Aug. 21, 1962 C. VOLKHAUSEN ETAL 3,049,949

ROLLING MILL

Filed Aug. 11, 1959

5 Sheets-Sheet 1

FIG. 1
PRIOR ART

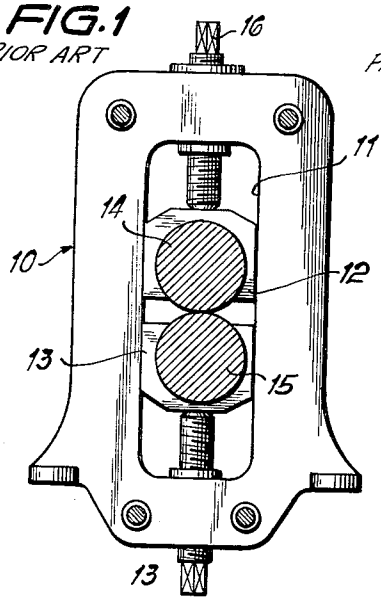


FIG. 2
PRIOR ART

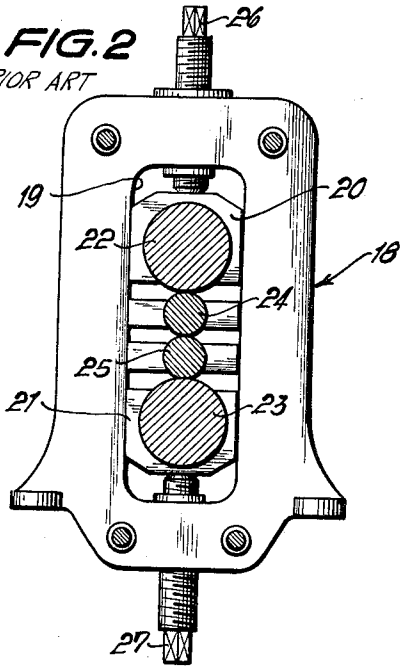


FIG. 3
PRIOR ART

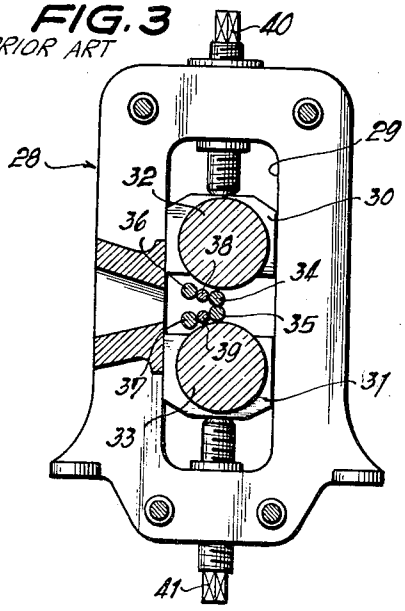
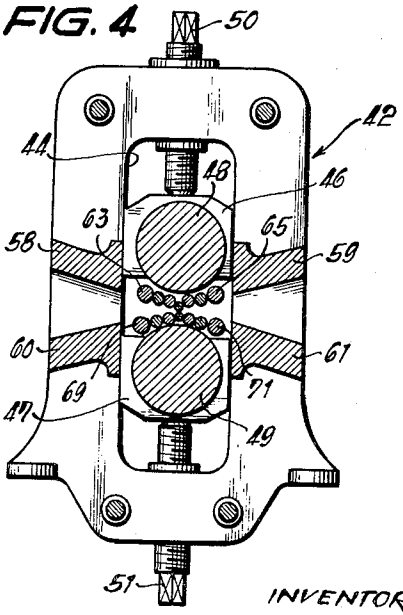


FIG. 4



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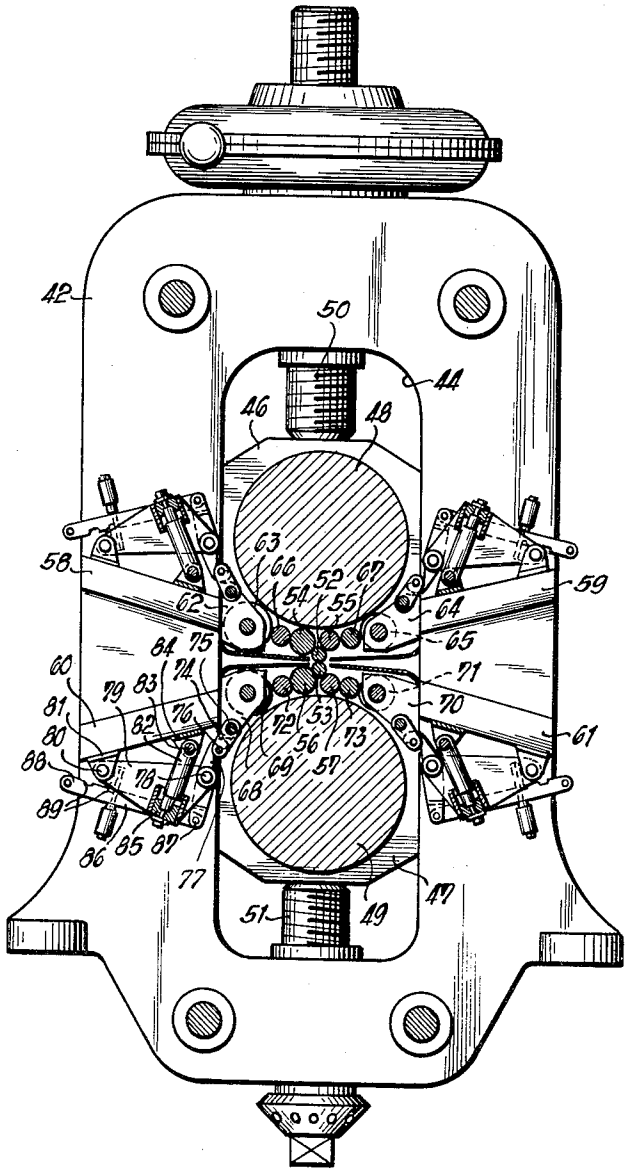
Aug. 21, 1962 C. VOLKHAUSEN ETAL 3,049,949

