United States Patent [19]

Monahan

[11] **3,884,129**

[45] **May 20, 1975**

[54] **INTERMITTENT WEB DRIVE MECHANISM EMPLOYING UNIDIRECTIONAL CLUTCHES**

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[73] Assignee: **G. T. Schjeldahl Company,** Northfield, Minn.

[22] Filed: **Apr. 10, 1973**

[21] Appl. No.: **349,778**

[52] **U.S. Cl.** ..... **93/8 R;** 74/121; 74/125.5; 156/515; 226/156; 93/33 H

[51] **Int. Cl.** **B31b 1/10**

[58] **Field of Search** ...74/125.5; 120, 121; 156/515; 93/DIG. 1, 33 H, 8 R; 226/156, 226/157; 83/401, 436

[56] **References Cited**

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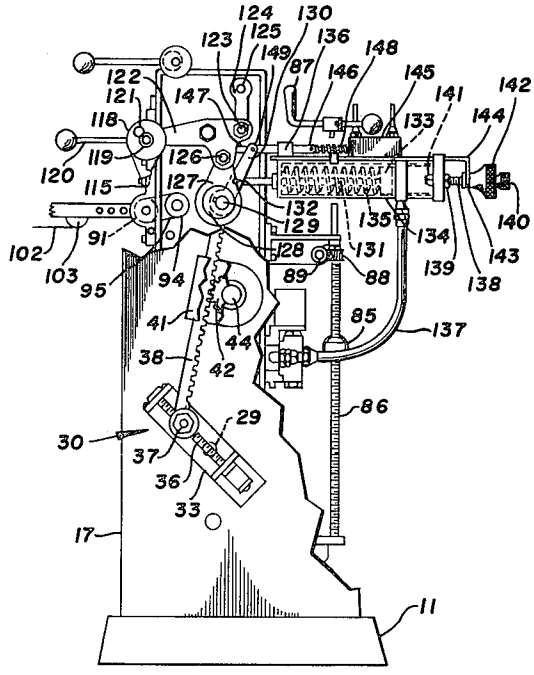
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2,997,889	8/1961	Schjeldahl et al.	74/813 X
3,483,772	12/1969	D'Amato et al.	226/156 X
3,663,338	5/1972	Wech	156/515
3,691,859	9/1972	Peters	74/125.5 X

Primary Examiner—Roy Lake
Assistant Examiner—James F. Coan

[57] **ABSTRACT**

Means for intermittently advancing a web of flexible film comprising drive means for imparting repeating cycles of intermittent motion and dwell to a web of flexible film with the web motion normally being in only the forward direction. The drive means includes an output shaft having first and second input driver means coupled to the output shaft, with the driver means being arranged in phased relationship, one to another, so as to achieve motion in the output shaft for more than 180° of motion in the input shaft. The driver means are arranged in overlapped phased relationship, one to another, so as to achieve motion from each driver means for less than 180° of motion in the input shaft. Coupling means including first and second unidirectional clutch means such as a one way or overriding clutch are provided for intermittently intercoupling the first driver means to the input and output shafts for initiating rotation of the output shaft, and for continuing the rotation for a predetermined motion segment of less than one-half cycle of rotation of the input shaft or until the rate of speed of the second driver means overtakes the rate of the first driver, at which point decoupling of the first driver means occurs, along with substantially simultaneous intercoupling occurring between the second driver means and the input and output shafts for the continued rotation of the output shaft for a second pre-determined motion segment of less than one-half cycle of rotation of the input shaft, at which point, de-coupling the second driver means occurs.

