Aug. 30, 1949. J. D. BOLTON 2,480,180

METHOD OF APPLYING STEEL REINFORCEMENT TO EXISTING COLUMNS

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Fig. 2.

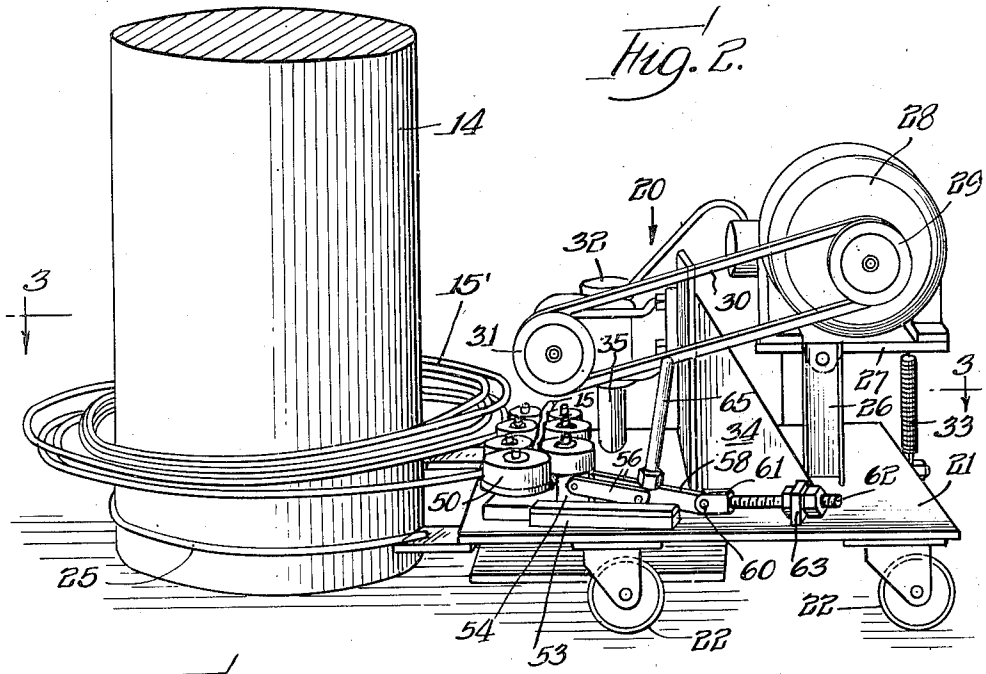
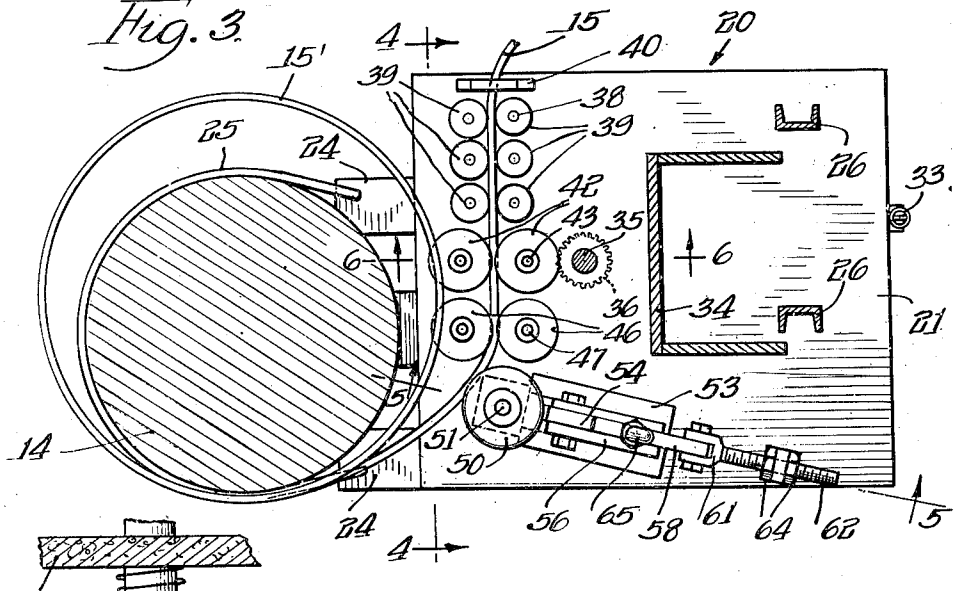


Fig. 3.



