Jan. 24, 1967 W. J. HILL 3,299,609

ROD BUNDLING MACHINE

Filed July 31, 1964 4 Sheets-Sheet 1

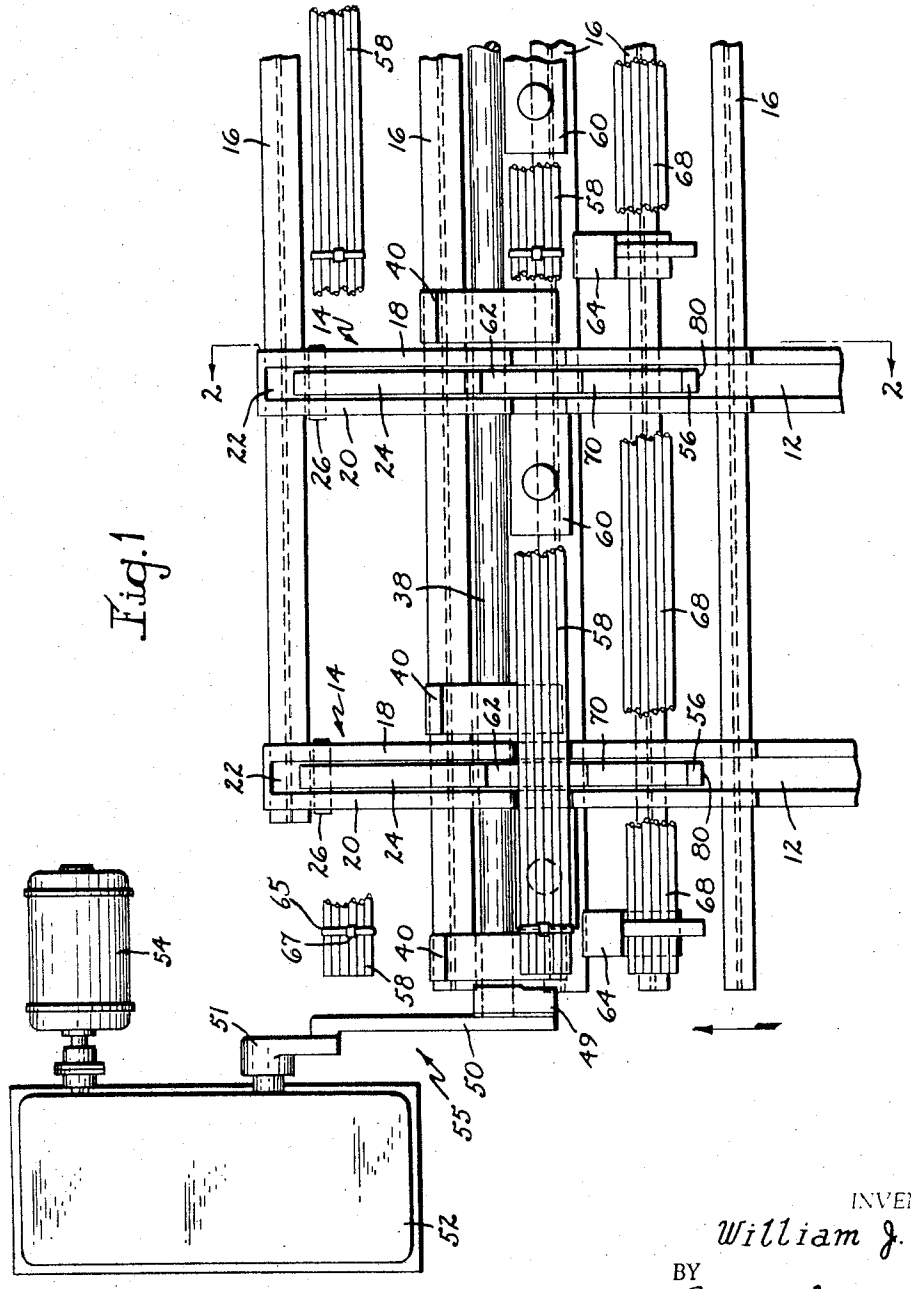


Fig. 1

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