July 26, 1938. H. H. TALBOT 2,124,677

VERTICAL MILL

Filed Sept. 20, 1933 5 Sheets-Sheet 1

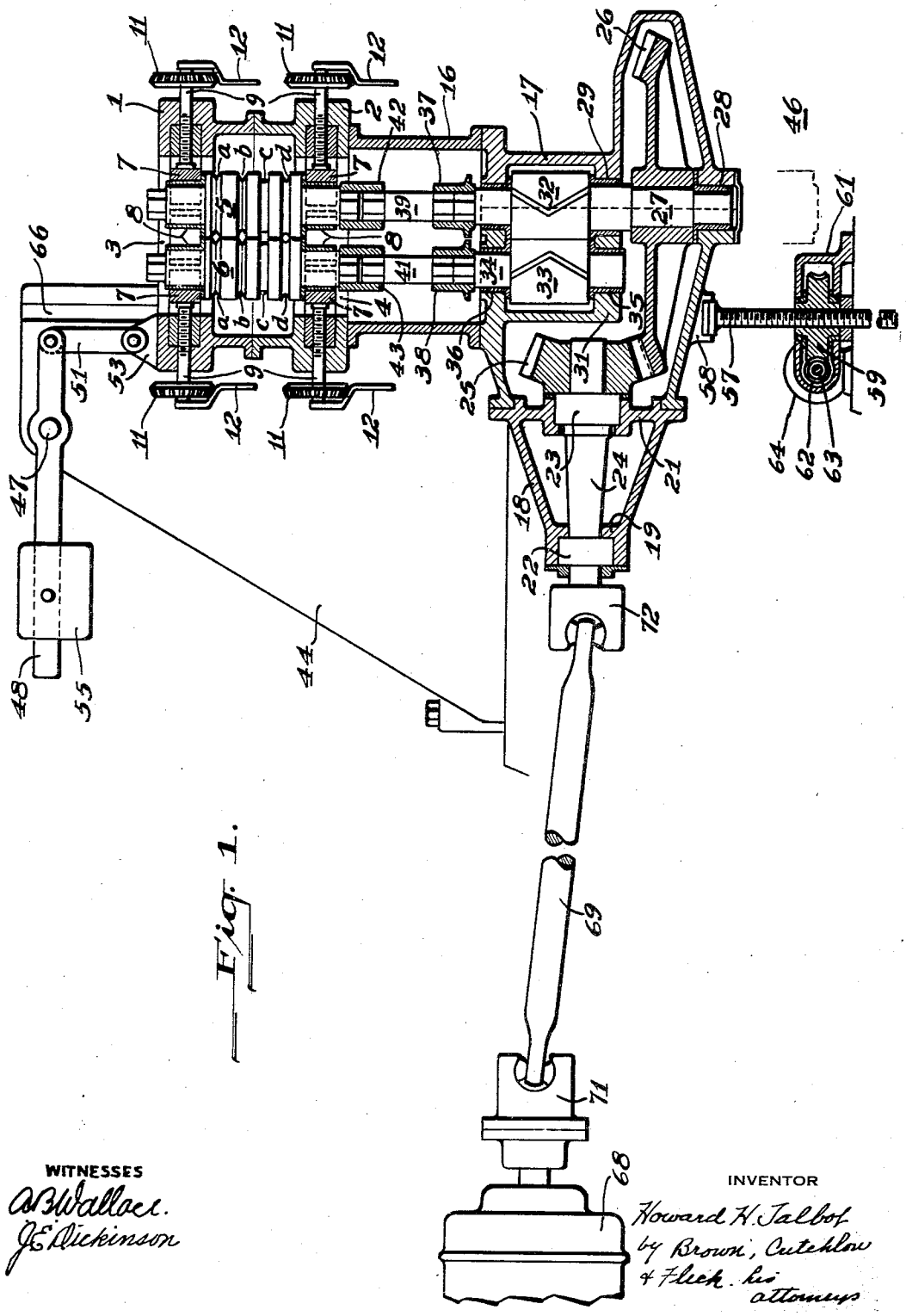

Fig. 1.