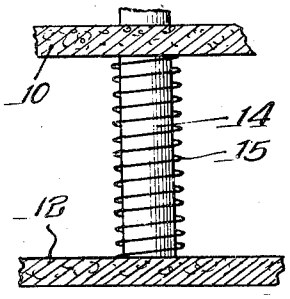


Fig. 1.

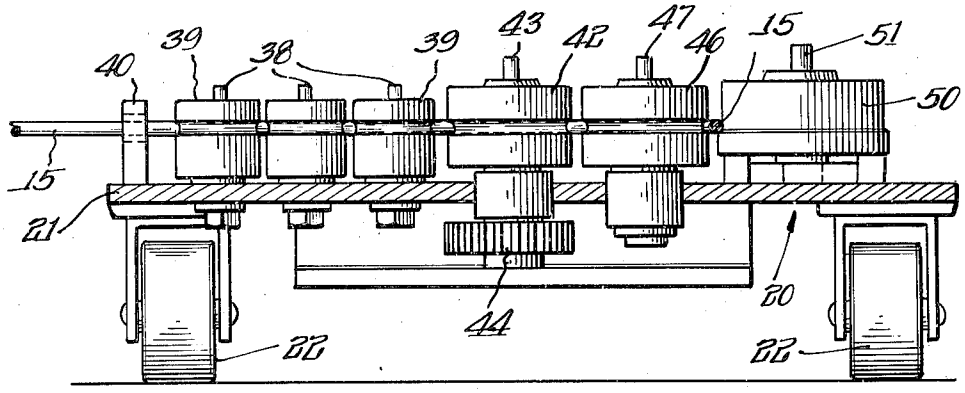
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Fig. 4.



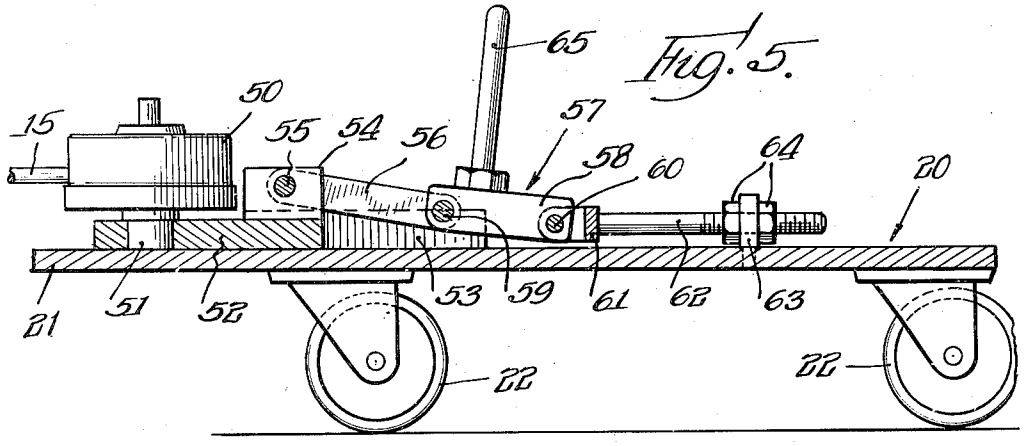


Fig. 5.