ROLLING MILL

Filed Aug. 11, 1959

5 Sheets-Sheet 2

FIG. 5



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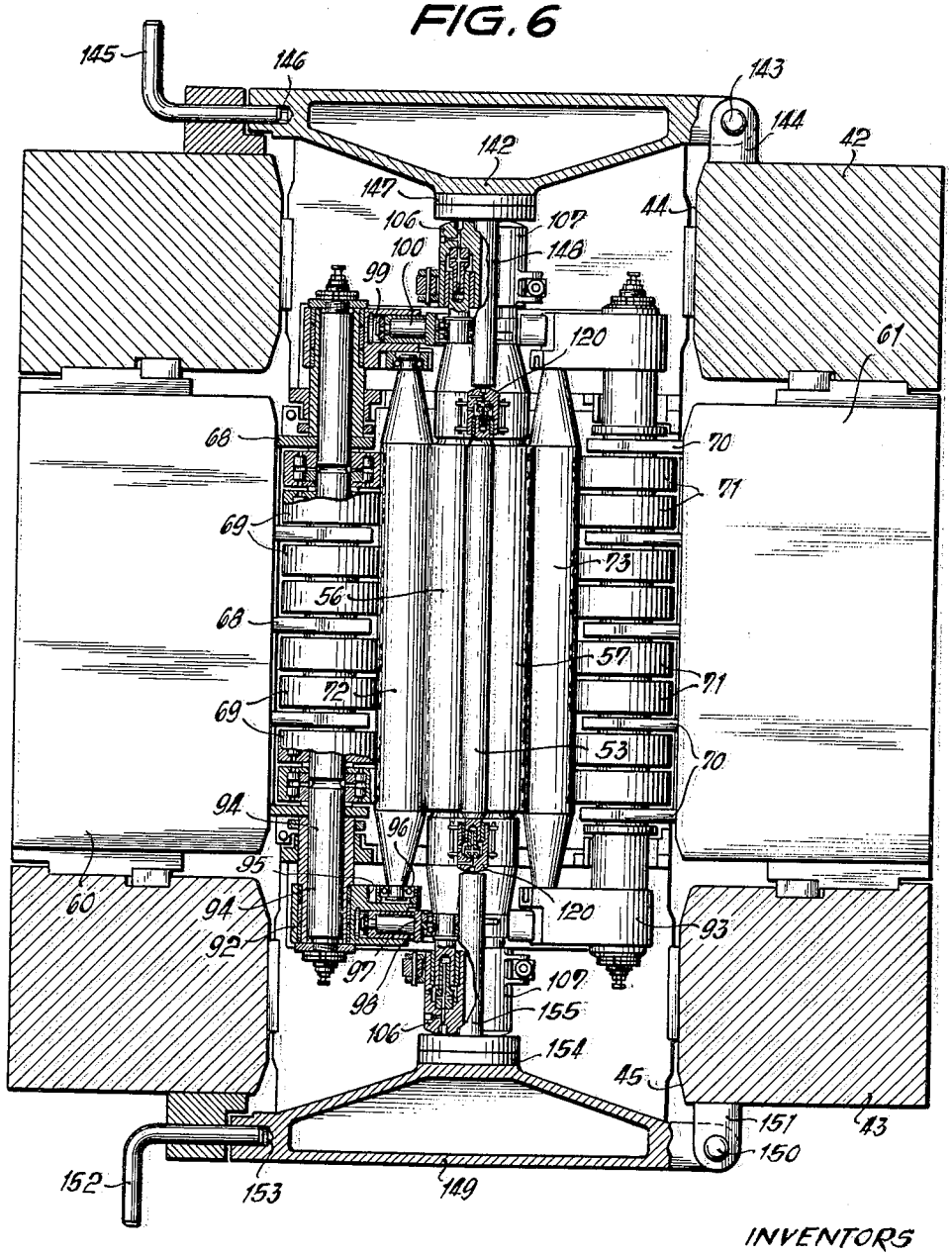
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ROLLING MILL

