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[54] **SHIFTABLE MULTIPLE ROLL FORMING APPARATUS**

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[52] **U.S. Cl.** **72/181**, 72/228, 72/234

[51] **Int. Cl.** **B21d 5/08**, B21d 5/14

[58] **Field of Search** 72/176, 177, 178, 72/179, 180, 181, 227, 228, 234, 226, 232, 233

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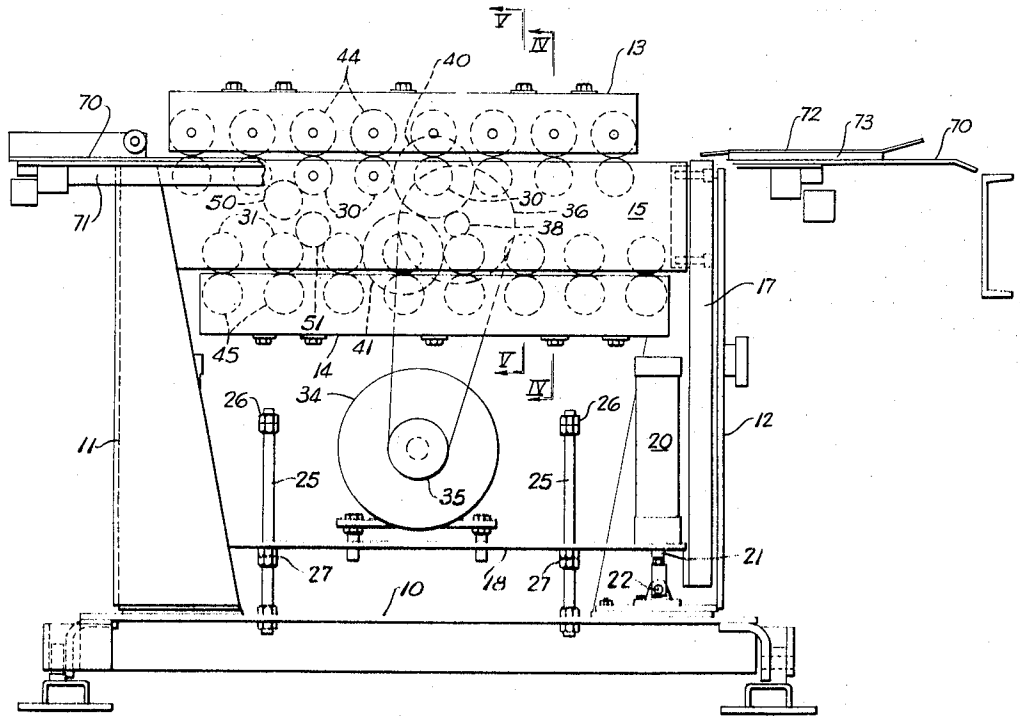
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[57] **ABSTRACT**

A roll forming apparatus for sheet metal comprises a generally stationery framework having a vertically movable carriage supported thereby, which carriage includes two separate sets of progressive forming rolls, one above the other. The carriage is movable vertically by fluid cylinder means to dispose either of the two sets of forming rolls at a particular working level to selectively form two different types of formations in a work sheet. A drive motor for the forming rolls and the transmission therefrom to the forming rolls is mounted upon the vertically movable carriage.

