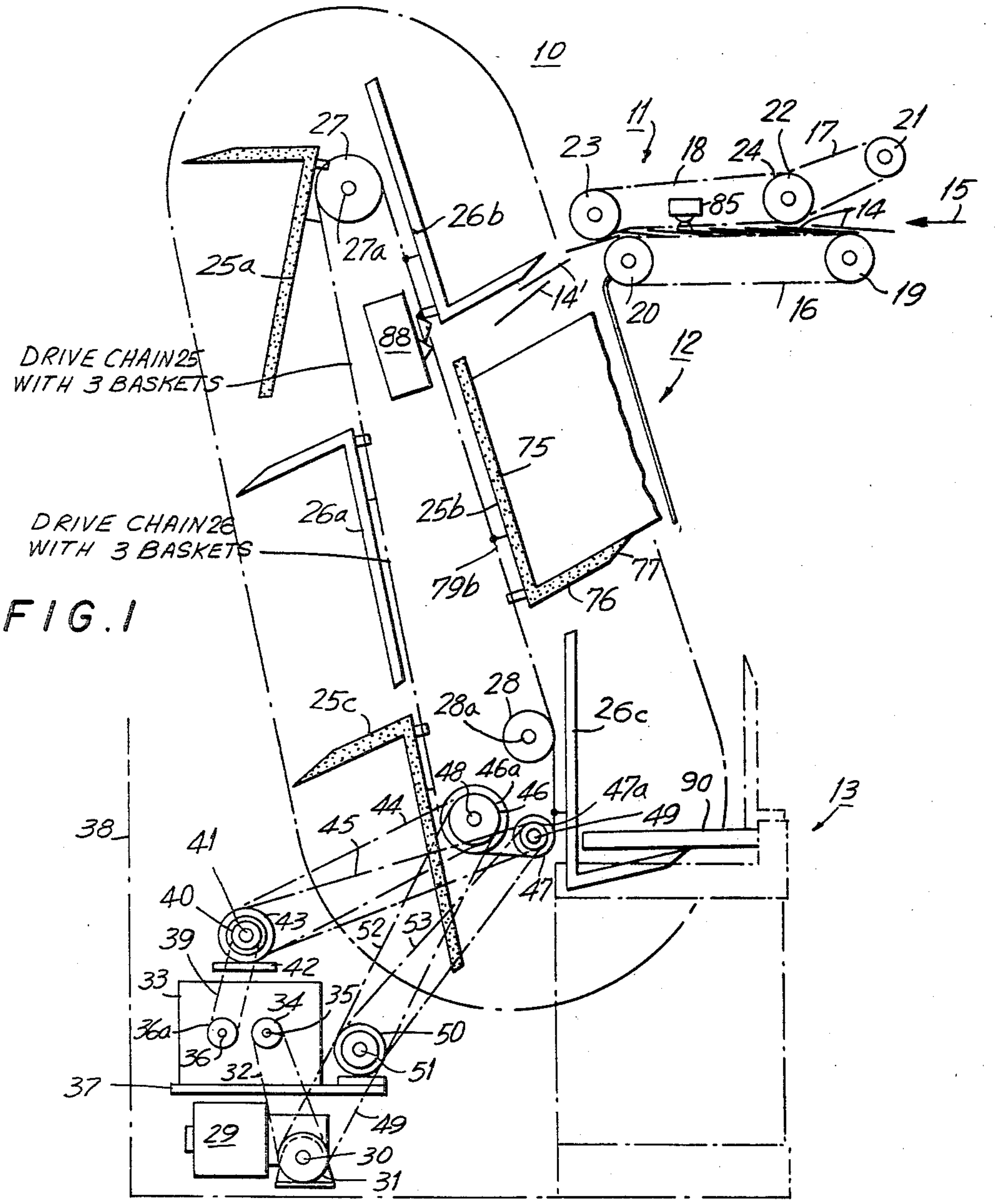

FIG. 1

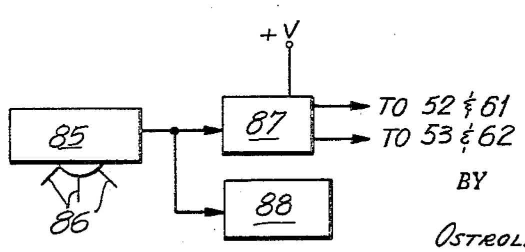

FIG. 3

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BUCKET DRIVE

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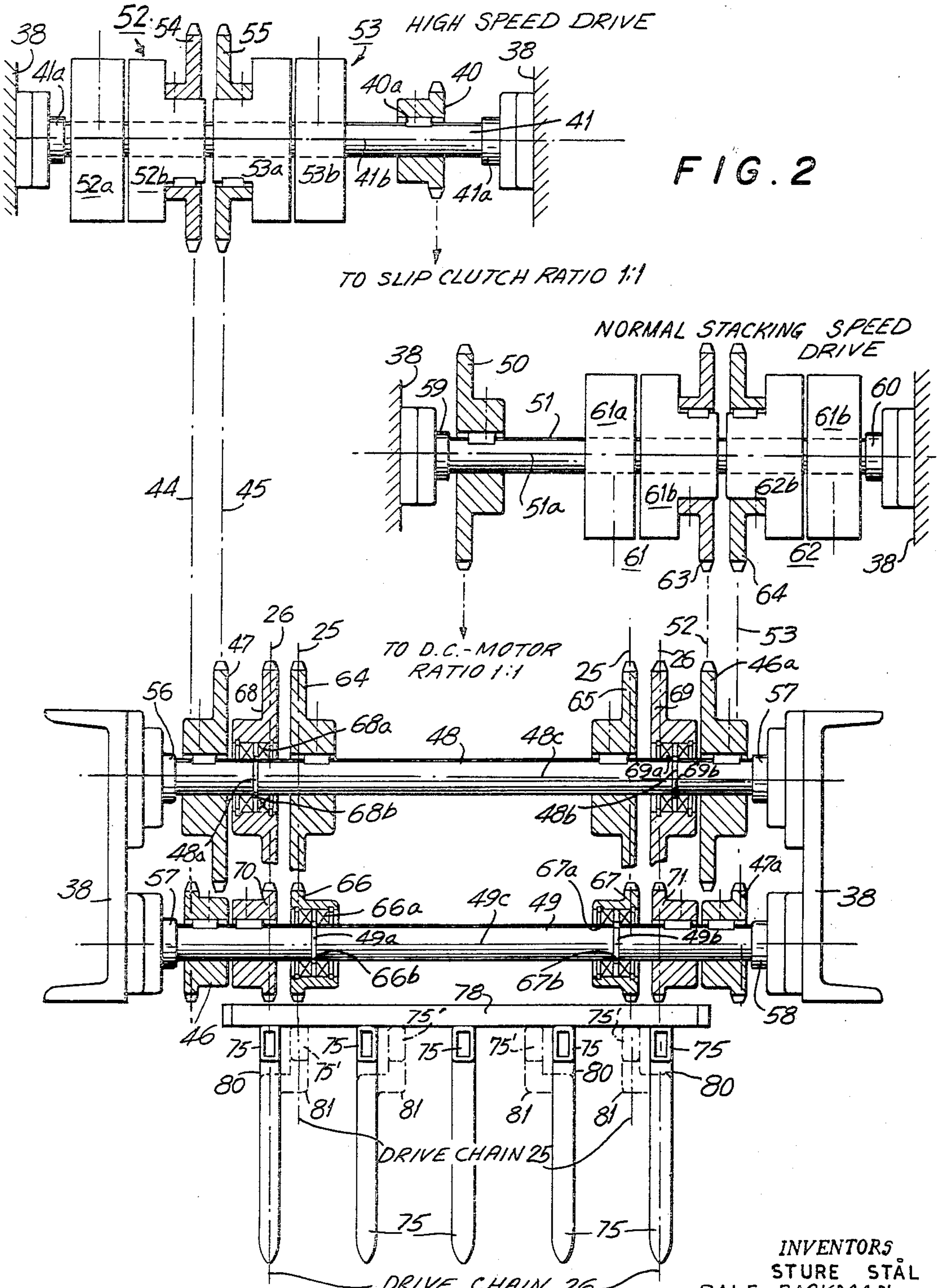

