United States Patent

[11] 3,600,925

[72] Inventors: Michael Frank Field, Dollard des Ormeaux, Quebec; John Frederick Barry Wood, Montreal, Quebec, both of, Canada

[21] Appl. No. 822,564
[22] Filed May 7, 1969
[45] Patented Aug. 24, 1971
[73] Assignee Dominion Engineering Work Limited, Montreal, Canada
[32] Priority May 21, 1968
[33] Canada
[31] 020,424

[54] EDGER FOR STEEL MILL

10 Claims, 5 Drawing Figs.

[52] U.S. Cl. 72/237, 72/249

[51] Int. Cl. B21b 31/00

[50] Field of Search 72/199, 237, 249, 241, 224, 225; 164/76

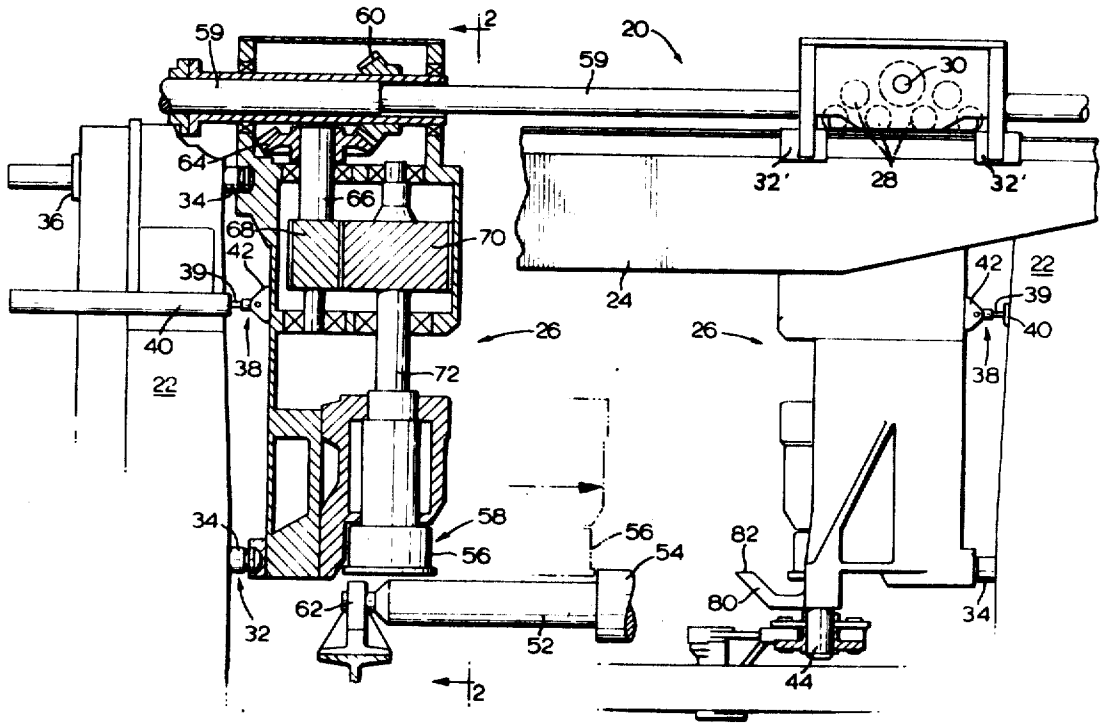
[56] References Cited

UNITED STATES PATENTS

1,807,324	5/1931	Peterson	72/237
2,183,388	12/1939	Biggert, Jr.	72/234 X
2,195,502	4/1940	Smitmans	72/249 X
2,767,602	10/1956	Henrickson	72/237 X
1,808,752	6/1931	Banner	72/225

Primary Examiner—Milton S. Mehr
Attorney—Henry C. Westin

ABSTRACT: This invention is directed to a rolling mill and in particular to a vertical edging mill.