6 Claims, 5 Drawing Figures



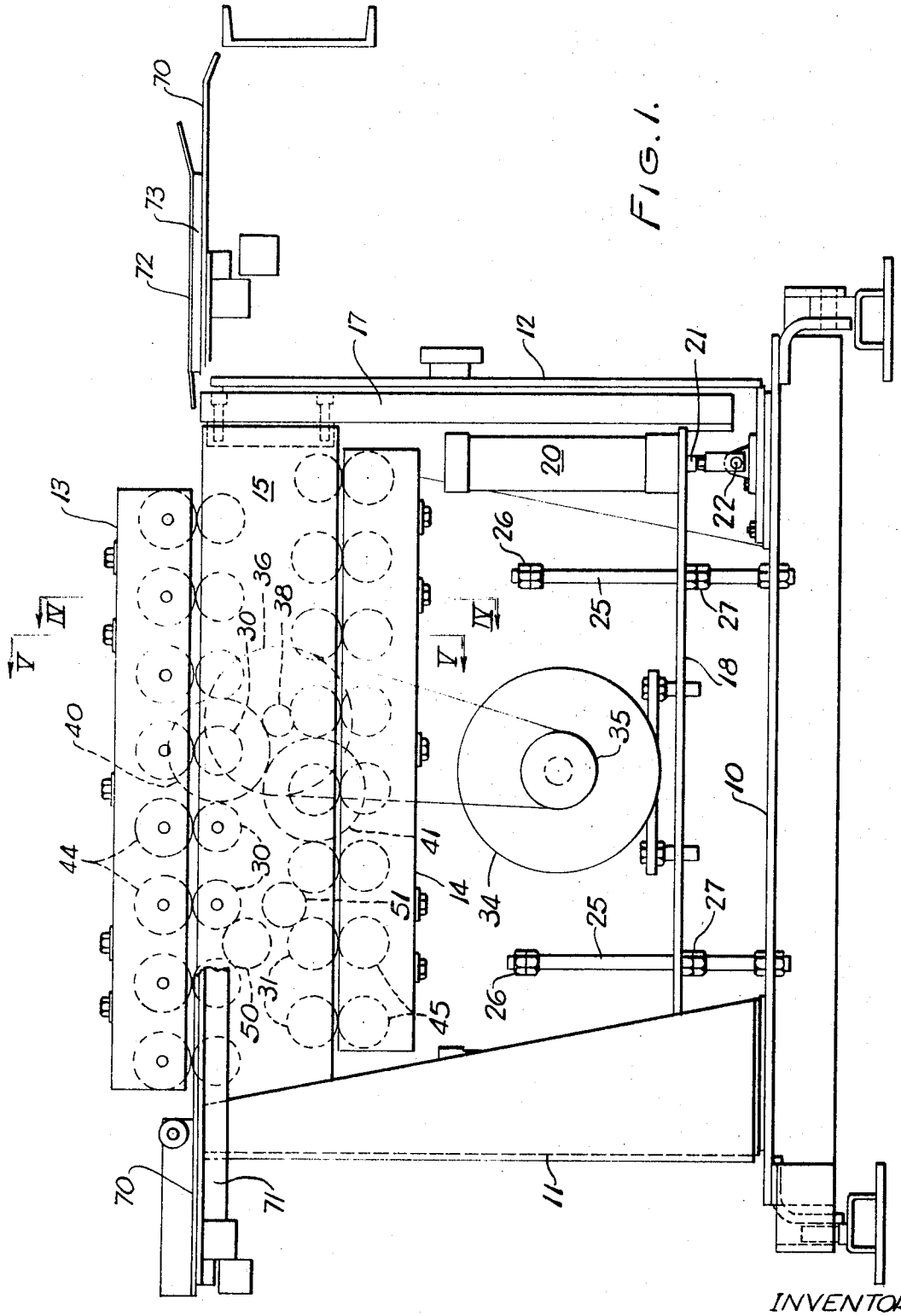


FIG. 1.

