Oct. 7, 1969 H. G. FROSTICK 3,471,673

APPARATUS FOR INDUCTIVELY HEATING A TRAVELING METAL SLAB

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FIG. 1.

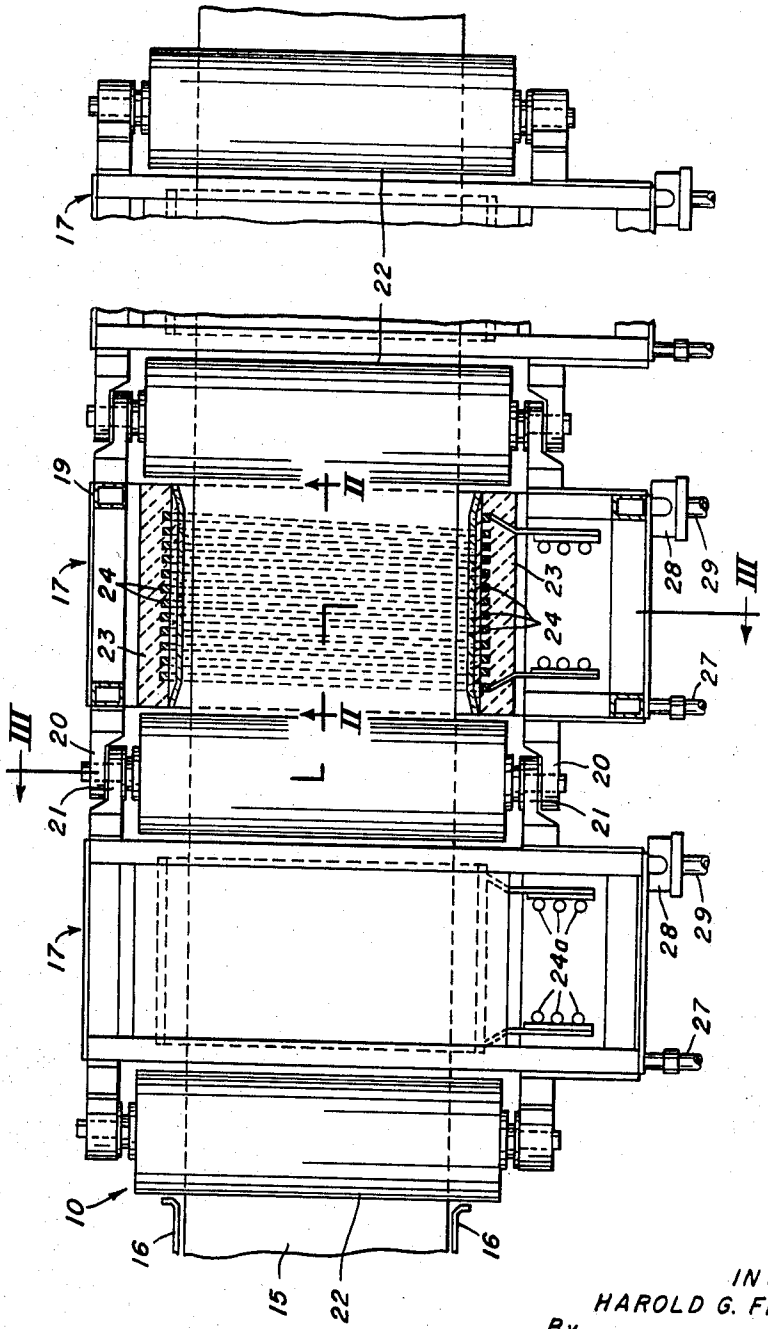

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FIG. 2.

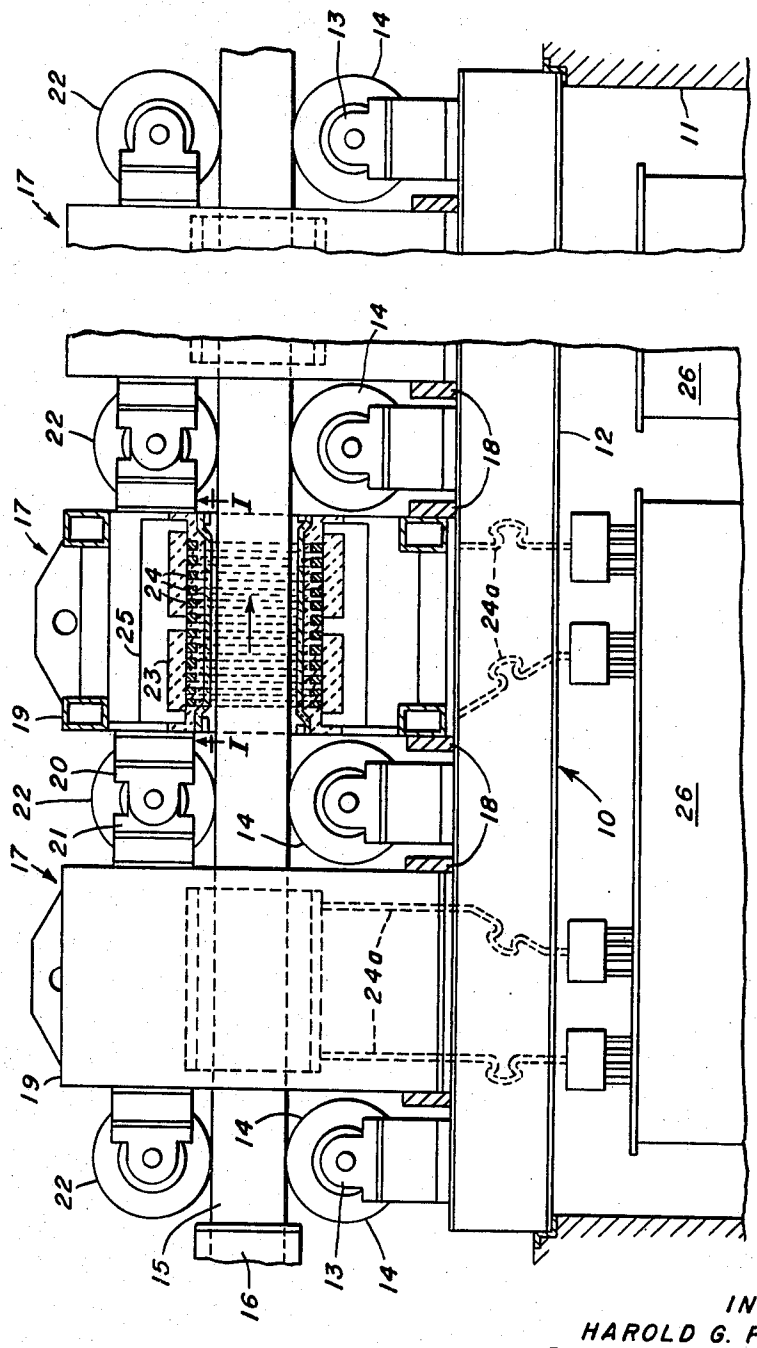

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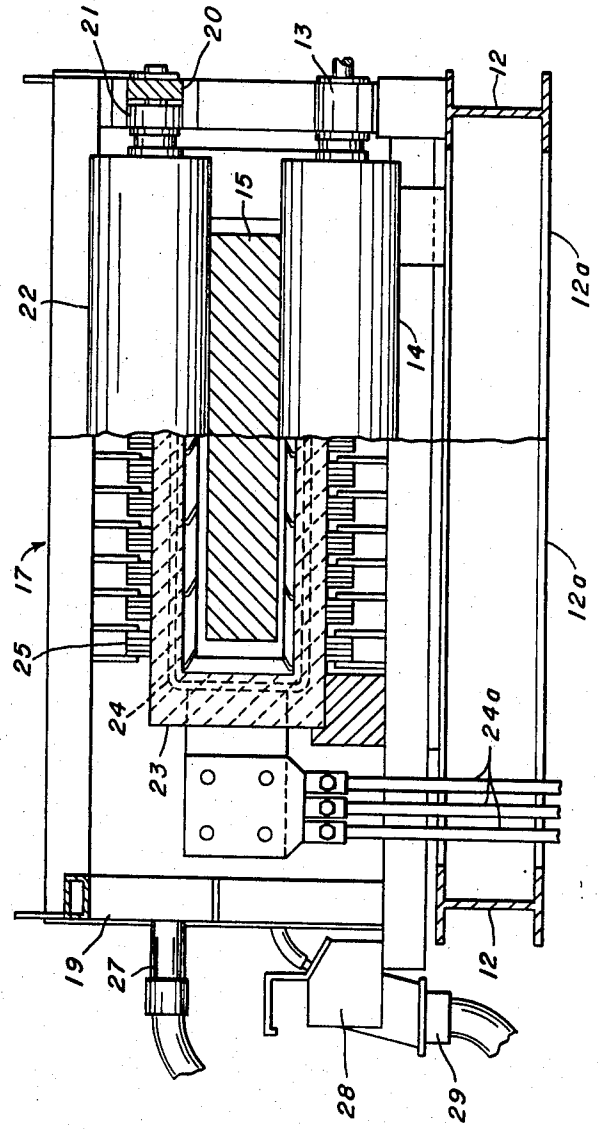
FIG. 3.



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APPARATUS FOR INDUCTIVELY HEATING A TRAVELING METAL SLAB

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Int. Cl. H05b 5/02
U.S. Cl. 219—10.69 7 Claims

ABSTRACT OF THE DISCLOSURE

A roller conveyor for slabs has a series of induction-heating units disposed one between each pair of adjacent conveyor rollers and resting normally on the conveyor frame. Each heating unit carries an induction coil through which the slab passes, enclosed in a supporting frame. Rollers journaled in the unit frame are adapted to ride on the upper surface of the slab and thus lift the frame slightly off the conveyor frame which has stops limiting horizontal movement of the unit frame. The rollers between adjacent unit frames are journaled in bearings secured to both frames and all the unit frames are thus pivoted together in a chain.

This invention relates to apparatus for inductively heating slabs of indefinite length, such as those produced by continuous casting, preparatory to hot rolling.

BACKGROUND OF THE INVENTION

In the production of slabs of indefinite length by continuous casting, it is desirable to effect some degree of hot rolling thereof after the slab, initially cast in a vertical mold, has been partially cooled, bent on an arc and delivered horizontally. Such hot rolling demands a reheating of the slab to equalize the temperatures throughout the various portions thereof as much as possible. Heretofore the necessary reheating has been effected in a furnace fired with gas or oil. Excessive scaling of the slab surfaces has resulted. In addition, such furnaces require considerable floor space which is at a premium in a continuous slab-casting line.

SUMMARY OF THE INVENTION

I have invented novel induction-heating apparatus for traveling slabs which overcomes the aforementioned objections. In a preferred embodiment, I provide a plurality of induction units, each comprising a frame and a coil supported therein through which the slab travels. The units are pivotally connected in a chain disposed above a fixed roller conveyor and have rollers journaled therebetween riding on top of the slab. The induction units are thus suspended between adjacent conveyor rollers.

BRIEF DESCRIPTION OF THE DRAWINGS

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating the present preferred embodiment. In the drawings:

FIGURE 1 is a plan view with a portion in horizontal section;

FIGURE 2 is a side elevation with a portion in vertical section along the plane of line II—II of FIGURE 1; line I—I of FIGURE 2 shows the plane on which the sectional portion of FIGURE 1 is taken; and

FIGURE 3 is a transverse section taken on the plane of line III—III of FIGURE 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in detail to the drawings, a conveyor **10** mounted on any suitable support such as foundation **11**, comprises spaced parallel stringers such as beams **12** having bearings **13** spaced therealong and cross members **12***a*. Rollers **14** journaled in the bearings support a slab **15** moving along the conveyor in the direction of the arrow. The slab is confined between side guides **16** as it enters conveyor **10**.

A plurality of induction units **17** are disposed between adjacent rollers **14**. Units **17** normally rest on beams **12** confined between stops **18**. Each unit **17** comprises a box cage or frame **19**. Bearings **20** and **21** extend outwardly from opposite sides of the frame. Bearings **20** of one frame interfit with bearings **21** of the adjacent frame and a common roller **22** is journaled in the two sets of interfitting bearings. The several frames are thus pivotally connetced in the manner of a chain. When slab **15** enters conveyor **10**, rollers **22** ride on the upper surface thereof, lifting units **17** slightly, in succession, from their normal position of rest on beams **12** and floatingly supporting them.

Each unit suspends within the frame **19** thereof an inductor **23** comprising a winding **24** adapted to permit passage of slab **15** therethrough and a core **25** in which the winding is embedded. The terminals of windings **24** are connected by flexible conductors **24***a* to transformers **26** below conveyor **10** and serve to induce eddy currents in the slab which generate heat therein.

The unit frame **19** is made up of tubular members, as shown, and they are inter-connected so as to permit the flow of cooling fluid continuously therethrough. Fluid is admitted to the unit frames through inlets **27** and after passing therethrough is discharged into a collecting trough **28** having an outlet connection **29**.

It will be evident that each point of slab **15** is subjected to repeated inputs of heat on passing through the inductors **23** of successive units **17**. The amount of heat input may be controlled in the known manner so as to bring the slab to a substantially uniform temperature throughout, by the time it leaves conveyor **10**, which is suitable for rolling or other working. When the trailing end of slab **15** passes through each unit the latter settles down on beams **12** until the entry of the succeeding slab.

The apparatus of my invention affords simple, compact and effective means for heating a traveling slab without excessive scaling thereof. The heat input of each unit may be closely controlled by known means. By high-frequency excitation of the inductors, the heating of the slab may be concentrated near the surfaces where it is most effective in overcoming cold spots resulting from surface cooling by conduction or radiation.

I claim:

1. Apparatus for inductively heating a traveling metal slab comprising a conveyor including a frame and slab-supporting rollers journaled thereon in spaced relation therealong, an induction unit liftably disposed between a pair of adjacent rollers, said unit including a frame having mounted therein an induction coil depending be-

tween the last-mentioned rollers, through which the slab passes, and rollers journaled in said unit frame positioned therein to engage the upper surface of the slab passing through the coil and floatingly suspend the unit therefrom.

2. Apparatus as defined in claim 1, characterized by stop means on said conveyor frame preventing movement of said unit therealong.

3. Apparatus as defined in claim 1, characterized by there being a plurality of said units pivotally connected linkwise in a chain.

4. Apparatus as defined in claim 3, characterized by bearings on adjacent units alined on a common axis and a roller common to adjacent units journaled in said bearings.

5. Apparatus as defined in claim 4, characterized by said last-mentioned roller being generally in the vertical plane through one of the conveyor rollers.

6. Apparatus as defined in claim 1, characterized by cooling passages in said unit frame and inlet and outlet connections thereto for cooling fluid.

7. Apparatus for heating a slab traveling longitudinally by electromagnetic induction comprising an elongated base, conveyor rollers spaced therealong for supporting the slab, said rollers defining a path along which the slab travels, a heating unit including an enclosing and supporting frame resting loosely on said base, an induction coil mounted in said frame and depending therefrom so a slab moving along said path will pass through the coil, and spaced rollers journaled on said frame in position to ride on top of the slab as it travels through the coil and thus lift said frame slightly above said base.

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