Nov. 17, 1953 R. G. McLAGAN 2,659,598

PROPORTIONAL SEQUENCE CONTROL FOR FOLDERS

Filed March 8, 1950 2 Sheets-Sheet 1

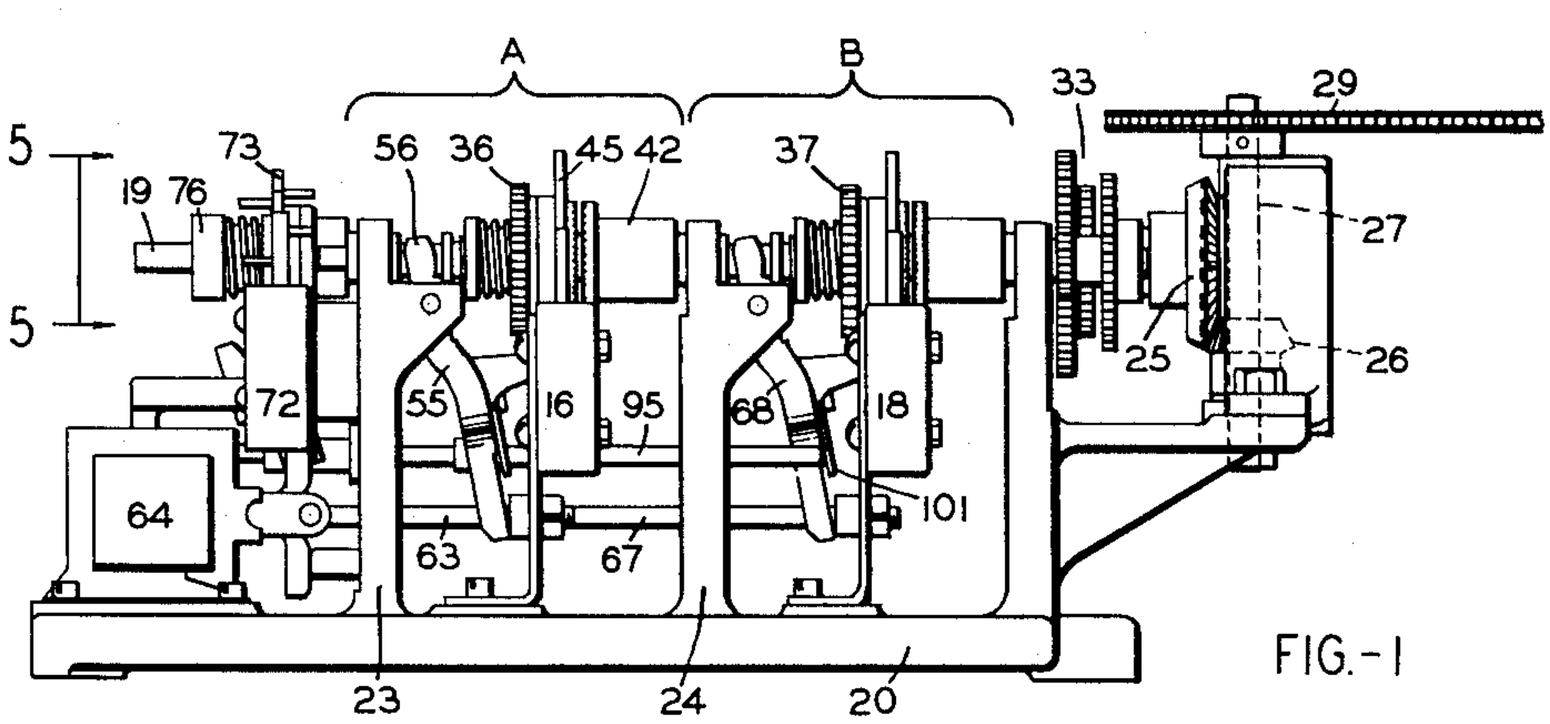

FIG.-1