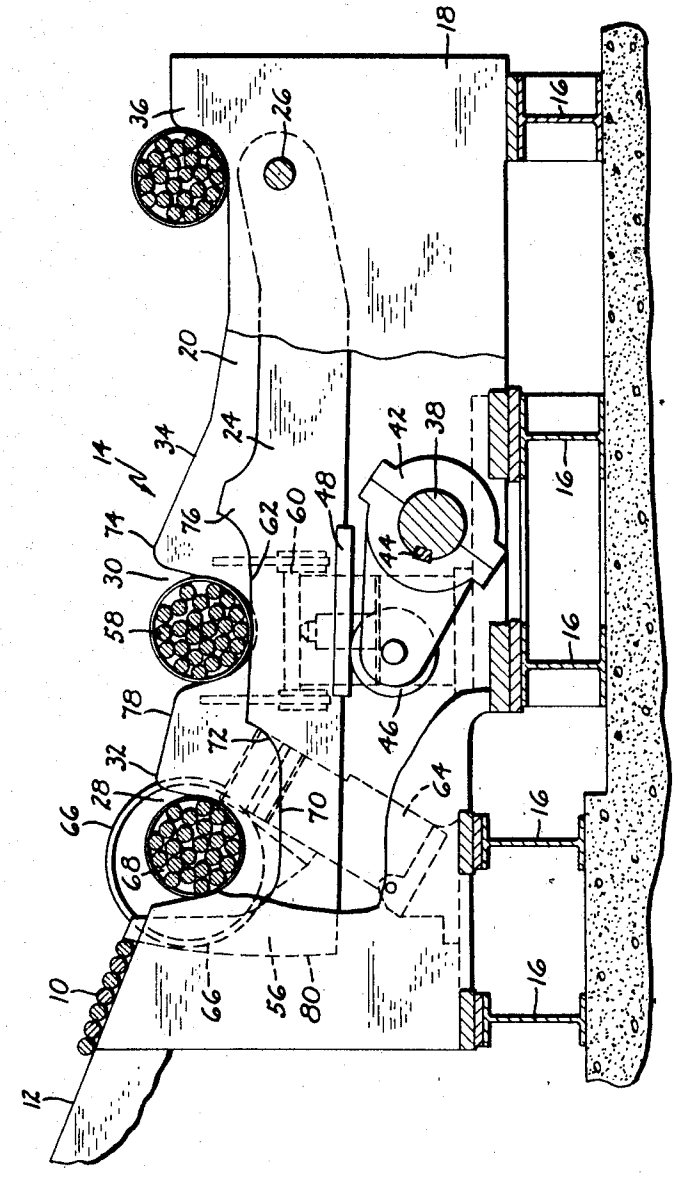


Fig. 2

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ROD BUNDLING MACHINE

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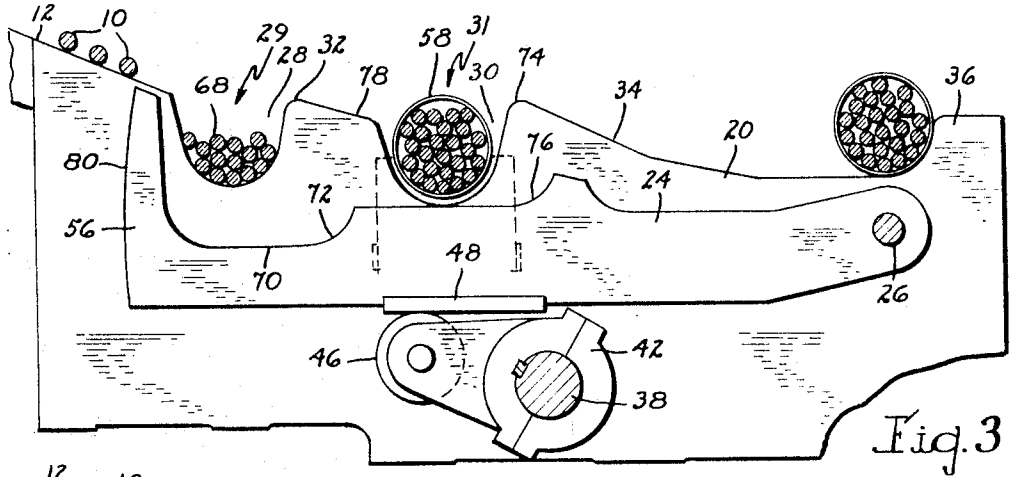