FIG. 2

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Nov. 25, 1969 S. STAL ET AL 3,479,932

BUCKET DRIVE

Filed March 14, 1968 4 Sheets-Sheet 3

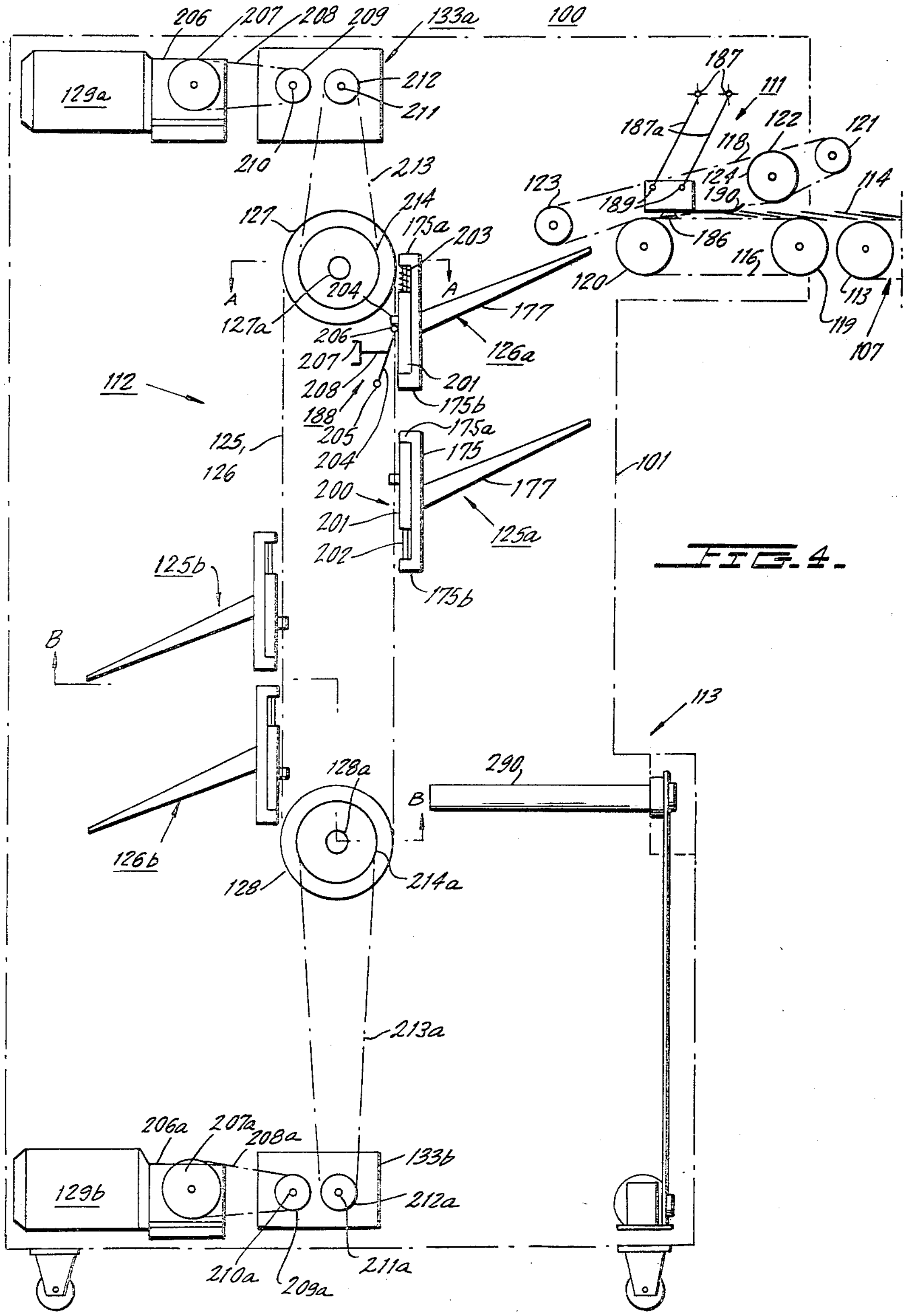


FIG. 4.

FIG. 5a

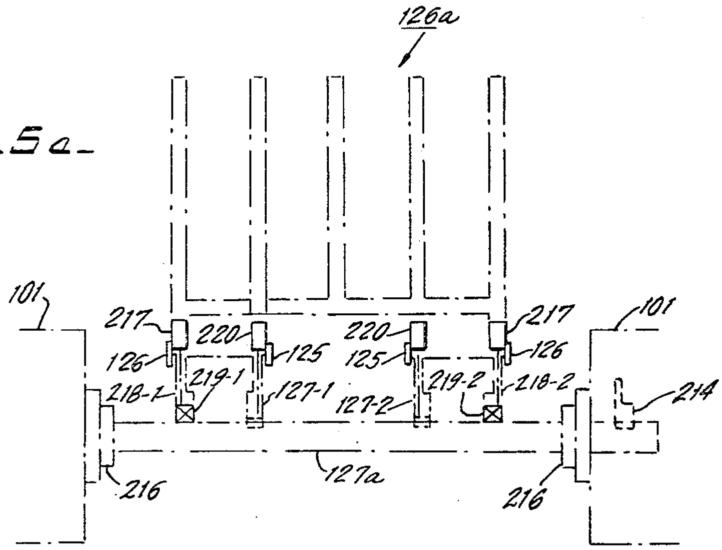


FIG. 5b

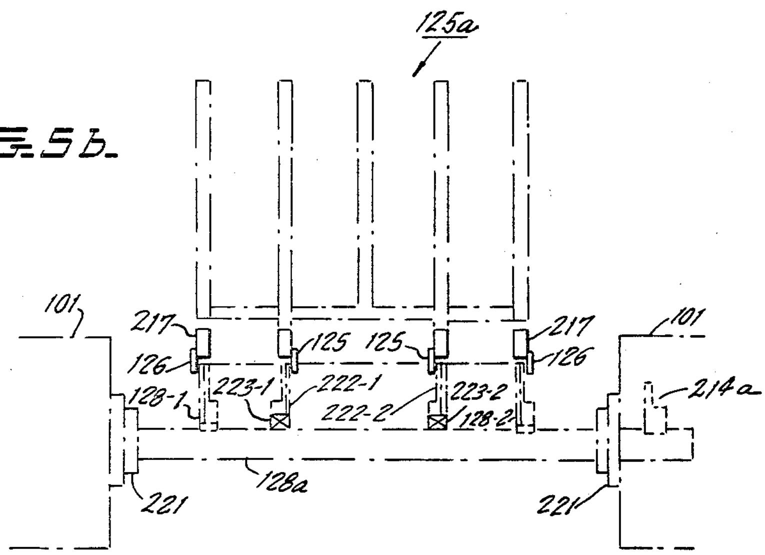
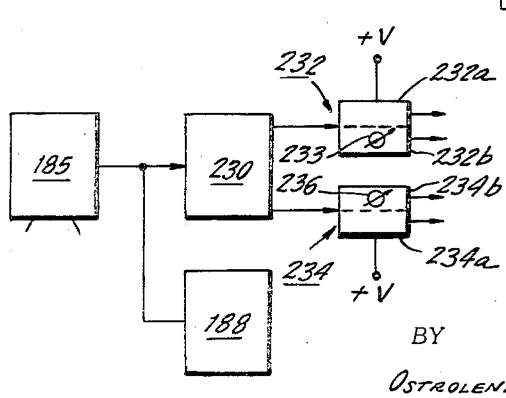


FIG. 6



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3,479,932
BUCKET DRIVE

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Int. Cl. B65h 33/16
U.S. Cl. 93—93 19 Claims

ABSTRACT OF THE DISCLOSURE

A stacker for newspapers, and the like, in which folded newspapers entering the stacker in an overlapped fashion are collected upon a moving bucket intercepting the stream of newspapers to form newspaper bundles of an accurate, predetermined count in readiness for subsequent wrapping and delivery operations.

