Dec. 19, 1939. E. A. MATTESON ET AL 2,183,890

GALVANIZING MACHINE

Filed April 6, 1938

3 Sheets-Sheet 1

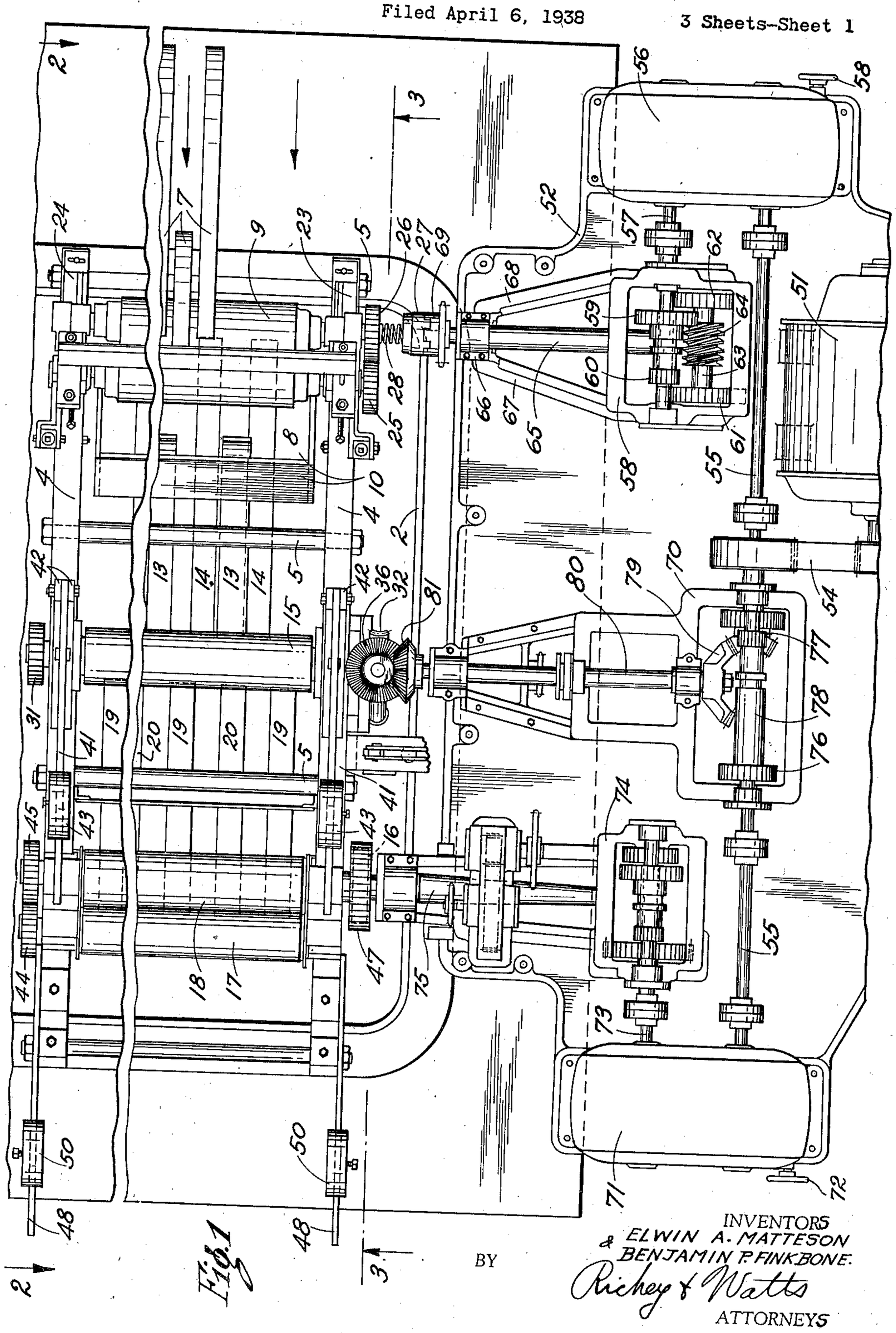

Fig. 1

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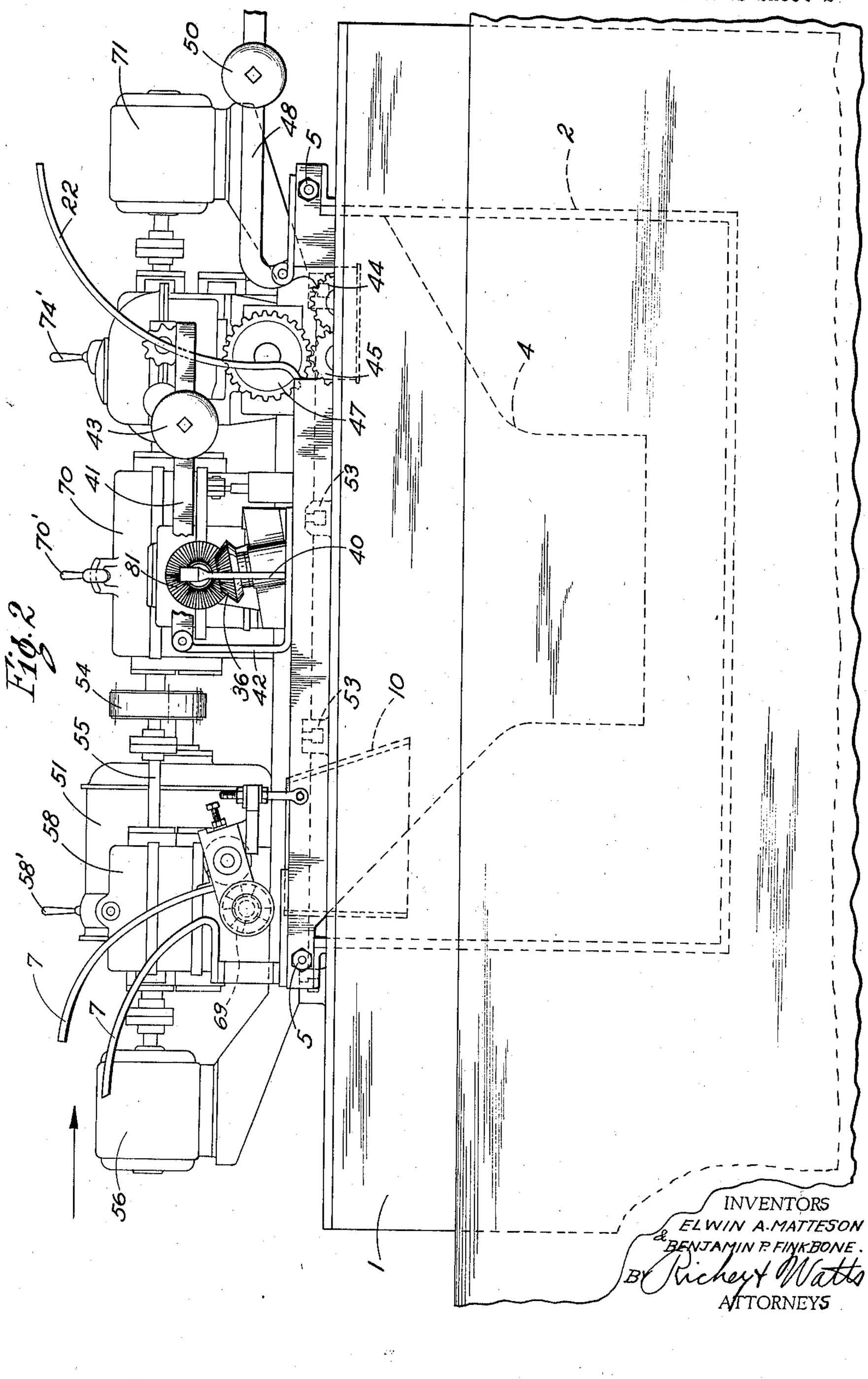

Fig. 2

Dec. 19, 1939. E. A. MATTESON ET AL 2,183,890

GALVANIZING MACHINE

Filed April 6, 1938 3 Sheets-Sheet 3

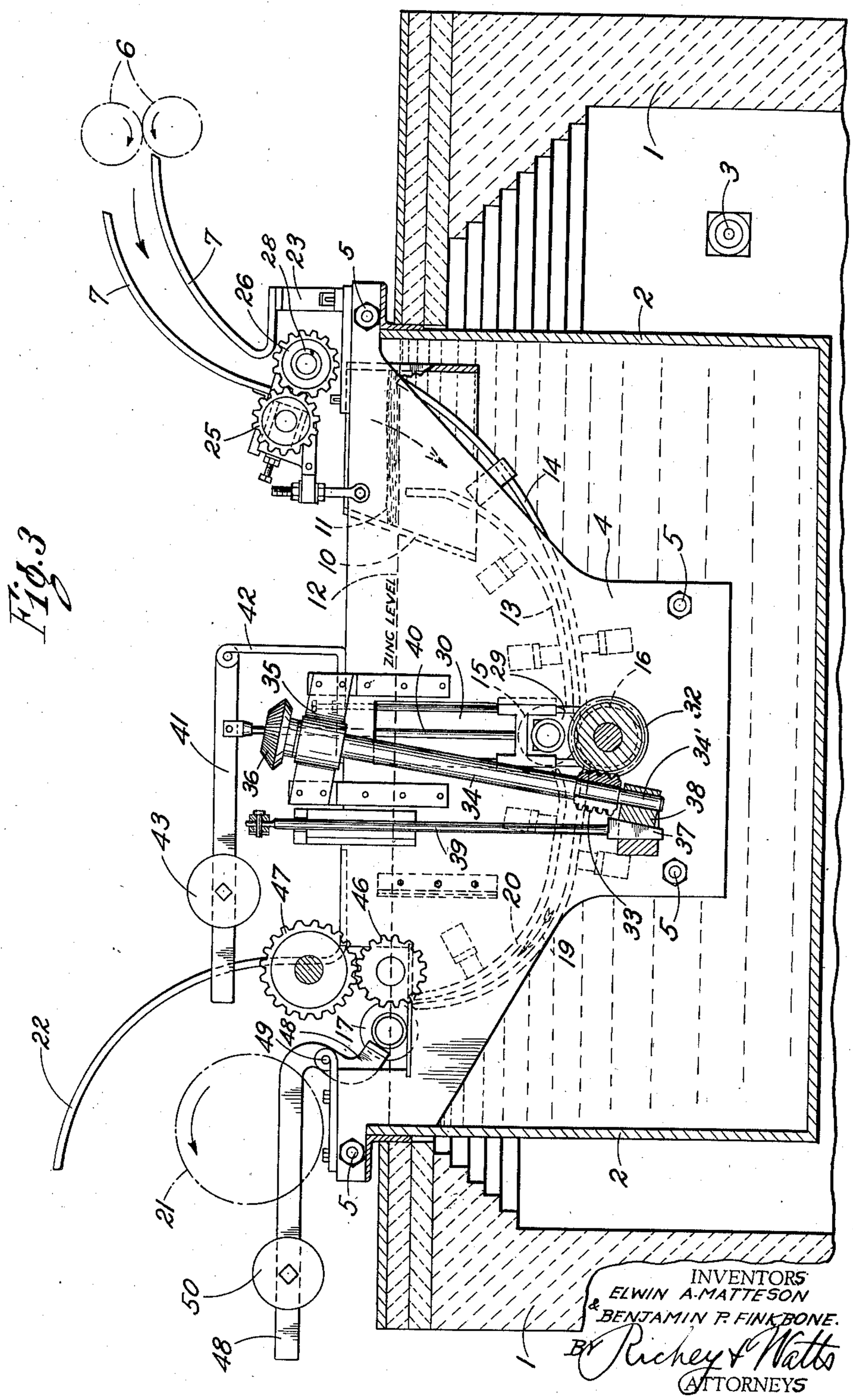

Fig. 3

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2,183,890

GALVANIZING MACHINE

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Application April 6, 1938, Serial No. 200,486

2 Claims. (Cl. 91—12.7)

This invention relates to metal coating and more particularly to improved mechanism for obtaining and maintaining complete synchronism of the rolls of sheet galvanizing machines, or other similar metal coating machines.

In the art of galvanizing sheets a machine is commonly used which consists of a pair of flux or entry rolls, a pair of bottom rolls, and a pair of exit rolls. The flux rolls feed the sheet to be galvanized through a layer of flux and into the bath of molten spelter and the bottom rolls carry the sheet through the molten spelter to the exit rolls, which are placed at the level of the molten bath. As it is important that the sheet be in two pairs of rolls at one time to assure continuous travel, the surface speed of all the rolls must be substantially the same and uniform to avoid buckling and scratching. Also, as each pair of rolls is working under different conditions, the flux rolls in air, the bottom rolls completely immersed in the molten zinc, and the exit rolls half immersed, different degrees of wear and alloy build up take place. This alloy build up on the rolls, caused by the alloying of zinc and iron, often makes an appreciable difference in the diameter of the bottom rolls and thus results in non-uniform speed both in the entering and exit ends of the unit. Such differences in roll speeds cause scratches and buckles and produce sheets unfit for the trade.

