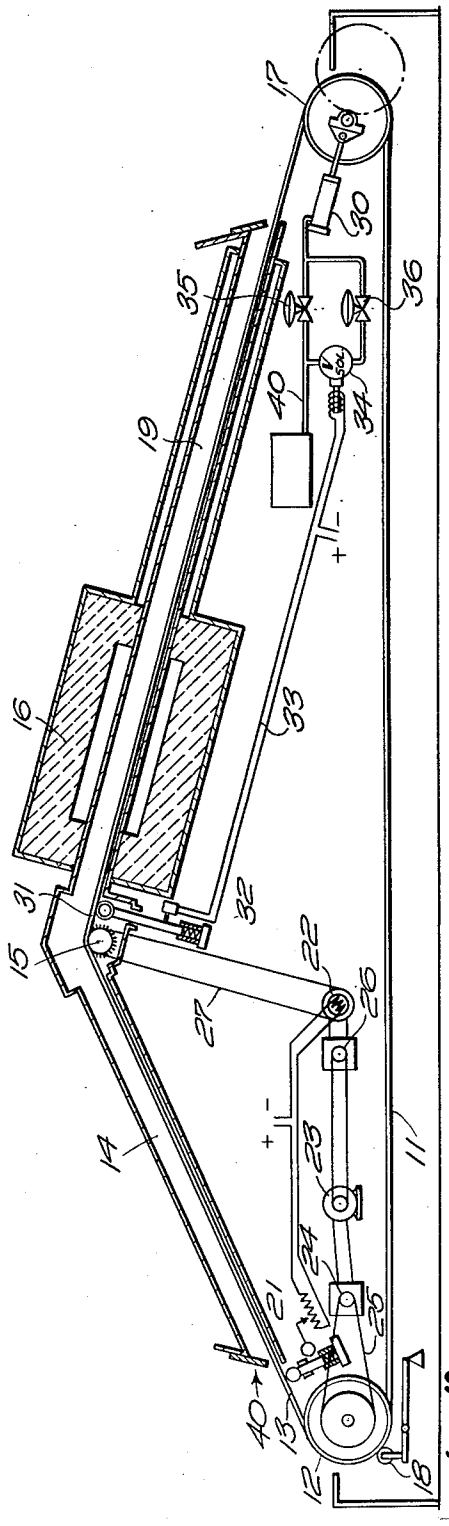


FIG. 1

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HUMP TYPE FURNACE BELT DRIVE

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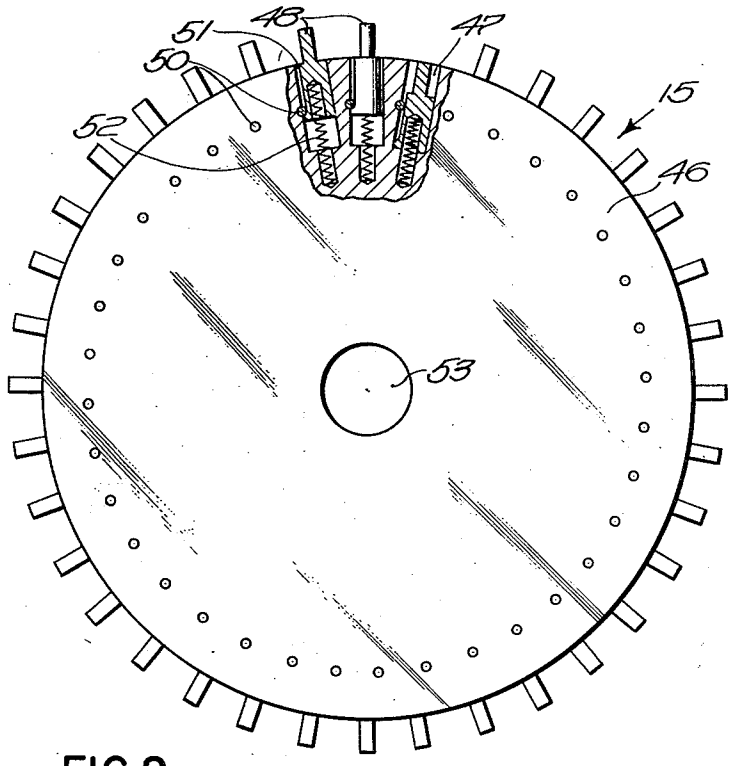