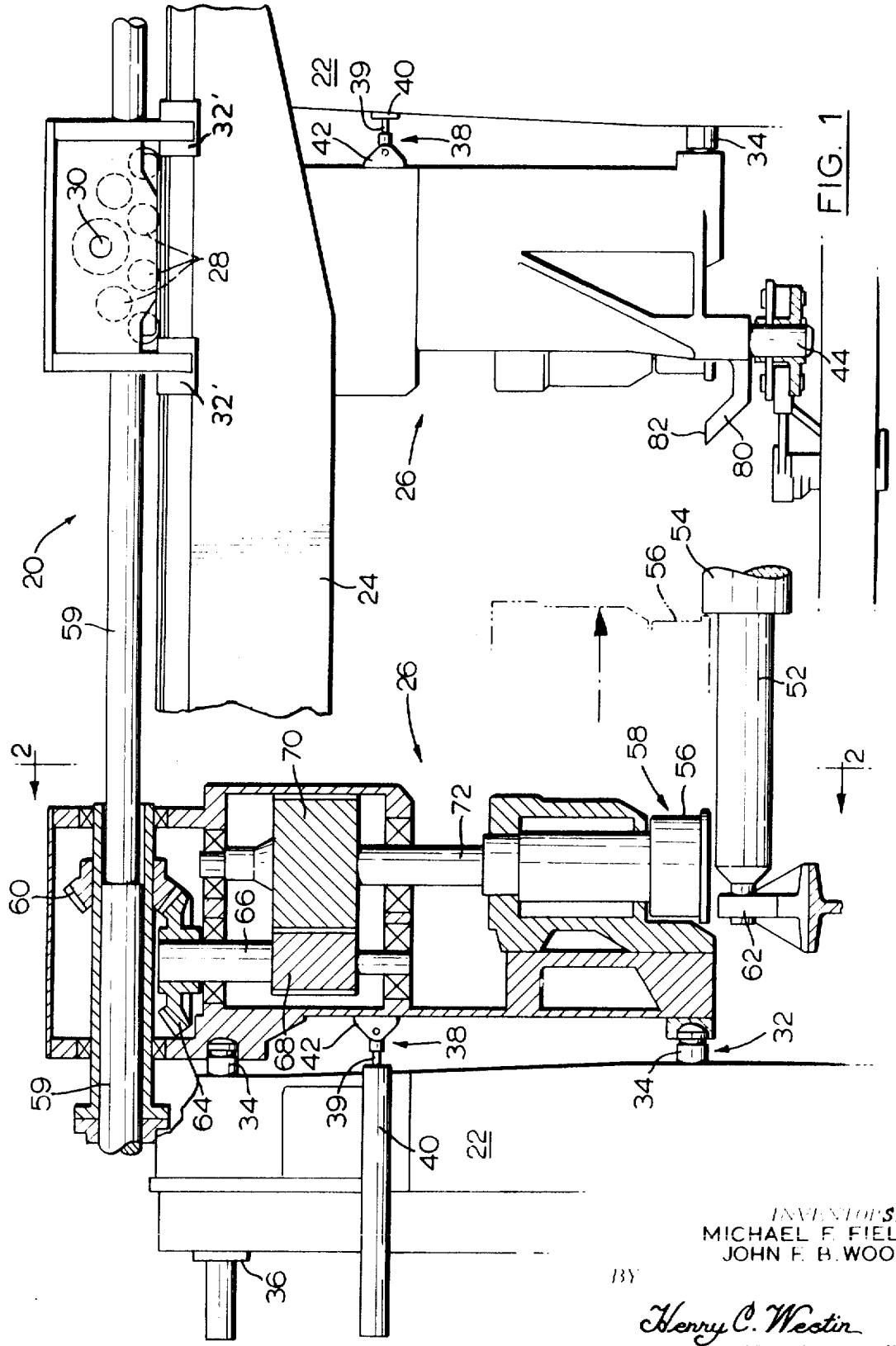


FIG. 1

INVENTORS.
MICHAEL F. FIELD
JOHN F. B. WOOD

BY

Henry C. Westin
THEIR ATTORNEY.