Fig. 3

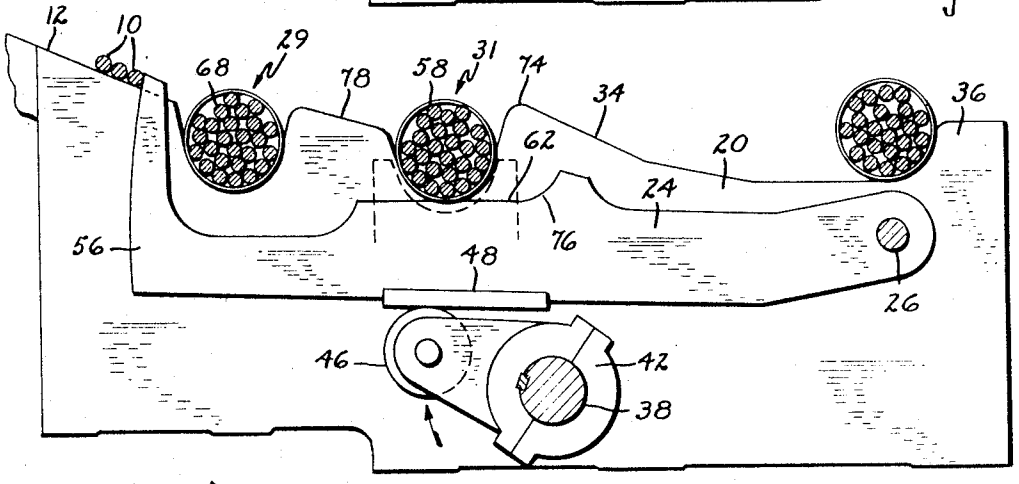


Fig. 4

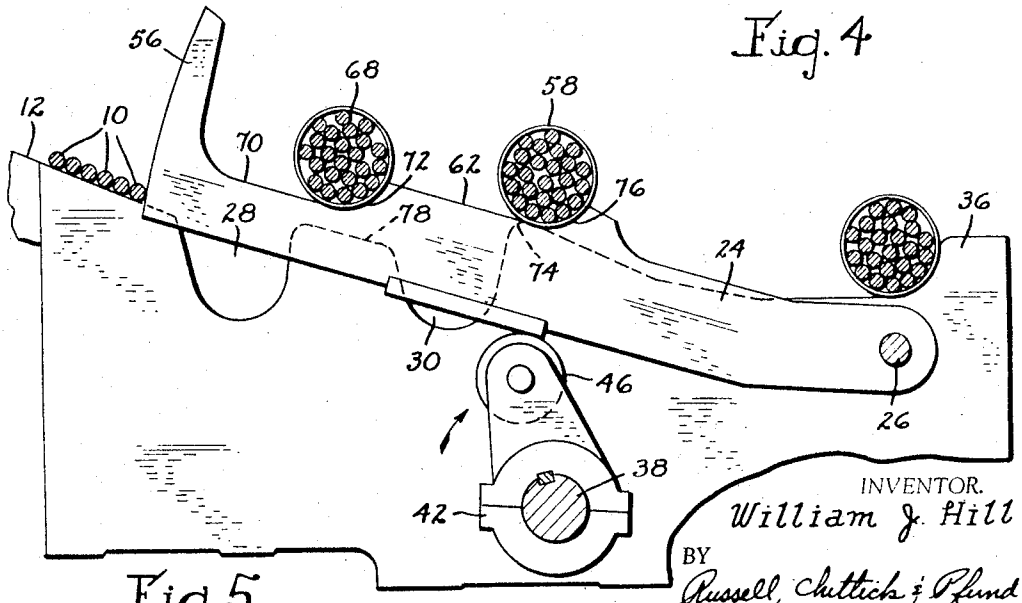


Fig. 5

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ROD BUNDLING MACHINE

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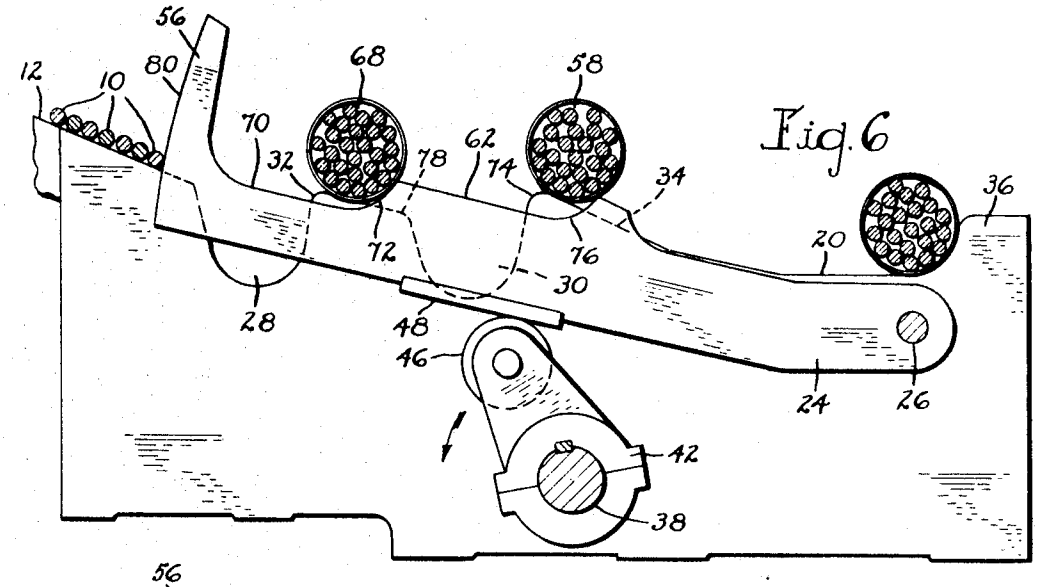