9 Claims, 9 Drawing Figures



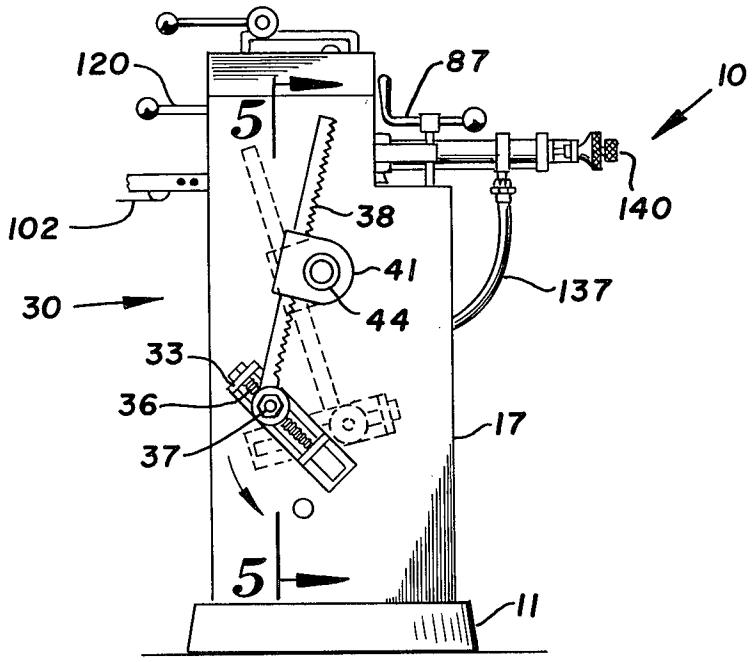


FIG. 1

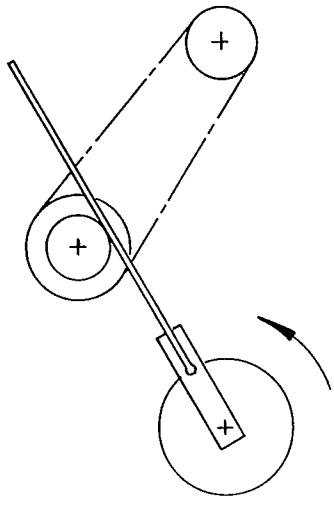


FIG. 4a

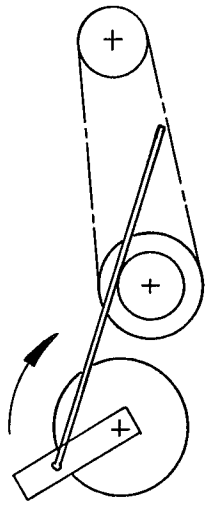


FIG. 4b

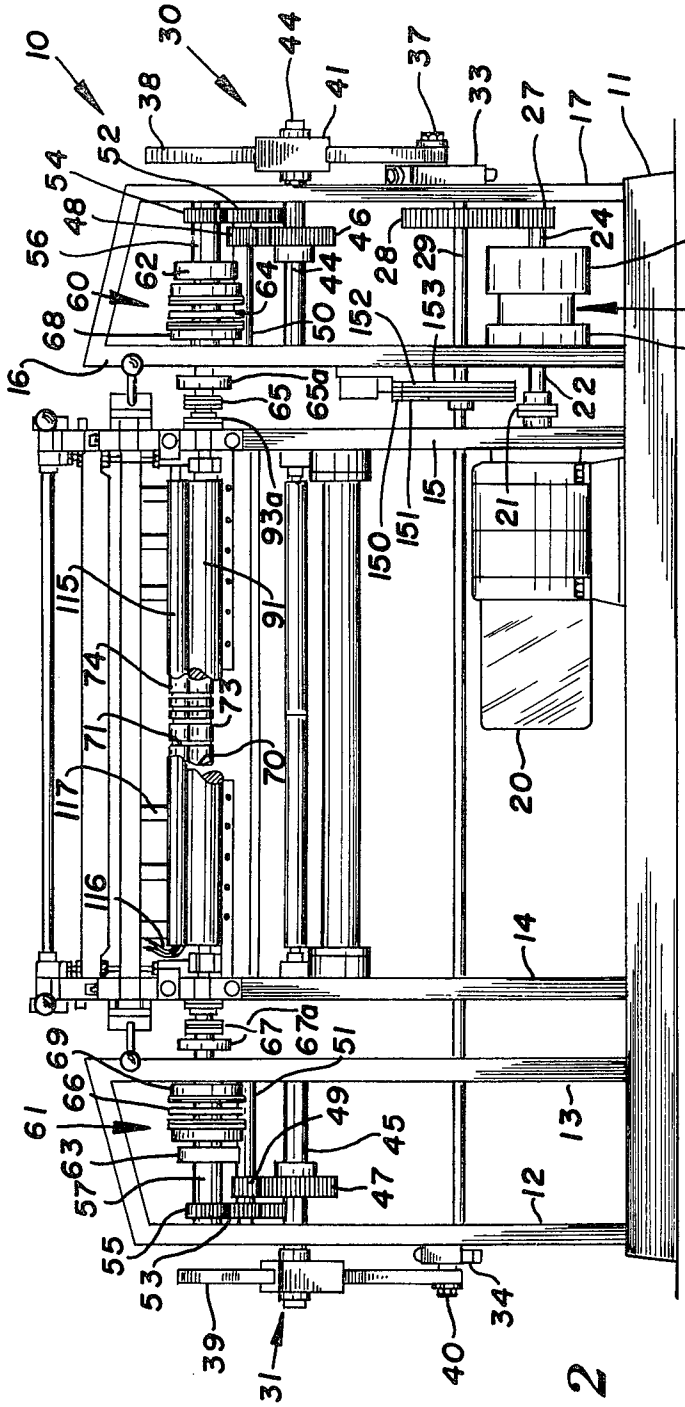

10
30
44
41
37
38
33
27
17
11
52
54
48
56
62
60
68
16
46
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25
28
29
64
44
50
152
153
23
26
65
65a
22
93a
15
150
151
21
91
115
74
73
71
70
117
116
20
14
67
67a
51
69
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61
63
57
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45
47
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12
13
34
39
31
40