Alternate buckets are coupled to different pairs of drive chains which are selectively driven at either normal stacking speed or four times stacking speed to permit the next bucket to be placed in the readiness position for intercepting the stream while the preceding bucket is receiving and stacking newspapers being delivered by the incoming stream.

The present invention relates to stackers and counters for newspapers, signatures, and the like, and more particularly to a novel bucket drive system comprised of two pairs of drive chains selectively driven at either normal stacking speed or at high speed enabling the next bucket to receive newspapers from the incoming newspaper stream to be moved rapidly to the intercept position while the preceding bucket is receiving and stacking newspapers delivered from the incoming stream.

Stackers and counters find widespread use throughout the graphic arts industry wherein it is desired to stack newspapers, magazines and other like signatures into bundles of predetermined size, which bundles may then subsequently be tied and in readiness for delivery. Stackers which are suitable for performing these functions are set forth in detail in U.S. Patent No. 3,326,353, issued June 20, 1967, and in copending application Ser. No. 670,729, filed Feb. 15, 1966, both of which are assigned to the assignee of the present invention. Basically, such stackers are comprised of an infeed conveyor section which receives newspapers, and like signatures, for example, delivered from a press room in folded, overlapping fashion. The newspaper delivery stream feeds the newspapers at the output rate of the press room which, in many present-day publishing establishments, are capable of delivering newspapers at the rate of over 70,000 per hour.

The above-mentioned U.S. application and U.S. patent disclose a stacker having an infeed conveyor section provided with means for counting the newspapers of the incoming stream. Chain driven buckets arranged at spaced intervals along the chain pass the downstream end of the infeed conveyor section as the chain drive is operated to cause the newspaper stream to be intercepted so that the newspapers will be delivered to and stacked upon a bucket. The bucket immediately behind the bucket receiving newspapers is moved to a latched position, and is restrained from intercepting the newspaper stream until the counting mechanism releases the latch, allowing the latched bucket to intercept the newspaper stream. When the unlatched bucket moves to the intercept position, newspapers passing through the downstream end of the infeed conveyor section are automatically diverted to the unlatched bucket, thereby preventing any further newspapers from being stacked upon the bucket previously receiving newspapers. This operation, in addition to forming the newspapers into bundles, guarantees that each bundle will contain a predetermined count of newspapers.

The stacker described in the above-mentioned issued patent and copending application is provided with a single pair of drive chains to which all buckets are mechanically linked. Thus, when a bucket is being driven at normal stacking speed, the remaining buckets will likewise be driven at normal stacking speed. This operation imposes a limitation upon bundle size for the following reason:

Once a bucket is unlatched and moved to the intercept position, the bucket is driven through the stacking region at normal stacking speed. This means that the bucket immediately behind the bucket moved into the intercept position likewise moves to the latched position at normal stacking speed. If the bucket being stacked receives the predetermined number of newspapers before the next bucket coupled to the drive chain reaches the latched position, then the next bucket in line will not be provided with the necessary amount of acceleration required to cleanly intercept the newspaper stream and thereby assure an accurate count. In addition thereto, when the stacker receives newspapers at very high press speeds, the rate of feed of the newspapers upon the bucket being stacked may be so great as to stack up the predetermined number of newspapers upon the bucket being stacked before the next bucket in line is moved to the latched position. This situation will again cause an error in the count of newspapers in each bundle being formed. Thus, it can be seen that conventional stackers have the disadvantages of being limited as to the smallest bundle which can be formed by the stacker and have an upper limit as to the number of newspapers per unit time which can be fed to the stacker for rapidly forming bundles of an exact predetermined count.

The present invention provides a novel bucket drive system for overcoming the above disadvantages.

This invention is characterized by providing first and second pairs of drive chains, each having a plurality of buckets mechanically coupled thereto so that the buckets of each pair of drive chains are alternately moved through the stacking region. For example, as one of the buckets coupled to a first pair of drive chains is moving through the stacking region, the next bucket in line which is mechanically coupled to the second pair of drive chains is moved to the latched position. The two pairs of drive chains are selectively driven at either normal stacking speed or at high speed. For example, when the bucket of a first pair of drive chains is driven through the stacking region at normal stacking speed, the remaining pair of drive chains is operated at high speed to allow the next bucket in line which is mechanically coupled to the remaining pair of drive chains to be rapidly moved to the latched position in readiness for movement to the intercept position. High speed movement of the next bucket in line to the latch position enables the next intercept operation to be performed a very short time interval after unlatching of the bucket ahead of it so as to enable a very small number of newspapers to be stacked upon the bucket moving through the stacking region, or conversely, so as to enable the stacker to receive newspapers from a press room at very high speeds.

In one preferred embodiment, a suitable motor means is provided for driving the first and second pairs of chains. The output shaft of the motor is coupled through a first mechanical coupling means to a first chain drive sprocket, and then is coupled through a second mechanical coupling means to a second chain drive sprocket. The first and second mechanical coupling means convert the output speed of the motor in such a manner as to operate the first drive sprocket at normal stacking speed and to operate the second drive sprocket at high speed, which in one preferred embodiment, is four times normal stacking speed. Electrically operated magnetic clutch means are provided for selectively coupling the first and second pairs of chains to the first and second drive sprockets so that that pair of drive chains having a bucket moving through the stacking region will be coupled to and driven by the first drive sprocket while the remaining pair of drive chains which are coupled to the next bucket in line will be mechanically coupled to and driven by a second drive sprocket, enabling the next bucket in line to be rapidly driven to the latched position well in advance of the time that the desired bundle size is stacked upon the bucket passing through the stacking region. The magnetic clutches are electrically controlled by the signature counting mechanism which alternately couples the first and second pairs of drive chains to the first and second drive sprockets as soon as the predetermined count of newspapers passes beneath the sensing mechanism.

In another preferred embodiment separate motor means may be employed for driving an associated pair of drive chains each having a plurality of buckets connected therewith. The drive chain of the bucket receiving signatures moves through the stacking region at a controlled rate of speed dependent upon the speed at which the newspaper stream is being delivered to the stacker, while the remaining drive chain is moved at high speed in order to rapidly move its next bucket in line into the latched position. The counting means reverses the operating speeds of each motor each time the buckets of the drive chains alternate between moving toward the latch position and receiving signatures, respectively.

It is, therefore, one primary object of the present invention to provide a novel stacker for newspapers, magazines, and other like signatures, which is comprised of means for rapidly driving the next bucket to be stacked to the latched position well before the bucket presently being stacked receives the predetermined count of newspapers so as to enable the stacking of newspapers into extremely small bundles, as well as enabling the stacker to receive and accurately stack newspapers being delivered at very high speed.

Another object of the present invention is to provide a novel stacker for newspapers, magazines, and other like signatures, which is comprised of first and second pairs of drive chains having stacking buckets mechanically coupled thereto wherein the buckets of the first and second drive chains are driven past the stacking region in an alternating fashion.

Yet another object of the present invention is to provide a novel stacker for newspapers, magazines, and other like signatures, which is comprised of first and second pairs of drive chains having stacking buckets mechanically coupled thereto wherein the buckets of the first and second drive chains are driven past the stacking region in an alternating fashion, and wherein means are provided for selectively and alternately driving the first and second drive chains at normal stacking speed or at high speed which is many times greater than normal stacking speed.

Still another object of the present invention is to provide novel stacking means for newspapers, magazines, and other like signatures, which is comprised of first and second pairs of drive chains, each having stacking buckets mechanically coupled thereto for movement through the stacking region in an alternating fashion, and further including drive sprockets driven at normal stacking speed and high speed, respectively, and further including magnetic clutch means for selectively and alternately coupling said drive sprockets to said first and second pairs of chains to enable the formation of bundles of any predetermined count, regardless of the rate of delivery of newspapers from the incoming stream.

These as well as other objects of the present invention will become apparent when reading the accompanying description and drawings in which:

FIGURE 1 shows a schematic elevational view of a stacker designed in accordance with the principles of this invention.