Fig. 6

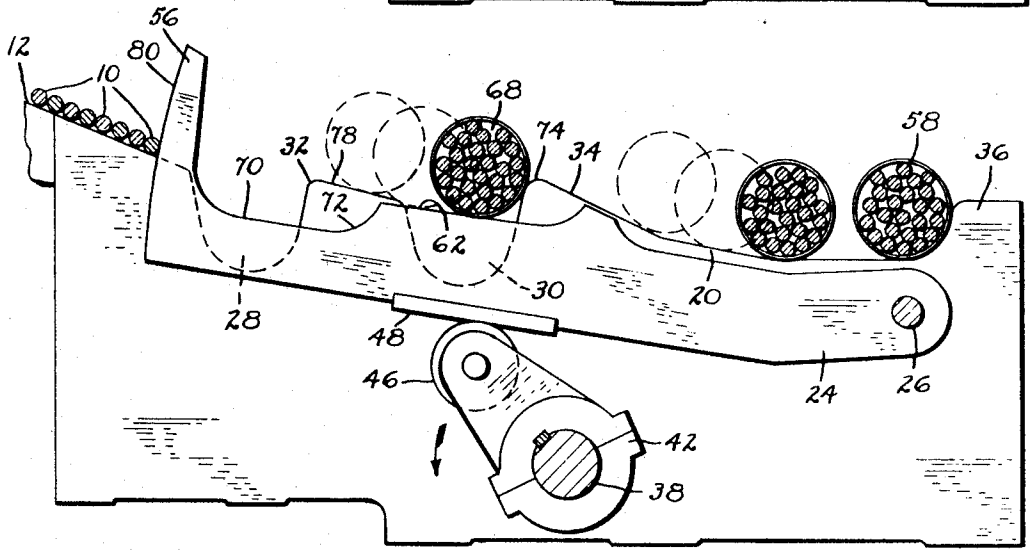


Fig. 7

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3,299,609

ROD BUNDLING MACHINE

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10 Claims. (Cl. 53—167)

This invention relates generally to an apparatus for handling elongated articles and more particularly to a means of collecting and tying predetermined numbers of said articles into bundles, each bundle subsequently weighed before being discharged from the apparatus.

Elongated elements such as bars or pipes produced by various industrial processes are frequently collected and tied into bundles prior to being stored for subsequent shipment to consumers. Reference will hereinafter be made in describing the invention to the handling of rods of the type typically produced by a rolling mill. However, it is to be understood that the invention is capable of bundling any type of elongated element regardless of its particular length and cross-sectional configuration.

The various types of apparatus presently being utilized for bundling and weighing elongated elements embody rather complex constructions, a factor which in turn renders them relatively expensive to purchase and operate. More particularly, known apparatus of the aforementioned type usually comprise considerable numbers of separately operable transfer assemblies. Since each transfer assembly performs a separate function, its movement must be carefully coordinated in conjunction with that of the other components in order to achieve the desired overall sequential operation. Consequently, in addition to requiring a relatively large investment to cover initial equipment costs, the prior art constructions require elaborate control systems and frequent maintenance if they are to perform satisfactorily

The present invention obviates these difficulties by providing a bundling and weighing apparatus which embodies fewer components and an improved sequence of operation. As will hereinafter be described in more detail, the invention includes the positioning of a weighing station adjacent a tying station. The movement of predetermined numbers of elongated elements to the tying station and the subsequent transfer of tied bundles from the tying station to the weighing station and thereafter to an adjacent accumulation surface is controlled solely by the pivotal action of one aligned set of bundle transfer arms. Consequently, both initial equipment costs and subsequent control and maintenance costs are greatly reduced without impairing the desired sequence of operation.

It is therefore an object of the present invention to provide an improved apparatus for collecting, bundling and weighing a predetermined number of elongated elements, said apparatus having a minimum number of operating components.

Another object of the present invention is to provide a bundling and weighing apparatus having a greatly simplified sequence of operation, this advantage being a direct byproduct of the aforementioned simplified construction.

A still further object of the present invention is the provision of an apparatus which due to its simple and rugged construction, is capable of extended periods of trouble-free operation without frequent maintenance by operating personnel.

Another object of the present invention is to provide an apparatus having a sequence of operation which is to a considerable extent self-coordinating, thereby considerably minimizing the number of control elements required

to achieve the desired coordination between various operating components.

Another object of the present invention is to provide a bundling and weighing apparatus having fewer operating components, thereby considerably reducing initial equipment expenditures and subsequent operating costs.