FIG. 2

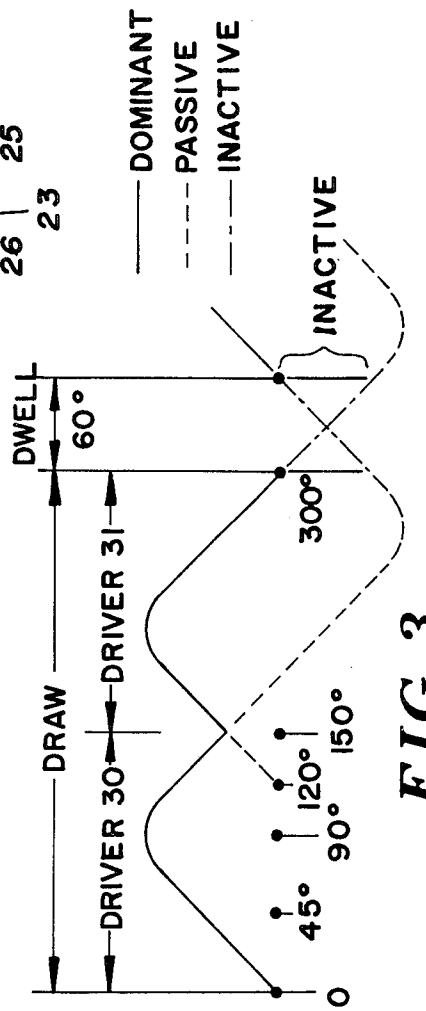

DOMINANT
PASSIVE
INACTIVE
INACTIVE
DWELL
60°
300°
DRAW
DRIVER 31
DRIVER 30
0
45°
90°
120°
150°

FIG. 3

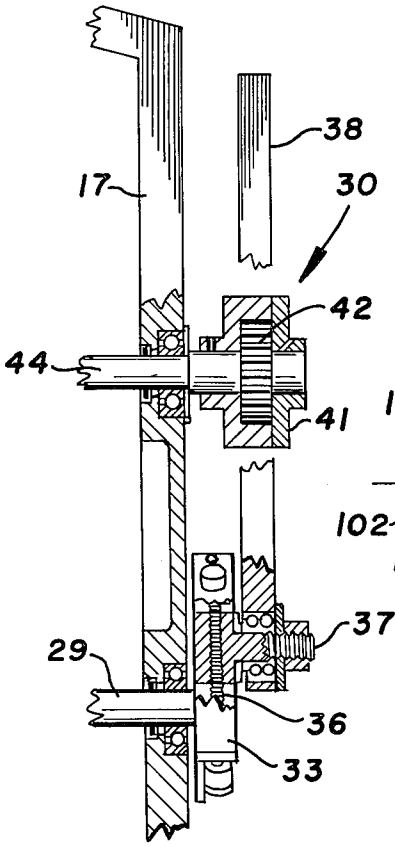


FIG. 5

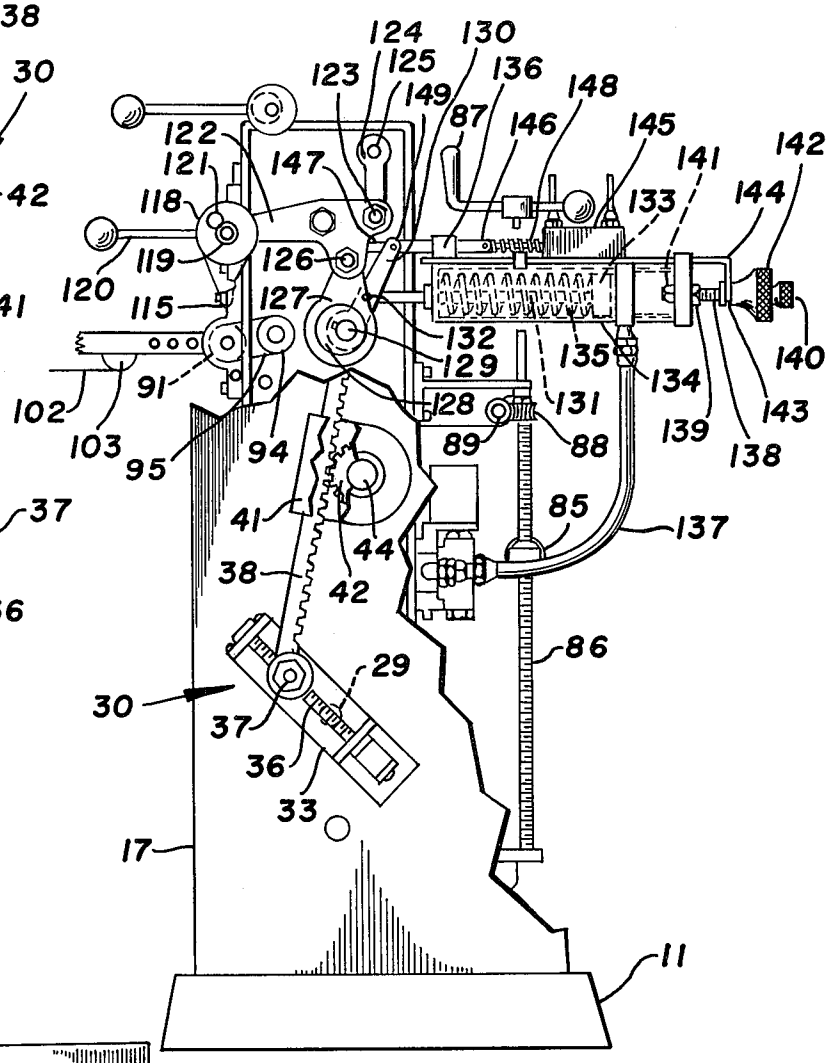


FIG. 6

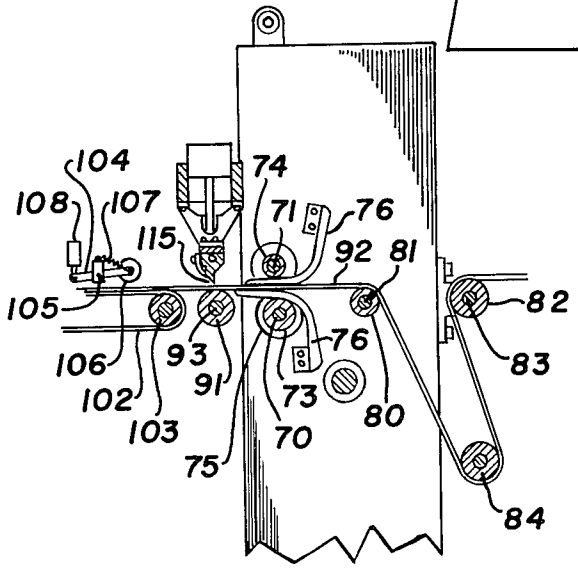


FIG. 7

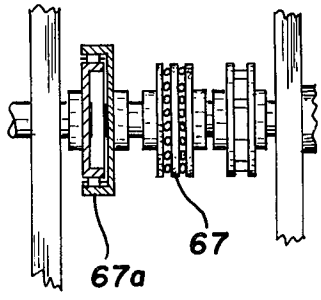


FIG. 8

INTERMITTENT WEB DRIVE MECHANISM EMPLOYING UNIDIRECTIONAL CLUTCHES

CROSS-REFERENCE TO RELATED APPLICATION

The present invention is an improvement over that invention disclosed and claimed in co-pending application Ser. No. 151,842, filed June 10, 1971, entitled "INTERMITTENT DRIVE MECHANISM," now U.S. Pat. No. 3,776,804 which application constituted a continuation in part of application Ser. NO. 81369, filed Oct. 16, 1970, also entitled "INTERMITTENT DRIVE MECHANISM," now abandoned, both applications being assigned to the same assignee as the present invention, and in which I am named as co-inventor.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to apparatus for intermittently advancing a web of flexible film, and more specifically to drive means in phased relationship, one to another, employing unidirectional clutch means for independently imparting repeating cycles of intermittent motion followed by a dwell cycle to a web of flexible film, the drive means being operated in synchronism with a sealing apparatus which performs an operation on the web, such as, for example, the simultaneous welding and severing of a pair of superimposed webs so as to form a side-weld bag structure or the like.

2. Description of the Prior Art

The apparatus of the present invention constitutes an improvement over those devices disclosed and claimed in U.S. Pat. No. 2,947,345, G. T. Schjeldahl, "Machine for Making Articles from Multiple Thermoplastic Webs" dated Aug. 2, 1960; and U.S. Pat. No. 2,997,889, G. T. Schjeldahl, et al., "Intermittent Engine," dated Aug. 29, 1961, both of these patents being assigned to the same assignee as the present invention.

In each of these prior patents, apparatus is described for the handling of thermoplastic webs, particularly superimposed thermoplastic webs which are treated with a hot-knife performing a simultaneous severing and welding operation on the webs. Each of the devices described in these patents utilizes rack-and-pinion drives for the intermittent actuation of the draw rolls. The apparatus of the present invention also utilizes a rack-and-pinion mechanism, the arrangement being modified so as to extend the draw cycle beyond the 180° of machine motion which constituted the maximum previously available with a conventional rack-and-pinion drive.

Machine speed is normally limited by the draw cycle, since the durability of the film being treated will determine the maximum acceleration rate possible in the web. Inasmuch as the apparatus of the present invention provides an extended draw cycle, it is possible to increase the cycle rate of the apparatus without increasing the rate of acceleration of the draw mechanism, thus providing an increased rate of production over that which would be possible with apparatus equipped with conventional drive mechanisms.

SUMMARY OF THE INVENTION

In accordance with the present invention, drive means are provided for imparting repeating cycles of intermittent motion and dwell to a web of flexible film, with the motion normally being imparted to the system with a pair of rack-and-pinion drives. The rack is coupled to an input shaft, with the teeth of the rack being in mesh with a pinion on an output shaft. The individual racks are preferably coupled through means associated with opposite ends of a draw roll, and are arranged in arcuately spaced phased relationship. In order to achieve proper relative motion between the