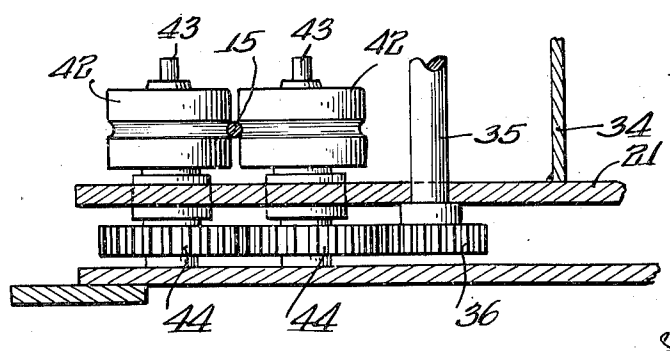


Fig. 6.

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2,480,180

METHOD OF APPLYING STEEL REINFORCEMENT TO EXISTING COLUMNS

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Application June 5, 1948, Serial No. 31,373

4 Claims. (Cl. 29—155)

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This invention has to do with the strengthening of structural columns in existing buildings, as distinguished from new building construction, and it deals specifically with the problem of applying helical steel-rod reinforcement to existing columns, in situ, as a step preliminary to the application of added external thicknesses of concrete.

A highly favored form of concrete column reinforcement consists of a continuous steel rod helix expanded lengthwise of the column, together with a group of vertical reinforcing rods tied to the helix and equally spaced circumferentially of the column; and on new building construction the helices can be coiled in advance to the desired radius of curvature and put in place in the forms without any particular difficulty. But sometimes it is necessary to reinforce existing columns by adding thereto further thicknesses of concrete; and where, in such cases, the architect or engineer specifies helical reinforcement, the problem of applying the reinforcement to the existing columns has proved to be a formidable one, because it is not practicable to coil the steel rod before setting it in place, as is done on new work.

As an example, take a job involving a large factory building wherein the floor space is occupied by machinery and other fixed equipment, and where it is necessary to proceed without removing any of the machines or equipment or interfering materially with normal factory operation—it would not be possible to apply the helical reinforcement to the existing columns by any of the methods or procedures heretofore known. To meet such a situation, according to the present invention a portable rod bending machine is provided to be moved from column to column and set in place immediately adjacent each successive column, and then, with the machine so positioned, the rod is run through the machine and the resultantly curved rod is led around the column as it emerges from the machine. By so doing it is possible to bend and apply to each column a specified length of perhaps six hundred lineal feet of ⅜'' round steel rod at the rate of about five minutes per column—a most satisfactory solution of the problem above stated, and one which may be achieved without significant interference with normal factory operations.

Portable rod-bending machines have previously been known, and no claim herein is made to any novelty of major importance in the disclosed bending machine per se. But the method herein to be described, which comprises bending a long rod into a helix of many turns and simultaneously wrapping the same around an existing column, as it emerges from the bending machine, is a feature of primary importance which, in short, is the substance and purport of the instant invention.

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Referring now to the accompanying drawings,

Figure 1 is a small scale elevational view of an existing building column, together with upper and lower floor sections, showing a steel-rod helix which has been wrapped around the column and expanded axially, the vertical reinforcing rods and new concrete having been omitted from this view in order to simplify the showing;

Fig. 2 is a perspective view showing the lower end portion of an existing building column, together with a portable bending machine resting on the floor adjacent the column, and illustrating how the reinforcing rod is bent and passed around the column as it emerges from the machine;

Fig. 3 is a horizontal view in section, taken on line 3—3 of Fig. 2;

Fig. 4 is a vertical sectional view, taken on line 4—4 of Fig. 3;

Fig. 5 is a sectional view, taken on line 5—5 of Fig. 3; and

Fig. 6 is a fragmentary section, taken on line 6—6 of Fig. 3.

In Fig. 1 there are shown two successive floor sections 10 and 12, and an intervening column 14, which is to be reinforced, and around which there is shown wrapped a helix 15 consisting of a considerable number of turns of steel rod. And in addition to the helix 15 the reinforcement ordinarily would include a number of vertical steel rods equally spaced around the column and secured to the helix by means of wire ties. The vertical rods have not been shown because they would tend to obscure the showing of the helix, and the invention is concerned only with the helix and its application to the column; and for a like reason the subsequently applied added shell of concrete has been omitted from the view.

It will, of course, be understood that after the reinforcing steel has been put in place, a form is built around the column, enclosing the added reinforcement, and the concrete then poured in or perhaps applied by the gunite process. So far as the present invention is concerned it is of no consequence whether the column to be reinforced is made of concrete or of wood, steel, brick or any other material; and the cross-section of the existing column, whether round or rectangular, is a matter of indifference.

Unless the helix 15 is of very much larger di-

ameter than the column to be reinforced, it would be impracticable, if not utterly impossible, to apply a previously formed helix to the column, assuming the helix to be made of stiff steel rod, as distinguished from relatively flexible wire; but the method of procedure according to the present invention completely and successfully circumvents that difficulty.

For the purpose of carrying out my invention, I employ a portable bending machine, such as is shown in Figs. 2–6, inclusive, and identified as a whole by the reference numeral **20**. This machine is well adapted to the job for which it is intended because the bending rolls can be placed conveniently close to the column. The steel rod is bent by such a machine and simultaneously the bent portion of the rod is passed around the existing column, as it emerges from the bending rolls as illustrated in Figs. 2 and 3 wherein, for the sake of conformity with Fig. 1, I have identified the steel rod by the reference numeral **15**, this being the same numeral used for identifying the helix in Fig. 1.

From Fig. 3 it will be seen that the rod **15** is being passed through the bending machine, wherein it is first straightened and then bent to the required radius of curvature; and that the curved rod emerging from the machine is directed around the column, thus forming a multiple turn coil **15'** encircling the column. As the coil builds up, its weight increases so that it may be necessary for the workmen in attendance to lift and pull it around with suitable tackle; and it may be helpful to place some heavy blocks on the floor and against the column to provide supports for the coil so that it can be manipulated around the column more easily. In Fig. 2 the coil **15'** is shown as if floating in space, but it will be understood that this has been done to clarify the drawing, and that in actuality the coil will rest partly on the floor and partly on the bending machine unless some other coil-supporting means is provided, such as the above-suggested blocks.

The bending machine **20** includes a truck consisting of a steel platform **21** equipped with four roller casters **22**. Extending horizontally from the platform **21** and spaced apart, (see Fig. 3) are two arms **24, 24** which bear against the column and serve to position the machine relatively to the column. The machine may be anchored to the column by means of a steel band **25**, the ends of which are detachably connected to the arms **24**.

While the band **25** serves to anchor the bending machine with certainty and may in some cases be important operationally, its chief value is that of a safety provision. If used in a factory where there are employees present and moving about, a fixed anchorage of the machine may become important to prevent injury resulting from inadvertent displacement and rolling of the machine across the floor.

Welded to the platform **21** and rising vertically therefrom are a pair of spaced channel irons **26, 26** on which is pivotally mounted a base plate **27** forming a support for an electric motor **28**, having a pulley **29**, which is connected through a V-belt **30** to the pulley **31** of a right-angled speed-reducing transmission **32**. A coil spring **33** is attached at its upper end to the base plate **27** and at its lower end to the platform **21**, and serves to keep the belt **30** under suitable tension.

The transmission **32** is mounted on a bracket **34** which, in turn, is welded to the platform **21**; and it includes a vertical shaft which extends downwardly through the platform **21** and carries a pinion **36** (see Fig. 6) the function of which will presently be explained. Rotatably mounted on vertical studs **38** which are secured to the platform **21** are six straightening rolls **39**, arranged in pairs, the members of each pair being spaced apart just sufficiently to receive the rod **15**; and positioned at the receiving end of the straightening rolls is a guide plate **40**, welded to the platform **21** and having a horizontally elongated opening of a width, vertically, sufficient to clear the rod. The rod is regularly shipped to the site of operation in the form of coils, since it is too long to be handled otherwise, and it must be straightened before being bent to the desired curvature. That is the function of the straightening rolls **39**.