WITNESSES

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July 26, 1938. H. H. TALBOT 2,124,677

VERTICAL MILL

Filed Sept. 20, 1933 5 Sheets-Sheet 2

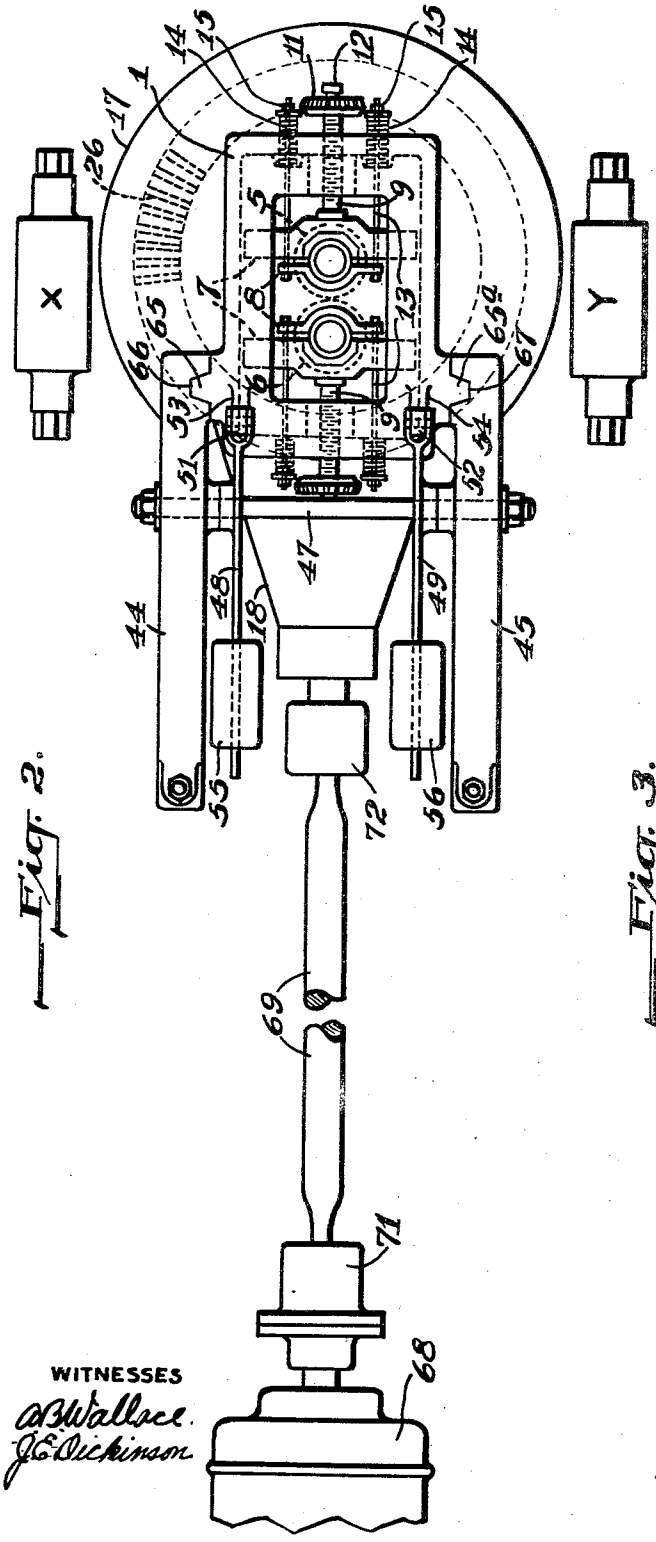
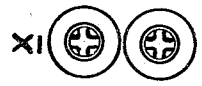


Fig. 2.



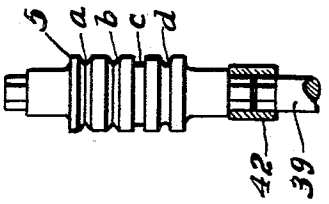
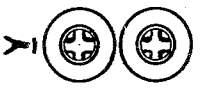


Fig. 3.



