Feb. 5, 1935. C. E. BOWRON ET AL 1,989,735

METHOD AND APPARATUS FOR SEPARATING SHEETS FROM A ROLLING MILL

Filed Nov. 18, 1932 3 Sheets-Sheet 1

Fig. 1

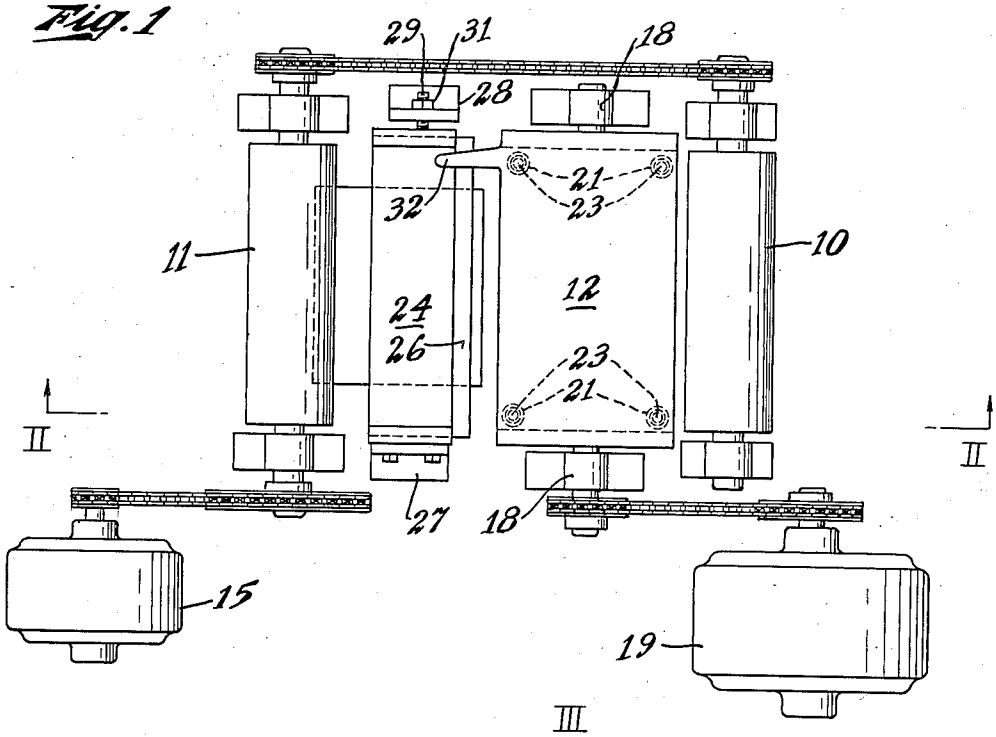


Fig. 2

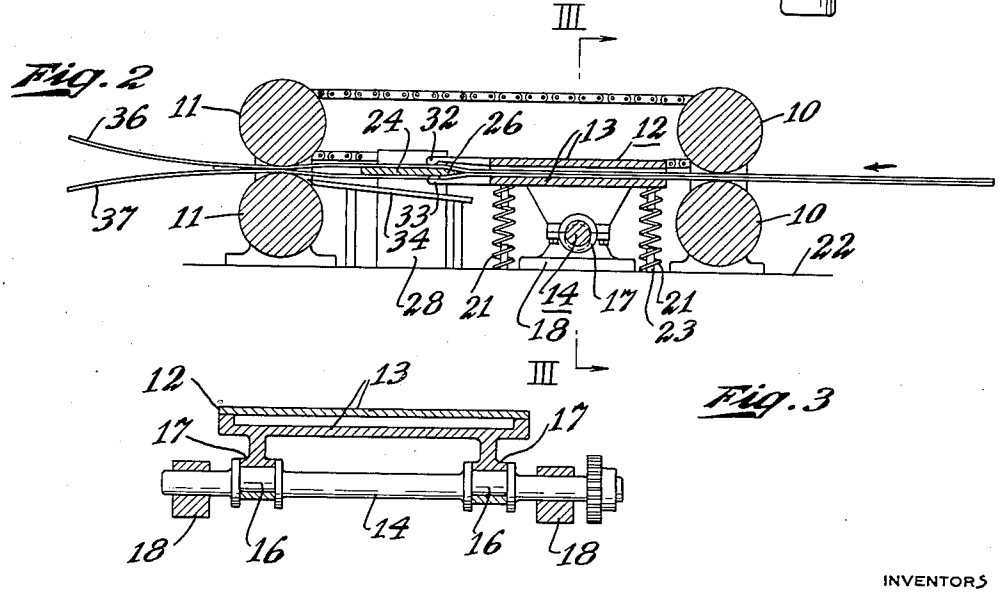


Fig. 3

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Filed Nov. 18, 1932 3 Sheets-Sheet 2

Fig. 4

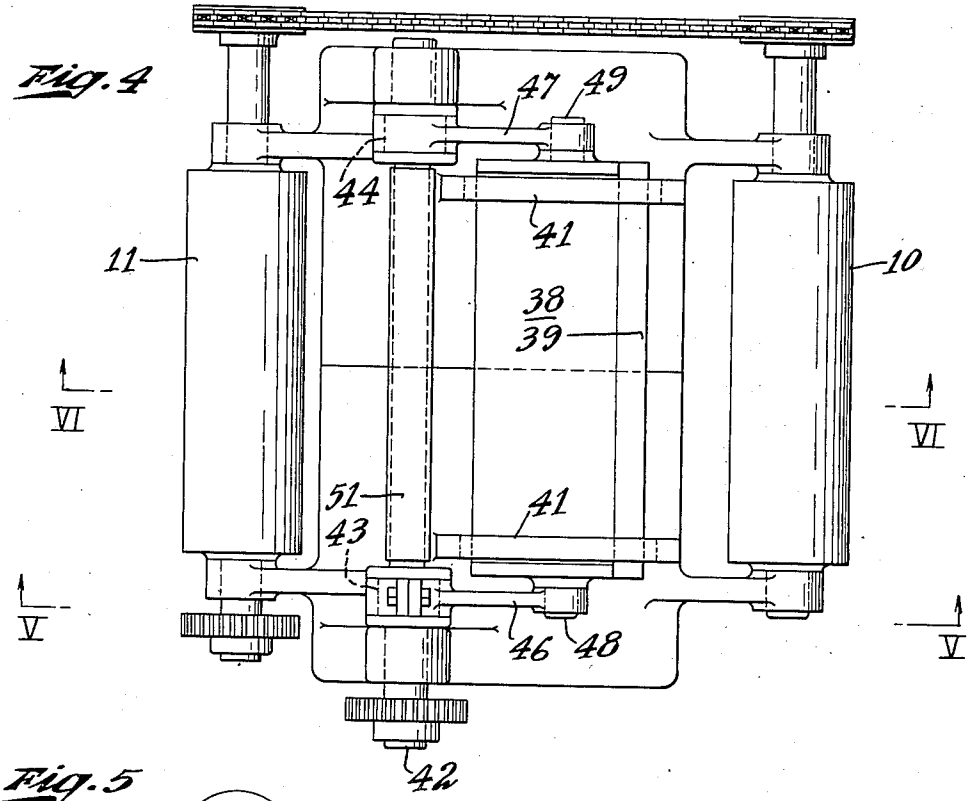


Fig. 5

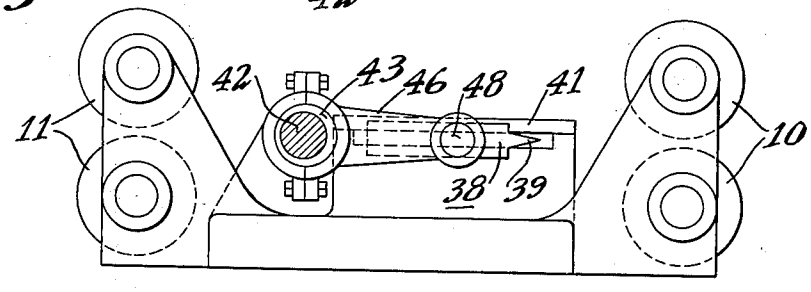
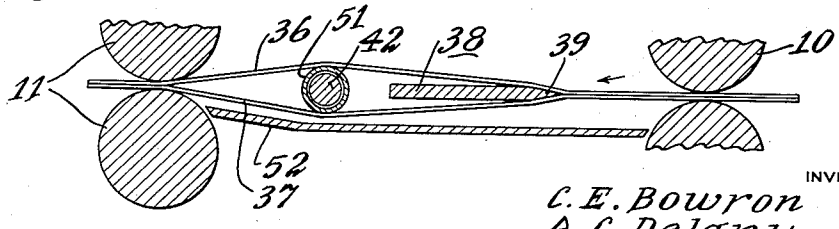


Fig. 6



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Filed Nov. 18, 1932 3 Sheets-Sheet 3

Fig. 7

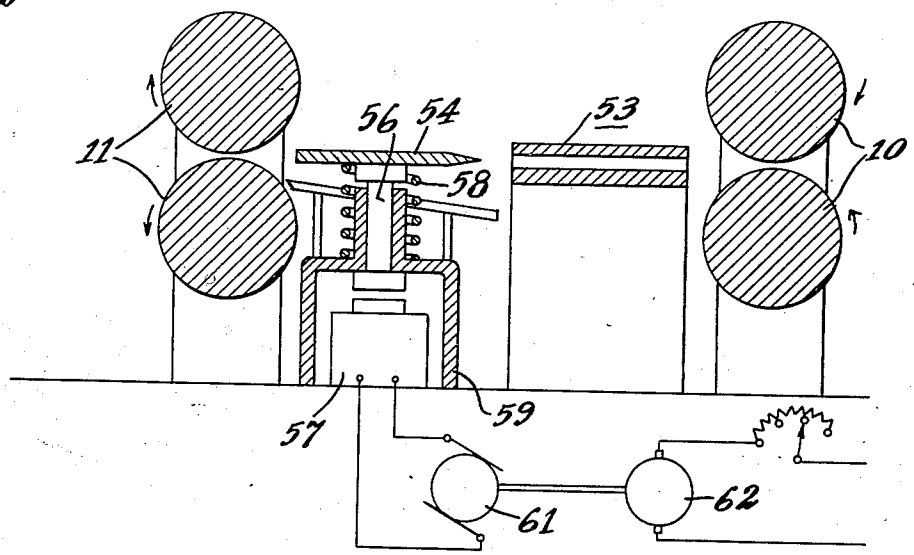
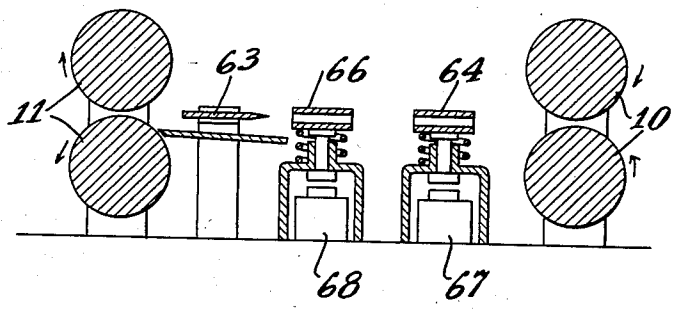


Fig. 8



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Patented Feb. 5, 1935 1,989,735

UNITED STATES PATENT OFFICE

1,989,735

METHOD AND APPARATUS FOR SEPARATING SHEETS FROM A ROLLING MILL

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Application November 18, 1932, Serial No. 643,234

6 Claims. (Cl. 29—17)

Our invention relates to a method and apparatus for separating sheets from a rolling mill, and has for its object the provision of an apparatus and method of the character designated which shall be effective to separate stuck together sheets expeditiously and without damage to the sheets.

A further object of our invention is to provide a method of separating sheets from a rolling mill wherein a vibratory force and a separating force are imposed upon the sheets simultaneously.

A still further object of our invention is to provide a method of separating stuck together sheets from a rolling mill wherein the sheets are subjected to a separating force exerted between the sheets, and simultaneously therewith the sheets are moved longitudinally in a direction to bring the stuck together portions in engagement with the separating force.

A still further object of our invention is to provide an apparatus for separating stuck together sheets from a rolling mill embodying a separating instrument adapted to be inserted between the sheets, means to move the sheets to engage the stuck portions with the separating instrument, and means to effect relative vibratory movement between the sheets and the separating instrument.

In the operation of sheet rolling mills, the sheets come from the mill in pairs which more or less adhere to each other. The majority of these sheets may be readily separated by workmen grasping the corners with tongs and pulling them apart. Others of the sheets are completely welded together and can not be separated without destroying the sheets. Between these two extremes are sheets which are only partially welded, or so tightly stuck together that they can not be manually pulled apart, but which still are separable without ruining them.

It has been the practice heretofore to separate such sheets by pulling the ends apart with tongs as far as possible and then slashing at the stuck portions with heavy knives or "swords". The manual slashing at the stuck portions of the sheets inevitably damages a large percentage of them so that they have to be scrapped, and also entails a great deal of heavy manual labor and loss of time. It is the particular purpose of our invention to provide a method and apparatus whereby the above mentioned difficulties may be overcome and stuck sheets be expeditiously separated without damage and without the exertion of heavy manual labor.

In carrying out our invention, we provide an apparatus whereby the sheets are caused to travel along suitable guides and during their travel are subjected to high frequency vibrations which may be varied in period to accomplish the result sought. A separator, or knife, is mounted to extend across the width of the sheets and between the sheets which are stuck together. Rolls are provided for feeding the sheets toward the knife, and other exit rolls are provided for pulling the sheets along to bring the stuck portions into engagement with the knife.

The vibrations to which the sheets are subjected may be brought about in a number of ways. For example, both the knife and the guides or supports for the sheets may be vibrated; the knife only may be vibrated; or the knife may be stationary and the guides or supports may be vibrated.

Apparatus embodying features of our invention is illustrated in the accompanying drawings forming a part of this application, in which

Fig. 1 is a plan view of one form of our invention;

Fig. 2 is a sectional view taken along the line II—II of Fig. 1;

Fig. 3 is a sectional view taken along the line III—III of Fig. 2;

Fig. 4 is a plan view of a modified form of our invention embodying a vibratory separator to which reciprocatory vibrations are imparted longitudinally of the stuck sheets;

Fig. 5 is a section taken along the line V—V of Fig. 4;

Fig. 6 is a section taken along the line VI—VI of Fig. 4;

Fig. 7 is a sectional view, more or less diagrammatic, showing a modified form of our invention; and

Fig. 8 is a view similar to Fig. 7, showing a further modified form.

Referring to Figs. 1 to 3 of the drawings, one form of our improved apparatus may comprise a pair of feeding rolls 10 and a pair of exit rolls 11, through which the sheets are passed and between which is the mechanism for effecting separation of the stuck sheets. The rolls 10 and 11 may be driven in unison from a motor 15 and connected sprockets, as shown in the drawings. Interposed between the rolls 10 and 11 is a vibratory table 12 having guides 13 between which the sheets travel. The table is supported on a shaft 14 having crank portions 16 on which fit bearings 17 depending from the table 12. The shaft 14 is mounted in outer stationary bearings 18 and is driven by a variable speed motor 19 whereby the period of vibration imparted to the sheets in their

travel over the table may be varied. The table 12 is provided lateral support by means of springs 21 extending upwardly from the foundation or base of the machine 22 to the table, and held in place by means of retaining pins 23.

Mounted beyond the table 12 in the direction of travel of the sheets is a separator 24 preferably formed with a knife edge 26. The separator 24 is mounted on upright stationary supports 27 and 28, and is maintained in tension by means of a bolt 29 and nut 31, the bolt 29 extending through the support 28. The separator 24 is preferably made of relatively light hardened steel, and, due to the tension imposed upon it, it may be vibrated with relatively short high frequency vibration by striking it a hammer blow.

In order that such vibrations may be imparted to it, we provide hammers 32 and 33 secured to one corner of the table 12 and extending above and below the separator 24, as shown in Fig. 2 of the drawings. As the table 12 is vibrated, it carries the hammers with it and they in turn strike the separator, so that it is being vibrated continuously when the machine is in operation. Beyond the separator 24 in the direction of the travel of the sheets and immediately in front of the exit rolls 11 is a guide member 34 for guiding the separated sheets into the exit rolls as they are being fed through the apparatus.

From a consideration of Fig. 2 of the drawings, the operation of this form of our apparatus will be readily understood. A pair of stuck sheets 36 and 37 first have their ends opened manually with tongs, as is the custom when the sheets come from the forming rolls, and if found to be stuck together they are laid aside to be run through our improved apparatus. The partially opened sheets are then inserted between the rolls 10 and caused to move in the direction as shown by the arrow at the right of drawings, through the guides 13, and the separator 24 is inserted between the ends of the sheets. The motor 19 imparts vibrations to the table 12, and from thence to the sheets through the guides 13. At the same time the hammers 32 and 33 cause vibration of the separator 24, and the feeding rolls 10 urge the stuck portions of the sheets toward the separator 24. When they have travelled sufficient distance, the ends of the sheets pass between the exit rolls 11 and are drawn longitudinally so that the separator 24 and table 12 effect a complete separation of the sheets without damage.

Referring now to Figs. 4 to 6 of the drawings, we show a modified form of our invention, in which a different type of vibration is imparted to the sheets. In accordance with this modification, we interpose between the rolls 10 and 11 a separator 38 having a knife edge 39 pointing in the direction of the feed rolls 10 and mounted in guides 41. Vibrations are imparted to the separator 38 by means of a shaft 42 having cranks 43 and 44 thereon, and connected to the ends of the separator 38 by means of connecting rods 46 and 47 and wrist pins 48 and 49. The shaft 42 is driven at a relatively high speed from any suitable source, not shown, and the throw of the connecting rods 46 and 47 is made relatively short so that the amplitude of the vibrations is extremely short, say in the neighborhood of $\frac{1}{32}$ of an inch. The shaft 42 is provided with a sleeve 51 against which the sheets 36 and 37 bear as they pass to the exit rolls 11.

Disposed beneath the separator 38 is a guiding means 52 which extends to the exit rolls 11 to insure the sheets 36 and 37 passing between the exit rolls.

With the modification of our improved apparatus just described, it will be seen that as the sheets are advanced from the feeding rolls 10 to the exit rolls 11, the separator 38 is vibrated with relatively short high frequency vibrations in a direction longitudinally of the sheets to be separated, and the knife edge 39 is thus entered between the stuck sheets as they are advanced toward the exit rolls 11, thus effecting separation of the sheets without damage to them.

Referring to Fig. 7 of the drawings, we show another form of our improved apparatus in which there is a stationary guide means 53 through which the sheets are fed to pass on opposite sides of a vibratory separator 54 constructed similar to those already described. The separator 54 is mounted on an armature 56 of an electro-magnet 57. A spring 58 is interposed between the separator 54 and base member 59, so as to move the separator upwardly when the electro-magnet 57 is de-energized. The electro-magnet 57 is preferably energized from an alternating current generator 61 driven by a variable speed motor 62, whereby the period of vibrations imparted to the separator 54 may be varied to produce the best results.

Referring to Fig. 8 of the drawings, we show still another modification of our invention, in which a separator 63 is rigidly supported, and the sheets to be separated are fed through two vibrating guides 64 and 66. The guides 64 and 66 are vibrated by means of electro-magnets 67 and 68, respectively, which may be energized in a manner similar to the electro-magnet 57 shown in Fig. 7. In the modification shown in Fig. 8, the stuck sheets are vibrated at two points before coming in contact with the separator 63, so that the separator 63 can complete the separation of the stuck sheets without the necessity of its being vibrated as shown in the previous modifications of our invention.

While we have shown our invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What we claim is:

1. In a mechanism for separating sheets from a rolling mill, the combination of feeding rolls, a vibratory table disposed adjacent the feeding rolls in the direction of movement of the sheets, a vibratory separator adjacent the vibratory table and adapted to be inserted between the sheets passing over the table, means for imparting vibrations to the separator from the vibratory table, and exit rolls adjacent the separator.

2. In a mechanism for separating sheets from a rolling mill, the combination of a separating instrument adapted to be inserted between the sheets to be separated, guide means for directing the sheets to the separating instrument, a pair of rolls for feeding the unseparated portions of the sheets toward the separating instrument, and means independent of the separating instrument for vibrating the sheets as they approach the separating instrument.

3. In a mechanism for seperating stuck sheets from a rolling mill, the combination of a separat-

ing instrument adapted to be inserted between the sheets to be separated, vibratory guide means for directing the sheets to the separating instrument, a pair of rolls for feeding the unseparated portions of the sheets toward the separating instrument, and means for vibrating the separating instrument as the sheets are drawn toward it.

4. In a mechanism for separating stuck sheets from a rolling mill, the combination of a separating instrument having a knife edge adapted to be inserted between the stuck sheets transversely thereof, a pair of rolls for drawing the unseparated portions of the sheets toward the knife edge of the separating instrument, guide means for guiding the stuck sheets toward the separating instrument, and means for vibrating the guide means.

5. In a mechanism for separating stuck sheets from a rolling mill, the combination of a separating instrument having a knife edge adapted to be inserted between the stuck sheets transversely thereof, a pair of rolls for drawing the unseparated portions of the sheets toward the knife edge of the separating instrument, guide means for guiding the stuck sheets toward the separating instrument, means for vibrating the guide means, and means for simultaneously vibrating the separating instrument.

6. The method of separating stuck sheets from a rolling mill which comprises introducing an edged vibratory separating instrument between the sheets, pulling the sheets to bring their stuck portions in engagement with the separating instrument, and simultaneously vibrating the sheets vertically and striking the vibratory separating instrument to cause it to vibrate.

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