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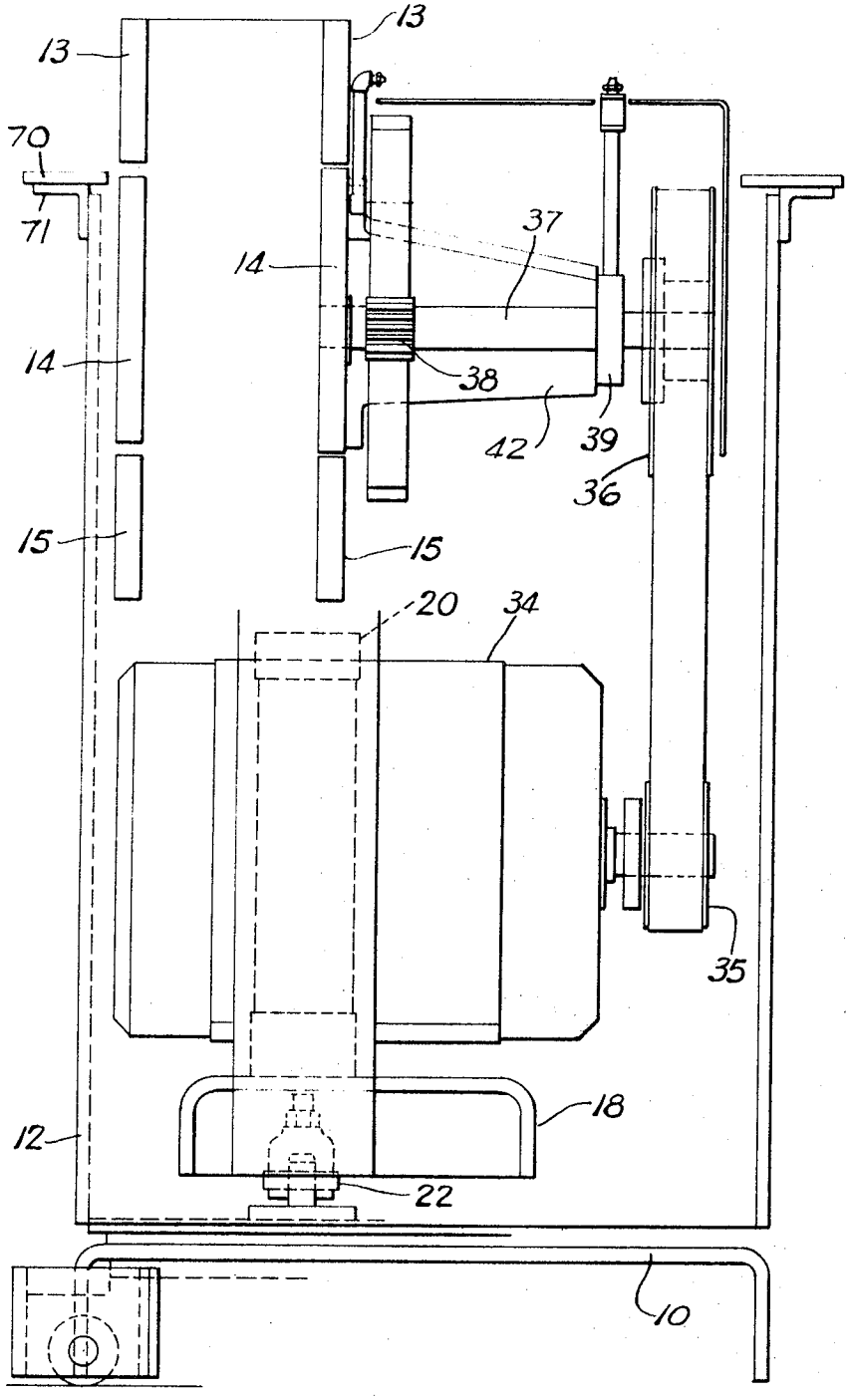


FIG. 2.