FIGURE 2 is a partially sectionalized view showing the motor means, drive means and magnetic clutches of FIGURE 1 in greater detail.

FIGURE 3 is a block diagram of the electronic control circuitry for the stacker of FIGURE 1.

FIGURE 4 shows an elevational view of another preferred embodiment of the present invention.

FIGURES 5*a* and 5*b* are sectional views of the embodiment of FIGURE 4 looking in the direction of arrows A—A and B—B, respectively.

FIGURE 6 is a block diagram showing the electronics employed in the alternative embodiment of FIGURE 4.

Making reference to the drawings, FIGURE 1 shows a stacker **10** comprised of an infeed conveyor section **11**, a stacking section **12** and an outfeed conveyor section **13**. The infeed conveyor section **11** receives folded newspapers **14** arranged with their folded edges forward and being fed in a stream in overlapping fashion, which stream is moving in the direction shown by arrow **15**. The newspaper stream enters into the upstream end of the infeed conveyor section **11** which is comprised of a lower conveyor assembly **16** and two upper conveyor assemblies **17** and **18**. The conveyor **16** is entrained about rollers **19** and **20** and is aligned substantially horizontally. Conveyor **17** is entrained about pulleys **21** and **22** and is inclined at an angle so as to form a tapering entry portion for the newspaper stream at the upstream end of infeed conveyor section **11**. Conveyor **18** is entrained about pulleys **23** and **24**, and is aligned at a slight angle relative to the horizontal so that the lower portion of conveyor **18** curves slightly around pulley **20** so as to divert the newspapers leaving the downstream end of the infeed conveyor section **11** to be fed outwardly and downwardly, as shown by newspapers **14'**, in order that the newspapers be directed toward and stacked upon the bucket passing through the stacking region. Although the pulleys **22** and **24** appear in FIGURE 1 to be superimposed upon one another, it should be noted that separate pulleys are provided upon a common shaft, and are arranged in alternating fashion upon the shaft. The conveyors **16**, **17** and **18** in actuality are comprised of a plurality of separate belts, each having a width of a few inches. Pulleys **19**, **20**, **21** and **23** may be solid rollers extending the entire width of each assembly **16**, **17** and **18**, whereas pulleys **22** and **24** may be separate pulley members, each having a width of a few inches to receive an associated conveyor belt. The above-mentioned copending application and issued patent show the conveyor section in greater detail, and the description set forth therein is incorporated herein by reference thereto. As one example, U.S. Patent No. 3,326,353 shows the conveyor assembly described briefly herein in FIGURES 3, 4 and 6.

The infeed conveyor section **11** has its conveyor assemblies **16**, **17** and **18** arranged so as to firmly squeeze the newspapers **14** of the incoming stream in order to flatten the newspapers as much as is practically possible and to remove any air present between adjacent sheets of each newspaper or present between adjacent sheets of adjacent newspapers. This operation acts to diminish the thickness of each newspaper and enables more accurate handling of the newspapers during the stacking operation, and causes bundles of reduced thickness to be formed.

The stacking section **12** of stacker **10** is comprised of first and second pairs of drive chains **25** and **26**. The stacking buckets **25*a***, **25*b*** and **25*c*** are mechanically coupled to drive chain pair **25**, while buckets **26*a***, **26*b*** and **26*c***, are mechanically coupled to drive chain pair **26**. The drive chain pairs **25** and **26** are enchained around guide sprockets **27** and **28** which are mounted for free-wheeling rotation upon shafts **27*a*** and **28*a***, respectively. In actuality, guide sprocket **27** consists of four sprockets mounted at spaced intervals along the length of shaft **27*a*** in order to mesh with the links of the four drive chains which make up the drive chain pairs **25** and **26**. In a like manner, guide sprocket **28** is in actuality comprised of four guide sprockets arranged at spaced intervals along the length of shaft **28***a* so as to mesh with the links of the four drive chains which make up the drive chain pairs **25** and **26**. It can clearly be seen that the buckets **25***a* through **25***c* are interspersed with the buckets **26***a* through **26***c* so that buckets of the drive chain pairs **25** and **26** will alternately pass through the stacking region. The means for driving each of the drive chain pairs **25** and **26** is comprised of a D.C. motor **29** having an output shaft **30**. A drive pulley **31** is mounted upon shaft **30** and is rigidly secured thereto so as to rotate with rotation of shaft **30**. A belt **32** is entrained about pulley **31** and a pulley **34** mounted upon a shaft **35**. Shaft **35** constitutes the input shaft of a slip-clutch mechanism **33** which is further provided with an output shaft **36**. Slip-clutch assembly **33** is mounted upon a suitable supporting frame **37** which, in turn, is rigidly secured to the stacker frame **38** (only a portion of which is shown for purposes of simplicity).

The slip-clutch assembly **33** may be of the type set forth in detail in copending U.S. application Ser. No. 724,156, filed Apr. 25, 1968 and assigned to the assignee of the present invention. The detailed description set forth in this application is incorporated herein by reference thereto. For purposes of understanding the present invention, it is sufficient to understand that the slip-clutch mechanism is comprised of a plurality of slip-clutch plates through which the input energy is coupled from the input shaft **35** to the output shaft **36**. The clutch plates are spring-loaded and make firm surface contact with one another. The slip-clutch plates are designed to "slip" relative to one another at a time when the drive chain coupled thereto is moved to the latched position while the motor drive **29** is still operating, thus enabling the motor to be continuously driven even though the output load coupled to output shaft **36** is locked in the latched fashion.

A pulley **36***a* is mounted upon and secured to slip-clutch assembly output shaft **36**. A drive belt **39** is entrained about pulley **36***a* and a pulley **40** mounted upon a shaft **41** which is journaled within suitable bearings (not shown) which, in turn, are mounted by support member **42** to the stacker frame **38**.

A second pulley **43** is rigidly secured to shaft **41** so as to rotate therewith as a result of rotation of pulley **40**. Pulley **43** has a pair of coupling belts **44** and **45** entrained about pulley **43** and pulleys **46** and **47**, respectively, which are secured to shafts **48** and **49**, respectively. Thus, it can be seen that energy from D.C. motor **29** is coupled through output shaft **30**, pulley **31**, belt **32**, pulley **34**, input shaft **35**, slip-clutch assembly **33**, output shaft **36**, pulley **36***a*, belt **39** and pulley **40** to shaft **41**. The rotation of shaft **41** is available to be simultaneously coupled through belts **44** and **45** to pulleys **46** and **47**. The rotational energy, however, is made available only to either one of the pulleys **46** and **47** by means of magnetic clutch assemblies which are to be more fully described.

The pulley **31** mounted to motor output shaft **30** has entrained about it a second belt **49** which is further entrained about a pulley **50** mounted upon shaft **51**. Pulley **50** has entrained therearound a pair of belts **52** and **53** which are further entrained about pulleys **46***a* and **47***a*, respectively. In summary, it can be seen that the motor-output shaft **30**, in turn, provides driving force through pulley **31**, belt **49**, pulley **50** and belts **52** and **53** simultaneously to the pulleys **46***a* and **47***a*, respectively. Again however, the rotational drive is coupled to only one of the pulleys **46***a* and **47***a* at any given instant of time under the control of magnetic clutches to be more fully described.

FIGURE 2 shows a more detailed plan view of the stacker driving mechanism and the magnetic clutches. Shaft **41**, which is shown at the top of FIGURE 2, is journaled in suitable bearings **41***a* which, in turn, are secured to the stacker frame **38**. Pulley **40**, which, in FIGURE 2 is in the form of a sprocket wheel, is coupled to pulley **36***a* (which, in turn, may be a sprocket wheel) through belt **39** which, in this particular embodiment, is comprised of a drive chain. Sprocket **40** is rigidly secured to shaft **41** by suitable keying means **40***a* so that any rotation imparted to sprocket wheel **40** causes rotation of shaft **41**.

Shaft **41** further has secured thereto a pair of magnetic clutch assemblies **52** and **53**, each comprised of clutch portions **52***a*–**52***b* and **53***a*–**53***b*, respectively. Clutch portions **52***a* and **53***a* are rigidly keyed to shaft **41** so that any rotation of shaft **41** is directly imparted thereto. Clutch portions **52***b* and **53***b* are mounted upon shaft **41** in a free-wheeling fashion, but are keyed to shaft **41** so as to prevent any linear movement of clutch portions **52***b* and **53***b* relative to the longitudinal axis **41***b* of shaft **41**. Sprocket wheels **54** and **55** are each rigidly secured to clutch portions **52***b* and **53***b*, respectively, so as to rotate therewith when either of these clutch portions are rotated.

Operation of the magnetic clutches is such that, upon energization of either clutch portion **52***a* and **53***a*, the magnetic field produced as the result of energization couples the associated clutch portion thereto, causing either clutch portions **52***b* or **53***b* to rotate so as to, in turn, rotate either sprocket wheel **54** or **55**.

Sprocket wheel **54** is coupled through a drive chain shown schematically by phantom line **56** to a sprocket wheel **46** rigidly secured to shaft **49**. Shaft **49** is journaled in bearings **57** and **58** so as to be free-wheeling, which bearings, in turn, are secured to the stacker frame **38**.

Sprocket wheel **55** is coupled through a drive chain, shown schematically by phantom line **59**, to sprocket wheel **47** which is rigidly keyed to shaft **48**. Shaft **48** is journaled in bearings **56** and **57** so as to be free-wheeling, which bearings, in turn, are rigidly mounted to the stacker frame **38**.

Shaft **51** is journaled in bearings **59** and **60** so as to be free-wheeling, which bearings, in turn, are secured to the stacker frame **38**. Sprocket wheel **50** is rigidly keyed to shaft **51** so as to impart all rotation of sprocket wheel **50** from motor output shaft **31** to shaft **51**. A second pair of magnetic clutch assemblies **61** and **62** are mounted along shaft **51**. The clutch portions **61***a* and **62***a* are rigidly secured to shaft **51** so as to rotate therewith while clutch portions **61***b* and **62***b* are mounted so as to be free-wheeling relative to shaft **51**, while at the same time, are adapted to be prevented from experiencing any linear motion relative to the longitudinal axis **51***a* of shaft **51**. Each of the clutch portions **61***b* and **62***b* are further provided with sprocket wheels **63** and **64**, respectively, such that when either of the magnetic clutch portions **61***a* or **61***b* become energized, the magnetic fields generated thereby cause rotation of their associated clutch portions **61***b* or **62***b*, respectively, to further cause rotation of the sprockets **63** or **64**, respectively, which are rigidly keyed to their associated driven clutch portions.

Sprocket wheel **63** is coupled through drive chain **52**, schematically represented by a phantom line, to sprocket wheel **46***a* which is rigidly keyed to shaft **48**. Drive chain **53**, which is schematically represented by a phantom line in FIGURE 2, is entrained about sprocket wheel **64** of shaft **51** and sprocket wheel **47***a* of shaft **49**.

The pair of drive chains **25**, **25**, shown schematically in FIGURE 2 by phantom lines, are entrained about sprocket wheels **64** and **65** rigidly keyed to shaft **48** and sprocket wheels **66** and **67** which are free-wheeling relative to shaft **49**. These sprocket wheels, together with sprocket wheels **27** and **28** of FIGURE 1, act to define the configuration of drive chains **25**, **25** as well as coupling driving power to the drive chain pair. In a like manner, the drive chain pair **26**, **26** are entrained about free-wheeling sprockets **68** and **69** mounted upon shaft **48** and further are entrained about sprocket wheels **70** and **71** rigidly keyed to shaft **49**. The sprocket wheels **68** and **69** are provided with bearing assemblies **68***a* and **69***a* which cause the sprocket wheels **68** and **69** to be free-wheeling relative to shaft **48**. Shaft **48** is provided with circumferential grooves **48***a* and **48***b* which cooperate with a suitable collar **68***b* and **69***b*, respectively, of the bearing assemblies **68***a* and **69***a* so as to prevent sprocket wheels **68** and **69** from experiencing any linear movement relative to the longitudinal axis **48***c* of shaft **48**. The bearing assemblies **66***a*, **67***a*, the collars **66***b* and **67***b* and the circumferential grooves **49***a* and **49***b* of shaft **49** are substantially identical in design and function to the sprocket wheels **68** and **69** in that they mount sprocket wheels **66** and **67** to shaft **49** in a free-wheeling manner while preventing these sprocket wheels from experiencing any linear movement relative to the longitudinal axis **49***c* of shaft **49**.

Each of the stacking buckets **26***a* through **26***c* are substantially of the design shown in the above-mentioned copending application in that they are comprised of a plurality of tubular members of substantially rectangular configuration forming the back **75** of the bucket **25***b*, for example. The bottom end of each member **75** is bent forwardly and outwardly to provide a plurality of tines **76** which act as the base support for the newspapers being stacked. The distal end of the tines **76** are tapered at **77** so as to very cleanly intercept the newspaper stream and provide a clean cut-off of newspapers from the last bucket being stacked to the next bucket being stacked.

Considering FIGURE 2, the back members **75** of buckets **26***a* through **26***c* (shown in solid line fashion) are rigidly secured to a supporting rib **78** which acts to rigidly position and align the back members **75** relative to one another. Two or more of such supporting ribs **78** may be provided, if desired. Each of the buckets are further provided with members **79** projecting rearwardly from the back side of each stacking bucket so as to be mechanically coupled to the drive chains (by suitable connecting pins, for example). Considering FIGURE 2, the coupling means may be provided at the rear of backing members **75** (shown in solid line fashion) for coupling the buckets **26***a* through **26***c* to drive chains **26, 26**. The buckets **25***a* through **25***c* have their bottom tines **76** bent inwardly at **80** and rearwardly at **81** so as to cause their back portions **75′** (shown in dotted fashion) to be off-set relative to the back portions **75** of buckets **26***a* through **26***c*. This off-set arrangement provides the dual functions of placing the back portions **75′** of the stacking buckets **25***a* through **25***c* into alignment with their associated drive chains **25, 25** as well as allowing the upper portion of a downstream bucket to telescope into the lower portion of the bucket located immediately behind it so as to enable a relatively close positioning between adjacent buckets which can occur as a result of the fact that one pair of drive chains is moving at normal stacking speed while the remaining pair of drive chains is moving at many times normal stacking speed.

The operation of the basket drive system is as follows: The bucket **25***b*, shown in FIGURE 1, which is in the process of being filled, is driven by shaft **49** via magnetic clutch assembly **62**. The magnetic clutches work in pairs such that either clutch assemblies **52** and **61** are energized, or clutch assemblies **53** or **62** are energized. Energization is under control of sensor **85**, shown in FIGURES 1 and 3. Considering FIGURE 1, the sensor-counter **85** is mounted just above the stream of incoming newspapers so that its projecting pins or feelers **86** are caused to be rotated when they are struck by the forward folded end of a newspaper in order to accumulate a predetermined count in the counter. When a predetermined number of newspapers is counted, the counter provides an output signal applied to a shift relay **87** which selectively couples a voltage source either to magnetic clutch assemblies **52** and **61** or to magnetic clutch assemblies **53** and **62**.

The bucket **25***b* of FIGURE 1 is driven as a result of energization of magnetic clutch assembly **61** which causes driving energy to be coupled through motor output shaft **30**, pulley **31**, belt **49**, sprocket **50**, shaft **51**, magnetic clutch assembly **61**, sprocket **63**, drive chain **52**, sprocket **46***a* and shaft **48** to sprockets **64** and **65** which drive chains **25, 25** at the normal stacking speed. As was previously described, sprocket wheels **66** and **67** are free-wheeling, and merely act as guide means for drive chains **25, 25**. The drive chain pair **25, 25** is thus driven at normal stacking speed synchronous to the speed of the infeed conveyor section **11**. Simultaneously therewith, the drive chain pair **26, 26** is driven by shaft **49** by way of magnetic clutch assembly **52**. In this instance, power is coupled through motor **31**, slip-clutch assembly **33** and chain **39** to sprocket wheel **40**, shaft **41**, magnetic clutch assembly **52**, sprocket wheel **54**, drive chain **44**, sprocket wheel **46** and shaft **49** to sprocket wheel **70** which drives the drive chain pair **26, 26** at high speed which, in the preferred embodiment, is four times normal stacking speed. At this time, sprocket wheels **68** and **69** being free-wheeling merely act as guides for the drive chain pair **26, 26**. The drive chain pair **26, 26** is mechanically coupled to stacking bucket **26***b* which is driven at four times the speed of drive chain pair **25, 25**, causing the stacking bucket to be very quickly latched. Once the bucket **26***b* is latched, chain **26, 26** is restrained from moving, causing the friction clutch to start slipping. When bucket **25***b* is filled with a pre-set number of copies, counter **85** applies its output signal to latching mechanism **88** (see FIGURES 1 and 3) releasing bucket **26***b* so that it may intercept the incoming stream and be filled with incoming newspapers. Simultaneously therewith, the shift relay **87** is activated by the output signal from counter **85**, causing the magnetic clutches **52** and **61** to be deenergized, and simultaneously therewith, causing magnetic clutch assemblies **53** and **62** to become energized. This, in turn, causes drive chains **25, 25** to be operated at four times normal stacking speed while causing drive chains **26, 26** to be operated at normal stacking speed so that the recently filled bucket is driven under control of magnetic clutch assembly **52** at four times its previous speed to cause the completed bundle to be rapidly delivered to the outfeed conveyor section **13**, and simultaneously therewith causing the next bucket **25***a* to be quickly moved to the latched position (occupied by bucket **26***b* in FIGURE 1). As each signal is developed by counter **85**, the magnetic clutches are alternately energized in the pre-set pairs **52–61** or **53–62** so that the bucket receiving copies from the stream is always driven at stacking speed synchronous to press speed while the buckets of the remaining drive chain are driven at four times press speed to simultaneously deliver the completed bundle in a very rapid manner to the outfeed conveyor section **13** and to move the next bucket in a very rapid manner to the latched position.

The desired speeds (i.e., normal stacking speed and high speed, are achieved by providing suitable gear ratios between mechanically coupled elements. In normal operating conditions, it is sufficient to provide a slip-clutch assembly only in the fast drive section since the bucket next to be latched is always that bucket which is moving at the high speed. However, it is possible that the reverse conditions can occur when the stacker is run manually, and it is, therefore, possible, if desired, to equip the slow drive assembly with a separate additional slip-clutch assembly. As a further modification, the output shaft **36** of slip-clutch assembly **33** may be coupled to shaft **51** instead of directly coupling shaft **51** through belt **49** to motor shaft **30**. This arrangement will allow the single slip-clutch assembly to be employed for both normal and high speed drives.

The buckets should be arranged along the drive chain pairs **25, 25** and **26, 26** so that bucket **26***c*, for example, will have sufficient time to move below the outfeed conveyor section rollers **90** before bucket **26***b* becomes latched. The shaft **49** is positioned so that the swinging motion of the bucket does not begin until the stack of newspapers delivered to the outfeed conveyor section rollers 90 has left the outfeed section.

The outfeed conveyor section is comprised of a plurality of rollers 90 (only one of which is shown in FIGURE 1) which are aligned substantially in a horizontal plane and which are all driven in either a first or a second direction about their longitudinal axes so as to move the completed bundle laterally away from the stacker. A more detailed description of the outfeed conveyor section may be found in the above-mentioned U.S. Patent No. 3,326,-353 and copending application Ser. No. 670,729. For purposes of understanding the present invention, however, it is sufficient to understand that the outfeed conveyor section simply moves the completed bundle laterally away from the stacking machine (to a wrapping or bundling facility, for example) in readiness for receipt of the next bundle to be delivered to the outfeed conveyor section.

Whereas a single motor drive means has been described herein, it should be understood that separate motor drive means may be provided for each of the two desired driving speeds.

FIGURE 4 shows an alternative embodiment 100 employing the separate motor drives. The stacker 101 is shown in phantom line fashion and is designed to receive the signature stream delivered from a conveyor 102 to the infeed conveyor section 111. The infeed conveyor section 111 is substantially identical to the infeed conveyor section 11 shown in FIGURE 1 and like elements are designated by like numerals which are proceeded, however, by the number 1. For example, a roller 121 of FIGURE 4 is equivalent to the roller 21 of FIGURE 1, and so forth. Since the two infeed conveyor sections are identical a detailed description thereof will be omitted for purposes of simplicity. The sensor counter structure 185 is substantially similar to the sensor counter structure 85 of FIGURE 1 and is comprised of a housing containing the sensor components including the rotatable projecting pins 186 for movement under control of the forward folded edges of each incoming signature 114. The sensor is pivotally mounted at 187 to the stacker frame 101 by mechanical links 187*a* which, in turn, are pivotally connected to the housing at 189, enabling the sensor to "float" above the newspaper stream. Newspapers are guided to pass beneath guide member 190 as they approach the sensor rotatable pins 186. The forward folded edge of each newspaper kicks or rotates the structure by an incremental amount indicating that one signature has passed beneath the sensor. The counter operates in the same manner as was previously described to deliver signals to the motors to cause switchover in their operating speeds in a manner to be more fully described.

The signature stacking section 112 is comprised of two pairs of drive chains 125 and 126 which are entrained about sprockets 127 and 128, respectively. As was previously described, sprocket 127 is actually comprised of four sprockets arranged at spaced intervals along shaft 127*a*, each designed to mesh with an associated drive chain. Likewise, sprocket 128 is actually comprised of four such sprockets arranged at spaced intervals along shaft 128*a* also designed to mesh with an associated drive chain.

The buckets 125*a* and 125*b* are mechanically coupled to drive chain pair 125 while buckets 126*a* and 126*b* are mechanically coupled to drive chain pair 126. Each bucket is comprised of a plurality of tines 177 secured at their inboard ends to a supporting bracket 175 which is coupled to its associated drive chain pair at 175*a* and 175*b*, for example, shown with reference to bucket 125*a*. A lost motion mechanism 200 is provided for each bucket and is comprised of a hollow cylinder 201 mounted to experience reciprocal movement along a shaft 202 passing therethrough with the limit of the movement being determined by the upper and lower ends 175*a* and 175*b* of back support 175. The reciprocating cylinders are coupled to the respective drive chains for their buckets and are further coupled to the upper end 175*a* of each back support by spring means 203. Each back support is further provided with a shoulder 204 rigidly secured thereto for latching engagement with the latching mechanism 188 which is comprised of a pivotally mounted arm 104, pivotally coupled to the machine frame at 205 and having a roller 106 at its upper end for bearing against shoulder 204. Bias means (not shown) normally biases the roller 106 into the path of the shoulder 204. Latch releasing solenoid 107 is coupled to arm 205 by an armature 108. The operation of the latching mechanism is as follows:

The chains for bucket 126*a*, for example, are driven at high speed until its shoulder 204 is restrained from further movement by roller 206. This action immediately halts the movement of back support 175 and hence tines 177. The cylinder 201 which is coupled to its associated drive chains is still free to move downwardly until its lower end bears against the stop 175*b*. At this time the drive chain is prevented from moving, causing the slip clutch (to be more fully described) to start slipping to allow its associated motor to continue running even though the drive chain has been halted. This operation charges spring means 203 in readiness for an intercept operation. As soon as the predetermined quantity of signatures is stacked upon bucket 125*a* sensor 185 emits a signal to latch release solenoid 107 which pulls roller 106 away from its blocking position against shoulder 204. This permits the drive chain associated with cylinder 201 to immediately start moving. Spring means 203 also released at this time rapidly accelerates back support 175 in the downward vertical direction causing the forward end of tines 177 (for bucket 126*a*) to rapidly and cleanly intercept the stream of incoming signatures. This operation is repeated for each bucket as its approaches the latching position.

The drive chain pair 125 is operated by D.C. motor 129*a* which is coupled through a suitable gear drive 206 to drive sprocket 207. Sprocket 207 is coupled through drive chain 208 to the sprocket 209 mounted upon the input shaft 210 of slip clutch mechanism 133 (which is substantially identical to the slip clutch 33 of FIGURE 1). The output shaft 211 of slip clutch 133*a* has mounted thereon a drive sprocket 212 which is coupled through drive chain 213 to drive sprocket 214. D.C. motor 129*a* is controlled to operate at either high speed or stacking speed in a manner to be more fully described.

The remaining drive chain pair 126 is driven by a similar arrangement comprised of D.C. motor 129*b*, gear drive 206*a*, sprocket 207*a*, drive chain 208*a*, input shaft 210*a* of slip clutch mechanism 133*b*, output shaft 211*a*, sprocket 212*a* and drive chain 213*a* to driven sprocket 214*a*.

The buckets such as, for example, bucket 125*a* containing a completed signature stack passes downwardly so that its tines move between the spaced parallel rollers 290 of the outfeed conveyor section 113 which is substantially identical to that shown and described in FIGURE 1. The outfeed conveyor moves the completed bundles transverse to the direction of movement of the buckets in readiness to receive the next completed bundle. After delivering a bundle to the outfeed conveyor section, each bucket is moved at a high speed around each sprocket 128 and 127 to again return to the latched position in readiness for intercepting the signature stream.

FIGURE 5*a* shows the sprocket drive at the upper end of the stacker in greater detail. The shaft 127*a* is journalled in suitable bearings 216, 216 secured to the machine frame 101. The driven sprocket 214 is keyed to shaft 127*a* to cause it to rotate with rotation of the sprocket under control of D.C. motor 129*a*. This rotation is transmitted to sprockets 127–1 and 127–2 which are likewise firmly keyed to shaft 127*a*. The bucket 126*a* is provided with rearwardly projecting portions 217, 217 which are pivotally connected to the drive chain 126, 126, which chains are entrained around free wheeling sprockets 218–1 and 218–2. The bearings 219–1 and 219–2 are keyed to shaft 127*a* to rotate therewith but enable sprockets 218–1 and 218–2 to rotate independently of the rotation of shaft 127*a*.

The drive chains 125, 125 are entrained about sprockets 127–1 and 127–2, respectively, and these drive chains are pivotally coupled to the rearwardly projecting portions 220, 220 of the bucket 126*b* which is positioned ahead of bucket 125*a*, as can best be seen in FIGURE 4.

FIGURE 5*b* shows the detailed view of the lower sprocket assembly of FIGURE 4 and is likewise comprised of a similar arrangement to that shown in FIGURE 5*a* wherein lower shaft 128*a* is journalled in suitably bearings 221, 221 secured to the machine frame 101. Lower driven sprocket 214*a* is keyed to shaft 128*a* to rotate the shaft upon rotation of sprocket 214*a*. Sprockets 128–1 and 128–2 are keyed to shaft 128*a* to rotate therewith under control of rotation of driven sprocket 214*a*. These sprockets are meshed with the drive chains 126, 126 which are pivotally connected to the rearwardly projecting portions 217, 217 of bucket 126*a*, for example.

Free wheeling sprockets 222–1 and 222–2 are provided with bearings 223–1 and 223–2, respectively, which are keyed to shaft 128 in order to allow sprockets 222–1 and 222–2 to rotate independently of shaft 128*a*. These sprockets mesh with drive chains 125, 125 which are pivotally coupled to the rearward projecting portions 220, 220 of bucket 125*a*. The operation of the drive chains is as follows:

Let it be assumed that bucket 126*a* is moving to the latched position while bucket 125*a* is receiving signatures from the incoming stream. This means that bucket 125*a* which is driven by D.C. motor 129*a* will be moving at normal stacking speed. The slow rotational speed of the motor is coupled to driven sprocket 214 of FIGURE 5*a* causing shaft 127*a* and sprockets 127–1 and 127–2 to rotate at normal stacking speed. This speed is imparted to bucket 125*a* which moves downwardly through the stacking region. It should be noted from FIGURE 5*b* that even though shaft 120*a* may be rotating at a different angular velocity, sprockets 222–1 and 222–2 are free to rotate at the same angular velocity as sprockets 127–1 and 127–2 of FIGURE 5*a*.

Simultaneously, with the above operation bucket 126*a* is rapidly moved toward the latched position by D.C. motor 129*b* which is operating at many times the angular velocity of D.C. motor 129*a*. This angular velocity is imparted to sprocket 214*a* of FIGURE 5*b* which, in turn, couples this rotation through shaft 128*a* and sprockets 128–1 and 128-2 to the drive chains 126, 126. The high speed movement is coupled through the drive chain to the projecting portions 217, 217 of bucket 126*a* (see FIG. 5*a*) moving it very rapidly to the latched position in readiness for the next signature bundle to be formed. The free wheeling sprockets 218–1 and 218–2 of FIGURE 5*a* about which the drive chains 126, 126 are entrained are free to move at the rotational speed of sprockets 128–1 and 128–2 in spite of the fact that shaft 127*a* is rotating at a much slower angular velocity.

As soon as a bundle containing the proper number of signatures is stacked upon bucket 125*a*, sensor counter 185 emits a pulse energizing solenoid 207 to release bucket 126*a* from the latched position, the combined movement of the drive chain pair coupled to bucket 126*a* and the release of the energy of charge spring 203 causes bucket 126*a* to rapidly and cleanly intercept the signature stream diverting the signatures previously stacked upon bucket 125*a* to be stacked upon bucket 126*a*.

Simultaneously therewith motor 129*b* is caused to rotate at a slower speed (i.e. normal stacking speed) in moving bucket 126*a* through the stacking region. Also, simultaneously therewith the buckets 125*a* and 125*b* coupled to drive chain pair 125 are driven at high speed in order to very rapidly move bucket 125*b* into the latched position well before the time that a bundle of the proper quantity of signatures is formed upon bucket 126*a*. This operation is continuously repeated in the above described manner with the buckets alternating from receiving a bundle and moving at normal stacking speed to movement at high speed toward the latched position. The buckets of each chain are alternately fed through the stacking region.

FIGURE 6 shows a black box diagram of the system electronics. The sensor 185 develops an output pulse each time a predetermined number of signatures passes beneath the sensor. This pulse is simultaneously applied to the latch releasing solenoid 188 and a first shift-relay 230. Energization of solenoid 188 releases roller 206 enabling the latched bucket to rapidly accelerate and intercept the signature stream. Shift-relay 230 operates in an alternating fashion applying a pulse to either of the shift-relays 232 or 234. For example, at a first count, shift-relay 232 receives a pulse while shift-relay receives no pulse. At the next completed count of sensor 185 shift-relay 234 receives a pulse while shift-relay 232 receives no pulse. This operation is repeated as each completed count is reached.

The shift relay 232 is comprised of two portions 232*a* and 232*b* each of which is coupled to the input of associated D.C. motor 129*a*. Shift-relay 232 is designed so that when no pulse is applied to its input section 232*b* is electrically coupled to power source +V to drive the motor 129*a* at the normal stacking speed. In normal stacking speed operation, the speed of the motor is controlled by the thickness of the signatures being fed to the stacker. Speed selection is made by multiposition switch 233 controlling the power fed to the motor input and thereby providing the proper normal stacking speed. If a pulse is applied to the input of shift relay 232 its section 232*a* is coupled to power source +V while section 232*b* is disconnected therefrom providing more power to the input of D.C. motor 129*a* and thereby driving it at a much higher speed than normal stacking speed.

In a similar manner, the shift-relay 234 is designed so that when no pulse is applied to its input the power source +V is coupled through its section 234*b* and so that the power source +V is coupled to section 234*a* and disconnected from section 234*b* when a pulse is applied to its input from shift relay 230. Section 234*b* is likewise provided with a multiposition selector switch 236 to adjust normal stacking speed controlled in accordance with the thickness of the signatures being fed to the stacker. It can clearly be seen that the D.C. motors 129*a* and 129*b* are alternately driven at normal stacking speed and high speed such that only one motor at any given instant is driven at the normal stacking speed while the remaining motor is driven at high speed. Motor speeds alternate each time the predetermined count is reached.

Although this invention has been described with respect to its preferred embodiments, it should be understood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred, therefore, that the scope of the invention be limited not by the specific disclosure herein, but only by the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Stacker means for stacking signatures delivered to said means in a substantially continuous stream with said signatures being arranged in overlapped fashion comprising:

first and second drive chain means each being arranged in closed-loop fashion; at least one portion of each of the closed-loops being substantially straight, and being positioned to confront said signature stream, the straight portions lying substantially in a common plane;

first and second groups of substantially L-shaped stacking buckets being coupled to said first and second drive chain means, respectively, at spaced intervals along each of the closed-loops;

power means for selectively moving said first and second chain drive means;

said first and second groups of L-shaped buckets being arranged in interleaved fashion so that the buckets coupled to said first and second drive chain means intercept said signature stream in alternating fashion as they pass along said one straight portion of said loops under control of said power means;

said power means comprising first and second means for selectively driving said first and second drive chain means at first and second differing speeds;

control means coupled between said first and second means and said first and second drive chain means for alternately coupling said power means thereto including first coupling means for coupling said first and second means to said first and second drive chain means when in a first operating condition and including second coupling means for coupling said first and second means to said second and first drive chain means when in a second operating condition.

2. The device of claim 1 further comprising sensing means positioned immediately adjacent the signature stream for sensing the passage of signatures; said sensing means including counting means for alternately driving said control means into said first and second operating condition each time a predetermined count is reached.

3. The device of claim 2 further comprising latch means for restraining the movement of a bucket approaching said stream just prior to the time that it reaches the point at which it will intercept said stream;

said latch means including latch release means coupled to said counter means for releasing the restrained bucket when the predetermined count is reached causing the signatures to be diverted from the bucket previously receiving signatures to the bucket which has just been released by said latch means.

4. The stacker means of claim 1 wherein said control means drives the drive chain means having a bucket receiving signatures at a first speed commensurate with the stacking operation while driving the remaining drive chain means at a second speed at least twice as great as said first speed.

5. The stacker means of claim 1 further comprising an outfeed conveyor section positioned near the bottom of said closed-loop straight portion for removing a signature stack from a bucket no longer receiving signatures;

said buckets being spaced at intervals along their respective drive chains so that the bucket being unloaded at said outfeed conveyor section and the bucket about to be latched are each coupled to the same drive chain means; said outfeed conveyor section being positioned to begin removal of the completed signature stack just prior to time that the bucket closest to said latching means becomes latched.

6. The stacker means of claim 1 wherein said first and second drive chain means are each comprised of a pair of closed-loop drive chains arranged in spaced parallel fashion;

one pair of drive chains being positioned between the remaining pair of drive chains;

a plurality of rotatable sprockets for each drive chain which define the cofiguration of each closed loop.

7. The stacker means of claim 6 further comprising

a first pair of drive sprockets rotatably mounted on a first common shaft, each engaging one of said first pair of drive chains;

a second pair of drive sprockets rotatably mounted on a second common shaft, each engaging one of said second pair of drive chains;

said first and second pairs of drive sprockets being selectively coupled to said first and second coupling means.

8. The stacker of claim 7 wherein said first coupling means is comprised of a third rotatable shaft; means coupling said power means to said third shaft;

first and second free-wheeling sprockets being mounted on said third shaft;

third and fourth drive chains coupling said first and second free-wheeling sprockets to said first pair of drive sprockets;

first and second magnetic clutch means coupled between said third shaft and said first and second free-wheeling sprockets, respectively, said magnetic clutches being alternately energized by said counter means each time said predetermined count is reached.

9. The stacker of claim 8 wherein said second coupling means is comprised of a fourth rotatable shaft; means coupling said power means to said fourth shaft;

third and fourth free-wheeling sprockets being mounted on said fourth shaft;

fifth and sixth drive chains coupling said third and fourth free-wheeling sprockets to said second pair of drive sprockets;

third and fourth magnetic clutch means coupled between said fourth shaft and said third and fourth free-wheeling sprockets, respectively, said magnetic clutches being alternately energized by said counter means each time said predetermined count is reached.

10. The stacker means of claim 9 wherein said first coupling means selectively drives either said first drive chain pair or said second drive chain pair at said first speed and wherein said second coupling means selectively drives either said first drive chain pair or said second drive chain pair at said second speed.

11. The stacker means of claim 7 wherein at least one of said first and second coupling means further includes slip-clutch means coupling between said power means and one of said first and second pairs of drive sprockets to provide slippage between said power means and the associated pair of drive sprockets.

12. The stacker means of claim 9 further comprising a source of electrical energy;

shift relay means controlled by said counter means for alternately coupling said electrical energy source either to said first and third magnetic clutches or to said second and fourth magnetic clutches.

13. Stacker means for stacking signatures delivered to said means in a substantially continuous stream with said signatures being arranged in overlapped fashion comprising:

first and second drive chain means each being arranged in closed-loop fashion; at least one portion of each of the closed-loops being substantially straight, and being positioned to confront said signature stream, the straight portions lying substantially in a common plane;

first and second groups of substantially L-shaped stacking buckets being coupled to said first and second drive chain means, respectively, at spaced intervals along each of the closed-loops;

power means for selectively moving said first and second chain drive means;

said first and second groups of L-shaped buckets being arranged in interleaved fashion so that the buckets coupled to said first and second drive chain means intercept said signature stream in alternating fashion as they pass along said one straight portion of said loops under control of said power means;

said power means comprising first and second means for selectively driving said first and second drive chain means at first and second differing speeds;

control means coupled to said first and second means for alternately driving said first and second drive chain means at said first and second speeds, respectively, when in a first operating condition and for driving said first and second drive chains at said second and first speeds, respectively, when in a second operating condition.

14. Stacker means for stacking signatures being delivered to said means in a substantially continuous stream by infeed means;

at least first and second stacking buckets for selectively receiving and stacking signatures directed toward said buckets;

outfeed means for receiving completed stacks of signatures from said buckets;

first means for moving said first bucket at a first speed from said infeed means toward said outfeed means and for moving said first bucket at a second speed from said outfeed means toward said infeed means;

second means for moving said second bucket at a first speed from said infeed means toward said outfeed means and for moving said second bucket at a second speed from said outfeed means toward said infeed means;

said second speed being greater than said first speed.

15. The stacker of claim **14** wherein said first and second means are each comprised of means for moving said first and second buckets along substantially closed-loop paths.

16. The stacker of claim **14** wherein said first and second means are arranged so that said first means moves said first bucket at said first speed when said second means moves said second bucket at said second speed and said first means moves said first bucket at said second speed when said second means moves said second bucket at said first speed.

17. The stacker of claim **16** further comprising means adjacent the signature stream for counting said signatures as they are delivered to said stacker;

said counting means being coupled to said first and second means for switching the speed of movement of said buckets the moment each bucket begins to move past said infeed means so as to occur each time a predetermined count is reached.

18. Stacker means for stacking signatures being delivered to said means in a substantially continuous stream by infeed means;

at least first and second stacking buckets for selectively receiving and stacking signatures directed toward said buckets;

outfeed means for receiving completed stacks of signatures from said buckets;

first means for moving said first bucket past said infeed means toward said outfeed means and to deliver a stack of signatures to said infeed means and for returning said first bucket toward said infeed means;

second means for moving said second bucket past said infeed means toward said outfeed means while said first bucket is being returned rapidly toward said infeed means and for rapidly returning said second bucket toward said infeed means while said first bucket is moving past said infeed means toward said outfeed means.

19. The stacker of claim **14** further comprising means adjacent the signature stream for counting said signatures as they are delivered to said stacker;

said counting means being coupled to said first and second means for controlling the movement of each bucket past said infeed means to be initiated each time as predetermined count is reached.

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