phased racks, unidirectional clutch means, such as a one way or overriding clutch is used between the pinion and the shaft, thereby rendering it possible for automatic shifting of drives to occur. Thus, the first rack will apply initial forward motion to the system, with the second rack taking over when its rate of speed exceeds that of the first rack. In a typical situation, the individual eccentric arms driving the racks may be displaced for 120° of arc, with the first rack driving the output shaft for 150° of motion. Upon achieving 90° of motion, the first rack decelerates and the arcuate rate of speed of the second rack overtakes that of the first and drives the output shaft at that point in the cycle. Since the second rack will, at that time, be advanced 30° from its individual starting point, it will continue driving the output shaft for an additional 150° of motion. At that point, the input shaft has rotated 300°, and the remaining 60° are available for the dwell cycle.

Therefore, it is the principal object of the present invention to provide an improved drive means employing unidirectional clutches for use in imparting repeating cycles of intermittent motion and dwell to a web of flexible film, the drive means utilizing rack-and-pinion structures and being capable of imparting motion to the web for more than 180° of machine operation.

It is yet a further object of the present invention to provide means for intermittently advancing a web of flexible film utilizing unidirectional clutches with twin rack-and-pinion drives, the individual racks being disposed in spaced phased relationship one to another, so as to impart motion to the web over more than 180° of input shaft rotation.

It is still a further object of the present invention to provide an improved bag-making machine utilizing drive means for intermittently advancing superimposed webs of thermoplastic sheet film, the drive means utilizing twin rack-and-pinion drives, with the racks being coupled to a common input shaft and being disposed in spaced-apart phased relationship so as to achieve drive cycles in excess of 180° of rotation of the input shaft.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the rack-and-pinion drive means employed in the present invention, and illustrating in solid lines, a rack-and-pinion assembly together with its unidirectional clutch on the near side of the apparatus, and illustrating, in phantom, the identical rack structure on the opposite side of the structure;

FIG. 2 is an end elevational view of the structure and illustrating the arrangement and disposition of the twin rack drives and unidirectional clutch, each of which is coupled to one end of the draw roll;

FIG. 3 is a plot of rotation of the input shaft versus draw rate for a typical operational cycle in one operational mode, and illustrating the active portion of the draw for the individual drivers in solid line, and illus-

trating idle portions for the individual driver mechanisms in dashed lines;

FIGS. 4*a* and 4*b* are schematic illustrations of the rack-and-pinion structures taken from opposite sides of the machines, and illustrating the spaced phase relationship existing between the individual rack structures, with FIG. 4*a* illustrating the rack and unidirectional clutch on one side of the structure at the start of its draw cycle, and with FIG. 4*b* illustrating the disposition of the rack on the opposite side of the structure in the disposition where its draw cycle is initiated after 120° rotation of the driver shaft;

FIG. 5 is a partial vertical sectional view of the rack-and-pinion structure shown in FIG. 1, and illustrating this portion of the apparatus in greater detail, this view being taken generally along the line and in the direction of the arrows 5—5 of FIG. 1;