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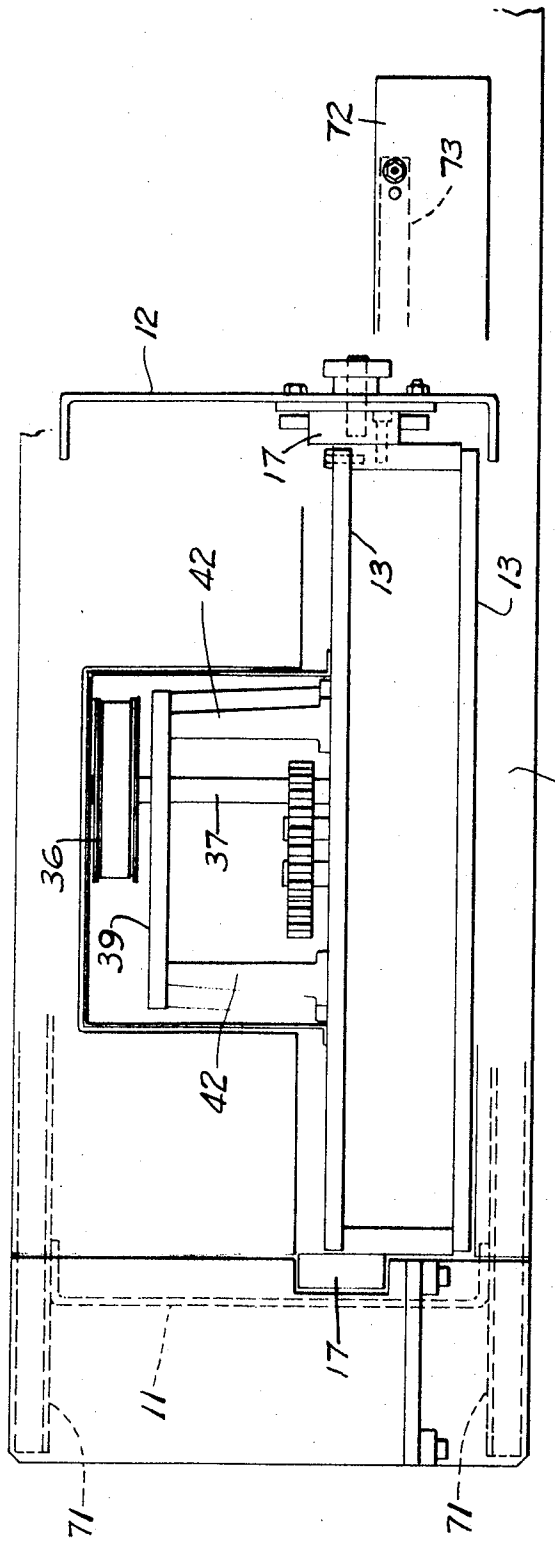


FIG. 3.

