April 8, 1958 B. E. ROCKHOFF ET AL 2,829,697

APPARATUS FOR STORING AND CHANGING ROLLS

Filed March 30, 1953 3 Sheets-Sheet 1

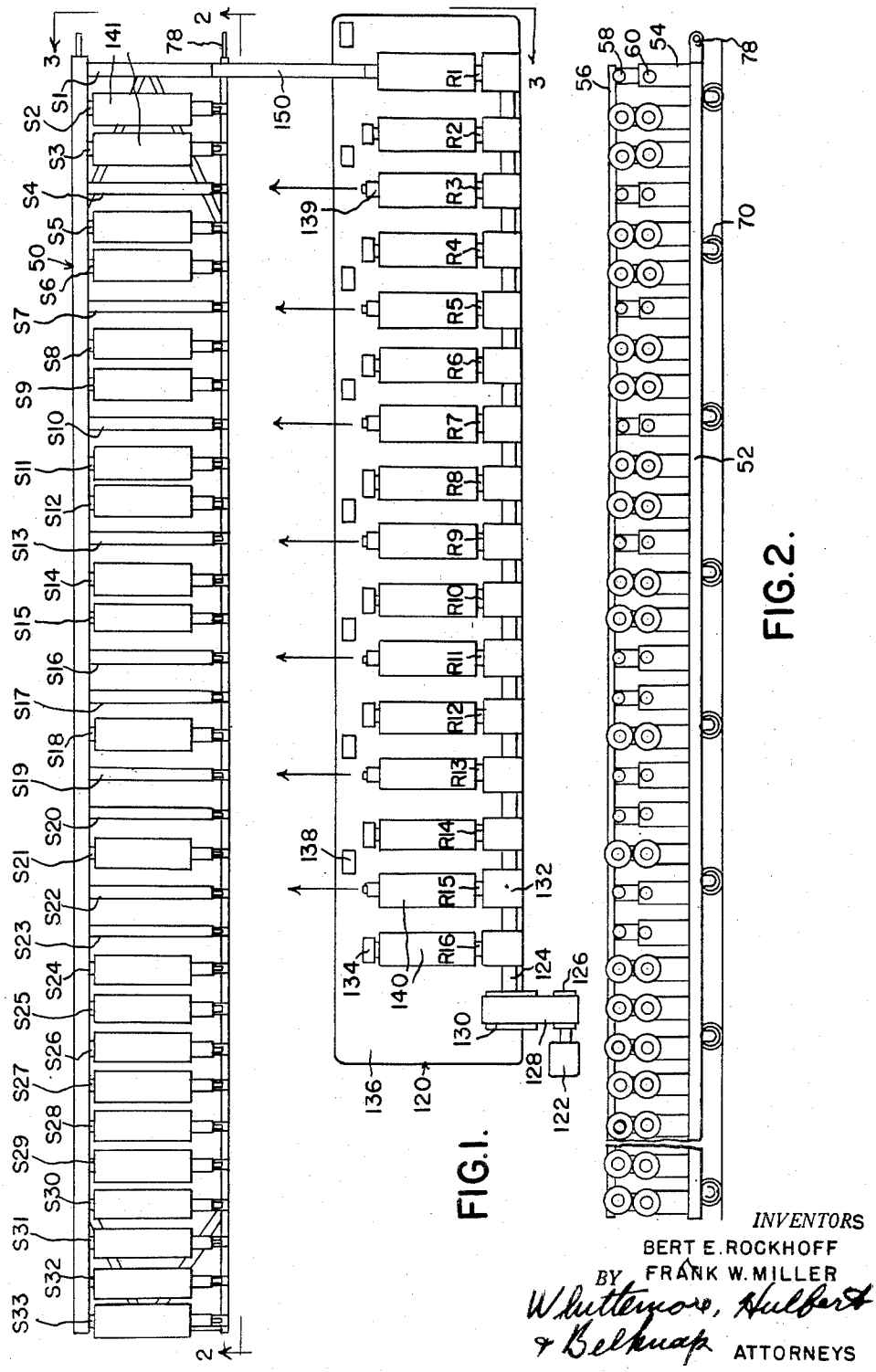

FIG. 1.

FIG. 2.