Stated somewhat in more detail, a further object of the invention is to position a series of stationary supporting members in spaced lateral alignment between a continuous source of elongated elements such as bars or pipes and the point where the completed bundles are to be retrieved for subsequent storage and shipment. Each stationary member is provided with tying and weighing notches which are aligned laterally to form a tying station and a weighing station. Pivotal arm members are mounted adjacent each stationary member for laterally aligned pivotal movement about a common axis relative to the tying and weighing stations.

In operation, a continuous supply of elongated elements are directed laterally to the tying station. When a predetermined number of elements have been collected, the pivotal arms are raised to an intermediate position in order to temporarily obstruct further movement of elements to the tying station. Thereafter, conventional strapping machines are actuated to tie the collected elements into a strapped bundle. It is to be understood that a previously strapped bundle is already in position at the weighing station where its weight has been determined by conventional scales. When the tying and weighing operations have been completed, the pivotal arms are raised to elevate both bundles simultaneously with the result that the weighed bundle is transferred to an adjacent accumulation surface while the bundle previously positioned at the tying station is transferred to the weighing station. In this manner, the transfer of both bundles is accomplished in the proper coordinated sequence through the pivotal displacement of one aligned set of bundle transfer arms.

These and other objects of the present invention will become more apparent as the description proceeds with the aid of the accompanying drawings wherein:

FIG. 1 is a plan view of a portion of the apparatus with bundles positioned at the tying and weighing stations and on the accumulation surface;

FIG. 2 is a section view of a typical bundle handling assembly taken along line **2—2** of FIG. 1 with a portion of one of the stationary supporting members partially broken away to show the means for elevating the bundle transfer arm pivotally associated therewith, and,

FIGS. 3 to 7 are diagrammatic illustrations similar to FIG. 2 depicting a typical sequential operation of the apparatus.

Referring initially to FIGS. 1 and 2 wherein are best shown general features of the present invention, it can be seen that individual elongated elements in the form of rods indicated typically by the reference numeral **10** descend laterally over sloping surface **12** to be presented to a plurality of transversely extending individual bundle handling assemblies **14**. It is to be understood that the bundle handling assemblies are positioned at laterally aligned intervals beneath the entire length of the product being handled and are fixed to common underlying horizontal supporting members **16**. However, since FIGURE 1 is a plan view of one end of the apparatus showing but a portion of the rods being handled, only two of the underlying bundle handling assemblies **14** appear in this illustration.

Each bundle handling assembly **14** is comprised basically of stationary bundle supporting side members **18** and **20** spaced to provide an intermediate space **22** within which is located a bundle transfer arm **24**. The bundle

transfer arms of each assembly 14 are pivotally connected between the bundle supporting side members 18 and 20 by means of short pivotal shafts 26. The pivotal shafts are in turn concentrically aligned to provide a common axis about which the bundle transfer arms may be pivoted in unison as will hereinafter be described in more detail.

When viewed from left to right as shown in FIG. 2, the stationary side members 18 and 20 of each bundle handling assembly 14 are provided with tying and weighing notches 28 and 30 spaced by an intermediate peak or raised shoulder 32. Weighing notch 30 is in turn followed by a gradually sloping edge 34 which terminates in a raised stop 36.

As can be best seen in FIG. 1, the tying notches 28 of each bundle handling assembly 14 are laterally aligned to form what will hereinafter be referred to as a "tying station 29." Similarly, the weighing notches 30 are also laterally aligned to form a "weighing station 31."

A single elongated drive shaft 38 extends transversely through each bundle handling assembly 14 and is journalled for rotation within a plurality of spaced bearings 40. As illustrated in FIG. 2 which is a sectional view showing a typical bundle handling assembly, shaft 38 is provided at a point beneath each bundle transfer arm 24 with a bell crank 42 fixed for rotation therewith by means of a key 44. Bell cranks 42 are somewhat elongated in shape with their free ends forming bifurcated extensions within which are mounted rotatable arm engaging rollers 46. The rollers are positioned to engage hardened bearing plates 48 fixed to the lower edge of each bundle transfer arm 24.

As can best be seen in FIG. 1, shaft 38 is provided at one end with an arm member 49 keyed thereto and connected by means of an intermediate link member 50 to the operating crank 51 of a gear reducer 52. When crank 51 is angularly displaced in a clockwise direction by operation of an electric motor 54 connected to gear reducer 52, the linkage assembly 55 comprised of intermediate link 50 and arm member 49 will initially impart clockwise rotation to shaft 38 followed by reverse counterclockwise rotation as crank 51 is rotated through a full 360°.

The initial clockwise rotation of shaft 38 and the bell cranks 42 operatively connected thereto will cause the bundle transfer arms 24 to be pivotally raised in unison about the common pivotal axis represented by aligned pivotal shafts 26. Similarly, the reverse counterclockwise rotation of shaft 38 will result in a downward pivotal displacement of the bundle transfer arms.

Having thus described the principal components which comprise the apparatus, the operational sequence will now be discussed with particular reference to the diagrammatic illustrations contained in FIGS. 3 to 7. As shown in FIGURE 3, the bundle transfer arms 24 have been pivoted to the lowermost position. At this point, the upwardly disposed extremity 56 of each arm is located below the level of sloping surface 12. Consequently, stock herein shown in the form of elongated bars 10 is allowed to roll laterally down surface 12 to be deposited in the laterally aligned tying notches 28 collectively referred to as tying station 29. Where the elongated elements are of different cross-sections, as for example squares, the slope of surface 12 may be increased to slide the elements transversely into tying station 29. As bars are being allowed to collect at the tying station, a previously strapped bundle indicated by the reference numeral 58 is already in position at weighing station 31. It should be understood that at this point, bundle 58 is totally at rest on a number of aligned conventional scale cradles 60 positioned adjacent each bundle handling assembly 14. In this manner, the weight of the bundle is accurately determined while individual rods are being collected at tying station 29.

When a predetermined number of bars have been deposited at tying station 29, motor 54 is energized to rotate drive shaft 38 in a clockwise direction until the upwardly disposed end extremity 56 of each bundle transfer arm 24 protrudes slightly above sloping surface 12. This condition which prevents additional bars from being deposited at the tying station, is clearly illustrated in both FIGURES 2 and 4. At this point in the operating cycle of the apparatus, previously strapped bundle 58 has been engaged by the raised surface 62 of each bundle transfer arm 24 and has been elevated slightly from the scales 60. Conventional strapping machines 64 positioned at convenient intervals along the entire length of rods collected at tying station 29 then operate to place curved strapped tracks 66 around the loosely collected individual rods. Thereafter, the strapping machines operate to extend a length of retaining strap 65 (see FIG. 1) along the circular path defined by the tracks. Once extended, the retaining strap is tensioned, pulled from the strap track and a locking seal 67 (see FIG. 1) crimped thereto. The strap is then cut and the tracks 66 withdrawn, leaving the rods collected at the tying station in the form of a strapped bundle as indicated in FIGS. 2 and 4 by the reference numeral 68.

Once the strapping machines 64 have cycled, motor 54 is again energized to further rotate drive shaft 38. The resulting upward pivotal movement of the bundle transfer arms 24 will continue until they are positioned at a maximum elevation as indicated in FIG. 5.

As the bundle transfer arms are being raised to the level of FIG. 5, bundle 68 is engaged by depressed surface 70 and elevated simultaneously with bundle 58. At the point of maximum elevation shown in FIG. 5, bundle 68 has been raised above the intermediate shoulders 78 of bundle suporting side members 18 and 20 and allowed to move down the now inclined depressed surface 70 into engagement with arm stop 72. Similarly, bundle 58 has been raised above fixed shoulder 74 which is positioned to the right of weighing notches 30 and allowed to move into engagement with raised arm stop 76.

At this point, shaft 38 begins its reverse rotation in a counterclockwise direction, causing the bundle transfer arms 24 to be lowered about their respective pivotal shafts 26. In actual operation, the downward movement of bundle transfer arms 24 is continuous and uninterrupted from the point of maximum elevation indicated in FIG. 5 to the lowered position as indicated in FIG. 3. However, for purposes of illustration, this downward movement has been diagrammatically interrupted as indicated in FIGS. 6 and 7 to better describe the operation of apparatus.

More particularly, as shown in FIG. 6 bundle transfer arms 24 have been lowered to a point where bundle 68 is in a retained position by the downward moving raised arm stop 72 and the fixed intermediate raised shoulder 32. Similarly, bundle 58 is in a retained position engaged by both arm stop 76 and fixed shoulder 74. In effect, the fixed shoulders 32 and 74 are acting to temporarily hold the bundles as the bundle transfer arms are being lowered.

Further lowering of the bundle transfer arms results in raised arm stops 72 being depressed below the level of the short inclined surface 78 which extends between intermediate raised shoulder 72 and weighing notch 30. At the same time, raised arm stop 76 has been depressed below gradually sloping edge 34. With the bundle transfer arms so positioned, bundle 58 is free to move down gradually sloping edge 34 to a position at rest against raised stop 36. Simultaneously, bundle 68 is allowed to move for a short distance along the short inclined surface 78 before being transferred to the raised edges 62 of the bundle transfer arms.

