Jan. 25, 1966 P. W. DOBSON ETAL 3,230,752

MOVEMENT CONTROL OF STRIP MATERIAL

Filed June 27, 1963 2 Sheets-Sheet 1

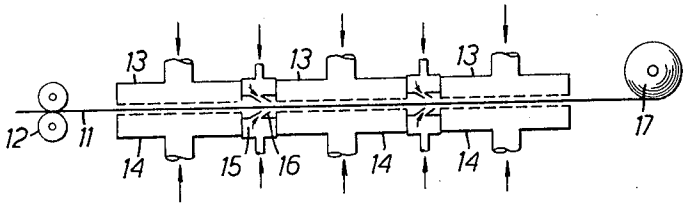

FIG. 1.

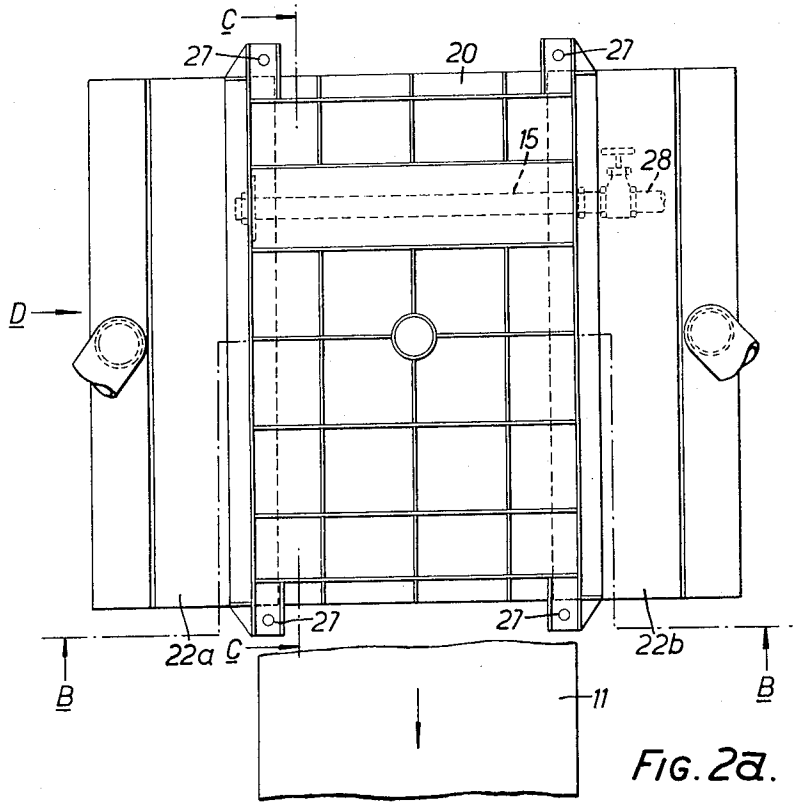

FIG. 2a.

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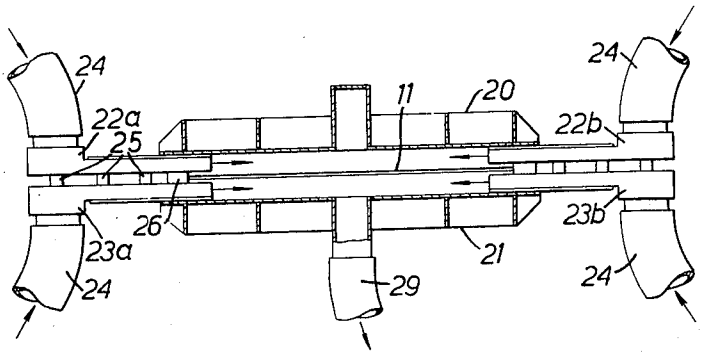

FIG. 2b.

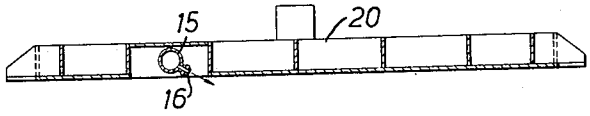

FIG. 2c.

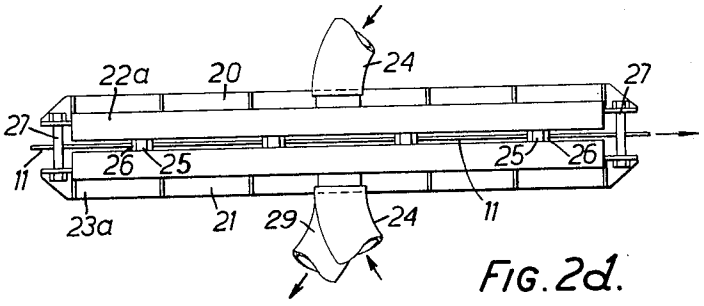

FIG. 2d.

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MOVEMENT CONTROL OF STRIP MATERIAL

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Claims priority, application Great Britain, June 27, 1962, 24,689/62
9 Claims. (Cl. 72—202)

This invention relates to the support and guidance of strip or sheet material, especially but not exclusively metal strip with reference to which the invention is hereinafter described.

In the continuous rolling strip materials, some form of support is necessary between the last stand of the mill and strip coiling machine. This support, or so-called run-out table normally takes the form of a series of motor-driven rolls which must be synchronised with the mill speed. Errors in this synchronisation and variations in relative speed between rolls and coiler cause damage to the strip which often is not removable in later operations, particularly in the case of non-ferrous metals.

In the hot rolling of steel strip to thin gauges, further difficulties arise owing to aerodynamic lift at the high line speeds involved this latter becomes the limiting factor when attempting to roll thinner gauges which would emerge from the last stand at even higher speeds.

One of the objects of this invention is to provide an improved means of supporting and controlling strip material, intended mainly when handling rolled metal strip as it passed from the last stand of the rolling operation to the coiling machine. For this purpose, strip is supported on a series of fluid cushions, which may be air, for the thinner gauges, and such cushions will normally be disposed on both sides of the material. The fluid cushions may be built up and maintained by discharge of fluid through orifices distributed over appropriate fluid bearing surfaces, or disposed adjacent the bearing surfaces peripheries.

In order to provide a driving force in the required direction, fluid jets, preferably liquid such as water, are employed by the invention. The nozzles or orifices providing such jets will be inclined in the direction of strip motion.

Thus, in one aspect the present invention provides apparatus for supporting and guiding strip material, comprising opposed fluid bearing means spaced above and below the path of strip movement, said bearing means being adapted to form and maintain fluid cushions between their respective bearing surfaces and the adjacent strip surface when strip passes therebetween, and means for directing fluid towards and transverse the strip path to drive strip therealong when supported between said cushions.

In order that the present invention may be clearly understood and readily carried into effect, the same will now be more fully described, by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 illustrates the operation with the invention in schematic manner, and

FIGURE 2 illustrates in more detail one arrangement of air bearings and water drive means for use in accordance with the invention.

In FIGURE 1 strip **11** passes from the last stand of a rolling mill represented by a pair of rolls **12**, between a series upper and lower air bearings **13** and **14**. Water pipes **15** having inclined nozzles **16** are located intermediate successive bearings, the inclination of the nozzles **16** being at an angle between the normal to the strip path and the direction of strip movement. The strip passes to a coiler **17** on emerging from the series of bearings.

FIGURE 2 shows one form of an opposed air of air bearings, each including a water pipe having inclined nozzles. In FIGURE 2, (a) is a plan view from above, (b) is a vertical section taken at B—B, (c) is a similar part-section taken at C—C, and (d) is a side view taken on arrow D.

The air cushions are formed between upper and lower cover plates **20** and **21**, air being discharged substantially continuously along the sides of the plates **20**, **21** between such plates and the strip path by pairs of box units **22***a*, **22***b* and **23***a*, **23***b*. Each box unit has an independent flexible air supply hose **24**, and adjacent upper and lower units **22***a*, **23***a* and **22***b*, **23***b* are separated by spacers **25** and edge rollers **26** for guiding the strip **11**. The opposing cover plates **20**, **21** are bolted together at adjacent corners by bolts **27** with the box units thus secured therebetween: this arrangement allows for adjustment of the penetration of the box units between the cover plates to take account of operation with different widths of strip.

A water pipe having inclined nozzles **16** is shown at **15**, in the upper bearing and it will be appreciated that a similar pipe is located in the lower bearing, each pipe having an individual flexible supply hose **28**.

The inclination of nozzles **16** is of the order of 30° to the horizontal.

Water drain outlets **29** are included in the lower cover plate **21**.

In operation it will be usual to maintain a higher pressure air cushion below the strip than above to take account of the strip weight. Also, in practice, it will be appreciated that a series of bearing arrangements such as shown in FIGURE 2 would be connected to form a run-out apparatus.

The principal advantages of the present invention are reduction of the run-out table difficulties noted above in that application of the invention with strip moving horizontally, as is almost invariably the case, good control is provided and aerodynamic lift is prevented. Also, by the use of liquid jets the strip may be cooled before entry to the coiling machine.

Finally, while the invention is particularly related to the rolling of hot metal strip in ferrous or non-ferrous forms, it can be applied to the transport of any continuous material, such as paper, board, and plastic film, etc. It may also be applied in the transport of individual sheets of material where the improved control over the sheets results in more successful handling, for example, in operations like shingling where successive sheets are overlapped. Thus the expression strip material used in the appendant claims is intended to include sheet material.

What is claimed is:

1. In a metal strip processing line, the sequence of a rolling mill, and apparatus for supporting and guiding rolled strip material along a predetermined path on exit from the mill, which apparatus comprises: first and second cover plates respectively located on opposite sides of said path in mutually facing disposition, a pair of first elongate air discharge box units individually disposed parallel to said path between the different side edges thereof and the corresponding side edges of said first cover plate to define with such plate a first air enclosure on one side of said path, a pair of second elongate air discharge box units individually disposed parallel to said path between the different side edges thereof and the corresponding side edges of said second cover plate to define with such plate a second air enclosure on the other side of said path, said first and second box units each having air supply inlets and having air discharge outlets facing inwardly of their respective air enclosures, spacing members interconnecting corresponding ones of said first and second box units, first and second water supply manifolds connected transverse said path to respective ones

of said cover plates, and first and second pluralities of nozzles connected to respective ones of said first and second manifolds, being disposed within respective ones of said first and second air enclosures, and being inclined towards said path and away from said mill.

2. Apparatus according to claim 1 wherein said box units are mounted for adjustment transverse said path to vary the width thereof, and wherein at least those spacing members nearest to said path are of strip edge guide roller form.

3. In a hot metal strip processing line, the combination of a rolling mill, a coiler, and apparatus for supporting, guiding and cooling rolled strip material during passage along a predetermined path from the mill to the coiler, which apparatus comprises: at least one pair of first and second fluid bearing gas enclosures, having air supply means connected thereto, openings for gas exit therefrom, and respectively located on opposite sides of said path with said openings in mutually facing disposition; and first and second water supply manifolds connected linearly transverse said path in association with respective ones of said enclosures, and first and second pluralities of nozzles connected to respective ones of said manifolds, which nozzles are inclined towards said path and away from said mill.

4. Apparatus for supporting and guiding strip material comprising a pair of fluid bearing gas enclosures each having gas supply means connected thereto and openings in one face thereof for gas exit, said enclosures being located with said openings in closely adjacent, mutually facing disposition to define a strip path therebetween, a pair of sets of nozzles, and liquid supply means connected to said sets, said sets being located on opposite sides of said path in respective association with said enclosures, and each set including a plurality of nozzles disposed linearly transverse said path with the nozzles inclined between the normal to said path and a common direction along said path.

5. Apparatus according to claim 4 wherein said liquid supply means includes a pair of manifolds to which respective nozzles sets are connected and which manifolds are supported in respective ones of said enclosures.

6. Apparatus according to claim 4 wherein said nozzles are inclined relative to said path at an angle of about 30°.

7. Apparatus for supporting and guiding strip material comprising first and second cover plates located in spaced apart mutually facing disposition to define a strip path therebetween, gas supply conduits connected to each of said cover plates, a pair of gas discharge means located between said cover plates and along respective edges of said path to form with said plates first and second fluid bearing gas enclosures on opposite sides of said path, first and second manifolds disposed linearly transverse said path within respective ones of said enclosures, liquid supply means connected to said manifolds, and first and second sets of nozzles connected along respective ones of said manifolds for liquid ejection therefrom, said nozzles being inclined between the normal to said path and a common direction along said path.

8. Apparatus according to claim 7 wherein said pair of gas discharge means each comprise first and second gas enclosures respectively connected with said first and second cover plates and inter-connected by spacing members at least partly in the form of strip edge guide rollers.

9. Apparatus according to claim 8 wherein said gas discharge means and guide rollers are adjustable to vary the width of said path.

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