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July 26, 1938. H. H. TALBOT 2,124,677

VERTICAL MILL

Filed Sept. 20, 1933 5 Sheets-Sheet 3

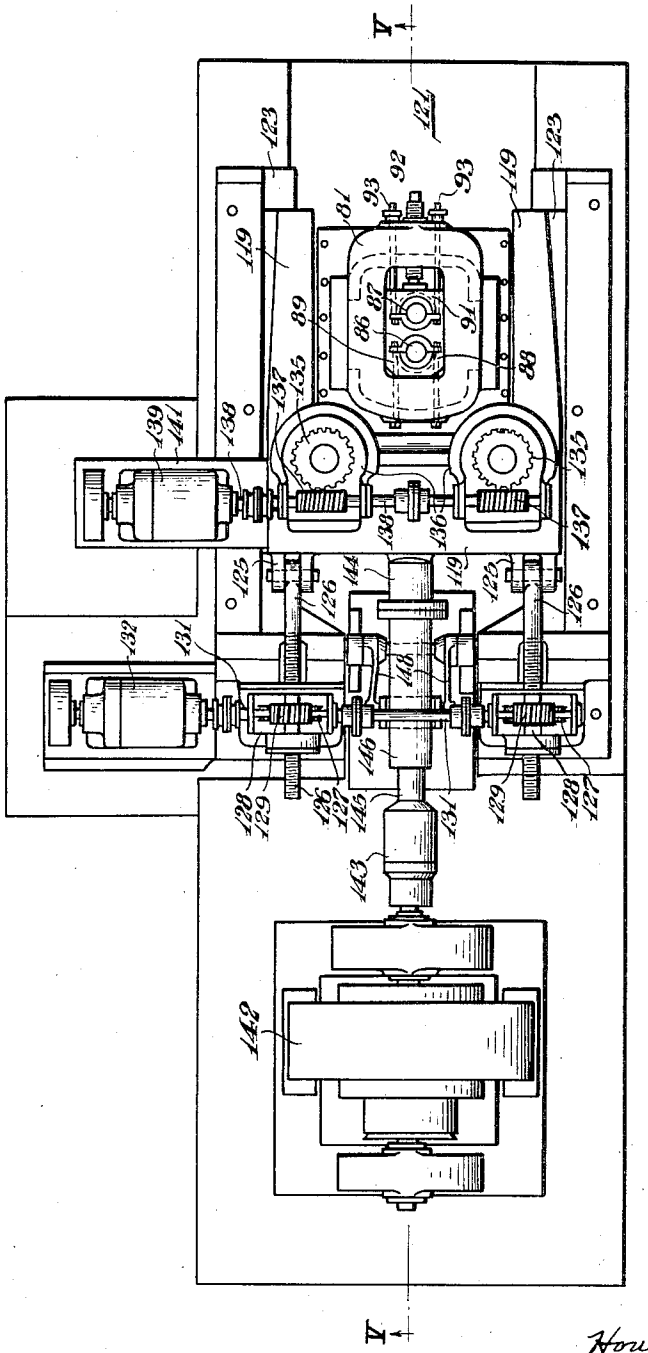

Fig. 4

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July 26, 1938. H. H. TALBOT 2,124,677