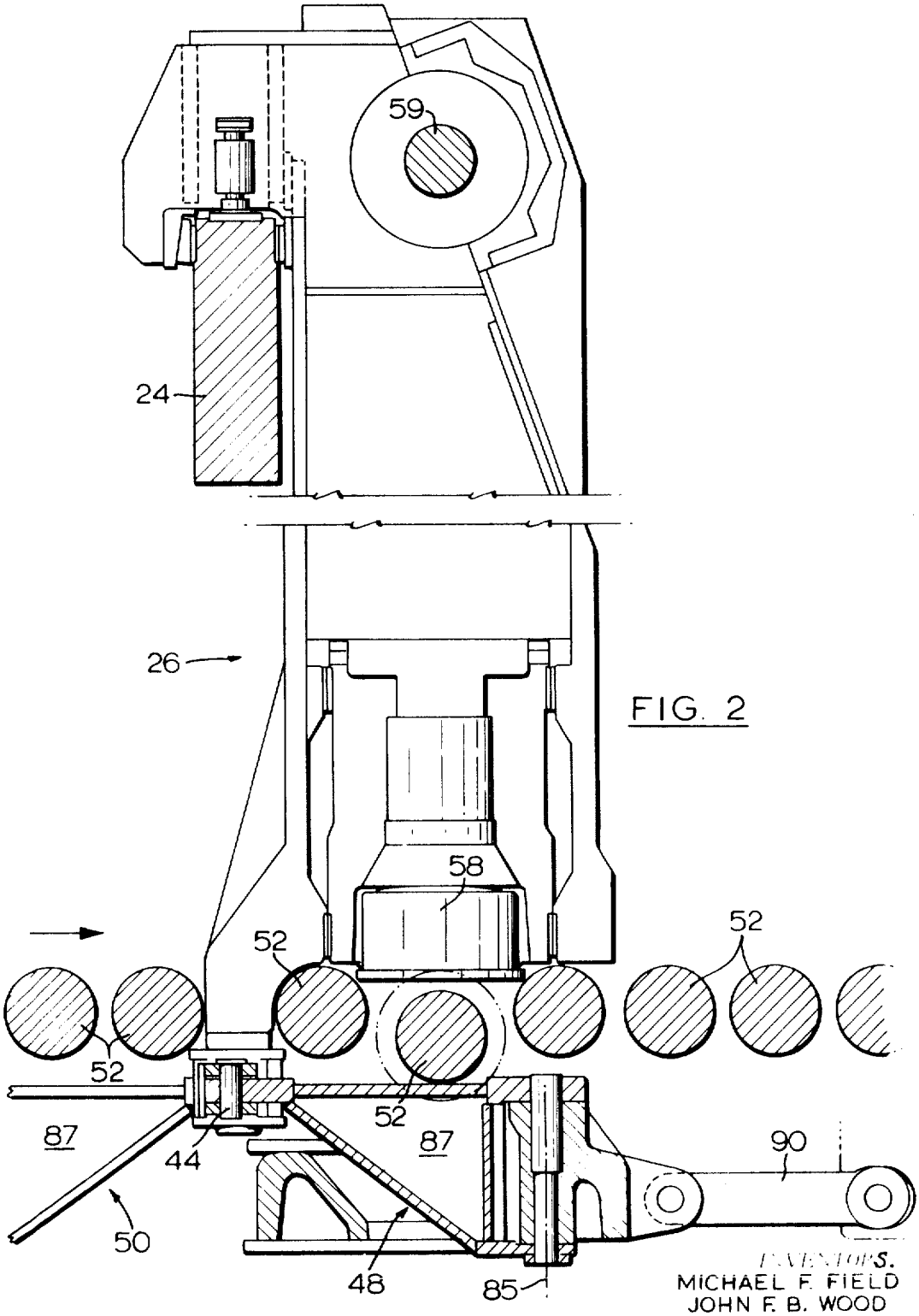


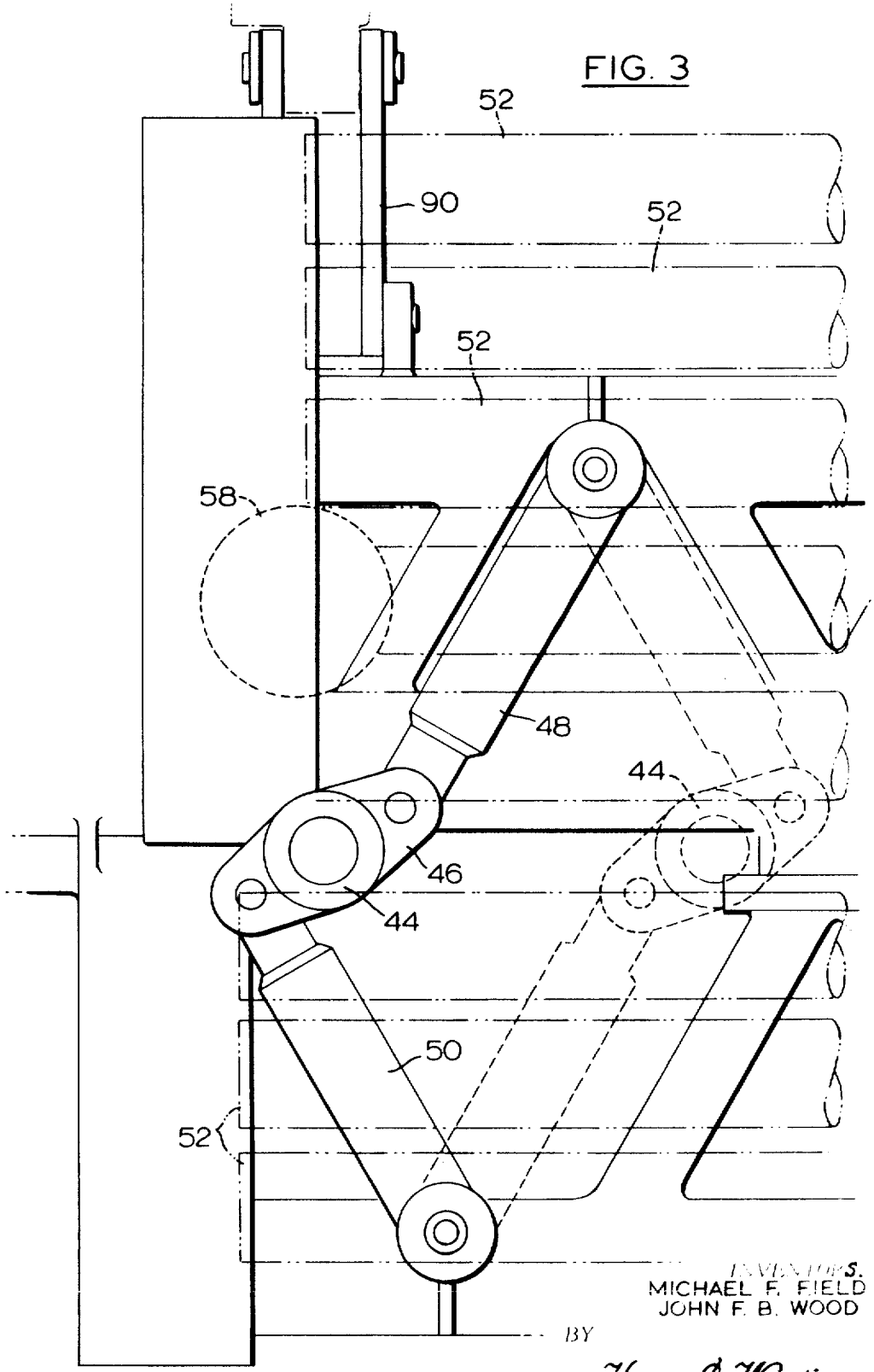
FIG. 2

INVENTORS.
MICHAEL F. FIELD
JOHN F. B. WOOD

BY

Henry C. Westin
THEIR ATTORNEY.

FIG. 3



INVENTORS.
MICHAEL F. FIELD
JOHN F. B. WOOD

BY

Henry C. Westin
THEIR ATTORNEY.