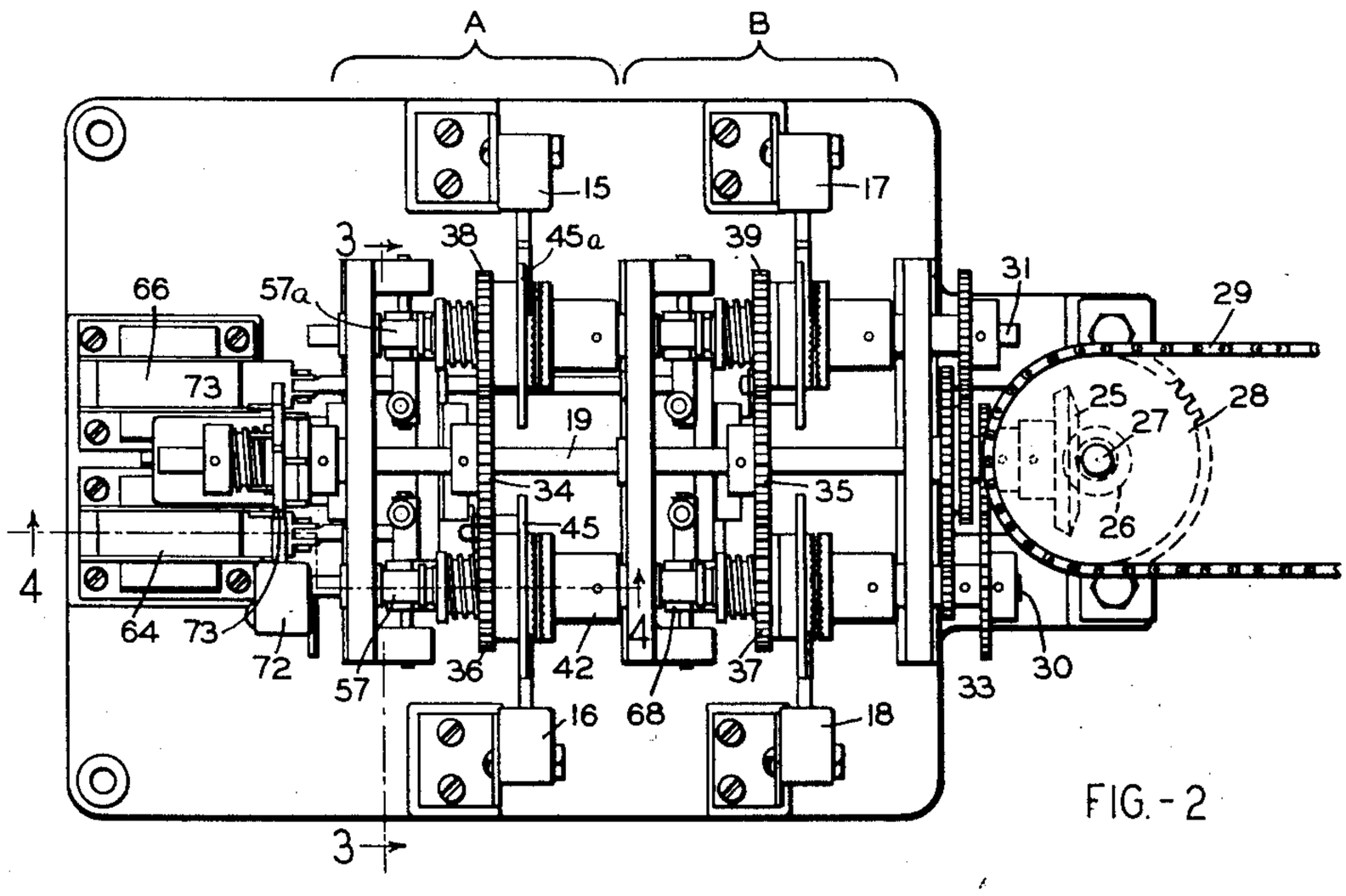

FIG.-2

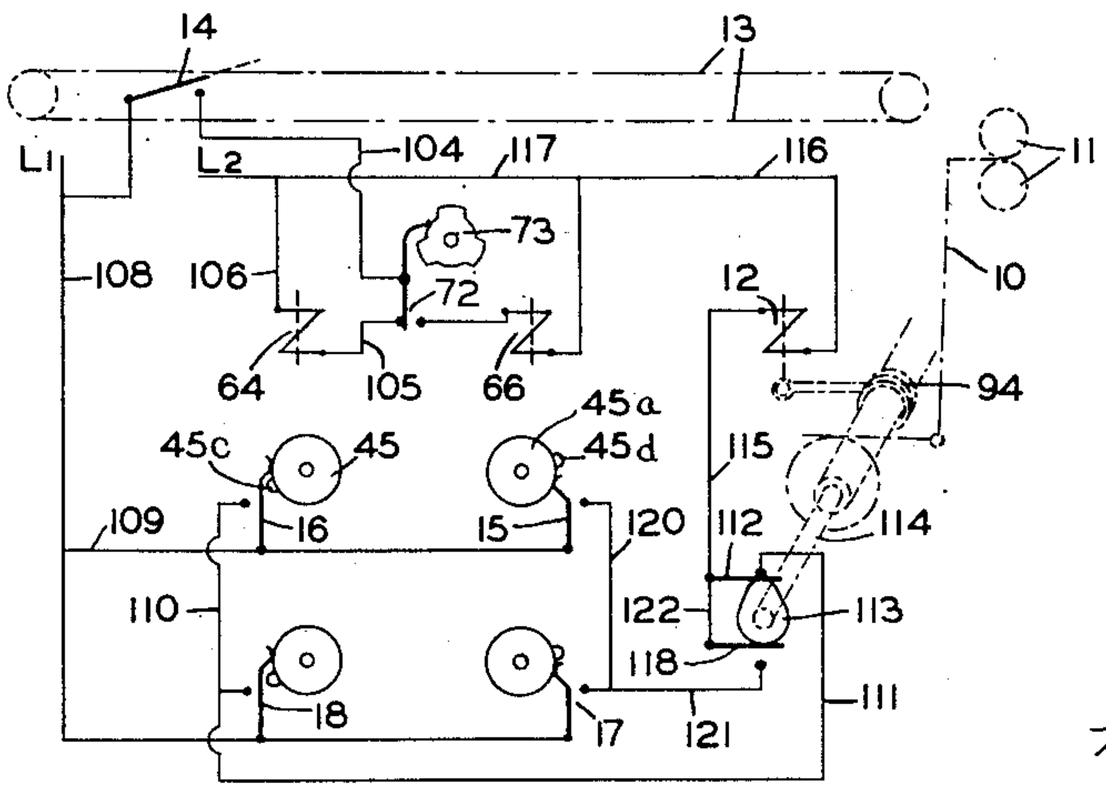

FIG.-6

INVENTOR.
RUSSELL G. McLAGAN
BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