It should be noted at this time that each bundle transfer arm 24 is further provided with an outer edge 80 having a radius of curvature swung about pivotal shaft 26. With this construction, bars 10 are not only temporarily obstructed on sloping surface 12 as the bundle transfer arms are being raised and lowered as previously

described, but in addition are held stationary due to the curvature of outer edge **80**. In this manner, the torque necessary to pivot each bundle transfer arm need not be increased by an amount necessary to push the accumulation of rods **10** up inclined surface **12**.

As the bundle transfer arms **24** are lowered from a position as indicated in FIG. 7 to their original depressed position as indicated in FIG. 3, bundle **68** is gradually lowered until it is gently deposited on scale cradles **60**. Moreover, the upwardly disposed extremities **56** of the arms are depressed below inclined surface **12**, with the result that individual rods **10** are again delivered to the tying station. When a predetermined number of rods have been deposited therein, the entire aforementioned cycle is again repeated.

In view of the above, it can be seen that with the present construction, bundles may be readily transferred from the tying station to the weighing station and thereafter to an adjacent accumulation surface by the pivotal displacement of an aligned set of bundle transfer arms. While one bundle is being strapped, the continuous supply of rods is temporarily obstructed by an integral part of the arms. Once the strapping operation has been completed, the strapped bundle is transferred to the weighing station and a previously strapped bundle cleared from the weighing station by downward pivotal movement of the arms. Consequently, it can be seen that to a considerable extent, the apparatus is self-coordinating in that the sequential transfer of bundles is controlled solely by the relative shapes of the bundle transfer arm and their adjacent bundle supporting side members.

It is my intention to cover all changes and modifications herein chosen for purposes of disclosure which do not depart from the spirit and scope of the invention.

I claim:

1. Apparatus for bundling and weighing elongated elements comprising the combination of: means for successively delivering laterally aligned elongated elements to a collecting station; tying means operable when a predetermined number of said elements have collected at said collecting station for tying said collected elements into a newly strapped bundle; a bundle weighing station adjacent said collecting station for weighing a previously strapped bundle transferred thereto from said tying station; bundle transfer means operatively positioned adjacent said collecting and bundle weighing stations for pivotal movement in relation thereto about a common axis; and means for pivoting said bundle transfer means following operation of said tying means and the weighing of said previously strapped bundle at said weighing station in order to first transfer said previously strapped bundle from said weighing station to an adjacent accumulation surface before transferring said newly strapped bundle from said collecting station to said weighing station.

2. The apparatus as set forth in claim **1** further characterized by stop means for interrupting the delivery of elements to said collecting station during operation of said tying means.

3. Apparatus for bundling and weighing a plurality of elongated elements comprising the combination of: a downwardly inclined surface over which a succession of said elements are carried under the influence of gravity and deposited in a first retaining means; tying means at said first retaining means for tying said elements into a bundle; a second retaining means adjacent said first retaining means; a first bundle transfer means for transferring said bundle from said first retaining to said second retaining means; weighing means at said second retaining means for weighing said bundle; and a second bundle transfer means for transferring said bundle from said second retaining means to an adjacent accumulation surface prior to another bundle being deposited therein by said first bundle transfer means, said first and second bundle transfer means mounted for pivotal movement about a common axis relative to said first and second retaining means.

4. The apparatus as set forth in claim **3** further characterized by stop means for temporarily arresting further movement of elements down said inclined surface when a predetermined number of said elements have been collected at said first retaining means, said stop means pivotal with said first and second bundle transfer means about said common axis.

5. Apparatus for use in collecting a continuous supply of elongated elements into bundles and thereafter weighing each said bundles comprising the combination of a downwardly sloping surface over which a succession of said elements travel under the influence of gravity in a direction transverse to their axial lengths, said surface terminating in a first depression in which said elements are initially collected; stop means for temporarily arresting further movement of elements down said surface when a predetermined number of said elements have been collected in said first depression; tying means associated with said first depression for tying elements collected therein into a bundle; a first bundle transfer means for transferring said bundle from said first depression to a second adjacent depression; weighing means at said second depression for weighing said bundle, and a second bundle transfer means for transferring said weighed bundle from said second depression to an adjacent accumulation surface prior to another bundle being deposited in said second depression by said first bundle transfer means, said stop means and said first and second bundle transfer means integrally fabricated and mounted for pivotal movement relative to said inclined surface and said first and second depressions about a common axis.