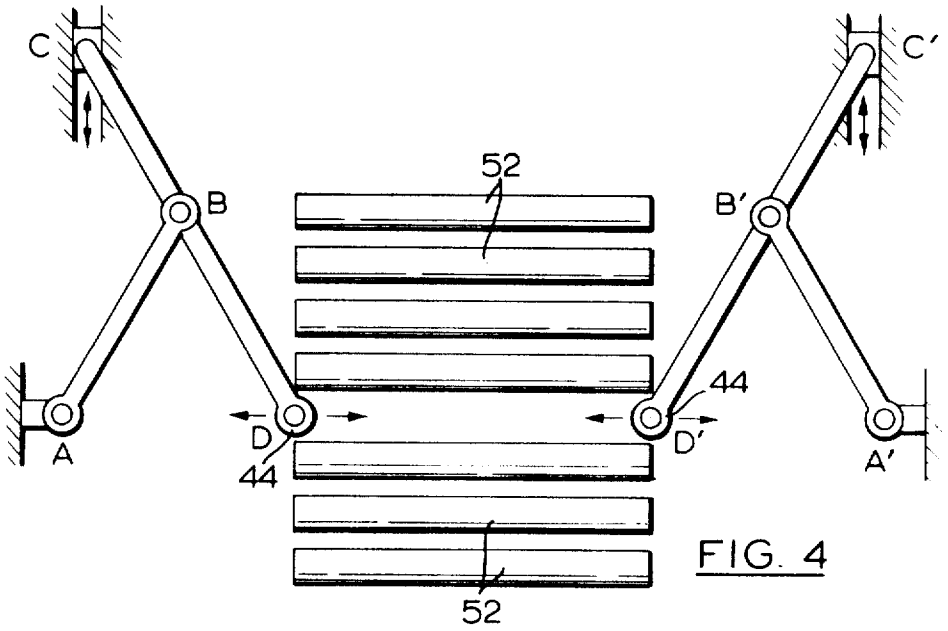


FIG. 4

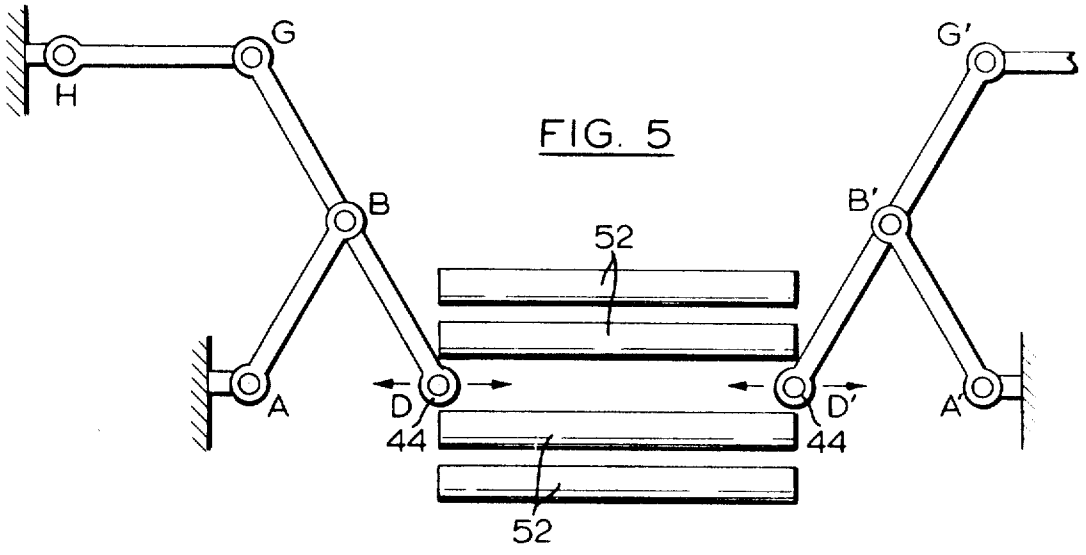


FIG. 5

INVENTORS.
MICHAEL F. FIELD
JOHN F. B. WOOD

BY

Henry C. Westin
THEIR ATTORNEY.

EDGER FOR STEEL MILL

In the production of plate and hot strip it has been general practice to provide a horizontal mill having an attached vertical edger for reducing the vertical sides of slab as it enters or leaves the horizontal rolls of the mill. Alternative arrangements of edger mills supported independently of the horizontal rolls of the mill have also been known.

In earlier arrangements certain specific problems have been encountered associated with the provision of rotational drive to the vertical rolls. The need for lateral adjustment of the rolls over a wide range of slab width has produced some complex and unduly large mill arrangements. The Certain types of mill arrangements are exemplified in U.S. Pat. Nos. 2,195,502 (Smitmans, Apr. 2, 1940) and 2,752,804 (Kalberkamp, July 3, 1956).

One of the characteristic difficulties presented by previous edger mill arrangements has been the difficulty encountered in adjusting and maintaining the mill, for roll changing and gear and drive maintenance.

The present invention provides a vertical edger having a pair of cooperative vertical rolls mounted in overhung arrangement from an offset monorail support structure providing substantially unrestricted access to the working parts of the mill.

In addition, the present invention provides an improved roll support arrangement including independent roll support housings with plural bogeys and utilizing a guide linkage with articulated links, in contrast to the type of slide rail previously used. The provision beneath the table rolls of the mill of a restraining linkage arranged with a pivot connection beneath the mill table rolls enhances the accuracy and durability of the arrangement.

In considering some of the problems involved in mills of this type it must be appreciated that slab sizes ranging in thickness up to about 18 inches and in width from 20 inches to 160 inches or more and weighing about 50,000 pounds, are encountered. It will be understood that the factors affecting mill stiffness and maintainability are of great significance, as downtime in a rolling mill installation is very costly. Other environmental factors, such as the high temperature encountered and the continuing presence of hardened mill scale falling beneath the mill table rolls, enhance the improved dependability, reliability and reduced wear characteristics of edger mills constructed in accordance with the present invention.

Certain embodiments of the present invention are described, reference being had to the drawings wherein:

FIG. 1 is an elevational view of the mill from the oncoming side;

FIG. 2 is a section on the line 2—2 of FIG. 1;

FIG. 3 is a plan view showing one form of the steadying linkage using a Watts-type linkage; and

FIGS. 4 and 5 are schematic arrangements corresponding with FIG. 3 of alternative restraining linkages using Pusilier-type linkages. Referring to FIG. 1 it will be seen that the mill installation comprises a fixed housing **20** having side towers **22** and a monorail bridge member **24** extending therebetween and shown mounted on the oncoming side of the towers **22**.

The monorail **24** carries a pair of movable housings **26**, each movable housing **26** being supported by a plurality of bogeys **28** in load-distributing arrangement on the top surface of the monorail by way of a pivot pin **30** from which the movable housings **26** are suspended. Side guide members **32'** serve to steady the housings **26** against the sides of the monorail **24**.

Each of the movable housings **26** are spaced from the side towers **22** by a pair of distance assemblies **32**. Each distance assembly **32** comprises a ram portion **34** and extension means **36** attached to the respective side towers **22**, by means of which the ram portions may be extended or retracted relative to the side towers **22**. The extension means **36** comprises a force or thrust nut (not shown) in threaded relation with the ram portion **34**, together with drive motor means to rotate the force nut and extend or retract the ram portion **34**.

The movable housings **26** are pulled back against the distance assemblies **32** by hydraulic pullback means **38** which comprise a hydraulic piston and cylinder **39** and **40** carried by the respective tower **22** and pinned to the respective housing **26** by way of a bracket **42**.

The bottom of the movable housings **26** is restrained against movement in the direction of the roll table by way of a downwardly extending pin **44** supported in pivoting relation by a plurality of restraining links **46**, **48**, **50** (see FIG. 3, generally known as Watt's straight-line motion), arranged to permit substantially straight-line motion of the linkage pin **44** only transversely of the mill roll table.

Referring to FIGS. **1** and **2** it will be seen that the mill includes a plurality of table rolls **52**, the working surfaces **54** formed thereby being aligned with the working face **56** of the edge roll **58**. It will be seen that at least one table roll is of larger diameter at its center than the other rolls, the support bearings **62** of the table rolls **52** being arranged in relation to the geometry of the mill and the working diameter of the respective table rolls **52** being varied accordingly.

The drive to the edge rolls **58** is provided by an input shaft **59** extending across the machine having a drive pinion **60** in splined driven relation therewith to drive the meshing bevel pinion **64**. Power is transmitted to the roll **58** by way of an intermediate shaft **66**, spur pinion **68** and mating gear **70** and connecting shaft **72** in driving connection with the underhung roll **58**.

From the bottom of the movable housing **26**, adjacent the pivot pin **44** there extends a slab guide bracket **80** having a top surface **82** coincident with the working surface **54** of the table roll **52**, being provided for the purpose of raising up the down-sagging corners of a slab passing through the mill.

Referring to the details of FIGS. **2** and **3**, the restraining linkage members **48** and **50** of the Watts linkage are pivotally mounted at **85**, having a deep support section **87** to provide stabilized support to the pin **44**. Additional stiffness is provided to the stabilizing linkage by the pinned support frame **90** attached thereto, which serves to transfer any working or unbalanced loads from the edge mill to the adjacent portions of the rolling mill.

Alternative linkage arrangements generally known as Pusilier linkages are illustrated in FIGS. **4** and **5**. Referring to FIG. **4** the steadying pin **44** for the moveable straight-line **26** is designated D, being carried by a link CD, the end C being free to slide in the feeding direction of the mill, while a radius arm AB is pivotally attached at B to the link CD, the other end A being pivoted from a fixed support of the mill. This mechanism can provide straight-line motion of the pins **44** normal to the main axis of the mill.

In the case of the embodiment illustrated in FIG. **5**, the slide point C of the linkage is replaced with a radius link GH. This provides a substantially straight-line path of travel for the pins **44**, so long as the linkage GH is maintained relatively long in relation to the other links.

The advantage afforded by the embodiments illustrated in FIGS. **3** and **5** is the avoidance of slide guides. In the embodiment of FIG. **4** the slide guides at C, C' lies to the sides of the mill and not beneath the table rolls, so that damage from mill scale can be largely avoided.

It will be seen that the mill structure embodying an offset monorail provides clear access by crane to the mill components such as transmission gearing and the edge rolls, while the use of pivoted restraining linkages provide a simple and readily maintained stabilizing structure.

The adoption of bogeys on the moving heads reduce the size of motor necessary to position the heads, while the pivotal mounting from the bogeys permits the housings to be maintained in correct attitude, despite any changes due to wear or sag in the monorail for different width settings. This provides the added advantages that roll drive shaft extending between the two sides of the mill is maintained substantially free of bending loads generally experienced in previous arrangements.

In accordance with the provisions of the patent statutes, we have explained the principle and operation of our invention and have illustrated and described what we consider to represent the best embodiment thereof.

We claim:

1. An edge mill for use in reducing metal products, having a pair of fixed side towers, table rolls between said side towers; bridge means spanning the width of the mill connecting the side towers; a movable housing on each side of the table rolls movably suspended from the bridge means having an underhung edge roll suspended therefrom; and housing restraint means extending beneath the table rolls of the mill including a guide linkage of articulated links connected in transverse guiding relation with each said housing to permit substantially straight-line motion of the respective housing parallel to the axes of said table rolls.

2. The edge mill as claimed in claim 1 wherein said articulated links comprise a pair of pivoted links having a third link pivoted therebetween in articulating relation and connected in transverse guiding relation with the respective said movable housing.

3. The edging mill as claimed in claim 1 wherein each said movable housing is suspended in pivoted relation from said bridge means, whereby the inclination of said housing is substantially unaffected by variation of sag in said bridge means.

4. An edge mill according to claim 1 in which said bridge means comprises a monorail arranged to be offset with respect to the axes of rotation of said edge rolls.

5. An edge mill according to claim 4 wherein said monorail is arranged on the entry side of said mill and said guide linkage is arranged below said monorail.

6. The edging mill as claimed in claim 4 wherein said articulated links first link means having one end connected in guiding relation with the respective said movable housing, second link means pivotally connected to said first link means intermediate the end thereof serving as a radius link thereto, and link guidance means connected with the other end of said first link means to provide substantially straight-line motion thereto, whereby movement of said one end is substantially limited to a direction parallel with the axes of said table rolls.

7. The edging mill as claimed in claim 6 wherein said link guidance means comprises a slide connected with said other end of said first link means, to provide linear motion thereto.

8. The edging mill as claimed in claim 6 wherein said link guidance means comprises a radius link connected with said other end of first link means, to provide transverse restraint thereto.

9. The edging mill as claimed in claim 4 including mill drive means having a power input shaft extending between said moveable housings, and bevel gear means connected thereto in driving relation with said edge roll through a reduction gear, said bevel gear and said reduction gear being offset in relation with said bridge means, to provide clear access by crane to said mill drive means.

10. The edging mill as claimed in claim 4 wherein each said movable housing is adjustable secured to the respective said side tower by power-operated pullback means adapted to draw the housing back in secured relation against at least one adjustable distance assembly extending between the tower and the housing in thrust-transmitting relation therebetween.