VERTICAL MILL

Filed Sept. 20, 1933 5 Sheets-Sheet 4

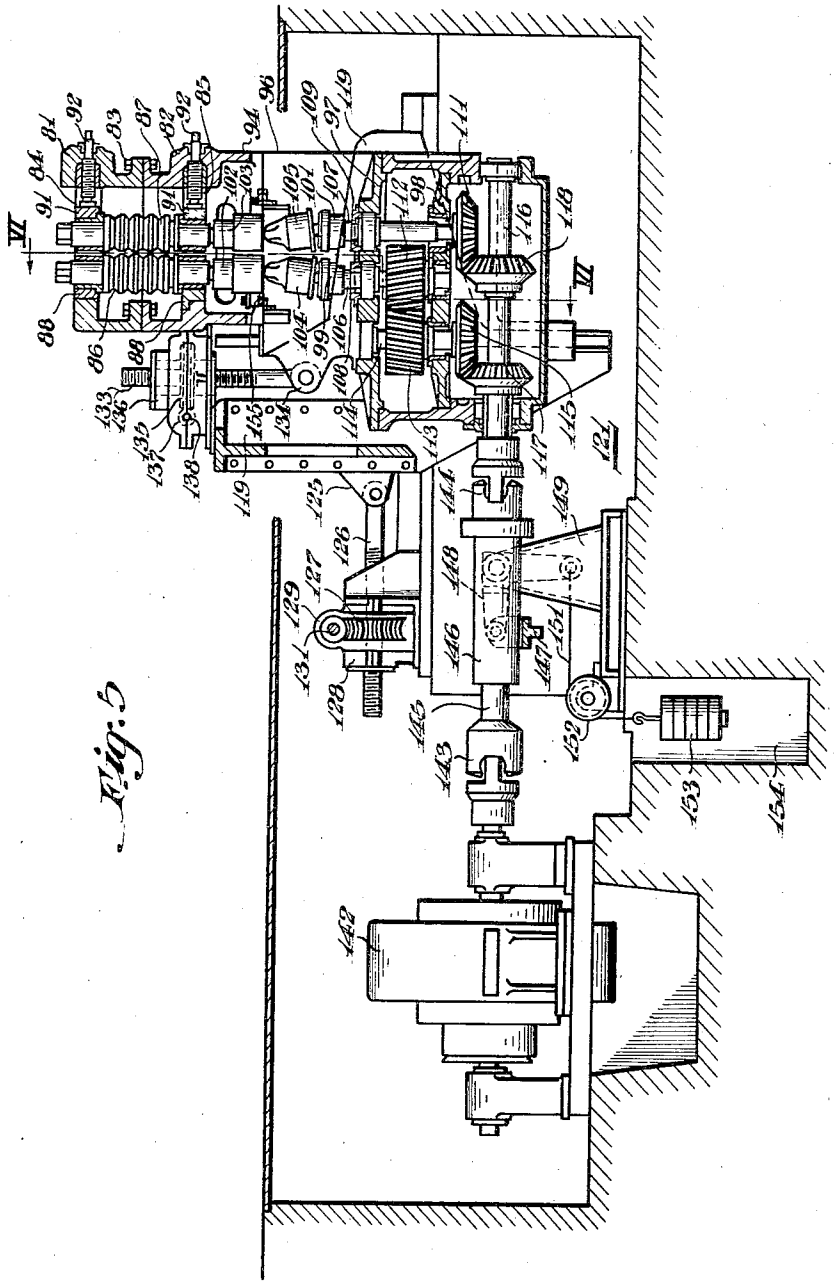

Fig. 5

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VERTICAL MILL

Filed Sept. 20, 1933 5 Sheets-Sheet 5

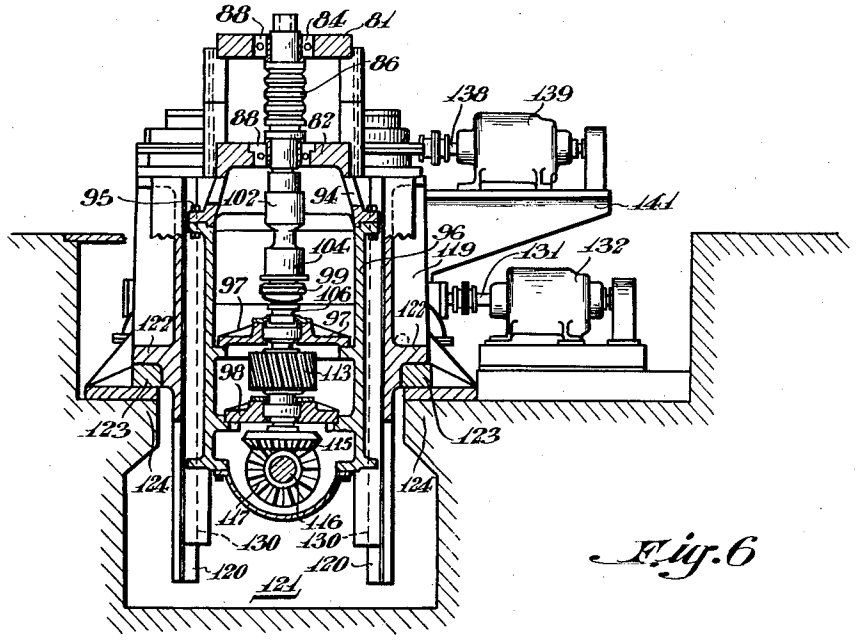

Fig. 6

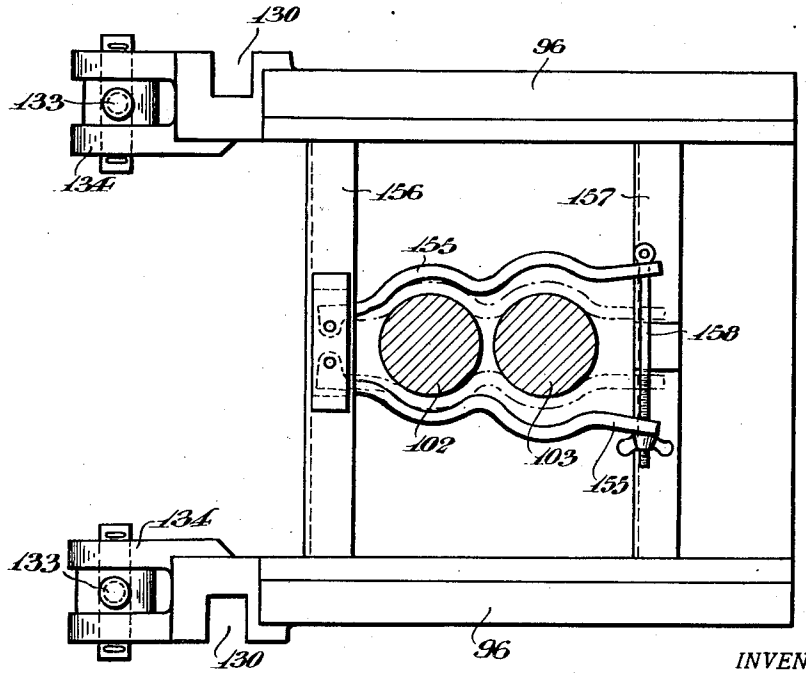

Fig. 7

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UNITED STATES PATENT OFFICE

2,124,677

VERTICAL MILL

Howard H. Talbot, Pittsburgh, Pa., assignor to United Engineering & Foundry Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application September 20, 1933, Serial No. 690,277

4 Claims. (Cl. 80—31.1)

This invention, which is a continuation in part of the invention disclosed in United States patent application Serial No. 645,767 filed by the present inventor December 5, 1932, relates to rolling mills, and more particularly to mills of the vertical roll type in which the working rolls are provided with a plurality of axially spaced working grooves.

The primary object of the invention generally stated is to provide a mill of this character which is simple and sturdy of construction, dependable in operation, easily adjustable so that its various working grooves may be adjusted to cooperate with the working grooves of a horizontal mill with which it may be associated, and equipped with an improved drive of novel form.

Another object is to provide a vertical mill which may be readily adjusted both horizontally and vertically from one working position to another and also moved entirely out of the line of passage of the stock through the working rolls of a horizontal mill with which it may be adjusted to cooperate, and all without requiring any modification or alteration of the driving connection employed for effecting its operation.

A further object is to provide such a mill with a simple rigid housing in which both the rolls and the driving gears for operating the rolls are supported.