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FIG. 6



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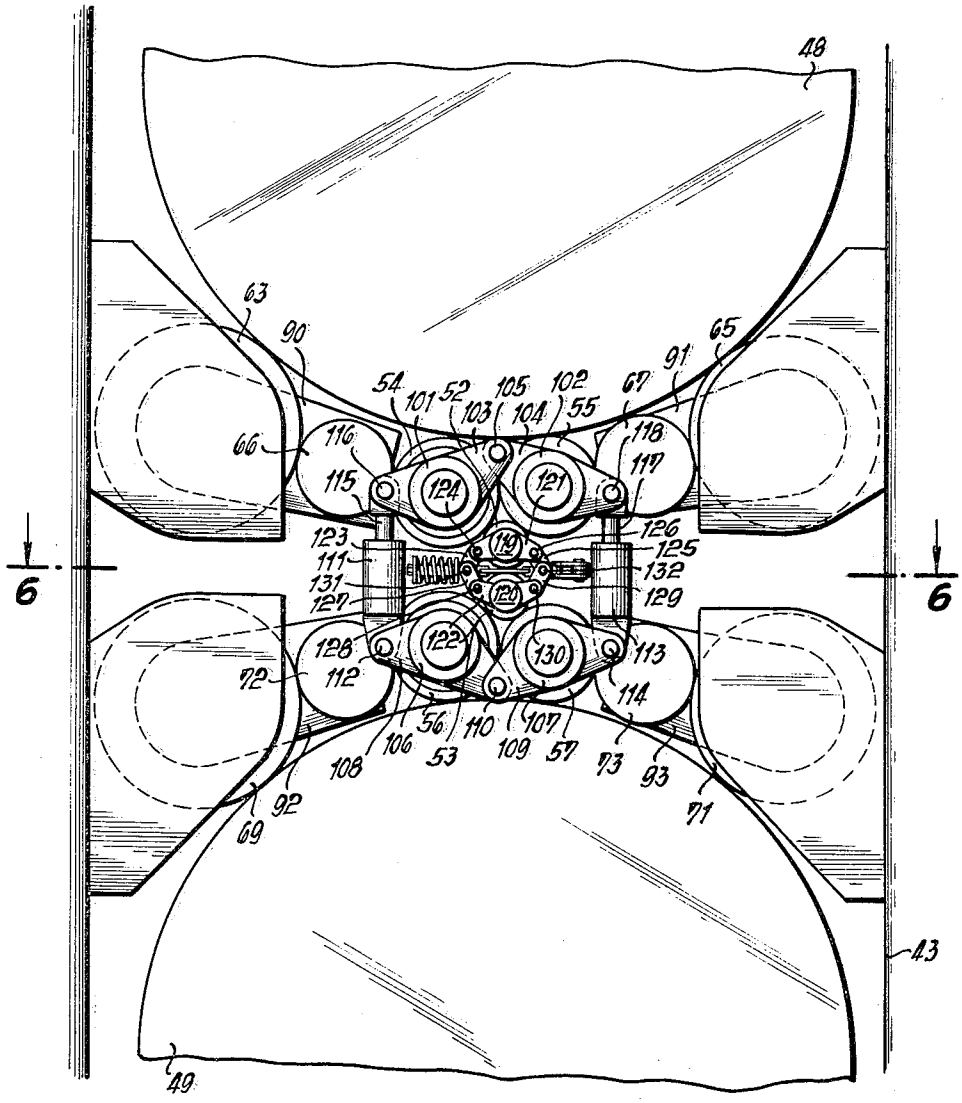
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FIG. 7



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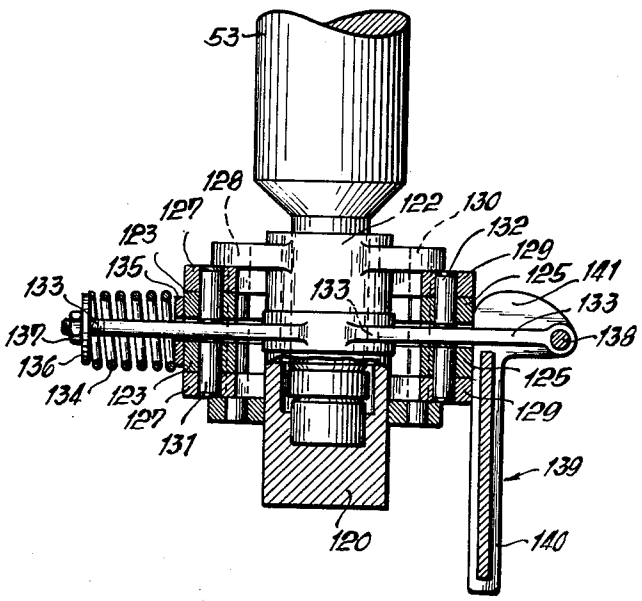
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FIG. 8



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3,049,949

ROLLING MILL

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Filed Aug. 11, 1959, Ser. No. 832,934
Claims priority, application Germany Aug. 12, 1958
9 Claims. (Cl. 80—38)

This invention relates to metal working and more particularly to a rolling mill in which freely rotatable working rolls are supported by pairs of supporting rolls which in turn engage positively driven backing rolls and are also additionally supported laterally by supporting rollers.