6. Mechanism for bundling and weighing a plurality of elongated elements comprising the combination of: means for successively delivering laterally aligned elongated elements to a collecting station; tying means operable when a predetermined number of said elements have assembled at said collecting station for tying said collected elements into a strapped bundle; a bundle weighing station adjacent said collecting station for weighing previously strapped bundles; a plurality of aligned bundle transfer means operatively positioned adjacent said collecting and bundle weighing stations, each said bundle transfer means mounted at one end for pivotal movement about a common transverse axis, the other ends of said bundle transfer means terminating in a series of laterally aligned element stops; and pivotal means for initially pivoting said bundle transfer means about said common transverse axis from a lowered position to an intermediate raised position in order to place said element stops across the path of elements being delivered to said collecting station, thereby interrupting the delivery of elements to said collecting station during operation of said tying means, said pivotal means subsequently operable to further raise said bundle transfer means in order to first transfer a previously strapped bundle from said weighing station to an adjacent accumulation surface and thereafter to transfer said strapped bundle from said collecting station to a supported position overlying said weighing station whereby downward displacement of said bundle transfer means will result in said strapped bundle being deposited at said weighing station as said element stops are retracted to permit further delivery of elements to said collecting station.

7. Apparatus for bundling and weighing a plurality of elongated elements prior to depositing said bundled elements onto an adjacent accumulation surface, said apparatus comprising the combination of: a plurality of spaced supporting members extending from a point adjacent a continuous supply of said elements to said accumulation surface, each said supporting members provided with tying notches aligned laterally to form a tying station, said supporting members further provided with weighing notches separated from said tying notches by intermediate raised shoulders and laterally aligned to form a weighing station; means for successively delivering laterally aligned elongated elements to said tying station; tying means oper-

able when a predetermined number of said elements have assembled at said tying station for tying said collected elements into a strapped bundle; weighing means at said weighing station for determining the weight of a previously strapped bundle transferred thereto from said tying station; bundle transfer means positioned adjacent said supporting members and mounted for aligned pivotal movement in relation thereto about a common transverse axis; aligned element stops on said bundle transfer means for temporarily arresting delivery of elements to said tying station during operation of said tying means, said element stops operable when said bundle transfer means are pivoted upwardly between intermediate and fully raised positions; and means for pivoting said bundle transfer means from lowered inoperative positions to said intermediate positions during the tying operation and thereafter to said raised position in order to simultaneously raise said strapped bundle above said intermediate raised shoulders while transferring said previously strapped bundle from said weighing station to said accumulation surface, said intermediate raised shoulders cooperating with said bundle transfer means during downward pivotal displacement of the latter to deposit said strapped bundle at said weighing station.

8. The apparatus as set forth in claim 7 wherein said spaced supporting members are further characterized by second raised shoulders immediately following said weighing notches, said second shoulders gradually sloping away towards fixed abutments to form said accumulation surface.

9. The apparatus as set forth in claim 8 wherein said bundle transfer means are provided with aligned first and second upwardly disposed bundle stops.

10. Apparatus for bundling and weighing a plurality of elongated elements comprising the combination of: a plurality of horizontal laterally aligned spaced supporting members, the upper edge of each said supporting members depressed at a point adjacent one end thereof to form a tying notch, the tying notches of each said supporting members aligned laterally to provide a tying station, said supporting members further provided with weighing notches separated from said tying notches by raised intermediate shoulders and aligned laterally to form a weighing station, the upper edges of said supporting members following said weighing notches being formed into second raised shoulders gradually declining towards the other end of said supporting members to form a bundle accumulation surface; means for successively delivering

laterally aligned elongated elements to said tying station; tying means operable when a predetermined number of said elements have assembled at said tying station for tying said collected elements into one strapped bundle; weighing means at said weighing station for weighing another previously strapped bundle transferred thereto from said tying station; bundle transfer means adjacent said supporting members, said bundle transfer means mounted for pivotal movement about a common transverse axis and having first and second bundle stops protruding upwardly therefrom, said bundle transfer means further provided with element stop means for temporarily arresting delivery of elements to said tying station during operation of said tying means, said element stop means operable when said bundle transfer means are pivoted upwardly between intermediate and fully raised positions; and means for pivoting said bundle transfer means from lowered inoperative positions to said intermediate positions during the tying operation and thereafter to said raised positions in order to raise said one strapped bundle from said tying station above said raised intermediate shoulders to a position at rest on said bundle transfer means against said first bundle stops while simultaneously raising said other previously strapped bundle from said weighing station to a position overlying said second raised shoulders at rest on said bundle transfer means against said second bundle stops, whereby subsequent lowering of said bundle transfer means will result in said other previously strapped bundle being pushed by said second raised shoulders over said second bundle stops onto said bundle accumulation surface prior to said one strapped bundle being pushed over said first bundle stops by said intermediate raised shoulders to a position at rest on said bundle transfer means against said second bundle stops, thereafter to be lowered onto said weighing station as said bundle transfer means are lowered to an inoperative position.

References Cited by the Examiner

UNITED STATES PATENTS

2,607,467	8/1952	Morgan	198—39
3,135,076	6/1964	Hill	53—198
3,221,641	12/1965	Adams et al.	53—198

FOREIGN PATENTS

682,133	10/1939	Germany.

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