FIG. 2

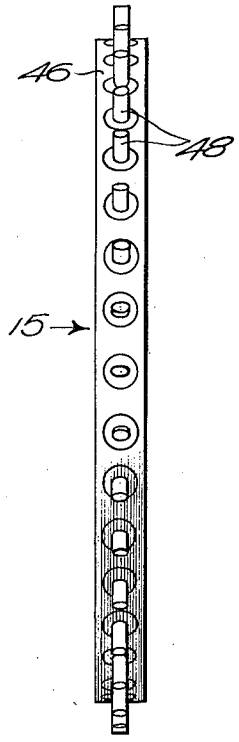


FIG. 3

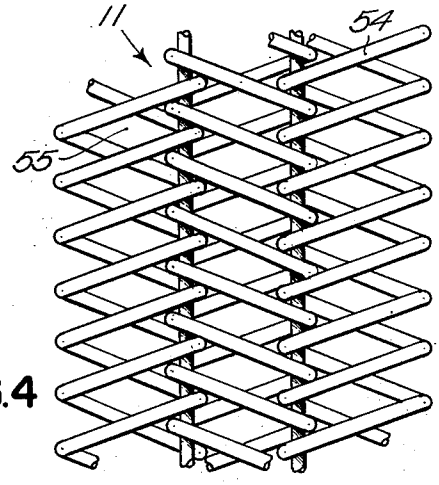


FIG. 4

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# HUMP TYPE FURNACE BELT DRIVE

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8 Claims. (Cl. 263—8)

This invention relates to the belt drive of a hump type furnace and more particularly to the controls for keeping the belt taut.

An object of the present invention is to provide a new type of mechanism for driving the continuous conveyor belt of a furnace.

Another object of the present invention is to provide improved means for keeping the continuous conveyor belt taut.

Other objects of the present invention will be pointed out in part and become apparent in part in the following specification and claims.

A hump type furnace is a furnace designed to aid in the control of lighter than air atmospheres which envelop the work during the process of heat treatment.

A feature of this type furnace is the location of the purging, heating and cooling chambers at a level above the door openings of the entrance and exit ends of the conveyor belt. Thus providing the minimizing of the infiltration of oxidizing air and moisture into the purging, heating and cooling chambers, even in the presence of room drafts.

Endless conveyor belts are used to carry the work from the entrance to the purging chamber up the incline to and through the heating chamber and down to the exit of the cooling chamber. The conveyor belts are made of heat resisting alloy material. The high temperature of the heating chamber reduces the strength of the belt. The maximum stress upon the belt occurs at the exit end of the heating chamber; which is the point furthest from the conventional belt traction point located at the loading point or furnace entrance.

The maximum stress includes the force required to move the work loaded belt up the incline through the purging and heating chambers. The stress from the heat, friction and gravitational pull through heat and purging chambers could be so great that no work could be placed on the conveyor belt without exceeding the tensile strength of the belt.

If the force required to move the work loaded belt up the incline and through the purging chamber did not have to be added to the force required to move the belt through the heating chamber, then the weight of the work carried by the belt through the heating chamber would be high. Applicant provides such an arrangement in a pin type drive roller which positively engages the wire mesh of the conventional conveyor belt. The drive roller being located at the junction of the purging and heating chambers, and at the top of the incline.

This arrangement entails other considerations. If the slack in the conveyor belt, due to heating and loading is not adequately compensated for belt failure will occur. Applicant provides for this contingency by automatically controlling the tautness of the continuous conveyor belt.

Referring to the drawing wherein like reference numerals refer to like parts:

Figure 1 is a diagrammatic side elevational view partly in section of the new and improved hum type furnace belt drive.



Figure 2 is a side elevational view, partly in section of the new pin type drive roller.

Figure 3 is an end view of Figure 2.

Figure 4 is a fragmentary plan view of the wire mesh conveyor belt.

Referring to Figure 1 wherein an endless conveyor belt **11** of conventional wire mesh construction is shown passing over drive drum **12**, sensing roller **13**, into and through purging chamber **14**, over pin drive roller **15**, into and through heating chamber **16**, through cooling chamber **19**, over takeup drum **17** and back to drive drum **12** which is provided with a pinch pulley **18**.

An electric magnetic clutch **22** is provided which has the inherent characteristic of slippage between the face plates of the clutch. The degree of slippage depending upon the voltage input of the clutch. Sensing roller **13** adjusts the resistance of a potentiometer **21**. This potentiometer **21** electrically connected to magnetic clutch **22**, controls the voltage input to magnetic clutch **22**. Sensing roller **13** in contact with belt **11** and actuated by the change in tautness of belt **11**, transmits this actuation or motion to potentiometer **21**, thereby changing the electrical resistance of potentiometer **21**, hence the voltage input to magnetic clutch **22**.