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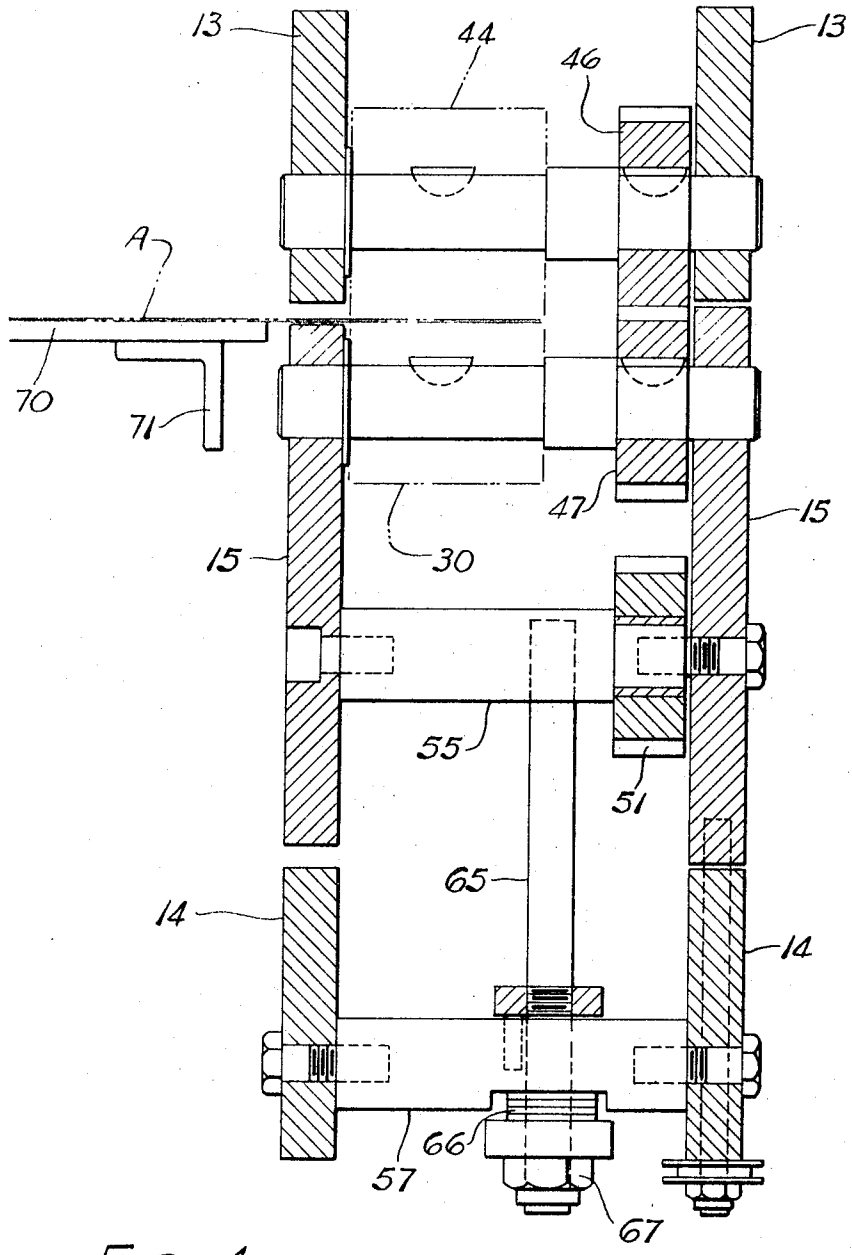


FIG. 4.

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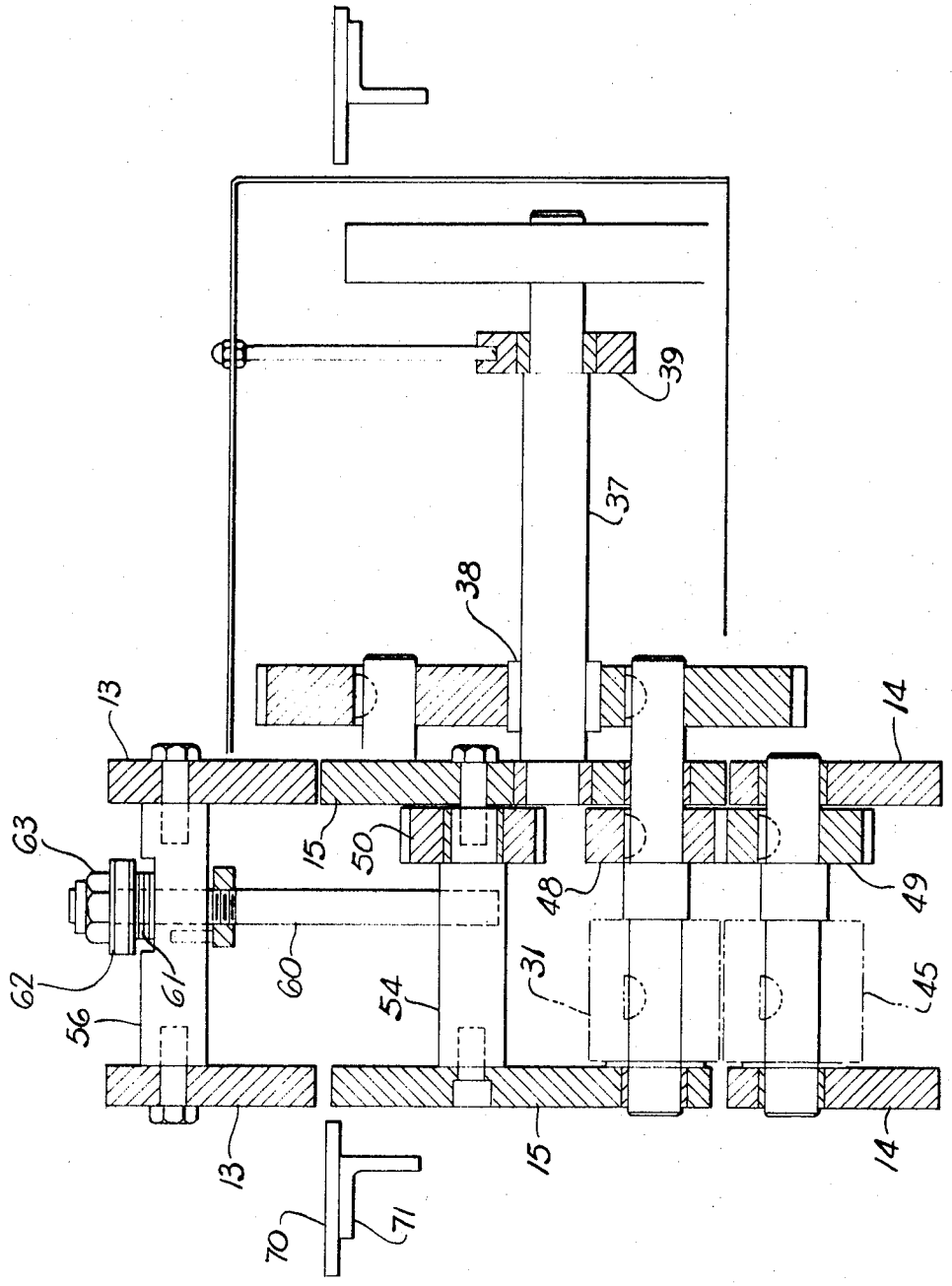