These and various other objects as well as the various other novel features and advantages of the invention will be apparent when the following detailed description is read in conjunction with the accompanying drawings, of which Fig. 1 is a vertical section taken through a mill constructed in accordance with the invention; Fig. 2 a plan view of the mill shown in Fig. 1 and illustrating schematically the working rolls of a pair of associated horizontal mills; Fig. 3 an elevational view illustrating, respectively, the positions of the working rolls of the mill assembly shown in Fig. 2; Fig. 4 a plan view of a modified form of the invention; Fig. 5 a sectional view taken on the line V—V of Fig. 4; Fig. 6 a sectional view taken on the line VI—VI of Fig. 5; and Fig. 7 a plan view of the lower gear-supporting section of the housing with the driving gears removed.

As illustrated in the embodiment of the invention shown in Figs. 1 to 3, inclusive, of these drawings, the housing of the mill consists of a single rigid fabricated structure which houses both the working rolls and the gear assembly employed to effect their drive.

Referring to it in detail, its roll-supporting portion is made up of a pair of oblong housing sections 1 and 2 which are provided with windows 3 and 4 in which the ends of a pair of working rolls 5 and 6 are supported in the customary roll bearings. These bearings, while they may take other forms, are made to slide in the windows 3 and 4 and comprise a main backing section 7 and an inner section 8 employed more particularly for holding the rolls in position.

For adjusting the rolls 5 and 6 a plurality of screws 9 is provided in the housing sections 1 and 2, at the ends of the windows 3 and 4, and arranged to bear against the backing sections 7 of the roll bearings being equipped with turning and locking means 11 and 12 for adjusting them to and locking them in different positions. To hold the rolls in position against the backing sections 7 of the bearings a pair of connecting rods 13 is extended from the edges of the inner bearing sections 8 on either side of the rolls through the ends of the housing sections and provided with helical springs 14 which normally tend to hold the rolls against the main bearing sections 7 at all times, while to transmit the pressure of these springs 14 to the rods 13 caps or nuts 15 are mounted on the outer ends of the rods and preferably secured thereto by threaded engagement so that the pull back pressure of the springs may be adjusted.

At the bottom of the lower roll-supporting housing section 2 there is attached a hollow intermediary housing section 16 which in turn is secured to a main gear housing section 17 that has a drive shaft bearing supporting section 18 attached to one side of it. In a pair of walls 19 and 21 comprising the ends of this latter section 18 there is provided a pair of spaced bearings 22 and 23 which form the support for a drive shaft 24 by which the rolls 5 and 6 are driven. On the inner end of such shaft there is keyed a beveled pinion 25 which is arranged to mesh with a cooperating beveled gear 26 mounted on a shaft 27 which is supported in a bearing 28 located in the bottom of housing section 17, a bearing 29 located in an inner partition 31 provided in the housing section 17 and a third bearing located in the top of section 17, all of which are in substantial alignment with the center of working roll 5. On this latter shaft 27 between the wall 31 and the top of the housing section 17 a gear 32 is keyed which is meshed with a gear 33 mounted on a shaft 34 that in turn is supported in bearings 35 and 36 located in the partition 31 and the top of section 17 in substantial alignment with roll 6.

On the ends of the two shafts 27 and 34 which project in the intermediary housing section 16 there is mounted a pair of wobbler-type connectors 37 and 38 by means of which such shafts are flexibly connected to lower ends of a pair of shafts 39 and 41. These shafts in turn are connected by wobbler-type connectors 42 and 43 to the lower ends of the rolls 5 and 6, thus permitting the lateral adjustment of the rolls 5 and 6 without interfering with the drive.

To provide for vertically adjusting the mill so that any one of the plurality of working grooves *a*, *b*, *c* or *d* in the working rolls may be brought into service at a fixed roll pass elevation, or the mill entirely moved out of the line of pass of the stock, the mill housing is adjustably supported between a pair of spaced uprights 44 and 45 which are arranged at opposite sides of the mill housing and at opposite sides of a pit 46 into which the mill is adapted to be lowered. In these uprights there is provided a shaft 47 on which a pair of counterbalancing levers 48 and 49 is mounted which in turn are connected by suitable links 51 and 52 to brackets 53 and 54 provided at the sides of the inner end of the upper housing section 1. On these levers there is secured a pair of weights 55 and 56 which are adapted to practically counterbalance the weight of the mill and housing to thereby facilitate its adjustment. Below the mill a jack screw 57 is arranged to bear in a bracket 58 against the bottom of the gear housing section 17 at a point as near the center of gravity of the mill as is possible so that when the mill is raised or lowered by such screw it will tend to move in a vertical plane. For turning the screw it is threadably engaged in the hub of a worm wheel 59 mounted in a housing 61 disposed in the bottom of the pit 46, being in turn meshed with a worm 62 mounted on the drive shaft 63 of a reversible motor 64. Hence by operating the motor in one direction or the other the mill may be raised or lowered as desired.

To insure the proper alignment of the mill when it is being raised and lowered, vertical ribs 65 and 65*a* are formed on the sides of the housing sections 1 and 2 and arranged to slide in cooperating vertical grooves 66 and 67 provided in the supporting uprights 44 and 45, while for driving the mill a motor 68 or other suitable driving means or power connection is provided and connected by a shaft 69 with the drive shaft 24 supported in the gear housing section 18. The ends of this shaft are connected to the motor 68 and the gear drive shaft 24 by flexible couplings 71 and 72, respectively. These couplings may take any suitable form, a number of which are known to the art and are so constructed as to readily permit sufficient elongation of the power connection to take care of the change in distance between the motor 68 and the end of the drive shaft 24 when the mill is adjusted to different positions, thereby permitting the motor to have a permanent mounting.

In adjusting the mill set forth heretofore to bring the various working grooves of the work rolls into registration with the line of passage of the stock to be worked as established by the mills X and Y, all that need be done is to actuate the elevating motor 64 to move the mill to the position desired. This, as is obvious, may be done either with the mill running or not and without an adjustment of the drive. Furthermore, with the proper depth of pit and length of adjusting screw 57, as are contemplated by the invention, the mill may be moved or lowered entirely out of the path of the stock which is desirable at various times, while to vary the roll passes this may be readily done by merely turning the adjusting screws 9.