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APPARATUS FOR STORING AND CHANGING ROLLS

Filed March 30, 1953 3 Sheets-Sheet 2

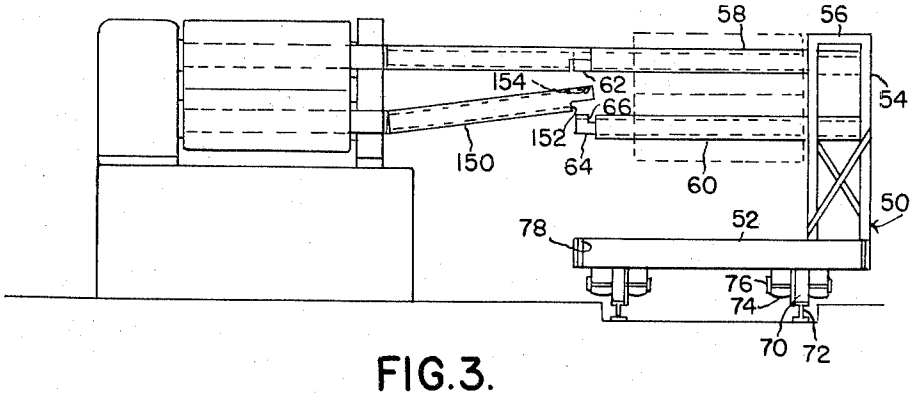

FIG.3.

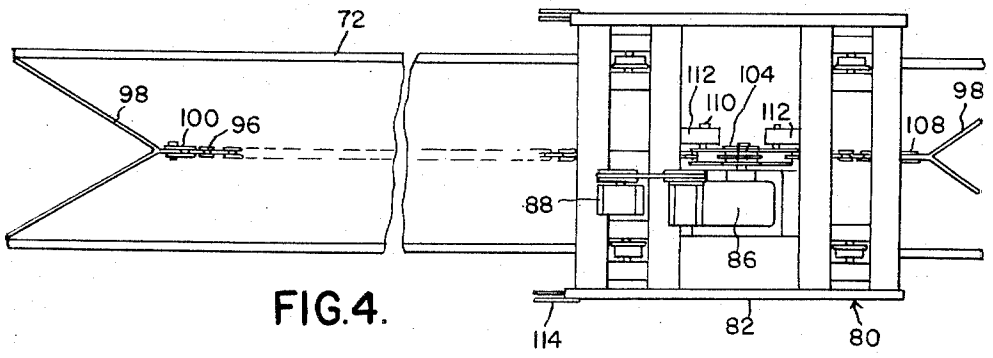

FIG.4.

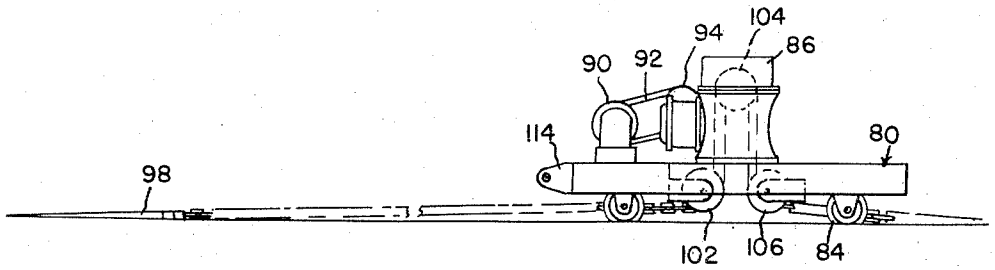

FIG.5.

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APPARATUS FOR STORING AND CHANGING ROLLS