In certain types of rolling operations, it is desirable to utilize relatively small working rolls and since such rolls are incapable of transmitting the torque necessary to rotate the same and further since such rolls are subject to undue deflection caused by the rolling pressures it has been found expedient to support the working rolls by means of backing rolls and also to drive the working rolls frictionally from the backing rolls. Such an arrangement will operate satisfactorily in certain applications and it has also been found expedient in certain cases to provide a portion of the power necessary to conduct the rolling operation by exerting a pull on the material being rolled. It has also been proposed to accomplish the desired result by offsetting the axes of the working rolls from the plane of the axes of the backing rolls and by providing additional lateral support for the working rolls in order to prevent lateral shifting of the same by means of supporting rollers.

In the present invention, it is proposed to utilize relatively small diameter working rolls which are freely rotatable and in which the axes of the working rolls are disposed substantially in the plane of the axes of relatively large diameter positively driven backing rolls. Disposed between the working rolls and the backing rolls are pairs of supporting rolls which engage both the backing rolls and the working rolls and such supporting rolls are supported laterally either by direct engagement with supporting rollers rotatably mounted on fixed beams or through intermediate rolls disposed between the supporting rollers and the pairs of supporting rolls. The working rolls are driven by frictional engagement between the supporting rolls and the backing rolls and also by frictional engagement of the supporting rollers with the backing rolls. Means are also provided for urging the supporting rolls into engagement with the backing rolls and with the supporting rollers or intermediate rolls and means are also provided for urging the working rolls into engagement with the pairs of supporting rolls.

It is accordingly an object of the invention to provide a rolling mill utilizing relatively small working rolls and incorporating provisions for adequately supporting and driving the working rolls.

A further object of the invention is the provision of a rolling mill incorporating relatively small freely rotatable working rolls, each working roll being supported by a pair of supporting rolls which in turn are supported and driven by backing rolls, such supporting rolls being also supported laterally by a plurality of supporting rollers rotatably mounted on rigid beams.

A still further object of the invention is the provision of a rolling mill incorporating freely rotatable working rolls, each working roll being supported by a pair of supporting rolls which in turn engage backing rolls, such supporting rolls being supported laterally by supporting rollers and in which one of each pair of supporting rolls may be of larger diameter than the other supporting roll of each pair.

Another object of the invention is the provision of a rolling mill incorporating freely rotatable working rolls supported by supporting rolls which in turn engage backing rolls, such supporting rolls being supported laterally by a plurality of supporting rollers rotatably mounted on rigid beams there being also provided fluid pressure operated means for maintaining the supporting rolls in engagement with the backing rolls and also in engagement with the supporting rollers or with intermediate rollers disposed between the supporting rollers and the supporting rolls.

A further object of the invention is the provision of a rolling mill incorporating freely rotatable working rolls which are supported by supporting rolls which in turn engage backing rolls and incorporating spring operated toggle means for maintaining the working rolls in engagement with the supporting rolls.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a vertical sectional view showing a conventional rolling mill incorporating driven working rolls;

FIG. 2 a view similar to FIG. 1, but showing a rolling mill incorporating working rolls frictionally driven by backing rolls;

FIG. 3 a view similar to FIG. 1, but showing working rolls having their axes offset from the plane of the axes of backing rolls and in which additional supporting rollers provide lateral support for the working rolls;

FIG. 4 is a vertical sectional view showing more or less diagrammatically the structure of this invention incorporating freely rotatable working rolls supported by pairs of supporting rolls which in turn are supported by backing rolls and laterally supported by supporting rollers;

FIG. 5 a view similar to FIG. 4, but to an enlarged scale and showing further details of the mountings for the supporting rollers;

FIG. 6 a sectional view taken substantially on the line 6—6 of FIG. 7 and showing the lower working roll, the lower pair of supporting rolls, the lower intermediate rolls and the lower supporting rollers, together with the mounting means for such rolls and rollers;

FIG. 7 a side elevational view with parts shown more or less diagrammatically and showing in particular, the fluid pressure operated means for maintaining the pairs of supporting rolls in engagement with the backing rolls, as well as the resilient toggle means for maintaining the working rolls in engagement with the supporting rolls; and

FIG. 8 a fragmentary plan view with parts in section for greater clarity and showing the structure at one end of the working rolls for maintaining such working rolls in engagement with the supporting rolls.

With continued reference to the drawings, there is shown in FIG. 1 a more or less conventional rolling mill and the structure shown in this figure, as well as in FIGS. 2 and 3 are illustrated and briefly described for the purpose of indicating the evolution of this invention. In FIG. 1 there is shown a housing 10 having a window 11 therein and in which is slidably mounted upper and lower bearing chocks 12 and 13 respectively. An upper working roll 14 is rotatably carried by the upper bearing chocks 12 and a lower working roll 15 is rotatably carried by the lower bearing chocks 13. The working rolls 14 and 15 are positively driven and the upper working roll 14 may be adjusted vertically by suitable screw threaded adjusting means 16 and the lower working roll 15 may be adjusted vertically by suitable screw threaded adjusting means 17. In a rolling mill of this type, the minimum diameter of the working rolls 14 and 15 is determined

by the rolling pressure and also by the torque which must be transmitted by such rolls. Consequently, where rolling pressure and torque are relatively high, working rolls of relatively large diameter must be used and in certain types of rolling operations such large diameter working rolls are not desirable.

The structure shown in FIG. 2 attempts to overcome the deficiencies of the rolling mill above described in connection with FIG. 1 and in FIG. 2 there is shown a rolling mill, including a housing **18** having windows **19** within which are slidably mounted for vertical movement an upper bearing chock **20** and a lower bearing chock **21**. An upper backing roll **22** is rotatably carried by the upper bearing chock **20** and a lower backing roll **23** is rotatably carried by the lower bearing chock **21**. Disposed between the upper and lower backing rolls **22** and **23** respectively are upper and lower working rolls **24** and **25** respectively. Upper backing roll **22** is positively driven and serves to drive upper working roll **24** by frictional engagement therebetween. In a similar manner, lower backing roll **23** is positively driven and serves to drive lower working roll **25** by frictional engagement therebetween. The upper backing roll **22** and upper working roll **24** may be adjusted vertically by suitable screw threaded adjusting means or the like **26** and lower backing roll **23** and lower working roll **25** may be adjusted vertically by suitable screw threaded adjusting means or the like **27**.

A still further attempt of solving the problem of providing small working rolls is shown in FIG. 3 wherein a housing **28** is provided with windows **29** in which are slidably mounted upper and lower bearing chocks **30** and **31**. An upper backing roll **32** is rotatably carried by the upper bearing chock **30** and a lower backing roll **33** is rotatably carried by the lower bearing chock **31**. Upper and lower working rolls **34** and **35** are disposed between the upper and lower backing rolls **32** and **33** respectively and it is to be noted from an inspection of FIG. 3 that the plane of the axes of the upper and lower working rolls **34** and **35** is offset from the plane of the axes of the upper and lower backing rolls **32** and **33**. The upper and lower working rolls **34** and **35** are supported laterally by upper and lower supporting rollers **36** and **37** which engage intermediate rolls **38** and **39** respectively which in turn engage the upper and lower working rolls **34** and **35**. In this form of rolling mill the supporting rollers **36** and **37** also engage the backing rolls **32** and **33** respectively in order to provide a frictional drive for the working rolls **34** and **35** in addition to the drive suply by the direct engagement of working rolls **34** and **35** with the backing rolls **32** and **33**. The upper backing roll **32** and upper working rolls **34** may be adjusted vertically by suitable screw threaded adjusting means or the like **40** and the lower backing roll **3** and lower working roll **35** may be adjusted vertically by suitable screw threaded adjusting means or the like **41**.

With particular reference to FIGS. 4 to 8, there is shown a rolling mill constructed in accordance with this invention and which may well comprise a roll housing composed of spaced side members **42** and **43** provided with windows **44** and **45**. Slidably mounted in the windows **44** and **45** are upper and lower bearing chocks **46** and **47** and rotatably carried by the upper bearing chock **46** is an upper backing roll **48** which is positively driven by means, not shown, and rotatably carried by the lower bearing chock **47** is a lower backing roll **49** which is positively driven by means, not shown. Upper bearing chock **46** and upper backing roll **48** may be adjusted vertically by suitable screw threaded adjusting means or the like **50** and lower bearing chock **47** and lower backing roll **49** may be adjusted vertically by suitable screw threaded adjusting means or the like **51**.

Disposed between upper and lower backing rolls **48** and **49** are upper and lower working rolls **52** and **53** respectively and it is to be noted that these rolls **52** and **53** are of relatively small diameter and that the axes of such rolls lie substantially in the plane of the axes of backing rolls **48** and **49**. Upper and lower working rolls **52** and **53** are freely rotatable and are supported by an upper pair of supporting rolls **54** and **55** and the lower working roll **53** is supported by a lower pair of backing rolls **56** and **57**. It is to be noted that the supporting rolls **54** and **56** are of somewhat larger diameter than the supporting rolls **55** and **57**. The upper pair of supporting rolls **54** and **55** frictionally engage the upper backing roll **48** and are driven thereby and these rolls in turn serve to frictionally drive the upper working roll **52**. In a similar manner, the lower pair of supporting rolls **56** and **57** frictionally engage the lower backing roll **49** in order to frictionally drive the lower working roll **53**. It should also be noted that as clearly shown in FIG. 5, the ratio of the diameters of backing rolls **48** and **49** to the diameters of supporting rolls **54** and **55** and **56** and **57**, respectively, is approximately 34:4.5. This relatively large ratio is necessary in order to provide for proper disposition and operation of the rolls.

In order to provide lateral support on both sides for the upper and lower pairs of supporting rolls an upper pair of rigid beams **58** and **59** extend between the side members **42** and **43** of the housing and in a similar manner, a lower pair of rigid beams **60** and **61** also extend between the side members **42** and **43** of the housing. Mounted on the beam **58** for vertical adjusting movement is a carriage **62** which serves to rotatably mount a plurality of axially spaced supporting rollers **63** and in a similar manner, a carriage **64** is mounted for vertical adjusting movement on the beam **59** and serves to rotatably mount a series of axially spaced supporting rollers **65**. Disposed between supporting rollers **63** and upper supporting roll **54** is an intermediate supporting roll **66** and disposed between supporting rollers **65** and upper supporting roll **55** is an intermediate supporting roll **67**.