Nov. 17, 1953 R. G. McLAGAN 2,659,598

PROPORTIONAL SEQUENCE CONTROL FOR FOLDERS

Filed March 8, 1950 2 Sheets-Sheet 2

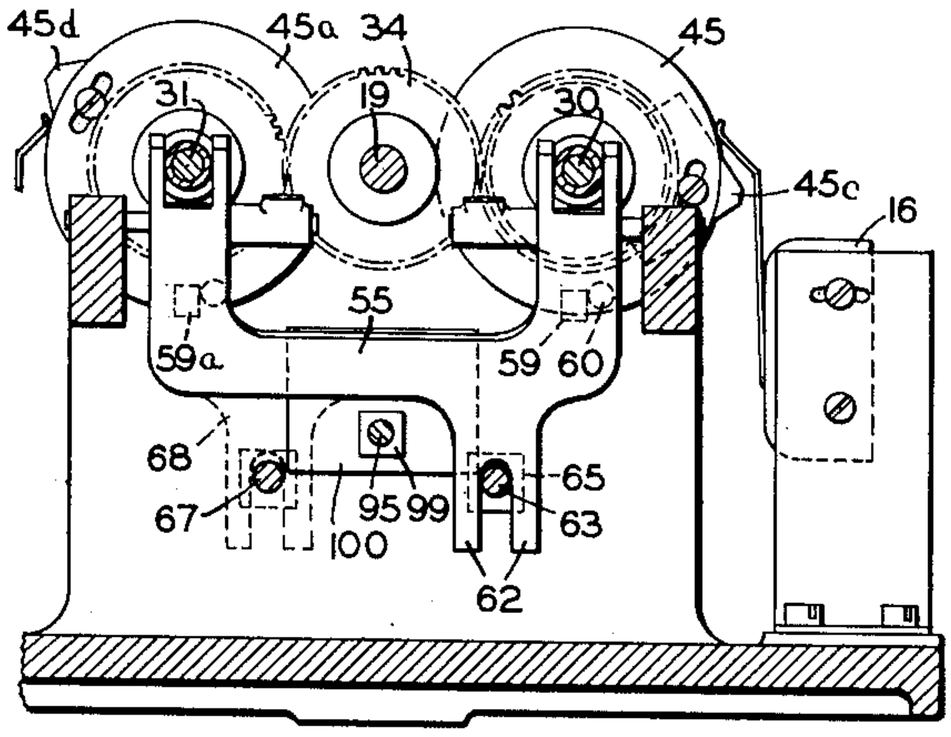

FIG.-3

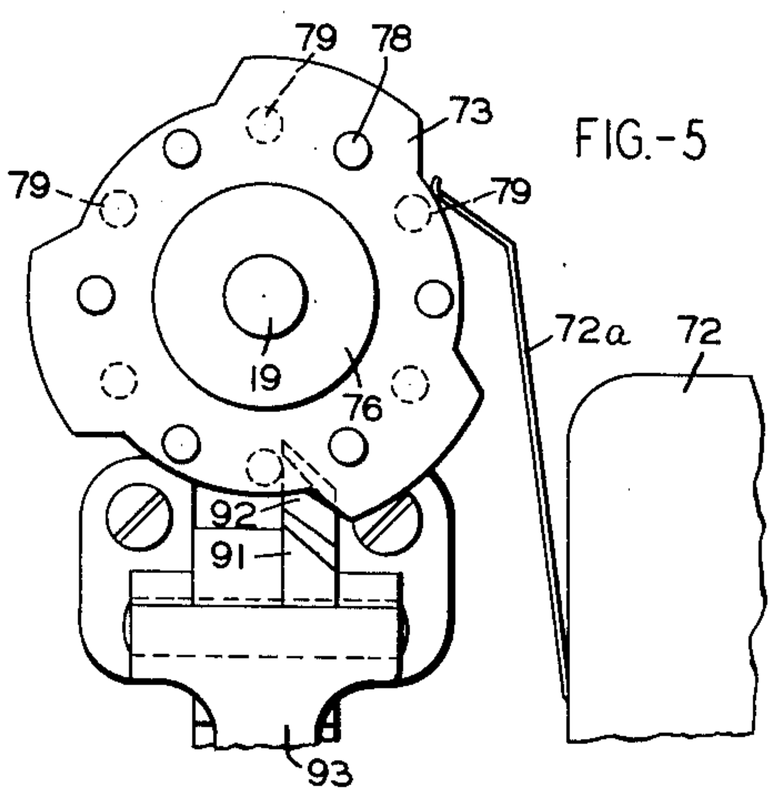

FIG.-5

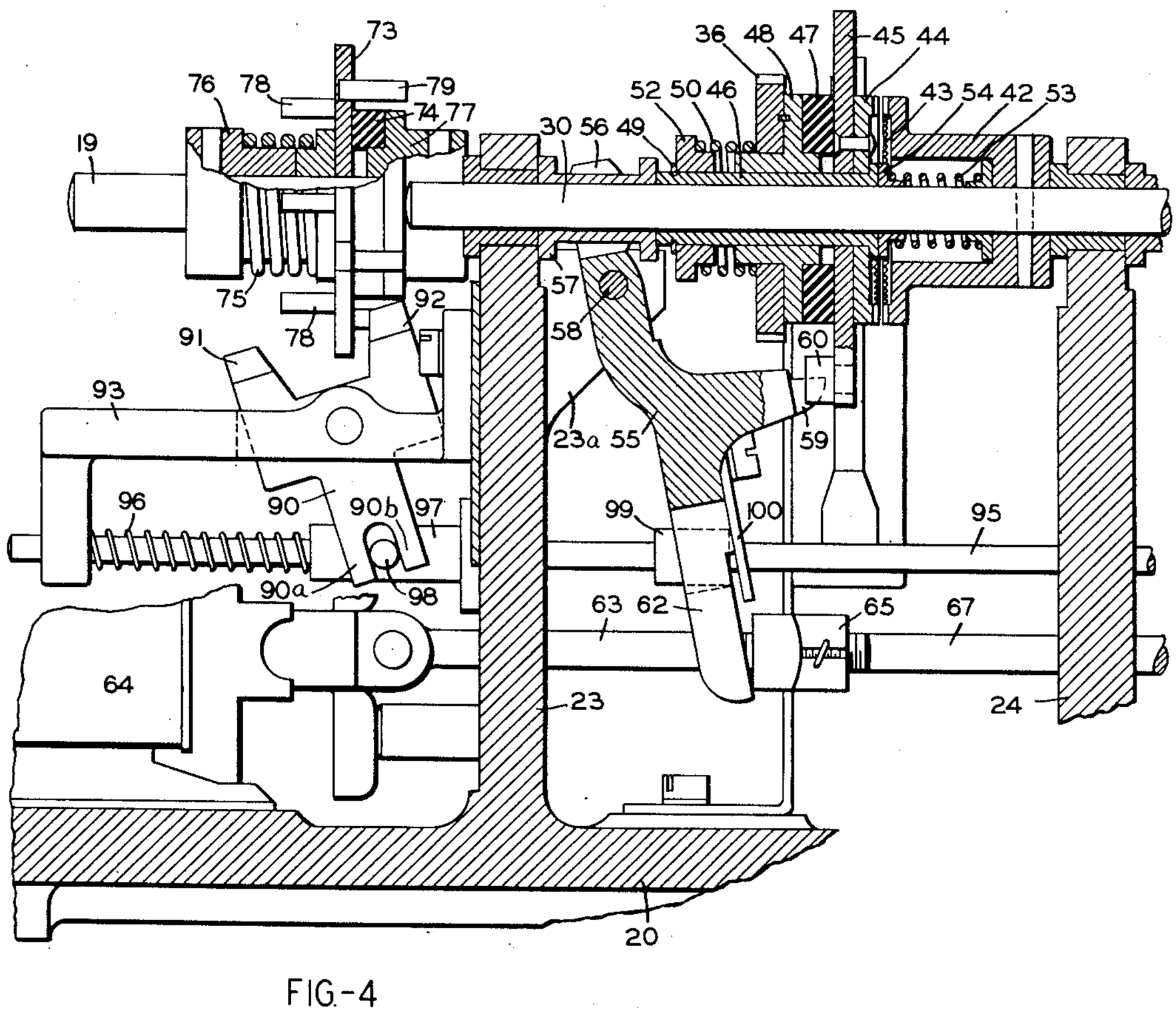

FIG.-4

INVENTOR.
RUSSELL G. McLAGAN
BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

Patented Nov. 17, 1953

2,659,598

UNITED STATES PATENT OFFICE

2,659,598

PROPORTIONAL SEQUENCE CONTROL FOR FOLDERS

Russell G. McLagan, Milford, Ohio, assignor to The American Laundry Machinery Company, a corporation of Ohio

Application March 8, 1950, Serial No. 148,453

7 Claims. (Cl. 270—80)

1

The invention relates to a novel and improved sequence control device for the timed control of one or more operations on a traveling article. It will be specifically described with relation to its adaptation to the performance of proportional folding operations on flat work such as laundry towels, sheets, or the like.

The invention herein to be disclosed is especially adapted for use with a laundry flat work folding machine such as is disclosed in U. S. Letters Patent No. 2,464,823, granted March 22, 1949, to C. S. Malott, Jr., for Folding Machine.

The Malott machine includes continuous conveyor means for conveying a series of sheets, towels, or the like to a position where the leading edge of each article feeds downwardly adjacent a reciprocatable horizontal folding arm. To perform the conventional one-quarter three-quarter fold the arm remains inactive until one-quarter of the article has passed it in a downward direction. At this moment the arm is rocked laterally past the plane of the descending article so that the article now drapes over the arm and continues to move downwardly on the other side of the arm. When the three-quarter point of the article arrives in registry with the folder arm, the arm is again energized to move forwardly to its first described position, whereupon the last quarter of the article drapes downwardly over the first quarter. The article is then routed to pass between folding rolls.

The present invention may be adapted for controlling devices other than the folding machine just described, but for simplicity and convenience, and in no sense of limitation, my invention will be described with occasional reference to the Malott folding machine above briefly characterized.

An object of the invention is to provide a novel and improved sequence control device of positive mechanical type, electrically energized to initiate an operation on a moving article at a point or points having predetermined proportionate relationships to the length of the article. By the terms "proportionate relationships" or "proportional" as used herein, I mean an operation at the quarter point, three-quarter point, or elsewhere fractionally of the article length.