Immediately adjacent the output end of the group of straightening rolls **39**, there is mounted on the platform **21** a pair of grooved driving or feed rolls **42, 42**, each of which is keyed to a vertical shaft **43, 43**, journaled in suitable bearings and each carrying a gear **44, 44** at its lower end (see Fig. 6). The two latter gears are intermeshed and of the same pitch diameter, so that the two feed rolls **42, 42** are driven at the same speed, and one of said gears is also meshed with the pinion **36** through which the feed rolls are driven.

It will be apparent that the feed rolls **42, 42** grip the rod **15** and serve to force the same lengthwise through the straightening rolls. As the rod emerges from the feed rolls it passes between a pair of guide rolls **46, 46** which, like the straightening rolls, are mounted on vertical studs **47, 47**; and it is thereupon engaged by a bending roll **50** which cooperates with the guide rolls **46, 46** to apply bending pressure to the rod. The bending roll **50** is rotatably mounted on a stud **51** the lower end of which is secured to a carriage **52** which is slidably mounted in a guide member **53** and provided with an upstanding lug **54** to which is pivotally connected, by means of a pin **55**, a two-piece link **56** forming an arm of a toggle **57** whose other arm comprises a link **58**. The latter is pivotally connected at one end to the adjoining end of the link **56** by means of a pin **59** and at its other end it is pivotally connected by a pin **60** to a clevis **61** which, in turn, is fixedly secured to one end of an adjusting screw **62**, which passes through an aperture in a lug **63** welded to the platform **21**; the adjusting screw being secured by a pair of lock nuts **64, 64**. An upstanding arm **65** is rigidly secured to the link **58** and serves as a means whereby a workman can manipulate the toggle **57** to effect forward and backward movement of the bending roll **50** and its carriage **52**.

The operative position of the bending roll **50** is determined by the adjustment of the screw **62** whose position is then fixed by adjustment of the lock nuts **64**. The curvature imparted to the rod is, of course, a function of the operative position of the bending roll, relative to the guide rolls **46**. In order to start the bending operation, when a fresh rod is inserted, it is necessary to retract the bending roll **50** and then force it forwardly against the rod, and this is accomplished by means of the toggle arm **65** in the manner already explained. It is desirable to adjust the bending machine so that the curvature imparted to the rod will result in a helix of the prescribed diameter. This can readily be done by running through the machine a length of rod and measuring its curvature with a templet, as

adjustments proceed, until exactly the right curvature is obtained.

I claim:

1. The method of applying an encircling steel-rod coil to an existing building column, which comprises progressively bending the steel rod at a fixed point adjacent the column to the desired curvature and passing the curved rod lengthwise around the column as the bending operation proceeds forming a multiple turn coil around the column in situ.

2. The method of applying an encircling steel-rod coil to an existing building column, which comprises placing a bending machine in a fixed position adjacent the column and passing the steel rod therethrough to bend the same to the desired curvature, and leading the curved steel rod lengthwise around the column as it emerges from the bending machine forming a multiple turn coil around the column in situ.

3. The method of reinforcing an existing structural column which comprises progressively bending a steel rod in a fixed position adjacent the column to form a multiple turn coil thereof, and continuously leading the bent rod around the column, lengthwise of the rod, as the bending operation proceeds, so that the coil, upon completion, encircles the column, then axially expanding the coil longitudinally of the vertical dimension of the column to form a helix extending lengthwise of the column, disposing a plurality

of vertical reinforcing rods in spaced relation around the column and securing the same to the helix to provide support for the helix, and then applying to the exterior of the column a shell of plastic concrete mixture of a sufficient thickness to embed the rod reinforcement.

4. The method of applying an encircling steel-rod coil to an existing building column, which comprises progressively bending the steel rod at a fixed point adjacent the column to the desired curvature and passing the curved rod lengthwise around the column as the bending operation proceeds forming a multiple turn coil around the column in situ and then expanding the multiple turn coil axially longitudinally of the vertical dimension of the column.

JOHN D. BOLTON.

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