Drive drum **12** is driven by means of an electric motor **23** driving a speed reducer **24** which is connected to drive drum **12** by means of a belt **25**. Motor **23** also drives electric magnetic clutch **22** through the medium of a speed reducer **26**. A chain **27** connects electric magnetic clutch **22** with pin drive roller **15**.

Take up drum **17** is under the control of an air cylinder **30**. A second sensing roller **31** contacting belt **11** on the side of pin driver roller **15** opposite to the position of sensing roller **13**, actuates an electric switch **32** electrically connected through wires **33** to solenoid valve **34** which controls regulating valve **36** leading to air cylinder **30**. Thus, in the event that conveyor belt **11** builds up ahead of pin drive roller **15**, in the direction of belt travel, interferring with the working height of belt **11** in purging chamber **14**, sensing roller **31** will cause take up drum **17** to take the slack out of conveyor belt **11** by energizing the circuit leading to solenoid valve **34** which will actuate valve **36**, initiating movement of air cylinder **30** and take up drum **17** into the dot and dash position shown in Figure 1.

A source of air supply of 100 p. s. i. is provided to conduit **40** which leads to regulating valve **35** and to solenoid valve **34**. Air cylinder **30** is under control of regulating valve **35** which maintains a pressure of 40 p. s. i. on the piston in air cylinder **30**. Thus providing a predetermined position for take up drum **17**, thereby applying a predetermined stress on belt **11**.

When belt **11** carries a work load and expands and contracts as it passes into and out of the heating chamber **16**, sensing roller **31** in contact with belt **11**, is actuated by the tautness of belt **11**. The motion imparted to sensing roller **31** by the change in tautness engages and disengages electric switch **32** which controls solenoid valve **34** through electric wires **33**. Solenoid valve **34** controls the flow of air supply to regulating valve **36** which permits air to flow to air cylinder **30**, actuating the piston therein and moving take up drum forward toward the dot and dash position shown in Figure 1. When solenoid valve **34** shuts off the air supply to regulating valve **36**, the piston in air cylinder **30** is under the influence of regulating valve **35**. Conveyor belt **11** will have a tendency at times to move take up drum **17** from the dot and dash position to the full position shown in Figure 1. Since regulating valve **36** is rendered inoperative by solenoid valve **34**, it behooves regulating valve **35** to prevent an

excessive amount of pressure from building up in air cylinder **30**. To that end a bleeder vent is provided in regulating valve **35**, which allows the air pressure in air cylinder **30** to reduce itself to the predetermined pressure of regulating valve **35**.

It will be noted that regulating valve **35** maintains a constant predetermined low pressure on air cylinder **30** while regulating valve **36** adds air pressure to air cylinder **30** when work loads on the conveyor belt **11** demand tautness on belt **11** through take up drum **17**.

In operation, work to be heat treated will be placed upon continuous conveyor belt **11** at entrance point **40**. The weight of the work will tend to produce slack in belt **11** thereby reducing the effectiveness of the drive of the belt **11** at drive drum **12** and in some instances permit the slack in belt **11** to build up to a point of piling. Thereby hindering the passage of the work and the belt through purging chamber **14**. Sensing roller **13** prevents this undesirable condition when it actuates potentiometer **21** controlling the voltage, hence the torque of electric clutch **22**. Motor **23** through speed reducer **26** drives one face plate of electric clutch **22**. The other face plate drives pin drive drum **15**. The amount of slippage between the face plates is regulated by the voltage, controlled by potentiometer **21**. Sensing roller **13** when slack in belt **11** dictates, causes pin drive drum **15** to increase in speed and torque, thereby taking the slack out of belt **11**.

Thus it will be observed, that applicant provides two points of drive for continuous conveyor belt **11** instead of the usual one. It will be further noted that the two drives **12** and **15** for belt **11** are ancillary one to the other with drive **15** becoming effective when needed most, namely, when the belt carries a heavy work load.

Another advantage of this ancillary drive **15** is to allow drive **15** to loaf, thereby minimizing wear on the drive **15** and belt **11** when drive drum **12** can alone effectively move belt **11**.

Sensing roller **31** functioning as previously described maintains a predetermined tautness in belt **11** in the area of the heating chamber **16**.

Referring to Figures 2, 3, and 4 wherein is shown the detail construction of the new pin drive drum **15**, consisting of a disk **46**, having a multiple number of pin receiving cavities **47**. Pins **48** are slidably mounted in pin receiving cavities **47** and are retained therein by means of dowels **50** which engage grooves **51** in the sides of pins **48**. Coils springs **52** or any other resilient medium are interposed between the base of pin receiving cavities **47** and the base of pins **48**, thereby urging pins **48** outwardly from the base of cavities **47**. The construction just enumerated is substantially that of a spring detent except a novel construction of detents is provided for effecting a new use; namely a belt drive. The pins **48** are spring actuated in order to permit pins **48** to be pushed into the body of disk **46** when a pin **48** strikes the body portion **54** of meshed wire conveyor belt **11** of linked construction instead of contacting a space **55** in the wire mesh of said belt **11**. A bore **53** is provided in center of disk **46** to permit mounting upon a rotating shaft.

This is a preferred form of the invention. Modifications would include a Reeves drive, a variable belt and pulley drive or fluid clutch members in place of the magnetic electric clutch and appropriate means between the sensing device and the alternate variable speed means for regulating their output in accordance with tension or tautness in the belt.

Having shown and described a preferred embodiment of the present invention, by way of example, but realizing that structural changes could be made and other examples given without departing from either the spirit or scope of this invention.

What I claim is:

1. In apparatus of the class described, the combination of a conveyor belt, a first drum for supporting the front end portion to the belt, a second drum for supporting the rear end portion of the belt, means for adjustably mounting said second drum for movement toward or from said first drum, a third drum for supporting the belt intermediate the first drum and second drum, an electric magnetic clutch operatively connected to said third drum, an electric motor operatively connected to drive said first drum and said electric magnetic clutch, a sensing roller in engagement with said belt, a potentiometer electrically connected to said electric magnetic clutch, said sensing roller being operatively connected to said potentiometer to transfer the movement of the tautness and slackness of the belt to said electric magnetic clutch to vary the speed of rotation of said third drum.

2. In apparatus of the class described, the combination of a conveyor belt, a first drive drum for supporting the front end portion of the belt, a second drum for supporting the rear end portion of the belt, means including an air cylinder for adjustably mounting said second drum for movement toward or away from said first drum, a third drum for supporting the belt intermediate the first drum and second drum, and electric magnetic clutch operatively connected to said third drum, and electric motor operatively connected to drive said first drum and said electric magnetic clutch, a first sensing roller engaging said belt and adapted to move therewith in accordance with changes in the tautness of the belt, a potentiometer electrically connected to said electric magnetic clutch, and adapted to be operated by the movement of said first sensing roller to change the torque of said electric magnetic clutch and thereby control the speed of rotation of said third drum, a first regulating valve provided with an automatic predetermined pressure bleeder connected on one side to said air cylinder, a second regulating valve connected on one side to said air cylinder, a source of air supply to said first and said second regulating valves, a solenoid valve interposed between the source of air supply and said second regulating valve, an electric switch, electrically connected to said solenoid valve and a second sensing roller engaging said belt, adapted to move therewith in accordance with changes in the tautness of the belt, said movement of the sensing roller, engaging and disengaging said electric switch to open and close the source of air supply to said air cylinder through said solenoid valve and said second regulating valve.

3. In a furnace consisting of a work loading table, a heating chamber located above said work loading table, a purging chamber connecting said work loading table with said heating chamber, a work unloading table, a cooling chamber connecting said heating chamber with said work unloading table, a continuous conveyor belt passing from said work loading table, to and through said purging chamber, heating chamber, cooling chamber to said work unloading table and back to said work loading table, a first drive drum supporting said conveyor belt at said work loading table, a belt take-up second drum supporting said conveyor belt at said work unloading table, means for adjustably mounting said belt take-up second drum for movement toward and away from said first drive drum, a pin type drive third drum supporting said conveyor belt at the junction of said purging and heating chambers, an electric magnetic clutch, an electric motor driving said first drive drum and said electric magnetic clutch operatively connected to said pin type drive third drum and means for sensing the tautness of said conveyor belt at said first drive drum and relaying said conveyor belt tautness to said pin type drive third drum through said electric magnetic clutch to thereby automatically effect adjustment in the tautness of said conveyor belt to maintain a predetermined normal operative tautness in said conveyor belt.

4. A claim as delineated in claim 3 further characterized in that, a second means for sensing the tautness of said conveyor belt at the juncture of said purging chamber and said heating chamber, a source of air supply, a first regulating valve connected to said air supply and to said air cylinder to maintain a constant predetermined

pressure on said air cylinder, a second regulating valve connected to said air supply and to said air cylinder, a solenoid valve interposed between said air supply and said second regulating valve, an electric switch responsive to the second means for sensing the tautness of said conveyor belt, electrically connected to said solenoid valve to allow the source of air supply to pass to said second regulating valve to charge said air cylinder and thereby actuate said belt take-up second drum toward and away from said first drive drum.

5. In a furnace consisting of a work loading table, a heating chamber located above said work loading table, a purging chamber connecting said work loading table with said heating chamber, a work unloading table, a cooling chamber connecting said heating chamber with said work unloading chamber, a continuous conveyor belt passing from said work loading table to and through said purging chamber, to and through said heating chamber, to and through said cooling chamber and to said work unloading table, returning to said work loading table, a first drive drum, means for driving said first drive drum supporting said conveyor belt at said work loading table, a belt take-up second drum supporting said conveyor belt at said work unloading table, means for adjustably mounting said belt take-up second drum for movement toward and away from said first drive drum, a third drum supporting said conveyor belt at the junction of said purging and heating chambers, means for sensing the tautness of said conveyor belt at the juncture of said purging and heating chambers, adjacent said third drum, a source of air supply, a first regulating valve connected to said air supply and to said air cylinder to maintain a constant predetermined pressure on said air cylinder to maintain an initial tautness on said conveyor belt and an air bleeder orifice in said first regulating valve to relieve air pressure in said air cylinder when the air pressure in the air cylinder exceeds a predetermined pressure, a second regulating valve connected to said air supply and to said air cylinder, a solenoid valve interposed between said air supply and said second regulating valve, an electric switch responsive to the means for sensing the tautness of said conveyor belt, electrically connected to said solenoid valve to allow the source of air supply to pass to said second regulating valve to build up a pressure in said air cylinder beyond the predetermined pressure of said first regulating valve when the tautness of the conveyor belt falls below a predetermined amount due to the heat exchange of the belt when passing through the purging, heating and cooling chambers and due to the work load, said pressure build up in said air cylinder moving said take-up second drum away from said first drum and thereby causing tautness in said conveyor belt.

6. A continuous conveyor belt of wire mesh construction comprising in combination a positive driving element consisting of disk having a multiple number of pin receiving orifices, a multiple number of pins, one for each orifice, slidably mounted therein and retained in sliding position by means of a dowel pin, each pin having a longitudinal groove engaging a dowel pin, a coil spring positioned in each orifice urging said pin outwardly from the base of the orifice, a bore located in the center of said disk to engage means for driving said disk and said continuous conveyor belt as each pin successively engages the wire mesh, said pins retracting into said pin receiving orifices as a pin engages the wire of the wire mesh.



7. In a furnace consisting of a work loading table, a heating chamber located above said work loading table, a purging chamber lying in an inclined plane connecting said work loading table with said heating chamber, a work unloading table, a cooling chamber lying in an inclined plane connecting said heating chamber and said work unloading table, a continuous conveyor belt having an open mesh construction passing from said work loading table up the inclined plane to and through said purging chamber, to and through said heating chamber, to and through said cooling chamber down said inclined plane to said work unloading table and back to said work loading table, a first drive drum supporting said continuous conveyor belt at said work loading table, and means for driving said belt and said first drive drum, a tightening and belt loosening second drum supporting said continuous conveyor belt at said work unloading table, means for adjustably mounting said second drum for movement to tighten and loosen said continuous conveyor belt, a positive driving third drum supporting said continuous conveyor belt at the junction of said purging chamber and said heating chamber which carries the weight of said continuous conveyor belt at the point where the continuous conveyor belt is subjected to stress from the heat of the entrance of said heating chamber, said positive driving third drum consisting of a disk having a multiple number of pin receiving orifices, a multiple number of pins, one for each orifice and slidably mounted therein and retained in sliding position by means of dowel pins fixed in said disk at the side of each orifice, each pin having a longitudinal groove engaging a dowel pin, a coil spring positioned in each orifice urging the pin outwardly from the base of the orifice, a bore located in the center of said disk engage means for driving said disk and said continuous conveyor belt as each pin in the rotation of said disk engages the open mesh of said continuous conveyor belt, said pins retracting against the tension of said springs when said pins engage the body of said continuous conveyor belt, the means for driving said disk being ancillary to and driven by the means for driving said first drive drum.

8. In apparatus of the class described, the combination of a conveyor belt, a first drum for supporting the front end portion of the belt, a second drum for supporting the rear end portion of the belt, means for adjustably mounting said second drum for movement toward or from said first drum, a third drum for supporting the belt intermediate the first drum and second drum, means operatively connected to drive said first drum and means therefrom for driving said third drum, said last mentioned means having interposed therein a variable speed means and a sensing means in engagement with said belt between the first and third drums, responsive to the variation in tension therein for determining the regulating effect of said variable speed means, thereby to control the speed of said third drum relative to the speed of the first drum to maintain a prescribed tension in said belt.


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