In a similar manner, a carriage **68** is mounted for vertical adjusting movement on the beam **60** and serves to rotatably mount a series of axially spaced supporting rollers **69**. Mounted on the beam **61** for vertical adjusting movement is a carirage **70** and rotatably mounted on such carriage **70** are a series of axially spaced supporting rollers **71**. Disposed between the supporting rollers **69** and the lower supporting roll **56** is an intermediate supporting roll **72** and disposed between the supporting rollers **71** and the lower supporting roll **57** is an intermediate supporting roll **73**.

Means is provided to adjust the carriages **62, 64, 68** and **70** vertically in order to move the supporting rollers **63, 65, 69** and **71** into and out of engagement with the upper and lower backing rolls **48** and **49** and since such means is common to all carriages a description of one is considered sufficient to adequately describe this structure. Accordingly, with particular reference to the lower lefthand portion of FIG. 5, there is shown a link **74** pivotally connected at **75** to the carriage **68** and link **74** is provided with a pin **76** which may be releasably engaged by the hook end of a lever **77** which is pivotally mounted at **78** on one end of an arm **79** which in turn is pivotally mounted at the opposite end **80** on a bracket **81** secured to the beam **60**. A fluid pressure cylinder **82** is pivotally mounted at **83** on a bracket **84** secured to the beam **60** and a piston **85** slidably received in the cylinder **82** is fixed to the arm **79**. Consequently, operation of the fluid pressure cylinder **82** will move the arm **79** about the pivot **80** which in turn will pull the supporting rollers **69** carried by the carriage **68** downwardly into frictional engagement with the lower backing roll **49**.

In order to engage or disengage the hooked end of the lever **77** with the pin **76** on the link **74**, there may be provided a rod **86** pivotally connected at **87** to the end of the lever **77** and the rod **86** may be provided with a handle **88** for conveniently manipulating the same and notches **89** may be provided in the rod **86** engageable by a suitable detent to releasably maintain the rod **86** and hook end of the lever **77** in desired position.

In order to maintain the supporting rolls, intermediate supporting rolls and supporting rollers in proper relationship, there are shown in FIG. 7, upper brackets 90 and 91 and lower brackets 92 and 93. It is to be understood that these brackets are duplicated at opposite ends of the rolls and rollers and the upper brackets 90 and 91 are mounted for pivotal movement about the axes of the upper supporting rollers 63 and 65 and the lower brackets 92 and 93 are mounted for pivotal movement about the axes of the lower supporting rollers 69 and 71. Since all of the brackets are identical a description of one will suffice for all and accordingly, the bracket 92 which is shown in detail in FIG. 6, will now be described.

The bracket 92 is pivotally mounted on the shaft 94 carrying the supporting rollers 69 and the bracket 92 is provided on the inner side thereof with an elongated recess 95. Slidably mounted in the recess 95 is a bearing 96 which supports the outer end of intermediate supporting roll 72. By reason of this structure, the supporting roll 72 may move toward or away from the supporting rollers 69, but these rollers and the intermediate supporting roll 72 are maintained in proper relationship by reason of the mounting the intermediate roll 72 in the recess 95 of the bracket 92 and, of course, in the bracket at the opposite end of the intermediate roll 72. The supporting roll 56 is provided at each end with a bearing 97 and engaging such bearing is a forked member 98 provided with a plunger 99 slidably received in a bore 100 in the bracket 92. The plunger 99 and bore 100 may act as a dash pot to hold the supporting roll 56 in position or if desired, a compression spring may be provided in the bore 100 for yieldably urging the supporting roll 56 away from the intermediate supporting roll 72 and the supporting rollers 69. It will be clear that the above described structure permits relative movement between the supporting rollers 69, the intermediate supporting roll 72 and the supporting roll 56, but operates to maintain the axes of these rolls and rollers in the same plane.

In order to maintain the upper supporting rolls 54 and 55 in engagement with the upper backing roll 48 and also in order to maintain the supporting rolls 54 and 55 in engagement with the intermediate supporting rolls 66 and 67 and to maintain such intermediate supporting rolls in engagement with the supporting rollers 63 and 65 and also in order to maintain the lower supporting rolls 56 and 57 in engagement with the lower backing roll 49 and to maintain these lower supporting rolls in engagement with the lower intermediate supporting rolls 72 and 73 and at the same time, to maintain such intermediate supporting rolls in engagement with the lower supporting rollers 69 and 71 there is provided a structure, best shown in FIG. 7, and which may well comprise a combined radial and thrust bearing 101 mounted on the end of upper supporting roll 54 and a similar combined radial and thrust bearing 102 mounted on the end of the other upper supporting roll 55. Carried by the bearing 101 is an arm 103 and a similar arm 104 is carried by the bearing 102. The inner ends of the arms 103 and 104 are pivotally connected together by a pin or other suitable means 105. In a similar manner, a combined radial and thrust bearing 106 is mounted on the end of lower supporting roll 56 and a combined radial and thrust bearing 107 is mounted on the end of the other lower supporting roll 57. An arm 108 is carried by the bearing 106 and a similar arm 109 is carried by the bearing 107. The inner ends of arms 108 and 109 are pivotally connected together by a pin or other suitable means 110.

A fluid pressure cylinder 111 is pivotally connected at 112 to the outer end of arm 108 and a fluid pressure cylinder 113 is pivotally connected at 114 to the outer end of arm 109. A plunger 115 is slidably received in the fluid pressure cylinder 111 and such plunger 115 is pivotally connected at 116 to the outer end of arm 103.

In a similar manner, a plunger 117 is slidably received in the fluid pressure cylinder 113 and such plunger is pivotally connected at 118 to the outer end of arm 104.

As will be seen from an inspection of FIG. 7, the arms 103 and 104 together with the arms 108 and 109 provide toggles which may be operated by the fluid pressure cylinders 111 and 113 to move the upper supporting rolls 54 and 55 upwardly and outwardly and to move the lower supporting rolls 56 and 57 downwardly and outwardly. Varying degrees of pressure may be applied to the fluid pressure cylinders 111 and 113 in order to provide the proper degree of engagement between the supporting rolls and the associated backing rolls and intermediate supporting rolls. It is, of course, understood that the toggle mechanism above described is duplicated at the opposite ends of the upper and lower supporting rolls.

Since it is also necessary to maintain the upper and lower working rolls 52 and 53 in engagement with the upper supporting rolls 54 and 55 and with the lower supporting rolls 56 and 57 respectively there is provided a toggle mechanism for accomplishing this purpose and such mechanism is best shown in FIGS. 7 and 8. Rotatably mounted on the outer end of upper working roll 52 is a combined radial and thrust bearing 119 and a similar combined radial and thrust bearing 120 is rotatably mounted on the outer end of lower working roll 53. An arm 121 is carried by the bearing 119 and projects outwardly on opposite sides thereof and a similar arm 122 is carried by the bearing 120 and also projects outwardly on opposite sides thereof. A link 123 is pivotally connected at 124, one end of the arm 121 and a similar link 125 is pivotally connected at 126 to the opposite end of arm 121. A link 127 is pivotally connected at 128 to one end of the arm 122 and a similar link 129 is pivotally connected at 130 to the opposite end of arm 122. Links 123 and 127 are pivotally connected by a pin 131 to form a toggle and on the opposite side links 125 and 129 are pivotally connected by a pin 132 to form another toggle.

As best shown in FIG. 8 a rod 133 extends transversely of the toggle mechanisms and through the pivot points 131 and 132 and surrounding the rod 133 at one end is a compression spring 134 which at the inner end engages a washer 135 contacting the toggle formed by the links 123 and 127 at the pivot point 131 and the compression spring 134 at the outer end engages a washer 136 received on the rod 133 and retained in place by a nut 137 threadedly received on the rod 133. Pivotally mounted on the opposite end of the rod 133 at 138 is a cam lever 139 having a handle portion 140 and a cam portion 141. Operation of the cam lever 139 will, as shown in FIG. 8, operate to compress the spring 134 and thereby apply force to the toggles on opposite sides of the working rolls 52 and 53 to urge such rolls upwardly and downwardly and into engagement with the upper supporting rolls 54 and 55 and with the lower supporting rolls 56 and 57 respectively. Operation of the cam lever 139 in the opposite direction will operate to release pressure from the toggles and permit movement of the working rolls 52 and 53 away from the associated supporting rolls in order to permit removal of the working rolls 52 and 53 or for any other desired purpose. It is, of course, understood that this toggle mechanism above described, is duplicated at both ends of the working rolls 52 and 53.

In order to permit convenient removal or replacement of the working rolls 52 and 53 and the upper supporting rolls 54 and 55, as well as the lower supporting rolls 56 and 57 through the windows 44 and 45 in the members 42 and 43 forming the housing, there may as shown in FIG. 6, be provided an arm 142 pivotally mounted at 143 on a bracket 144 secured to the frame member 42, the arm 142 being swingable across the window 144 in the frame member 42. The arm 142 may be releasably secured in position across the window 44 by a latch pin 145 receivable in a recess 146 in the end of the arm 142

opposite the pivot pin 143. The arm 142 may be provided on the inner side thereof with a thrust plate 147 which serves to engage the outer ends of combined radial and thrust bearings 106 and 107 on the ends of the lower supporting rolls 56 and 57. Also provided on the arm 142 is an inwardly projecting rod 148 which serves to engage the outer end of combined radial and thrust bearing 120 on the end of lower working roll 53.

In a similar manner, an arm 149 is pivotally mounted at 150 on a bracket 151 secured to the frame member 43 and the arm 149 may swing across the window 45 in the frame member 43 and be secured in closed position by a latch pin 152 removably received in a recess 153 in the end of the arm 149 opposite the pivot pin 150. A thrust plate 154 is provided on the inner side of the arm 149 and such thrust plate serves to engage the outer ends of combined radial and thrust bearings 106 and 107 on the lower supporting rolls 56 and 57. A rod 155 extends inwardly from the arm 149 and such rod engages the outer end of combined radial and thrust bearing 120 on the end of lower working roll 53.

It will accordingly be seen that by the above described construction, the working rolls, as well as the upper and lower supporting rolls are held in axial position, but may be conveniently removed through either window 44 or 45 in the frame members 42 and 43 by opening the arms 142 or 149.