FIG. 5.

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SHIFTABLE MULTIPLE ROLL FORMING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to roll forming apparatus for producing longitudinally extending formations in metal sheets or strips by passing the same between successive pairs of forming rolls which progressively form the sheet or strip until it reaches the desired ultimate shape. Such progressive roll forming machines are well known in the sheet metal and allied arts.

In sheet metal shops where metal ducts and the like are being fabricated and in other similar sheet metal operations, it is frequently necessary to form sheet metal in either one of two separate shapes. When this is the case, it is ordinarily necessary to have two separate machines, each containing sets of rolls for forming metal in accordance with one of the two required shapes. An instance of this is in sheet metal shops where sheet metal ducts for heating, ventilating, and the like, are being formed and wherein frequent use is made of Pittsburgh lock joints and button lock joints which are well known in the sheet metal art.

The male portions of these joints are the same and accordingly present no problem but the female Pittsburgh lock joint part and the female button lock joint part are entirely different and require different sets of rolls for their formation. In the past the only practical means for alternatively forming either a Pittsburgh lock joint female part or a button lock joint female part has been to have two complete roll-forming machines, one having rolls for forming the Pittsburgh lock joint female part, and the other having rolls for forming the button lock joint female part.

SUMMARY OF THE INVENTION

In brief, the present invention provides a machine wherein there are two complete sets of progressive forming rolls for effecting two different formations in a metal sheet or strip. One set of rolls is above the other and means are provided for shifting the entire roll assembly vertically upwardly and downwardly to selectively position either the upper set of forming rolls or the lower set of forming rolls at the working level.

In the embodiment set forth herein by way of example, the entire drive means for the two sets of forming rolls, including the electric drive motor, is mounted as a unit for vertical movement by operation of fluid pressure cylinders.