The exit rolls require changing more often than the bottom and flux rolls and it is often necessary to machine these exit rolls to obtain a proper surface for good coating of the sheets. Change gears and variable speed transmissions have been used for some time to compensate for differences in diameter of the bottom rolls and the exit rolls. Such arrangements were effective as far as the exit end of the machine was concerned, but difficulties still arose in the entry end due to different surface speeds of the flux and bottom rolls.

It is therefore among the objects of our invention to provide a drive for a galvanizing machine of the type described such that the operator may have perfect stepless speed control both between the flux rolls and the bottom rolls and between the bottom rolls and the exit rolls. Other objects of our invention are the provision of a galvanizing machine drive which will eliminate scratches and buckles of the sheet, thus producing a greater amount of salable product; the provision of a galvanizing machine in which the rolls may be re-machined when necessary without holding to fixed diameters as is required when change gear transmissions are employed; the provision of a galvanizing machine in which light gauge material, for example, from 24 to 30 gauge sheets, may be maintained under slight tension while in the galvanizing bath, thus assuring against buckling of the sheets; the provision of a galvanizing machine in which the flux rolls and the exit rolls may be changed when necessary without regard to their diameter relation to the bottom rolls; the provision of a drive for galvanizing machines which permits of the compensation in speed necessary due to alloy build up on the bottom rolls and the provision of a galvanizing machine in which the speed of the entire unit may be changed to suit various gauges of metal and coating conditions without disturbing the speed relation between the various sets of rolls.

The above and other objects and advantages of our invention are obtained by our improved apparatus, one embodiment of which is illustrated in the accompanying drawings. Broadly speaking, we have accomplished the above noted desirable results by driving the bottom rolls of the galvanizing machine directly from a variable speed power source, placing a stepless variable speed transmission between the bottom roll drive and the flux roll drive, and placing a second stepless variable speed transmission between the bottom roll drive and the exit roll drive. Thus, all rolls can be set to a uniform surface speed and any subsequent change in speed of the power supply will cause the speed of all of the rolls to be raised or lowered in perfect synchronism. Also, with any change of diameter of any pair of rolls, whatever the cause, the speeds can immediately be adjusted so that they are again properly synchronized.

In the drawings—

Figure 1 is a plan view of a galvanizing machine incorporating our improved drive and roll control, some of the cover plates, etc., being removed more clearly to show the arrangement of parts.

Figure 2 is a side elevation of the apparatus shown in Figure 1 taken from the side of the machine indicated by line **2—2** of Figure 1.

Figure 3 is a vertical cross-sectional view of the galvanizing machine illustrated in Figure 1 and taken on line **3—3** of Figure 1.

As will be best seen from Figures 1 and 2, the set up of equipment includes the usual refractory material furnace structure **1** in which the metal galvanizing kettle **2** is disposed. Fuel is burned in the space between the walls of the

furnace 1 and the kettle 2 and may be supplied through suitable burners, such as indicated at 3. The galvanizing machine is supported in the kettle 2 and includes a pair of spaced supporting plates 4 which are secured together by transversely extending rods or bolts 5. These plates are supported on the top edges of opposite sides of the kettle 2 and form the main support for the sheet moving rolls, guides, adjusting mechanisms, etc., of the machine. Sheets are fed to the galvanizing machine in any suitable manner as by the rolls 6 and are guided by the guide bars 7 into the flux or entry rolls 8 and 9. These rolls feed the sheet down through the flux box 10 which extends across the kettle 2 between the spaced plates 4 and is open at its top and bottom to permit the sheets to enter and leave while maintaining a layer of flux 11 on the surface of the spelter 12 in the kettle. As the sheet leaves the flux rolls 8 and 9 it enters the guide strips 13 and 14 which guide it to the bottom rolls 15 and 16. From these bottom rolls the sheet is guided to the exit rolls 17 and 18 by suitable guides 19 and 20.

As the sheets leave the galvanizing bath they may pass over a large roller, indicated at 21, and be guided by a curved bar 22 to a suitable conveyor or other means for carrying the sheets away from the galvanizing machine.

As is clearly seen in Figures 1 and 3 the flux or entering rolls 8 and 9 are rotatably supported in brackets 23 and 24 and are geared together for simultaneous rotation by gears 25 and 26. The jaw clutch coupling member 27 is secured to the shaft of the roll 9 through a coil spring connection 28. The lower bottom roll 16 is supported in suitable bearings in the side plates 4 and the upper bottom roll 15 is journalled at its ends in bearing blocks 29 which are vertically slidable in slots 30 which extend through the side plates 4. The two bottom rolls 15 and 16 are also geared together by gears 31, the upper of which is seen in Figure 1.

A worm gear 32 is mounted on the opposite end of the shaft of the lower bottom roll 16 from the gear 31 and is disposed outside of the adjacent supporting plate 4. This worm gear 32 engages a worm 33 carried by upwardly extending shaft 34. The upper end of shaft 34 has a bearing in the bracket 35 which is secured to the side plate 4 and a bevel gear 36 is mounted on its upper end. Means are provided for adjusting the position of the lower end of the shaft 34 and the worm 33 relative to the worm gear 32, such means include a tapered adjusting wedge member 37 which fits into a correspondingly tapered aperture in the half-bearing block 38. This block is adapted to engage the lower extended end 34' of the shaft 34 and to exert a pressure tending to push the worm 33 into engagement with the worm gear 32. An operating rod 39 extends up to the top of the apparatus and suitable means, not shown, are provided to lift or lower the rod 39 thus varying the position of the worm 33 toward or away from the worm gear 32.

A rod 40 is secured to the sliding bearing block 39 of the upper bottom roll 15 and is pivoted at its upper end to a lever 41. A bracket 42 provides a pivotal support for the end of the lever 41 and a slidable adjustable weight 43 permits the pressure which is exerted through the rod 40 upon the bearing for the roll 15 to be increased or decreased in accordance with operating requirements.

The exit rolls 17 and 18 are also supported by the side plate frame members 4. Gears 44 and 45 connect the rolls 17 and 18 and the roll 18 is provided at its opposite end with a gear 46 which is driven by the gear 47 of the driving mechanism, as will be later described.

As indicated in Figure 3 the spelter level is maintained at approximately the center line of the rolls 17 and 18 so that these rolls are operating half in air and half in molten zinc. In order to maintain the desired pressure between the rolls, the ends of the roll 17 are engaged by a lever arm 48 which is pivoted at 49 and which carries an adjustable weight 50 at its outer end. By changing the position of the weight 50 on the lever 48 the pressure of the exit roll 17 upon the exit roll 18 may be adjusted as desired.

Our improved drive control mechanism for the galvanizing machine described above is best seen in Figures 1 and 2. The variable speed drive motor 51 is mounted on a frame or base 52 which is preferably so supported on slideways 53 (see Fig. 2) that the base 52 and all its associated mechanisms can be moved to a limited degree toward and away from the kettle 2. This movement of the drive mechanism is desirable in order to permit withdrawal of the drive mechanism from engagement with the corresponding parts of the roll carrying mechanism when it is desired to lift the rolls from the galvanizing kettle.

The motor 51 is connected by a belt or chain 54 to drive the shaft 55. One end of the shaft 55 extends to the stepless variable speed transmission device indicated at 56. This variable speed transmission may be of any suitable variety which is adapted to give an inflinte number of speed ratios between its driving shaft 55 and the driven shaft 57. The adjusting handle 58 is adapted to regulate the speed ratio between shafts 55 and 57. The shaft 57 extends into the two-speed gear box 58 which has a pair of connected change speed gears 59 and 60 slidably mounted on the shaft 57. As illustrated, these gears are shown in neutral position but they may be moved on the shaft 57, being keyed or splined thereto, so that gear 60 engages the gear 61 or the gear 59 engages gear 62. The gears 61 and 62 are mounted on a shaft 63 along with the worm 64. The worm 64 engages a worm gear (not seen in the drawing) which is secured to the end of the shaft 65 which is supported at its outer end by a suitable bearing 66 carried by the arms 67 and 68 and carries at its end a jaw clutch coupling member 69 which engages with the coupling 27, as shown in Figure 1, to complete the drive to the flux rolls 8 and 9. The portion of the shaft 55 which extends to the left of the driving belt or chain 54 (Fig. 1) passes through the change speed gear box 70 to the stepless variable speed transmission unit 71. This unit may be exactly the same as the unit 56 and includes a control handle 72. The driven shaft 73 from the transmission 71 extends into the two-speed gear box 74, which in turn drives the shaft 75. The gear box 74 may be substantially the same as gear box 58 and provides the same two-speed ratios between shafts 73 and 75 as are provided between shafts 57 and 65. The gear 47 is carried at the end of shaft 45 and engages the gear 46 on the exit roll 18 and thus the drive to the exit rolls 17 and 18 is completed in generally the same manner as the drive to the flux rolls 8 and 9.

The change speed gear box 70 includes the gears 76 and 77 which are carried by a sleeve 78 slidably keyed or splined to the shaft 55. This

permits two different speeds to be imparted to the bevel gear 79 which is mounted on the shaft 80. The bevel gear 81 at the opposite end of the shaft 80 engages the bevel gear 36 on the top of the bottom roll drive shaft 34

The shifting of the change speed gears in the gear boxes 58, 70 and 74 is controlled by the handles 58', 70', and 74' illustrated in Figure 2. In operation these gear boxes are always so set that all of the drives are either in high speed or in low speed and the purpose of the gear boxes is to increase the total speed range of the drive for the galvanizing machine. For example, when all of the gear boxes are set in low speed the lineal speed of the sheet through the machine might be varied from say 10 feet per minute to 40 feet per minute by varying the speed of the motor 51 while, when all of the change speed gear boxes are in high speed position the range of rate of travel of the sheets through the machine might be from 40 feet to 160 feet per minute, the range of motor speed remaining the same, of course, in both instances.

In the operation of our improved galvanizing machine, it will be seen that by varying the speed of the motor 51 through any suitable control means (not shown) the speed of the bottom rolls 15 and 16 may be set to give the desired lineal speed of the sheets through the bath. By means of the independently controlled stepless transmissions 56 and 71 the speeds of the flux rolls 8 and 9 and of the exit rolls 17 and 18 may be adjusted independently of each other, so that the proper relationship is established between the speed of the flux rolls and the bottom rolls and the speed of the exit rolls and the bottom rolls. As noted above numerous factors may vary this relationship, such as replacing the exit rolls with rolls of different diameter. When this occurs it is only necessary for the operator to move the handle 72 until the speed of the rolls 17 and 18 is such that their surface speed is substantially the same as that of the bottom rolls 15 and 16. In like manner, the speed of the flux rolls 8 and 9 may be controlled to compensate for any changes in roll diameter, etc.

After the three sets of rolls have been set to the same surface or peripheral speed the speed of the entire group can be varied as a unit by merely varying the speed of the motor 51, thus permitting the rate of travel of the sheets through the spelter to be set to give the best galvanizing results.

It will be seen from the above description of one embodiment of our invention that our improved control mechanism provides an exceedingly flexible and universal means for varying the speeds of the three sets of rolls employed in the usual type of galvanizing machine, completely overcomes all problems of synchronization and eliminates scratching and buckling of the sheets. Rolls may be changed without regard to the diameter of the other sets of rolls being used in the machine and the operator can very easily re-set the machine to give the best galvanizing results by merely adjusting the stepless transmissions.

Although we have described the illustrated embodiments of our invention in considerable detail it will be understood that variations and modifications can be made without departing from the spirit of our invention. For example, the change speed gear boxes 58, 70 and 74 might in some cases be omitted, particularly where a great range of sheet speeds is not required. Furthermore, our drive and control mechanism is readily adaptable to types of roll arrangements other than that illustrated and to metal coating equipment other than that designed for galvanizing, and we do not, therefore, wish to be limited to the specific form of our invention herein shown and described, but claim all embodiments thereof coming within the scope of the appended claims.

We claim:

1. In a galvanizing apparatus of the type described, the combination of a pair of flux rolls, a pair of exit rolls, a pair of bottom rolls, means for driving said rolls including a single source of power, driving means connecting said pair of bottom rolls to said source of power, driving means including a stepless variable speed change mechanism for connecting said source of power to said flux rolls, and driving means including a second independently operable stepless variable speed change mechanism for connecting said source of power to said exit rolls, said speed change mechanisms being operable while the rolls are being driven either to increase or decrease the speed of rotation of said flux and/or exit rolls without changing the speed of rotation of said bottom rolls.

2. In galvanizing apparatus of the type descibed, the combination of a pair of flux rolls, a pair of exit rolls, a pair of bottom rolls, means for driving said rolls including a single source of power, driving means connecting said pair of bottom rolls to said source of power, driving means including a stepless variable speed change mechanism for connecting said source of power to said flux rolls, driving means including a second independently operable stepless variable speed change mechanism for connecting said source of power to said exit rolls, said speed change mechanisms being operable while the rolls are being driven either to increase or decrease the speed of rotation of said flux and/or exit rolls without changing the speed of rotation of said bottom roll, and a change speed gear mechanism in each of the driving connections from said power source to said pairs of rolls.

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