The above described invention provides a rolling mill which is unique in construction and which is particularly suitable for the purpose intended.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A rolling mill comprising a housing, upper and lower positively driven spaced backing rolls rotatably mounted in said housing, upper and lower freely rotatable working rolls disposed between said backing rolls, said working rolls being spaced from said backing rolls, an upper pair of supporting rolls engaging said upper working roll and said upper backing roll, an upper pair of rigid beams secured to said housing and disposed on opposite sides of said upper backing roll in spaced parallel relation, an upper pair of supporting rollers rotatably mounted on said beams, upper intermediate rolls disposed between said supporting rollers and said supporting rolls, said upper supporting rollers engaging said upper backing roll and said intermediate rolls and providing lateral support for said upper supporting rolls, the lower pair of supporting rolls engaging said lower working roll and said lower backing roll, a lower pair of rigid beams secured to said housing and disposed on opposite sides of said lower backing roll in spaced parallel relation and a lower pair of supporting rollers comprising a plurality of axially spaced rollers rotatably mounted on said lower beams, lower intermediate rolls disposed between said lower supporting rollers and said lower supporting rolls, said lower supporting rollers engaging said lower backing roll and said lower intermediate rolls and providing lateral support for said lower supporting rolls.

2. A rolling mill as defined in claim 1 in which said upper supporting rolls are of different diameters and said lower supporting rolls are of different diameters.

3. A rolling mill as defined in claim 1 in which the axes of two corresponding upper and lower supporting rolls are disposed a different distance from the plane of the axes of said upper and lower backing rolls than the axes of the other two corresponding upper and lower supporting rolls.

4. A rolling mill as defined in claim 1 in which an upper pair of arms are rotatably mounted on the opposite ends of said upper pair of supporting rolls, said arms projecting laterally on opposite sides of the respective upper supporting rolls, the inner ends of each upper pair of arms being pivotally connected, a lower pair of arms rotatably mounted on the opposite ends of said lower pair of supporting rolls, said lower arms projecting laterally on opposite sides of the respective lower supporting rolls, the inner ends of each lower pair of arms being pivotally connected, and fluid pressure operated means connected between the outer ends of said upper pairs of arms and the outer ends of said lower pairs of arms, whereby upon operation of said fluid pressure means to move said upper and lower pairs of arms apart, said upper and lower pairs of supporting rolls will be moved into engagement with said upper and lower backing rolls respectively and said upper supporting rolls will be moved apart and said lower supporting rolls will be moved apart.

5. A rolling mill as defined in claim 1 in which an upper pair of arms are rotatably mounted on the opposite ends of said upper pair of supporting rolls, said arms projecting laterally on opposite sides of the respective upper supporting rolls, the inner ends of each upper pair of arms being pivotally connected, a lower pair of arms rotatably mounted on the opposite ends of said lower pair of supporting rolls, said lower arms projecting laterally on opposite sides of the respective lower supporting rolls, the inner ends of each lower pair of arms being pivotally connected and pressure producing means connected between the outer ends of said upper pairs of arms and the outer ends of said lower pairs of arms, whereby upon operation of said pressure producing means to move said upper and lower pairs of arms apart, said upper and lower pairs of supporting rolls will be moved into engagement with said upper and lower backing rolls respectively and said upper supporting rolls will be moved apart and said lower supporting rolls will be moved apart.

6. A rolling mill as defined in claim 1 in which an upper arm is rotatably mounted on each end of said upper working roll, said upper arm having free ends projecting laterally on opposite sides of said upper working roll, an upper pair of links pivotally connected to the free ends of said upper arms, a lower arm rotatably mounted on each end of said lower working roll, said lower arm having free ends projecting laterally on opposite sides of said lower working roll, a lower pair of links pivotally connected to the free ends of said lower arms, said upper and lower pairs of links being pivotally connected to provide opposed toggles and resilient means for applying pressure to said toggles to urge said upper and lower working rolls into engagement with said upper and lower pairs of supporting rolls respectively.

7. A rolling mill as defined in claim 6 in which said resilient means comprises a bar extending between said toggles, a compresison spring on one end of said bar engaging one toggle and a cam lever pivotally mounted on the opposite end of said bar and engaging the other toggle, whereby upon operation of said cam lever said spring will be compressed to apply pressure to said toggles.

8. A rolling mill as defined in claim 4 and in which an upper arm is rotatably mounted on each end of said upper working roll, each of said last named upper arms having free ends projecting laterally on opposite sides of said upper working roll, an upper pair of links pivotally connected to the free ends of said last named upper arms, a lower arm rotatably mounted on each end of said lower working roll, each of said last named lower arms having free ends projecting laterally on opposite sides of said lower working roll, a lower pair of links pivotally connected to the free ends of said last named lower arms, said upper and lower pairs of links being pivotally connected to provide opposed toggles and resilient means for applying pressure to said toggles to urge said upper and lower working rolls into engagement with said upper and lower pairs of supporting rolls respectively.

9. A rolling mill as defined in claim 8 in which said resilient means comprises a bar extending between said toggles, a compression spring on one end of said bar engaging one toggle and a cam lever pivotally mounted on the opposite end of said bar and engaging the other toggle, whereby upon operation of said cam lever said spring will be compressed to apply pressure to said toggles.

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