FIG. 6 is a view similar to FIG. 1, and additionally illustrating the details of the reciprocating hot-knife structure employed in a bag-making machine utilizing the drive mechanism of the present invention;

FIG. 7 is a partial vertical sectional view taken through the center axis of the apparatus, and illustrating details of the draw roll and sealing sections of the apparatus; and

FIG. 8 is a detail view showing the arrangement of the overriding clutch as it is mounted with relationship to the draw roll.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with the preferred modification of the present invention, the bag-making apparatus generally designated **10** is provided with a frame structure including a base **11**, and upright frame mounting members **12, 13, 14, 15, 16** and **17.** Details of a conventional bag-making machine utilizing a conventional drive are set forth in U.S. Pat. No. 2,947,345, as referred to hereinabove. A drive motor **20** is mounted on the base member **11** by conventional means, the shaft of motor **20** being coupled at **21** to drive shaft **22,** shaft **22** being coupled to the input of a conventional clutch-brake assembly generally designated **23.** Shaft **24** rotates with shaft **22** through clutch portion **25,** or is idle when the clutch-brake assembly **23** is stopped against its brake portion **26.** Drive gear **27** is fast upon shaft **24,** and is in mesh with gear **28,** which, in turn, is fast upon the end of input shaft **29.** It will be observed that input shaft **29** extends across the entire width of the apparatus, and is appropriately journaled for rotation with suitable bearings in each of the upright post members **12–17** inclusive.

At opposite ends of the input shaft **29,** there are disposed driver units such as the driver units generally designated **30** and **31,** these being of the rack-and-pinion type. With particular attention being directed to FIGS. **1** and **2** of the drawings, a crank element is secured to each end of the shaft **29,** such as the crank elements **33** and **34,** each comprising a component part of drivers **30** and **31** respectively. Each of the cranks **33** and **34** is provided with a screw adjustment such as the screw adjustment column **36** for radially adjusting the respective crank pins, such as the pin **37** at a desired radial distance from the axis of shaft **29.** A gear rack **28** is pivotally secured to pin **37** and a similar gear rack **39** is pivotally secured to pin **40** which is a portion of driver **31.** At each side of the machine, a rack guide such as the rack guide **41** is provided, along with a pinion gear **42** (illustrated in detail in FIG. **5**) which is alternately driven in one direction and then in the other during the rotation of input shaft **29** and its respective cranks. Each of the pinions **42** is secured fast onto shafts such as the respective shafts **44** and **45,** these shafts being provided with gearing **46** and **47** respectively. Gears **46** and **47** drive pinions **48** and **49** secured to shafts **50** and **51** respectively, shafts **50** and **51** being journaled in parallel relationship to shafts **44** and **45.** Also secured to each of the shafts **50** and **51** are gears **52** and **53** respectively, which, in turn, drive gears **54** and **55** which are secured to sleeves **56** and **57,** sleeve **56** being journaled across frame members **16** and **17,** sleeve **57** being journaled across frame members **12** and **13.** Sleeve **56** is secured to clutch-brake assembly **60,** while sleeve **57** is coupled to clutch-brake assembly **61.** As is apparent in the drawing, sleeve **56** is coupled to clutch member **62** in clutch-brake assembly **60,** while sleeve **57** is secured to clutch member **63** in clutch-brake assembly **61.** The core **64** in clutch-brake assembly **60** is operatively coupled through an overriding clutch assembly **65***a* to one end of the draw roll drive shaft **65** while core **66** of clutch-brake assembly **61** is operatively coupled through an overriding clutch assembly **67***a* to draw roll drive shaft **67** at the other side. Brake **68** in clutch-brake assembly **60,** as well as brake **69** in clutch-brake assembly **61,** are each adapted to hold the draw roll shaft stationary until either of the clutch members **62** or **63** is energized, whereupon the draw roll or output shaft **70** will rotate with either of the drivers **30** or **31** through the overriding clutches **65***a* or **67***a* respectively. (See FIG. **8** for details of this portion of the structure.) Thus, the draw roll shaft is initially energized by one of the drivers, for example, driver **30** through its overriding clutch **65***a,* and at its point in the driving cycle where its arcuate rate of speed decelerates to match the accelerating rate of speed of driver **31,** driver **31** will control the delivery of motion to the draw roll through its overriding clutch **67***a.* Thus, the clutch-brake assemblies may be simultaneously energized, and phased driving of the assemblies occurs without the need of an electrical flip-flop circuit. The overriding clutch assemblies are accordingly utilized as a replacement for the flip-flop circuits which would otherwise be required.

The use of a pair of racks on opposite sides of the draw roll enhance the dynamic balance of the apparatus, however it will be appreciated, of course, that both driver mechanisms may be provided on only one side or the other of the structure. Also, in addition to rack and pinion devices, Geneva drives or stepping motors may be employed.

Draw roll **70,** which is the output shaft of the structure, is suitably journaled in bearings within frame posts **14** and **15,** and is arranged in parallel relationship with a mating roll **71,** disposed immediately thereabove. Roll **71** is, of course, journaled in axial parallel relationship or alignment with roll **70,** and is preferably slidably mounted at each side of the apparatus in posts **14** and **15** respectively. Means are provided for permitting the upper roll **71** to be disposed in pressure engagement with the draw roll or output shaft **70.**

It is preferable that a resilient sleeve surround each of the shafts **70** and **71,** as shown in FIG. **7,** such as the resilient sleeves **73** and **74.** These resilient sleeves are preferably provided with a series of axially spaced cir-

cumferential slots such as the slotted area **75**, each slot being adapted to retain a finger **76**, as shown in FIG. **7**. The fingers each preferably terminate in a forwardly bent portion and prevent web material from clinging to the drive rolls and becoming wrapped therearound.