Furthermore, the rolls of each set are so arranged that one longituindal series of rolls of each set are movably mounted and resiliently urged toward the other longitudinal series of rolls of such set.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a general side elevational view of one form of the apparatus of the present invention;

FIG. 2 is a general end elevational view of the structure of FIG. 1;

FIG. 3 is a fragmentary top plan view thereof;

FIG. 4 is a vertical cross-sectional view taken approximately on the line IV—IV of FIG. 1; and

FIG. 5 is a vertical cross-sectional view taken generally on the line V—V of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Speaking generally, and referring particularly to FIG. 1, the stationery framework portion of the embodiment of the machine of the present invention shown and described herein by way of example, comprises a base **10** and end frame members **11** and **12** which extend upwardly therefrom. The vertically movable support structure for the forming rolls comprises generally upper, lower and medial spaced pairs of side walls designated, respectively, **13, 14** and **15.** The lateral spacing of the side walls **13, 14** and **15** is as shown in FIG. **2.** The medial side wall members **15** are connected by end members **16** to form a generally rectangular frame and the end members in turn are attached to vertical plates **17** which are fixed at their lower ends to a movable sub-base **18.**

Fluid pressure cylinders **20** are mounted at opposite ends upon sub-base **18** and piston rods **21** are pivoted at their lower ends to the base structure as at **22.** Operation of this fluid pressure machanism raises and lowers the roll supporting structure including sub-base **18,** vertical plates **17,** and the roll-supporting framework **15,16** to selectively position either of two sets of forming rolls at the work feeding level. Rods **25** fixed to base **10** extend upwardly through sub-base **18** and sets of adjusting nuts **26** and **27** limit vertical movement of sub-base **18** to establish its upper and lower limit positions, respectively.

A longitudinal series of parallel forming rolls **30** having their supporting shafts journaled at their ends in medial side wall **15** comprise the lower forming rolls of the upper forming roll assembly and a further horizontal series of parallel forming rolls **31,** likewise having their supporting shafts journaled at their ends in medial walls **15,** comprise the upper forming rolls of the lower forming roll assemblies.

An electric motor **34** for driving the forming rolls is mounted upon sub-base **18** and a pulley **35** connects the motor drive shaft to a pulley **36** which is fixed to a drive shaft **37** which also carries a pinion **38,** shaft **37** being journaled at one end in one of the medial side walls **15** and at its other end in a plate **39** mounted upon such side wall **15** by means of brackets **42.**

A pair of meshing gears **40** and **41** are mounted on the supporting shafts of one of the rolls **30** and one of the rolls **31,** respectively, as shown in FIG. **1,** the gears **40** and **41** being located outside of the spaced medial side walls **14** as shown in FIG. **2.** Pinion **38** meshes with gear **40** to drive the same and this drive is transmitted to the companion gear **41** for driving the lower forming roll **31.**

The upper side walls **13** journal the supporting shafts for a series of upper forming rolls **44** which are complementary to each of the lower forming rolls **30** of the upper set of forming rolls. Similarly, the lower side walls **14** journal the ends of the supporting shafts of a lower series of forming rolls **45** which are complementary with the upper row **31** of the lower set of forming rolls.

Each complementary pair of forming rolls is gear-connected but since the pitch diameters of these connecting gears are substantially coincident with the roll peripheries they are not illustrated in FIG. **1.** The connecting pinions for a pair of complementary forming rolls **30** and **44** are shown at **46** and **47** in FIG. **4** and

the connecting pinions for a lower pair of forming rolls 31 and 45 are shown at 48 and 49 in FIG. 5.

Each adjacent pair of forming rolls 30 is gear-connected by an idler pinion 50 which meshes with the gears 47 of such adjacent rolls 30 and each adjacent pair of rolls 31 is gear-connected by a pinion 51 which meshes with the gears 48 of each adjacent pair of rolls 31. For clarity of illustration, only one of the pinions 50 and one of the pinions 51 is shown in FIG. 1.

As shown in FIG. 5, the idler pinions 50 are mounted on tie rods 54 and as shown in FIG. 4, the idler pinions 51 are likewise mounted on tie rods 55, the tie rods 54 and 55 serving to connect the side walls 15 rigidly in spaced relation. Similarly, the upper pair of side walls 13 are connected in rigid spaced relation by tie rods 56 shown in FIG. 5 and the lower side walls 14 are connected in rigidly spaced relation by tie rods 57 as shown in FIG. 4.

The assembly comprising the upper side walls 13 and the upper series of forming rolls 44 is mounted for yieldable, vertical movement with respect to the side walls 15 and the rolls carried thereby so that the upper series of forming rolls 44 is spring-urged downwardly against the complementary lower forming rolls 30 of the upper set of forming rolls. A series of vertical rods 60 are threaded into tie rods 54 at their lower ends and extend upwardly through the tie rods 56 of side walls 13. A compression coil spring 61 is held between a washer assembly 62 on rod 60 and the tie rod 56 by a nut assembly 63, thus urging the upper side wall assembly 13 downwardly.

Similarly, referring to FIG. 4, vertical tie rods 65 are fixed at their upper ends with respect to tie rods 55 and extend through lower tie rods 57. Compression coil springs 66 and retaining nuts 67 are likewise provided for urging the lower side wall assembly 14 upwardly toward the medial side wall assembly 15.

For simplicity, the forming rolls 30, 31, 44 and 45 are shown in FIGS. 4 and 5 as plain cylinders but it is to be understood and is well known in the art, that the several rolls will have progressive peripheral formations of increasing depth to progressively form a workpiece into the desired final contour. Similarly, for simplicity, the several forming rolls 44 and their drive pinions 46 are not shown in FIG. 3 which is a fragmentary top plan view of the preferred embodiment.

Referring particularly to FIG. 1, a work receiving table 70 extends alongside the forming roll structure at a proper level for receiving and supporting work sheets, such work table being supported by angle irons 71 fixed to the end frame members 11 and 12. A work sheet supported on table 70 is indicated in dot and dash lines at A in FIG. 4. FIG. 1 also shows a guide rail 72 which is spaced above table 70 by means of a side gauge member 73.

A preferred embodiment of the present invention has been described and illustrated herein to illustrate the principles of the invention but it is to be understood that numerous modifications may be made without departing from the broad spirit and scope of the invention.

I claim:

1. Roll forming apparatus for sheet material comprising a supporting frame, a carriage supported thereby and mounted fo vertical movement on said frame, a first set of forming rolls comprising a longitudinal series of pairs of superposed forming rolls mounted on said carriage for progressively producing a desired formation in a work sheet, a second set of forming rolls mounted on said carriage beneath said first set and likewise comprising a longitudinal series of pairs of superposed forming rolls for progressively producing another desired formation in a work sheet, means for moving said carriage vertically to selectively position either of said sets of forming rolls at a desired working level and work sheet support means carried by said supporting frame at said working level to guide work sheets between the set of forming rolls positioned at said working level.

2. Roll forming apparatus according to claim 1 including a drive motor mounted on said carriage and means connecting the same with both sets of forming rolls for driving the same.

3. Roll forming apparatus according to claim 1 wherein said vertically movable carriage comprises a main frame portion with the lower rolls of said first set of forming rolls and the upper rolls of said second set of forming rolls journaled therein, an upper frame connected to said main carriage frame and means urging the same resiliently downwardly toward said main carriage frame, the upper rolls of said first set of forming rolls being journaled therein, and a lower frame connected to said main carriage frame and means urging the same resiliently upwardly toward said main carriage frame, the lower rolls of said second set of forming rolls being journaled therein.

4. Roll forming apparatus according to claim 3 including a drive motor mounted on said carriage and means connecting the same with both sets of forming rolls for driving the same.

5. Roll forming apparatus according to claim 1 including gear means for connecting all of the rolls of both sets of forming rolls for synchronous rotation.

6. Roll forming apparatus according to claim 3 including gear means for connecting all of the rolls of both sets of forming rolls for synchronous rotation.

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