Filed March 30, 1953 3 Sheets-Sheet 3

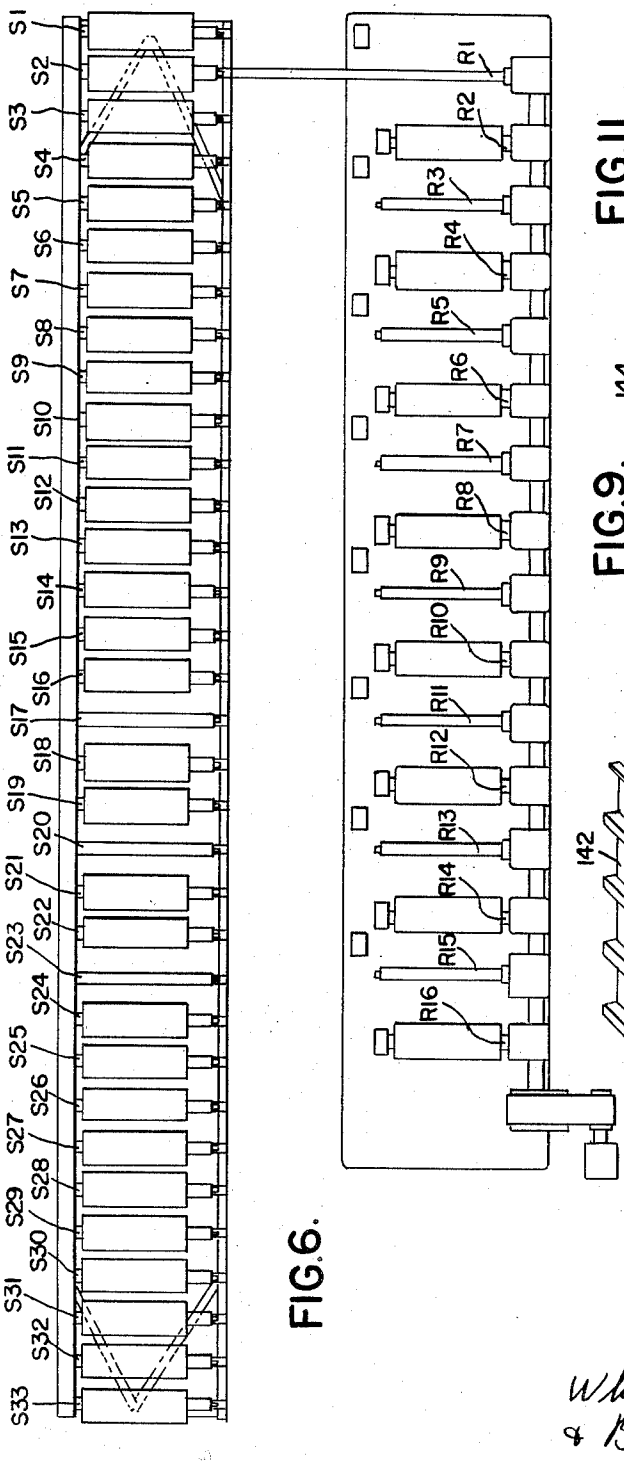

FIG.6.

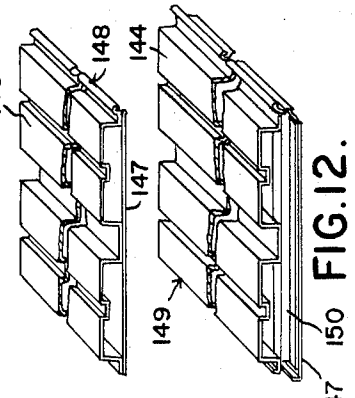

FIG.11.

FIG.12.

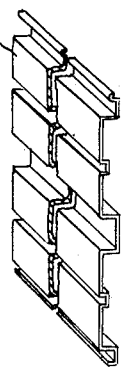

FIG.9.

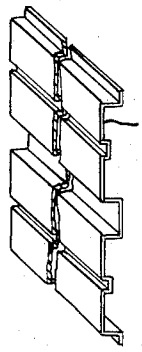

FIG.10.

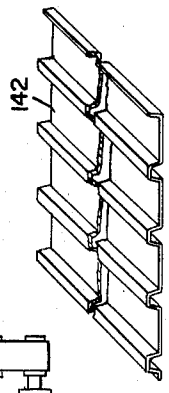

FIG.7.

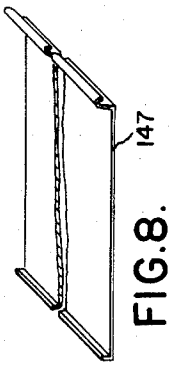

FIG.8.

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United States Patent Office 2,829,697 Patented Apr. 8, 1958

2,829,697

APPARATUS FOR STORING AND CHANGING ROLLS

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Application March 30, 1953, Serial No. 345,452

3 Claims. (Cl. 153—28)

The present invention relates to apparatus for storing and changing rolls and particularly the type of rolls used with apparatus for forming sheet metal into various shapes. Roll forming apparatus uses a series of pairs of rolls that withdraw a continuous strip of sheet material from a coil with each pair of rolls being shaped to develop the material into desired forms as the material is drawn through each succeeding pairs of rolls to the final form. By removing the pairs of rolls from the roll forming apparatus and replacing them with pairs of rolls of different shapes sheet material having other shapes can be formed. When a plurality of differently shaped sheet materials are formed on one roll forming machine a plurality of differently shaped series of pairs of rolls are required to be used with the machine necessitating frequent removals and replacements of the rolls. It is very desirable that the rolls be easily removed from and replaced on the machine and the extra rolls be stored where they are readily accessible and easily identified and/or located.

It is an object of the present invention to provide an apparatus for storing series of pairs of rolls, used with roll forming apparatus, where they are readily accessible and easily identified and/or located.

It is a further object of the present invention to provide an apparatus whereby pairs of rolls can be removed from roll forming apparatus to a stored position and other pairs of rolls replaced on the apparatus from a stored position.

It is still a further object of the present invention to provide an apparatus for storing and changing a plurality of series of pairs of rolls whereby a maximum number of pairs of rolls can be stored in a minimum amount of floor space consistent with convenience in handling by a novel arrangement of storage spindles.

It is another object of the present invention to provide an apparatus for storing and changing pairs of rolls that can be located adjacent the roll forming apparatus with the pairs of rolls being transferred by means of connecting bars.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a plan view of the storage apparatus of the present invention including a diagrammatic plan view of the roll forming apparatus in conjunction with which the storage apparatus is used, both views being greatly reduced in scale.

Figure 2 is a side elevation of the storage apparatus looking in the direction of the arrows 2—2, Figure 1.

Figure 3 is an enlarged end view elevation of the storage apparatus with the roll forming apparatus included in diagrammatic form, looking in the direction of the arrows 3—3, Figure 1.

Figure 4 is a plan view of the power car used to move the storage apparatus shown in Figures 1 and 2.

Figure 5 is a side elevation of the power car shown in Figure 4.

Figure 6 is a plan view of the apparatuses as shown in Figure 1, with the storage apparatus in a different position relative to the roll forming apparatus.

Figures 7, 8, 9 and 10 show the various shaped sections in which the sheet material is formed in the roll forming apparatus using rolls stored on the storage apparatus.

Figures 11 and 12 show assemblies made from the formed sections shown in Figures 8, 9 and 10.

Referring now to the drawings, the roll storing and changing car generally indicated at **50** comprises a base **52** which may be constructed of welded structural steel. A plurality of uprights **54** of welded structural steel are attached to the base along one longitudinal edge. A header bar **56** connects the top of the uprights together to provide rigidity. To each upright **54** are attached two spindles **58** and **60**. The spindles extend as cantilevers from the upright to the opposite edge of the car and are arranged spaced apart in vertical alignment. The spindles **58** and **60** each have a projecting portion **62** and **64** extending from the free end of the spindle. The projecting portion is smaller in diameter than the diameter of the spindle. The projecting portions are notched at **66** for purposes later to be described. In the embodiment of the invention selected for illustration, the storage car holds 33 pairs of spindles indicated at S1 to S33 in Figure 1.

In order that the car may be easily moved, wheels **70** adapted to roll on rails **72** are provided. The wheels are spaced in oppositely disposed pairs along the length of the car to evenly distribute the loading. Bearings **74** attached to the base **52** support the wheel axles **76**. Coupling brackets **78** are attached to the base **52** at each side of one end of the car.

Power to move the storage car along the rails is provided by a car generally indicated at **80**. The power car has a frame **82** of welded structural steel construction to which are attached wheels **84** adapted to roll on the tracks **72**. Mounted on a frame is a speed reducer unit **86**. An electrical motor **88** drives the speed reducer through pulley **90**, belt **92**, and pulley **94**. Traction is provided to the power car through the chain **96**. Anchors **98** are welded to the rails **72**. One end of the chain **96** is attached to one of the anchors by means of a U-shaped bracket **100**. The opposite end of the chain is threaded around the pulley **102**, thence around pulley **104**, and finally around pulley **106**. The free end of the chain is then attached to the other anchor **98** by the U-shaped bracket **108** that passes through the appropriate link to make the chain taut.

Pulley **104** is driven by the speed reducer **86** and is grooved in a manner to accommodate the links of the chain to prevent slippage between the chain and pulley when traction is being applied. Pulleys **102** and **106** are similar to pulley **104** and have their shafts **110** idle in bearings **112** which are attached to the frame **82**. Rotation of the pulley **104** propels the car back and forth along the rails by traction furnished by the chain **96** through the motor and speed reducer which are both adapted for clockwise and counterclockwise rotation.

A suitable starting and reversing switch (not shown) connected to a power supply by an extension cord (not shown) furnishes electric power to the motor. The chain **96** is of suitable length to propel the power car the necessary distance along the rails. The storage car **50** is attached to the power car **80** through the coupling brackets **78** and **114**.

Referring now to Figures 1 and 3, diagrammatic views are shown of the roll forming machine, generally indicated at **120**, with which the storage car is used. The

machine has 16 pairs of power driven roll shafts indicated at R1 to R16. Power is furnished by the motor 122 connected to a source of electric power (not shown). The motor drives the shaft, indicated at 124, by means of the pulley 126, belt 128, and pulley 130 which is connected to the shaft 124. The shaft drives the pairs of roll shafts all in unison and in the proper directions in a manner conventional to apparatus of this type, with one end of the pairs of roll shafts supported in drive heads indicated at 132. The opposite end of the pairs of roll shafts are supported by bearing brackets shown at 134. The bearing brackets 134 are adapted to be easily detached from the machine base 136 and moved to one side as at 138 when it is desired to change the rolls on the machine. Extending from the end of each roll shaft is a projection 139, the purpose of which will later be described.

Figures 7, 8, 9 and 10 illustrate differently formed sections which may be rolled in the roll forming machine 120 using rolls indicated at 140 on the machine and rolls indicated at 141 on the storage rack. If the sixteen pairs of rolls indicated at 140 on the machine are used to form the section shown at 142 in Figure 7 of the drawings, and it is desired to use the machine to form the section shown at 144 in Figure 9 of the drawings, the pairs of rolls 140 must be removed from the roll forming machine 120, transferred to the storage car 50, and appriate rolls transferred from the storage car onto the roll forming machine.

With the power car 80 coupled to the storage car 50, the storage car is moved along the rails by the power car until the storage spindles indicated at S1 line up with roll shafts R1 on the forming machine, a condition illustrated in Figure 1. The storage spindles are spaced along the length of the storage car so that every third pair of spindles on the car line up with every second pair of shafts on the forming machine, so that spindle S1 lines up with shafts R1, S4 lines up with R3, S7 with R5, etc. Also, the pairs of spindles on the storage car in line with pairs of rolls along the length of the machine are in vertical alignment with each other. It will also be observed from Figure 1 that the aligned spindles on the storage car do not hold any rolls in storage.

To facilitate transfer of the rolls a transfer bar 150 is employed. The bar is round and of a diameter slightly less than the diameter of the roll shafts of the forming machine. One end of the bar is hollow with an internal diameter concentric with the external diameter and of a dimension to fit snugly over the projections 139 of the shafts. The opposite end of the bar is notched as at 152. The length of the notch is greater than the length of the projecting portion 64 of the spindle. The unnotched portion is hollow with a pin 154 projecting down into the hollowed portion. The radius of the hollow portion and the depth of the notch 152 are of dimensions to allow the bar to be placed down over the projection 64 of the spindle with the pin 154 fitting into the notch 66. The bar is placed in position by sliding the unnotched end over projection 139 of the shaft and dropping the notched end in position over the projection 64. The pin 154 keeps the bar from rotating and thus holds it in place. The spaced relation between the car and machine is such that the distance between the shafts on the machine and the spindles on the car that the bar must span is the same for all the bars and spindles that come into alignment. Thus, a single transfer bar may be used with any aligned spindle and shaft.

The configurations on the rolls (not shown) required to form the material usually make it necessary for the rolls to be removed from the shafts together in pairs as they will not move relative to each other while on the shafts due to the interlocking of the configurations, Accordingly, two transfer bars must be used, one between each of the vertically aligned shafts and spindles, when transferring the pairs of rolls.

With the bearing brackets 134 detached and moved to one side and the transfer bars 150 in place, the pair of rolls on shafts indicated by R1 are transferred to the spindle indicated by S1 on the storage car. The dimension of the diameter of the storage spindles is the same as the diameter of the transfer bar, which is slightly less than the diameter of the rolls on the machine, thus the rolls slide readily on the bars. The remaining pairs of rolls indicated at R3, R5, R7, R9, R11, R13 and R15 are transferred in a like manner. If desirable, a plurality of pairs of transfer bars may be used and a plurality of pairs of rolls can be moved together.

The storage car is then moved along the rails so that pairs of spindles indicated at S2, S5, S8, S11 and S14 are in line with pairs of shafts indicated at R1, R3, R5, R7, and R9 as shown in Figure 6. The pairs of rolls indicated on spindles S2, S5, S8, S11 and S14 are a portion of those required for forming the section shown in Figure 9, and accordingly are transferred to the forming machine with the use of the transfer bars. After this transfer has been made, pairs of spindles S2, S5, S8, S11, S14, S17, S20 and S23 will be vacant.

The storage car is now moved along the rails until pairs of spindles S2 are in alignment with pairs of rolls R2 and consequently, S5 will line up with R4, S8 with R6, S11 with R8, S14 with R10, S17 with R12, S20 with R14, and S23 with R16. The remaining pairs of rolls used for forming the section 142 shown in Figure 7, are removed from the machine in the same manner as previously described for removal of the other pairs of rolls. The car is then moved so that S3 lines up with R2, S6 with R4, S9 with R6, S12 with R8, and S15 with R10. The pairs of rolls stored on the spindles are then transferred from the storage car to the machine.

The car is then moved so that S26 lines up with R11, S29 with R13, and S32 with R15 and the transfer of rolls made. By moving the car so that S27 lines up with R12, S30 with R14, and S33 with R16 the remainder of the rolls for forming the section 144 shown in Figure 9. are transferred and the roll forming machine may be put into operation to roll that section.

It is not always necessary to change all the rolls to change the setup for rolling a different section as some of the pairs of rolls can be used in the rolling of several sections. For instance, in changing the setup for rolling the section shown at 144 in Figure 9 to the section shown at 146 in Figure 10, only a portion of the pairs of rolls need changing as it will be observed that the two sections differ only along their terminal side edges. The section shown at 147 in Figure 8 being less complicated in form than the other section, fewer pairs of rolls will be required. Thus, when less complicated sections are rolled pairs of shafts on the forming machine will be left vacant.

The sections formed on the rolls are welded together to form an assembly. The assembly shown at 148 in Figure 11 is made by welding together the sections 147 and 146 shown in Figures 8 and 10. The assembly shown at 149 in Figure 12 is made from sections 147 and 144 shown in Figures 8 and 9 with U-shaped transverse elements 150 between them.

The sections are large in size, being approximately two feet in width, up to six inches in thickness, and up to twenty or more feet in length, and require a considerable area of floor space for storage. The sections are rolled in the machine at a high rate of production and must be temporarily stored in the working area until other sections that make up an assembly are also rolled. Frequent changes of the rolls on the forming machine are necessary so that a balanced supply of sections can be produced.

The apparatus of the present invention provides a device whereby a plurality of series of pairs of rolls can be

stored in a minimum of storage area consistent with convenience of handling, and whereby the rolls are readily accessible to be easily and quickly removed from and replaced on a roll forming machine.

The drawings and the foregoing specification constitute a description of the improved apparatus for storing and changing rolls in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What we claim as our invention is:

1. In combination, a roll forming machine comprising elongated support structure, a plurality of longitudinally equally spaced pairs of horizontal parallel vertically spaced roll supporting shafts carried thereby, means of supporting said shafts at one end, readily removable bearings supporting said shafts at the other end, a track located at the side of said machine which has said removable bearings, an elongated carriage on said track, said carriage having thereon a plurality of longitudinally equally spaced pairs of horizontal parallel vertically spaced roll supporting spindles, the number of said pairs of roll supporting spindles being in excess of the number of pairs of roll supporting shafts on said machine by an amount sufficient to receive all of a set of rolls carried by the pairs of shafts and in addition to provide a plurality of equally spaced empty pairs of roll supporting spindles, the horizontal spacing between said shafts being related to the horizontal spacing between said spindles such that a set of pairs of spindles of a first sequence of order registers with a set of pairs of shafts of a different sequence of order, means for moving said carriage longitudinally of said machine, and transfer members to connect the adjacent ends of registering spindles and shafts to transfer rolls therebetween.

2. Apparatus as defined in claim 1 in which the horizontal spacing between said pairs of spindles is less than the horizontal spacing between said pairs of shafts.

3. Apparatus as defined in claim 1 in which the horizontal spacing between said pairs of spindles is equal to two-thirds of the horizontal spacing between said pairs of shafts.

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