Another axially aligned roll assembly **80** lies parallel to the roll sections **70** and **71** as shown in FIG. **7**, and is also rotatably journaled for rotation on shaft **81** across frame elements **14** and **15** to permit independent rotation thereof. A further roll assembly **82** is journaled on shaft **83** which is on substantially the same plane as shaft **81**, and is provided with means journaling the shaft for rotation within the frame members **14** and **15**.

A synchronizing roll assembly **84** is also provided and arranged in axial alignment with the other roll assemblies. Shaft **84** is mounted for rotation within a pair of spaced blocks **85—85**, these spaced blocks being threadedly mounted upon a vertical screw rod **86** which is mounted for rotation between spaced brackets at the upper portion of each of the frame posts **14** and **15**. Handle element **87** is used to control the motion of the screw rod **86**, and if desired, a worm drive arrangement as shown at **88** and **89** may be used to drivably inter-connect a pair of oppositely disposed screw rods **86**. The details of this structure are discussed in U.S. Pat. No. 2,947,345 referred to hereinabove.

Also in alignment with draw rolls **70** and **71** is a back-up paid roll **91** for cutting and sealing webs. Roll **91** is tough and resistant to heat, and is preferably provided with an exterior layer of polytetrafluoroethylene (Teflon). The upper surface of roll **91** is substantially on the horizontal plane with the nip of the rolls **70** and **71**, with the web **92** being arranged to pass thereover. The cutting and sealing roll **91** has a central shaft **93** which is journaled in the frame elements **14** and **15**, and preferably has an axial extension to which sprocket **93***a* is secured. Sprocket **93***a* is drivably inter-connected with sprocket **94** by means of roller chain **95**. Thus, whenever draw roll **70** rotates, the cutting and sealing roll **91** will also rotate in the same direction. Since the roll **91** must rotate sufficiently fast to accommodate web travel, it is preferable to move the sealing roll at a somewhat more rapid peripheral rate of speed than the web speed so as to eliminate wrinkle or buckling of the web.

Forwardly of the cutting and sealing roll **91** is an endless delivery belt assembly **102** which is trained about roller means **103** to pick off severed and sealed articles from the roll **91** as shown in FIG. **7**. A rocking frame **104** is pivotally mounted at **105** just above the upper stretch of belt **102** and carries a pick-off roller **106** normally biased out of contact with belt **102** but depressible at the end of cutting and sealing of an article so as to pull it away from the roll **91** and cause it to travel on belt **102**, the individual articles may be disposed of in a manner common in the art, such as by stacking, or the like. The details of actuation of solenoid **108** are described in U.S. Pat. No. 2,947,345.

If desired, the web advancing may be controlled by an electric eye control system similar to that described in detail in U.S. Pat. No. 2,947,345, and also in other techniques well known in the art. In this event, however, the termination of coupling of driver **31** through clutch-brake assembly **61** will control the ultimate length of draw, with the initiation of the draw cycle being determined by driver **30**.

CUTTING AND SEALING OPERATION

In order to properly cut and seal the web **92**, a single straight hot knife blade **115** overlies the cutting and sealing roll **91** normally in spaced relation and is adapted to be depressed thereagainst when the superimposed webs forming web **92** have been advanced to their proper positions on roll **91**. Hot knife **115** is heated to a constant temperature through electric leads **116** from a controlled source of energy, not shown. Hot knife **115** has a latticed frame mounting **117** so constructed as not to permit accumulation of heat or the development of unevenly heated areas along the length of the blade **115**. The knife **115** is caused to slide vertically with respect to frame elements **14** and **15** and in guided relation therewith. The frame **117** is eccentrically mounted at a side of the machine to a pivot block **118**, the pivot block **118**, in turn, being secured to a shaft **119**, as shown in FIG. **6**. A handle **120** is secured forwardly on each of the pivot blocks **118** so that, when either handle **120** is raised, the knife **115** will be kept upwardly in spaced relation with the roll **91** at all times. The shaft **119** is rotatably mounted adjacent each end in arm **122**, the latter being pivotally suspended at **123** from a link **124**, in turn pivotally mounted at a fixed position **125** at corresponding sides of the frame elements **14** and **15**. On each of the arms **122** between the pivot points **119** and **123** is pivotally secured at **126** a depending yoke **127** which, in turn, rides loosely upon an eccentric **128**, as shown in FIG. **6**. Eccentrics **128** are secured in the same relative position to a shaft **129** which extends across the frame elements **14** and **15** and operates simultaneously. A crank arm **130** is secured to shaft **129** so that, whenever the crank **130** is secured to shaft **129** so that, whenever the crank **130** is moved counter-clockwise for a short distance, the yoke **127** will be permitted to lower at each position and will permit the knife **115** to descend toward the roll **91**. If the handles **120** are in lower position, the hot knife **115** will actually contact the roll **91** and press thereagainst with its own weight suspended thereon. Bearing pressure will then be removed from each of the yokes **127** and its corresponding eccentric **128**. In practice, a small clearance such as one-sixteenth on an inch is sufficient to permit the knife blade **115** to rest its weight upon roll **91** without being forced downwardly thereagainst.