A further object of the present invention is to provide a sequence control device of the type defined in the last preceding paragraph, comprising a plurality of control units, each unit distinct and complete in itself, and so disposed and operated that an operation on a pair of

2

immediately succeeding traveling articles is effected under the control of respectively distinct units, whereby one or more operations on a leading article, for example are controlled by one such unit, and one or more operations on the next succeeding article are controlled by another such unit.

Further objects of the invention will be in part obvious, or will become apparent upon a study of the following specification, in conjunction with the accompanying drawings, in which

Fig. 1 is a side elevational view of a sequence control device embodying my invention;

Fig. 2 is a top plan view as seen from above Fig. 1;

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a vertical sectional view, somewhat enlarged, taken on the line 4—4 of Fig. 2;

Fig. 5 is an end elevational view, somewhat enlarged, from approximately the position of the line 5—5 of Fig. 1; and

Fig. 6 is a wiring diagram, showing some operating parts schematically.

Referring now to the drawings, and speaking first generally, the control device is shown in Figs. 1 to 5 inclusive, and Fig. 6 indicates certain controlled elements such as a folding blade 10, a pair of folding rolls 11, a blade operating solenoid 12, an endless conveyor 13, and a trip switch 14 which is operated by the leading and trailing edges of an article (not shown) moving to the right on the top flight of the conveyor. The folding impulses are supplied to solenoid 12 by the sequence controller shown in Figs. 1 to 5.

Referring now to Fig. 2 the folding impulses originate either in switches 15 and 16 of a first folding control unit as indicated by the bracket "A" in Figs. 1 and 2, or in switches 17 and 18 of a second folding control unit as indicated by the bracket "B" in the same figures. In the representative example to which occasional reference will be made, and wherein a one-quarter and three-quarter fold are to be applied to moving flat work laundry articles such as sheets, unit A, in conjunction with other parts of the device, controls said folds on one sheet, and unit B, also in conjunction with other parts of the device, controls the same type folds on the next succeeding sheet. Unit A then controls the operations on the third sheet, and unit B on the fourth, etc.

In the embodiment here shown the sequence control device has a continuously rotating driving shaft 19 supported on a base 20 by means

of frame uprights 23 and 24. The shaft 19 has a bevel gear 25 driven by a pinion 26 on a vertical shaft 27 which has on its upper end a sprocket 28 driven by a chain 29 from the folding machine (not shown) so that there is positive synchronism between the controlling means and the folding machine. A pair of driven shafts 30 and 31 are driven at fractional arithmetically proportioned speeds relative to the driving shaft by means of a gear train 33 not herein necessary to characterize in detail, shaft 30 rotating at three-quarter the speed of the driving shaft 19, and shaft 31 at one-quarter the speed of driving shaft 19.

Through appropriate elements soon to be described shaft 30 produces intermittent energization of switch 16 in unit A for the one-quarter fold operation on a sheet, or of switch 18 in unit B for the one-quarter operation on a succeeding sheet. Shaft 31 takes care of the operation of switches 15 and 17 in the same way, so as to respectively control the three-quarter folds on the specified sheets. The part of unit A which controls the one-quarter fold will be known as the first section of unit A, and the part of unit A which controls the three-quarter fold will be known as the second section of unit A. Similarly understandable terminology will be applied to the first and second sections of unit B.

There is substantial similarity in the operation of each unit, and in the operation of each section of each unit, so that such operation will be described for the time being with reference mainly to the first and second sections of unit A. Each of the four sections is a complete timer unit.

Secured to shaft 19 are two gears 34 and 35, one for each unit, and these are in constant mesh with complementary gears 36, 37, 38 and 39 carried on shafts 30 and 31 in the positions shown best in Fig. 2. With special reference to the enlarged fragmentary view of Fig. 4 which shows the construction of one section of unit A (the one controlling the one-quarter fold) and with occasional reference to the general construction as shown in Figs. 1, 2 and 3, there is shown a cup-like clutch member 42 having an annular toothed face 43. Member 42 is pinned to shaft 30. A driven clutch member 44 is secured to a generally circular cam disk 45, both being freely rotatable on the periphery of a sleeve 46 which is free to turn on shaft 30. The clutch comprising the members 42, 44 will be hereinafter termed a positive clutch since its engagement is more mechanical than frictional. Disk 45 has frictional contact through a compressible ring 47 with a flanged sleeve 48 having attached thereto the gear 36 which, as heretofore noted, is driven directly from main driving shaft 19 through gear 34. Sleeve 48 is free on sleeve 46. Slippage between disk 45 and ring 47 is permitted when frictional adhesion between them is overcome by differential power applications respectively applied to each during operation, as will appear. The clutch comprising the members disk 45 and ring 47 will be hereinafter termed a slip clutch. A collar 52 is also rotatable on sleeve 46, and it abuts a retaining ring 49 on the sleeve. A compression spring 50 maintains endwise bias against ring 47.

The sleeve 46, and all elements carried thereby, including clutch part 44, are movable slightly to the right from the position shown in Fig. 4, against the bias of a compression spring 53, retained by a movable collar 54, such movement

being responsive to operation of a yoke lever 55 effective through fork fingers 56 against a spool 57 slidable on shaft 30. Such movement to the right produces engagement of the complementary positive clutch parts 42, 44. As previously noted, clutch part 42 rotates with the speed of shaft 30, which travels at three-quarter the speed of driving shaft 19. When the clutch parts 42, 44 are engaged, slippage occurs between disk 45 and friction ring 47, and the disk necessarily rotates with the speed of clutch parts 42, 44 and shaft 30. Under a certain condition when the clutch is not engaged, clutch part 44 rotates with friction ring 47 and gear 36, said gear 36 being directly driven from gear 34 on main shaft 19. Under a still further condition (as will appear) when the clutch is disengaged, and disk 45 is intentionally held so as to completely prevent its rotation, slippage also occurs between ring 47 and disk 45.

As shown in Fig. 4 the clutch 42, 44 is disengaged, but engagement can be effected by the aforesaid yoke lever 55 which is pivoted at 58 on a part 23*a* of frame upright 23. In the position shown the yoke lever, by means of a projecting finger 59, engages a stop lug 60 on disk 45. Lever 55 also similarly operates spool 57*a* (Fig. 2) on shaft 31 so as to cause operation of the analogous and identical clutch parts, etc., in unit A on shaft 31. Lever 55 has a second finger similar to 59, but operative on disk 45*a* in the second section of unit A, this second finger being indicated at 59*a* in dotted line on Fig. 3. Each timer disk 45, 45*a*, has attached thereto a cam or tripper 45*c* and 45*d* so located that in the unoperated position the tripper is slightly past the operating arm for switch 16, 15, etc. and the switch is in normally open position. Yoke lever 55 has a forked leg 62 which straddles an operating rod 63 operated by a solenoid 64, the rod having a fixed nut 65 on its end. For unit B another solenoid 66 has an operating rod 67 to operate a similar yoke lever 68 (Figs. 2 and 3) which controls the operation of analogous clutch members, etc., in unit B. As indicated in Fig. 3, yokes 55 and 68 have their operating legs staggered, left and right, so as to be operated by rods 63 and 67 in alignment respectively with solenoids 64 and 66.

The device for alternating units A and B in sequence is best seen in Figs. 2, 4 and 5. Its mechanical structure will now be described, and its operation will later more readily appear in conjunction with the description of the wiring diagram and the sequence of operations. It comprises a double throw switch 72, a cam 73, and means for rotating the cam at each operation. Cam 73 is mounted on the end of shaft 19 but is not secured thereto, being held in contact with a friction ring 74 by a compression spring 75 between two collars 76 and 77 pinned to shaft 19. Stop pins 78 and 79 extend alternately to the front and rear of cam 73. A rocker 90 having arms 91 and 92 is pivoted on a bracket 93 on frame upright 23. It has two positions, engaging either a front pin or a rear pin, either such position stopping cam 73. As the rocker is moved away from one position, releasing one pin, the cam undergoes an increment of movement before the other rocker arm is interposed in front of the next pin on the other side of the cam.

Operation of the rocker arm is effected by means of a rod 95 yieldingly urged to the right by a spring 96. Attached to rod 95 is a sleeve 97 carrying a pin 98 which has ends projecting

into a slot between fingers 90*a* and 90*b* on rocker 90. Rod 95 has an abutment collar 99 engaging a plate 100 on yoke 55, the rod end abutting a similar plate 101 on yoke 68 in unit B. Since the rod 95 passes freely through an aperture in plate 100, either yoke by movement to the left (Figs. 1 and 4) can operate rod 95 without affecting the position of the other yoke. The purpose of the sequence rocker of course is to permit operation of cam 73 which at certain times causes operation of double throw switch 72. Switch 72 in one position energizes solenoid 64 and in the other position energizes solenoid 66.

The operation of the device is as follows, referring both to the structural figures, and to the diagram, Fig. 6.

The compound gear train 33 is so arranged that while the rotation of driving shaft 19 is counterclockwise (Fig. 3) the rotation of shafts 30 and 31 is clockwise. In the wiring diagram the device is shown in the idle position with the double throw sequence switch in the circuit position for operation of solenoid 64 as soon as trip switch 14 is closed.

As soon as the leading edge of the first article (and we have selected as work pieces a succession of sheets to be folded) reaches trip switch 14 a circuit is completed from L_1 through switch 14, conductor 104, sequence switch 72 in the position shown (by reason of its switch arm being on a low segment of cam 73) and through conductor 105, solenoid 64, and conductor 106 to L_2. The solenoid 64 remains energized as long as the sheet is moving over trip 14.

Energization of solenoid 64 moves rod 63 to the left (Fig. 4) thereby swinging yoke 55 clockwise and releasing cam disk 45 while at the same time causing engagement of positive clutch parts 42 and 44. A similar result is produced in the second section of unit A. As previously described, the cam disks 45 and 45*a* begin to rotate, disk 45 at three-quarters the the speed of driving shaft 19 and disk 45*a* at one-quarter the speed of the driving shaft. This continues until the trailing edge of the first sheet passes trip 14, allowing the trip switch to reopen and deenergizing solenoid 64. Spring 53 disengages clutch parts 42, 44, and cam disks 45, 45*a* now rotate at full speed through slip clutch 45, 47 and gears 36, 34 to the driving shaft 19.

Observing the rotation of disk 45, as soon as its cam rise portion 45*c* operates switch 16 it completes a circuit to solenoid 12 which operates folder arm 10 to effect the first fold. The circuit is through L_1, conductors 108 and 109, switch 16, conductors 110 and 111, a switch 112 operated by a cam 113 on the folder shaft 114, conductor 115, solenoid 12, and conductors 116 and 117 to L_2. Operation of solenoid 12 and arm 10 energize a half revolution clutch mechanism 94 causing the arm to move to its rear position, the folder arm contacting the dropping sheet at its one-quarter point and causing the sheet to drape over the horizontal portion of the arm. As a result of said half-revolution rotation of shaft 114, cam 113 opens switch 112 and closes a switch 118. This rearranges the circuit for operation of the second fold timer of unit A.

When the cam rise 45*d* of disk 45*a* operates switch 15 the solenoid 12 is again energized through a circuit from L_1 through conductors 108 and 109, switch 15, conductors 120 and 121, switch 118, conductors 122 and 115, solenoid 12 and conductors 116 and 117 to L_2. Energization of solenoid 12 again operates folder arm 10, causes a half revolution of shaft 114, opens switch 118 and closes switch 112.

It will be understood that the folding zone is so disposed as respects the distance from the trip 14, and the cam rises 45*c* and 45*d* are circumferentially so disposed on disks 45 and 45*a* respectively, and the relative speeds of rotation of all shafts and the endless conveyor are so regulated, that the proper fold line of a sheet arrives at the folder arm coincidentally with energization of the solenoid 12, so that the folds are effected as planned. Changes may be made in some of these factors to effect a one-third two-third folding arrangement, etc.

The sequence operation by means of rocker 90 is as follows.

When solenoid 64 was energized as previously described, pulling rod 63 to the left (Fig. 4) and moving yoke 55 clockwise, plate 100 engaged collar 99 so as to push rod 95 to the left against the bias of spring 96, causing pin 98 to move rocker 91. As previously described this momentarily releases cam 73 to permit a segmental increment of rotation, an angular distance equivalent to the distance between a pin on one side of cam 73 and the nearest pin on the opposite side, for example from a pin 79 to a pin 78. Examination of Fig. 5 will show that this rotation (counterclockwise) is insufficient to affect the position of the arm 72*a* of switch 72. However, when solenoid 64 was deenergized by passing of the trailing edge of the sheet past trip 14, rod 95 moves to the right (Fig. 4) under the bias of spring 96, the collar 99 moving yoke 55 counterclockwise. Rocker 90 then moves back to its original position, again permitting the standard segmental rotation of cam 73, and at this time switch arm 72*a* is moved to the next high segment on cam 73 so as to cause operation of switch 72. This reversal of switch 72 now places solenoid 66 in circuit with trip switch 14, so that the next article which comes through on the endless conveyor will be under the control of solenoid 66, yoke 68, and the several timer sections of unit B.

Actuation by solenoid 66 for the one-quarter fold causes movement of cam 73 as before, but insufficient to drop switch arm 72*a* or operate switch 72. The return of yoke 68 upon deenergization of the solenoid 66 causes operation of the rocker 90, permits another segmental increment of rotation of cam 73, and one cycle of operation of units A and B has been completed.

In this specification and the appended claims, I use the words "arithmetically proportioned" to indicate any selected fractional increment of the standard of comparison. For example in comparing the speed of the driven shaft with the speed of the driving shaft in the embodiment disclosed, and under the relative rates of rotation disclosed, the words "arithmetically proportioned" mean that the driven shaft is rotating at three-quarter the speed of the driving shaft. In other possible embodiments the words would indicate the fact that a particular suitable ratio has been selected to attain the operation at the location desired.

What I claim is:

1. Control means adapted to time the execution of an operation on each of a series of spaced articles moving on a conveyor past measuring means, and wherein an operating member is energized to perform such operation responsive to rotation of a timing member past a point of registry, said control means comprising a first driving member, a second driving member, means

for rotating said driving members at different rates, means for producing and continuously maintaining planar frictional driving engagement between said timing member and said first driving member, stop means for preventing rotation of said continuous timing member despite said frictional driving engagement, means for producing positive driving engagement between said timing member and said second driving member while simultaneously rendering said stop means ineffective, whereby said timing member rotates responsive to said second driving member despite said continuous frictional engagement with said first driving member, and means for terminating said positive driving engagement while said stop means remains ineffective, to permit said timing member to be driven from said first driving member by means of the aforesaid frictional engagement until said timing member reaches said point of registry.

2. Control means adapted to time the execution of an operation on each of a series of spaced articles moving on a conveyor past measuring means, and wherein an operating member is energized to perform such operation responsive to rotation of a timing member to a point of registry, said control means comprising a first driving shaft, a second driving shaft, means for rotating said shafts at different rates, slip clutch means normally disposed to effect continuous frictional driving engagement between said timing member and said first driving shaft, stop means for normally preventing rotation of said timing member despite such continuous frictional driving engagement, a positive clutch which, when engaged effects direct driving inter-lock between said timing member and said second driving shaft, means responsive to passage of the leading edge of an article past said measuring means for simultaneously engaging said positive clutch and disengaging said stop means, whereby to cause said timing member to be driven from said second shaft despite said continuous frictional engagement with said first driving shaft, through said positive clutch, and means responsive to passage of the trailing edge of an article past said measuring means for disengaging said positive clutch while said stop means remains disengaged whereby to cause said timing member to be driven from said first shaft through said slip clutch until said timing member reaches said point of registry.

3. Control means adapted to time the execution of an operation on each of a series of spaced articles moving on a conveyor past measuring means, and wherein an operating member is energized to perform such operation responsive to rotation of a timing member past a point of registry, said control means comprising a first driving shaft and a second driving shaft, means for rotating said first driving shaft in synchronism with the movement of said conveyor, means for rotating said second driving shaft at a speed arithmetically proportional with respect to the speed of said conveyor, slip clutch means normally disposed to effect continuous frictional driving engagement between said timing member and said first driving shaft, stop means for normally preventing rotation of said timing member despite such continuous frictional driving engagement, a positive clutch which, when engaged, effects direct driving inter-lock between said timing member and said second driving shaft, means responsive to passage of the leading edge of an article past said measuring means for simultaneously engaging said positive clutch and rendering said stop means ineffective whereby to cause said timing member to be driven from said second shaft despite said continuous frictional engagement with said first driving shaft, and means responsive to passage of the trailing edge of the article past said measuring point for disengaging said positive clutch while said stop means remains disengaged, whereby to cause said timing member to be driven from said first shaft until said timing member reaches said point of registry.

4. Control means adapted to time the execution of a folding operation on each of a series of laundry flatwork articles moving on a conveyor past a measuring trip switch, and wherein a folding blade is energized to perform the folding operation responsive to operation of a second switch by rotation to contact therewith by a timing member, said control means comprising a first and a second driving shaft, means for rotating said first driving shaft in synchronism with the movement of said conveyor, means for rotating said second driving shaft at a speed arithmetically proportioned with respect to the speed of said conveyor, slip clutch means normally disposed to effect continuous frictional driving engagement between said timing member and said first driving shaft, stop means for normally preventing rotation of said timing member despite such continuous frictional driving engagement, a positive clutch which, when engaged, effects direct driving interlock between said timing member and said second driving shaft despite said continuous frictional driving engagement with said first driving shaft, means responsive to passage of the leading edge of an article past said trip switch for simultaneously engaging said positive clutch and rendering said stop means ineffective, and means responsive to passage of the trailing edge of the article past said trip switch for disengaging said positive clutch while said stop means remains disengaged, whereby to cause said timing member to rotate to contact with said second switch to thereby institute execution of said folding operation.

5. Apparatus of the character described including operation performing means for the execution of a proportional operation on each of a series of spaced articles moving on a conveyor, comprising a first driving shaft, means for rotating said first driving shaft in synchronism with the movement of said conveyor, a second driving shaft, means for rotating said second driving shaft at a speed arithmetically proportioned to the speed of said first driving shaft, a timing cam rotatable on said second driving shaft, a positive clutch operatively engageable with said timing cam and said second driving shaft, a slip clutch continuously frictionally engaging said timing cam and said first driving shaft, stop means normally engaging said timing cam to prevent rotation thereof despite engagement therewith of said slip clutch, means responsive to passage of the leading edge of an aforesaid article past a measuring point for engaging said positive clutch and for simultaneously disengaging said stop means to permit rotation of said timing cam, means responsive to passage of the trailing edge of said article past said measuring point for disengaging said positive clutch, while said stop means remains disengaged whereby engagement with the aforesaid slip clutch again drives said timing cam, and means thereafter responsive to operation of said timing cam and effective upon said operation performing means for initiating the performance of said proportional operation.

6. Apparatus of the character described including operation performing means for the execution of proportional operations on each of a series of spaced articles moving on a conveyor, comprising a driving shaft, means for rotating said driving shaft in synchronism with the movement of said conveyor, a first driven shaft and a second driven shaft, means for continuously rotating said first and second driven shafts at speeds arithmetically proportioned to each other and to that of the driving shaft, said first and second driven shafts each having a timing cam rotatable thereon, a first and a second positive clutch, the first positive clutch being engageable with the first driven shaft and the timing cam thereon, and the second positive clutch being engageable with the second driven shaft and the timing cam thereon, a first and a second slip clutch, each synchronously driven from said driving shaft the first said slip clutch continuously frictionally engaging the timing cam on the first driven shaft, the second said slip clutch continuously frictionally engaging the timing cam on the second said driven shaft, a first and a second stop respectively normally engaging the first and second timing cams to prevent rotation thereof despite engagement of the respective slip clutches, means responsive to passage of the leading edge of an aforesaid article past a measuring point for engaging both said positive clutches and for simultaneously disengaging both said stops, means responsive to passage of the trailing edge of the same article past the measuring point for

disengaging both said positive clutches while both said stops remain disengaged whereby frictional engagement between both the aforesaid slip clutches and their respective timing cams again drives both said timing cams, and means thereafter responsive to operation of both said timing cams, and successively effective upon said operation performing means for initiating the performance of successive proportional operations on the same article.

7. Control means as defined in claim 4 wherein the means responsive to passage of the leading edge of an article past the trip switch comprises a solenoid in electric circuit communication with said trip switch, and a lever operatively responsive to energization and de-energization of said solenoid, said lever being effective upon said positive clutch and said stop to engage said positive clutch and disengage said stop when said trip switch is closed, and to disengage said positive clutch when the trip switch is opened.

RUSSELL G. McLAGAN.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,607,407	Mayer	Nov. 16, 1926
1,697,010	Jones et al.	Jan. 1, 1929
2,261,226	Clegg	Nov. 4, 1941
2,291,487	Myers	July 28, 1942
2,458,544	Watson	Jan. 11, 1949
2,516,454	Doran	July 25, 1950