In accordance with the modification of the invention illustrated in Figs. 4 to 7, inclusive, a vertical mill is provided in which provision is made for adjusting the mill horizontally as well as vertically so that it may be used with a horizontal mill in which the working rolls are provided with a plurality of working grooves similar to the grooves in the working rolls of the vertical mill and adapted to cooperate with the latter in operating upon a piece of stock.

Referring in detail to this latter modification of the invention, the housing for both the rolls and the driving gears connected to such rolls as in the above-described embodiment of the invention comprises a single rigid construction which is made up of a pair of oblong roll-supporting sections 81 and 82 which are rigidly joined together by suitable bolts 83 and provided with windows 84 and 85 wherein the necks of a pair of working rolls 86 and 87 are supported. As shown, the bearings 88 for the one roll 86 are fixedly secured in the housing by means of bolts 89, while the bearings 91 for the other roll 87 are arranged to slide in the windows 84 and 85 to allow such latter roll to be adjusted to vary the size of the roll pass and permit rolls of different sizes being used. For adjusting such roll a pair of adjusting screws 92 is mounted in the ends of the sections 81 and 82 opposite the roll 87 and a plurality of bolts 93 is provided for clamping the outer section of these bearings against the inner section and the screws 92 when the roll is adjusted to a selected position.

The lower of the roll-supporting sections of the housing which is provided with a depending portion 94 about its periphery is connected by bolts 95 to the crank-supporting section 96. In the central portion of this latter section there is secured a horizontally disposed bearing-supporting wall 97 and at the required distance below it a similar wall 98 is mounted. Between the upper of such supporting walls and the rolls 86 and 87 there is arranged a pair of spindles 99 and 101 which comprise a pair of couplings 102 and 103 arranged to engage the ends of the roll necks, a pair of flexible connectors 104 and 105 adapted to allow for disalignment of the spindles, and a pair of stub shafts 106 and 107 which are supported in bearings 108 and 109 mounted in the wall 97.

The shaft 107 which is connected by the associated spindle 101 to the adjustable roll 87 is extended downwardly through the lower bearing wall 98 and equipped at its lower end with a miter gear 111. The other roll-actuating shaft 106 is connected to a gear 112 supported between the bearing-supporting walls 97 and 98 which is meshed with a similar gear 113 likewise supported between such walls. The latter gear is mounted on a shaft 114 which like the shaft 107 is projected below the lower bearing supporting wall 98 and equipped with a miter gear 115 at its lower end. Below these two miter gears 111 and 115 there is arranged a drive shaft 116 which is supported in suitable bearings located in the lower end of the lower housing section 96 and at one end projected through the rear wall of the housing to receive a driving connection from a suitable source of power which will be presently described. On this drive shaft there is provided a pair of miter gears 117 and 118, respectively, which are arranged to mesh with the first-mentioned miter

gears 111 and 115 to which the roll spindles are connected.

To render the mill horizontally adjustable so that it may be adjusted to place the grooves of its working rolls opposite any one of a number of grooves provided in the working rolls of a horizontal mill, the above-described mill housing is supported on a horizontally adjustable frame 119 which in plan is substantially U-shape. This frame as shown best in Fig. 6 is mounted in a mill pit 121 and provided on its lateral sides with horizontally disposed axially extending outwardly projecting ribs 122 that are arranged to slide on a pair of wear plates 123 mounted on suitable ledges 124 provided on the sides of the pit 121. On the rear wall of such frame adjacent its lateral edges as shown in Figs. 4 and 5 a pair of connecting lugs 125 is provided and to these a pair of screws 126 is secured. These screws are threadably engaged in a pair of worm wheels 127 mounted in suitable supporting stands 128. Cooperating with such worm wheels is a pair of worms 129 mounted on a shaft 131 that is connected to a reversible motor 132 by which the horizontal adjustment of the mill is effected.