The crank **130** is actuated by a piston rod **131** which is pivotally connected thereto at **132**. The piston rod **131**, in turn, is connected to a piston **133** which is slidably received within the hydraulic cylinder **134**. A compression spring **135** biases the piston **133** normally rearward so as to maintain the crank **130** rearward and the knife blade **115** in raised position. Cylinder **134** is rigidly mounted to a bracket **136** which, in turn, is secured to frame elements **14** and **15**. A hydraulic inlet tube **137** communicates with the rear end of the cylinder **134** for causing the piston to move forwardly against compression spring **135**. Upon release of pressure, the spring **135** will cause the piston to return and force fluid outwardly through the tube **137**. An adjustably abutment screw **138** is threadably mounted in the rear end **139** of the cylinder **134** and has a thumb nut **140** at the outer end thereof for adjusting the abutment stop **141**, which, in turn, determines the rearmost position of piston **133** under biasing influence of compression spring **135**. Another nut **142** has an annular groove **143** which is adapted to slidably receive a yoke **144** as

shown in FIG. 6. The yoke **144** extends forwardly in bracketed sliding engagement with the cylinder **134** and has mounted thereon a switch **145** which is operated by an actuator **146** having a bifurcated forward end **147** and normally biased forwardly by compression spring **148.** Crank arm **130** carries a pin **149** which is received in the bifurcated portion **147** of the switch actuator **146.** When the arm **130** and piston **133** are biased rearwardly, the switch **145** will establish one circuit while, when moved forwardly under the pressure of hydraulic fluid in line **137,** will establish another circuit, as will be described in detail under the operation of the machine.

ELECTRICAL CIRCUIT AND OPERATION

In order to establish a side-welding operation for the preparation of bags or other elongated structures from the web **92,** the web is initially positioned on the roll system, with the folded web being advanced by the output shaft operating the draw rolls **70** and **71.** The hot knife **115** will be maintained at a constant temperature suitable for cutting and welding the particular thermoplastic web in the desired thickness. The main drive motor **20** is constantly energized and rotates the input shaft **29** through gears **27** and **28** whenever clutch-brake assembly **23** is energized, it being understood that no rotation is imparted to input shaft **29** when clutch **25** is de-energized and brake **26** is energized. Cams **150, 151, 152** and **153** are all fixed to, and rotate with shaft **29** to establish the sequence of operation.

In operation, an operational cycle of the apparatus includes one complete rotation of input shaft **29** beginning with the individual crank arms **33** and **34** in out-of-phase alignment, but with the crank arm **33** in upright position and in alignment with the gear rack **38.** Thus, the position illustrated in FIG. **1** is subsequent to this point in the cycle, with the crank arms having progressed a short arcuate distance from the starting point. The individual crank arms are disposed 120° from each other, with the arm **33** leading the arm **34.** Energization of clutches **62** and **63** may occur simultaneously with the commencement of the draw cycle, and with clutch **62** being dominant in the beginning of the cycle. With attention being directed to FIG. **3** of the drawings, it will be observed that the rate of motion of the web increases until a peak or top speed is reached at 90° of motion of the input shaft **29,** and thereafter the rate decreases on a sinusoidal rate until 150° of motion has been achieved. At that point, clutch **63** continues to be energized so as to become dominant and couple driver **31** to the output shaft **70** through overriding clutch **67***a*, thus constituting the draw roll of the system. The driver **31** controls the motion for the portion of the cycle between 150° and 300° of rotation of the input shaft **29.** The remaining 60° are utilized for dwell, during which the sealing operation will occur. With this arrangement, long bag structures, up to 30 inches or more in length, may be fabricated at rapid machine rates. The peak speed for a 30-inch bag compares to that for an 18-inch bag fabricated by machines utilizing conventional draw cycles extending for only 180° of rotation.

In this normal operational mode, cam wheel **150** controls the clutch-brake system **23,** and cam wheel **153** controls the clutch-brake systems **60** and **61** which in turn drive and retain the output shaft or draw roll **70.** Cam wheel **151** initiates the cutting and sealing movement of hot knife **115** and a timing cycle which determines the dwell period thereof. Cam wheel **152** is utilized to control the operation of an electric eye in the system, when utilized.

The operation of the circuitry is set forth in detail in U.S. Pat. No. 2,947,345, and reference is made to that disclosure for the details of operation of the present structure, it being understood that the present arrangement is for a single web rather than a dual web as discussed in U.S. Pat. No. 2,947,345, and further that the clutch assemblies **62** and **63** are normally simultaneously energized for the entire draw cycle and simultaneously de-energized during the dwell cycle.

It will be appreciated, also, that the operation of cam wheels **150** and **153** is closely coordinated and controlled in order that the actuation occurs on a smooth basis, thus eliminating any tendency for the film to be abruptly jerked during the draw cycle.

Typically, in the normal operational mode, the extent of overlap of the individual drive cycles for the drivers **30** and **31** will be equal to the length of the dwell. Since 60° dwell is typical, a 60° overlap is normally employed, thus providing for the 120° phase shift. It will be appreciated that the modest ripple which occurs or appears in the draw cycle is less severe for the web than the rigorous treatment previously afforded by conventional units utilizing 180° draws. The apparatus of the present invention has been found capable of producing bags **31** inches in length at a cycle rate of 120 cycles per minute. Also, in a typical operational cycle of this type, the dwell cycle includes 80° of timing, with 30° of the dwell time being devoted to the actual sealing operation. The remaining 50° of dwell are utilized with one-half being devoted to a lowering of the knife, and one-half being utilized for the raising of the knife. Longer knife dwell times may be utilized for some sealing operations, such as for periods of up to at least 54°. At a sealing rate of 50° of dwell and for 1½ mil polyethylene, a bar temperature of 800° F. is employed, while temperatures ranging from between 750° and 850° F. may be found satisfactory. The conveyor speed for the output is held or maintained at a rate of 400 feet per minute, with rates from 350 feet per minute to 400 feet per minute being typical.

It will be appreciated that the times and temperatures set forth hereinabove, are typical of certain operational modes. It is possible, therefore, to utilize lower temperatures with longer dwell times and satisfactory seals are still obtained. In one operation, it has been found that 1½ mil polyethylene may be sealed with a sealing bar having a temperature of 300° F., however the dwell time is 30° of a 90 cycle per minute rate. It will also be appreciated that side-weld and bottom seals may be prepared utilizing this mechanism.