To adjust the mill vertically so as to place the different grooves in their working rolls in operative alignment with the working grooves of an associated horizontal mill and also provide for moving the mill out of the path of the stock for the purpose discussed hereinbefore, a pair of screws 133 is connected to a pair of lugs 134 provided on the opposite sides of the rear wall of the mill housing adjacent the upper edge of the lower section 96. These latter screws are engaged in a pair of worm wheels 135 mounted in suitable supports 136 located on the top rear end of the mill-supporting horizontally-adjustable frame 119. Cooperating with them is a pair of worms 137 which are keyed to a shaft 138 that is connected at one end to a reversible motor 139. This motor, as shown best in Fig. 6, is mounted on a bracket or support 141 which is secured to the horizontally adjustable frame 119 to adapt it to move with such frame when the latter is moved to adjust the mill horizontally. In order to guide the mill housing on its vertical movement in the supporting frame 119 the latter is provided with a pair of vertical ribs 120 which are disposed to fit in a pair of cooperating grooves 130 formed in the opposite sides of the housing section 96.

The driving power for the mill is provided by a motor 142 which is mounted in the mill pit 121 and flexibly connected to the drive shaft 116 located in the mill housing section 96 in such a way as to permit the mill to be adjusted both horizontally and vertically without interfering with the driving connection. This connection comprises a pair of universal couplings 143 and 144 which are mounted respectively on the adjacent ends of the drive shaft of the driving motor 142 and the drive shaft 116 of the mill. To the former of these couplings there is connected an inner splined shaft 145, and to the latter an outer telescoping shaft 146 which is splinably engaged with the former. Such joints and splined connections as will be readily appreciated permit all the movements required of the mill without interfering with the drive. To counterbalance the weight of the splined drive connection a cradle 147 is provided and arranged to engage the outer telescoping section 146 of the drive shaft, such cradle being supported by a pair of bell cranks 148 mounted on opposite sides of the shaft 146 in a bearing stand 149. The lower ends of these cranks are connected by cables 151 which are extended over a pair of pulleys 152 to a pair of weights 153 suspended in holes 154 provided in the base of the pit.

In such mills it is contemplated that the rolls may be changed by lifting the two upper sections 81 and 82 of the mill housing with the rolls therein from the base section 96 by removing the bolts 95 and after such sections are removed replacing the rolls in the most convenient manner available. In order that this operation and the replacement of the upper section of the housing rolls may be accomplished with the least difficulty, a pair of clamps 155 is mounted in a pair of cross bars 156 and 157 secured to the top of the housing section 96, and employed to hold the spindles 99 and 101 in position to receive the ends of the rolls when the upper sections of the housing are replaced on the lower section. Such clamps, of course, are normally maintained in their open position out of engagement with the spindles but are provided with a thumb screw 158 for clamping the spindles in the desired positions when new rolls are being placed in the mill.

Among the advantages of this latter embodiment of the invention as will be appreciated by those skilled in the art a mill is provided which may be used with a horizontal mill equipped with a plurality of working grooves in its working rolls and easily and quickly adjusted to align the working grooves of the vertical mill with those of the horizontal mill. Furthermore, it is provided with a most efficient and durable drive which requires no alteration or modification whatever during the operation of the mill.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A rolling mill comprising a rigid roll housing, a pair of vertically disposed working rolls mounted in said housing, means for adjusting one of said rolls to vary the roll pass, a flexible driving assembly including gearing interconnecting the rolls and mounted in said roll housing, a fixedly mounted motor, a shaft flexibly connecting said motor to said driving assembly a supporting frame for said housing mounted for movement in a horizontal plane, vertically adjustable means mounted on said supporting frame for holding said housing in said frame, a motor also mounted on said frame for actuating said vertically adjustable housing supporting means, and means for adjusting said frame and housing horizontally.

2. A rolling mill comprising a housing consisting of a plurality of rigid sections rigidly connected together, a pair of vertically disposed rolls mounted on a pair of said sections which are detachably connected to a third drive-encasing section, a drive including a pair of flexible spindles mounted on said latter section for actuating said rolls, and means for clamping said spindles in a fixed position when said rolls mounted in the detachable housing sections are being mounted on the drive-encasing section.

3. A vertical mill comprising a stationary base,

a frame mounted thereon and adapted for horizontal movement relative to said base, a mill housing mounted in said frame and adapted for vertical movement relative to said frame, said housing projecting in its operable position above said frame as a whole.

4. A vertical mill comprising a stationary base, a frame mounted thereon and adapted for horizontal movement relative to said base, a mill housing mounted in said frame, a pair of vertically disposed rolls and a driving gear assembly therefor all mounted in said housing, a stationary drive offset from said housing means for transmitting power to said driving gear assembly, and means mounting the mill housing in the frame for vertical movement to position the working portions of the rolls in their operating position completely above the frame.

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