The utilization of one-way or overriding clutches in the drive mechanism has been found to provide smooth mechanical switch-over from one input to the other, and any anomolies which occur in mechanical switching will not adversely affect performance. This is helpful in certain cases with webbing which could be adversely affected by abrupt changes in rates of speed of draw.

I claim:

1. Means for intermittently advancing a web of flexible film comprising:

a. drive means for imparting repeating cycles of intermittent motion and dwell to said web with the mo-

tion normally being along a certain predetermined web direction, said drive means including output shaft means having first and second input driver means operatively coupled thereto;

b. input shaft means and means for drivably rotating said input shaft in one rotational direction;

c. unitary output shaft means adapted to be operatively coupled to said web for imparting motion thereto;

d. first and second driver means arranged in phased relationship one-to-another and being responsive to the rotation of said input shaft means and operatively coupled to said output shaft for drivably rotating said output shaft in one rotational direction, each driver means being effective for the rotation of said output shaft for a driving cycle of said output shaft, with continuously varying rates of rotational velocity having acceleration from dwell to maximum velocity and deceleration from maximum velocity to dwell, and further being effective only during one-half of each rotational cycle imparted to each of said driver means by said input shaft;

e. means including first unidirectional clutch means inter-coupling said first driver means to said input and output shafts for initiating rotation of said output shaft and for continuing said rotation for a first motion segment not exceeding one-half cycle of rotation of said input shaft and for de-coupling said first driver means at the end of said first motion segment;

f. means including second unidirectional clutch means for intermittently inter-coupling said second driver means to said input and output shafts in phased relationship to said first driver means and for achieving over-riding de-coupling of said first driver means from said output shaft for continuing rotation of said output shaft for a second motion segment not exceeding one-half cycle of rotation of said input shaft and for de-coupling said second driver means upon completion of said second motion segment; and

g. means for maintaining said output shaft means in locked disposition while said first driver means and said second driver means are simultaneously de-coupled from said output shaft to impart a dwell cycle to said web.

2. The apparatus as defined in claim **1** being particularly characterized in that said first and second motion segments are substantially equal.

3. The apparatus as defined in claim **1** being particularly characterized in that said first and second driver means are arranged in phased relationship one-to-another by an arcuate distance of less than 180°.

4. The apparatus as defined in claim **1** being particularly characterized in that brake means are coupled to said output shaft means, and means are provided for energizing said brake means for that dwell portion of the cycle remaining after termination of said first and said second motion segments.

5. The apparatus as defined in claim **1** being particularly characterized in that said first and second driver means are in phased relationship, one-to-another by an arcuate distance of between 45° and 165°.

6. The apparatus as defined in claim **1** being particularly characterized in that said first and second driver means are rack-and-pinion drivers.

7. The apparatus as defined in claim **6** being particularly characterized in that said rack-and-pinion driver means are disposed on opposite ends of said input and output shafts.

8. Thermoplastic web treating apparatus comprising, in combination, drive means for intermittently advancing superimposed webs of thermoplastic sheet film material and for stopping said superimposed webs for a pre-determined period of dwell, and hot knife means for thermally welding said superimposed webs together at predetermined spaced intervals therealong, said drive means comprising:

a. drive means for imparting repeating cycles of intermittent motion and dwell to said web with the motion normally being along a certain pre-determined web direction, said drive means including output shaft means having first and second input driver means operatively coupled thereto;

b. input shaft means and means for drivably rotating said input shaft in one rotational direction;

c. unitary output shaft means adapted to be operatively coupled to said web for imparting motion thereto;

d. first and second driver means arranged in phased relationship one-to-another and being responsive to the rotation of said input shaft means and operatively coupled to said output shaft for drivably rotating said output shaft in one rotational direction, each driver means being effective for the rotation of said output shaft for a driving cycle of said output shaft, with continuously varying rates of rotational velocity having acceleration from dwell to maximum velocity and deceleration from maximum velocity to dwell, and further being effective only during one-half of each rotational cycle imparted to each of said driver means by said input shaft;

e. means including first unidirectional clutch means inter-coupling said first driver means to said input and output shafts for initiating rotation of said output shaft and for continuing said rotation for a first motion segment not exceeding one-half cycle of rotation of said input shaft and for de-coupling said first driver means at the end of said first motion segment;

f. means including second unidirectional clutch means for intermittently inter-coupling said second driver means to said input and output shafts in phased relationship to said first driver means and for achieving over-riding de-coupling of said first driver means from said output shaft for continuing rotation of said output shaft for a second motion segment not exceeding one-half cycle of rotation of said input shaft and for de-coupling said second driver means upon completion of said second motion segment;

g. means for maintaining said output shaft means in locked disposition while said first driver means and said second driver means are simultaneously de-coupled from said output shaft to impart a dwell cycle to said web; and

said hot knife means comprising:

h. heated blade means disposed generally transversely of the web axis and normally spaced from said web axis during advance of the web, and means for reciprocably moving said blade relative to said web to bring said blade into contact with

said superimposed webs for welding said webs together during said period of dwell.

9. The combination as defined in claim **8** being particularly characterized in that said hot knife means is adapted to move reciprocably toward and away from said superimposed webs, and into contact with said webs.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,884,129

DATED : May 20, 1975

INVENTOR(S) : Thomas J. Monahan

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 64, "gear rack 28" should read -- gear rack 38 --.

Column 6, lines 34 and 35, delete the repeated phrase "the crank 130 is secured to shaft 129 so that, whenever".

Signed and Sealed this

twenty-ninth Day of *July 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks