United States Patent

[11] 3,545,599

[72] Inventors **Fred T. Smith; Harry A. Barber; Ben J. Zink, Aurora, Illinois**

[21] Appl. No. **713,359**
[22] Filed **March 15, 1968**
[45] Patented **Dec. 8, 1970**

[73] Assignee **Barber-Greene Company Aurora, Illinois a corporation of Illinois**

[54] **AUTOMATIC BELT CENTERING METHOD AND APPARATUS**
26 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **198/202;** 74/241
[51] **Int. Cl.** **B65g 39/16**
[50] **Field of Search** 198/202; 226/21, 23; 74/241

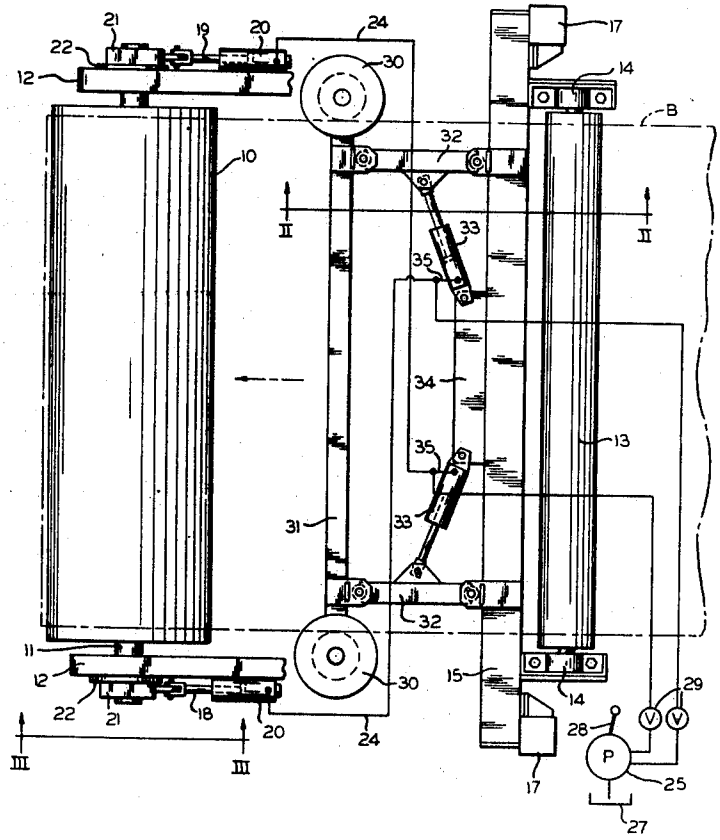
[56] **References Cited**

UNITED STATES PATENTS

2,751,067	6/1956	Nicholson	198/202
2,914,957	12/1959	Johnson	198/202X
3,278,002	11/1966	Robins	198/202
2,294,962	9/1942	Cassell	198/202
3,368,665	2/1968	Jinkins	198/202

Primary Examiner—Robert G. Sheridan
Attorney—Hill, Sherman, Meroni, Gross & Simpson

ABSTRACT: An endless belt is maintained in substantially running alinement with a pulley over which it is trained by sensing offcentered shifting of the belt through sensors in the form of rotary feelers along the opposite edges of the belt. These control translation, through a correctional hydraulic servosystem, into skewing of the pulley away from the shift for running return of the belt to the preferred substantially centered running alinement with respect to the pulley. Respective hydraulic pistons connected to the opposite ends of the pulley shaft control belt-tensioning action of the pulley and a respective hydraulic servomotor for each hydraulic piston is responsive to the sensor at the adjacent side of the belt.



PATENTED DEC 8 1970

3,545,599

SHEET 1 OF 3

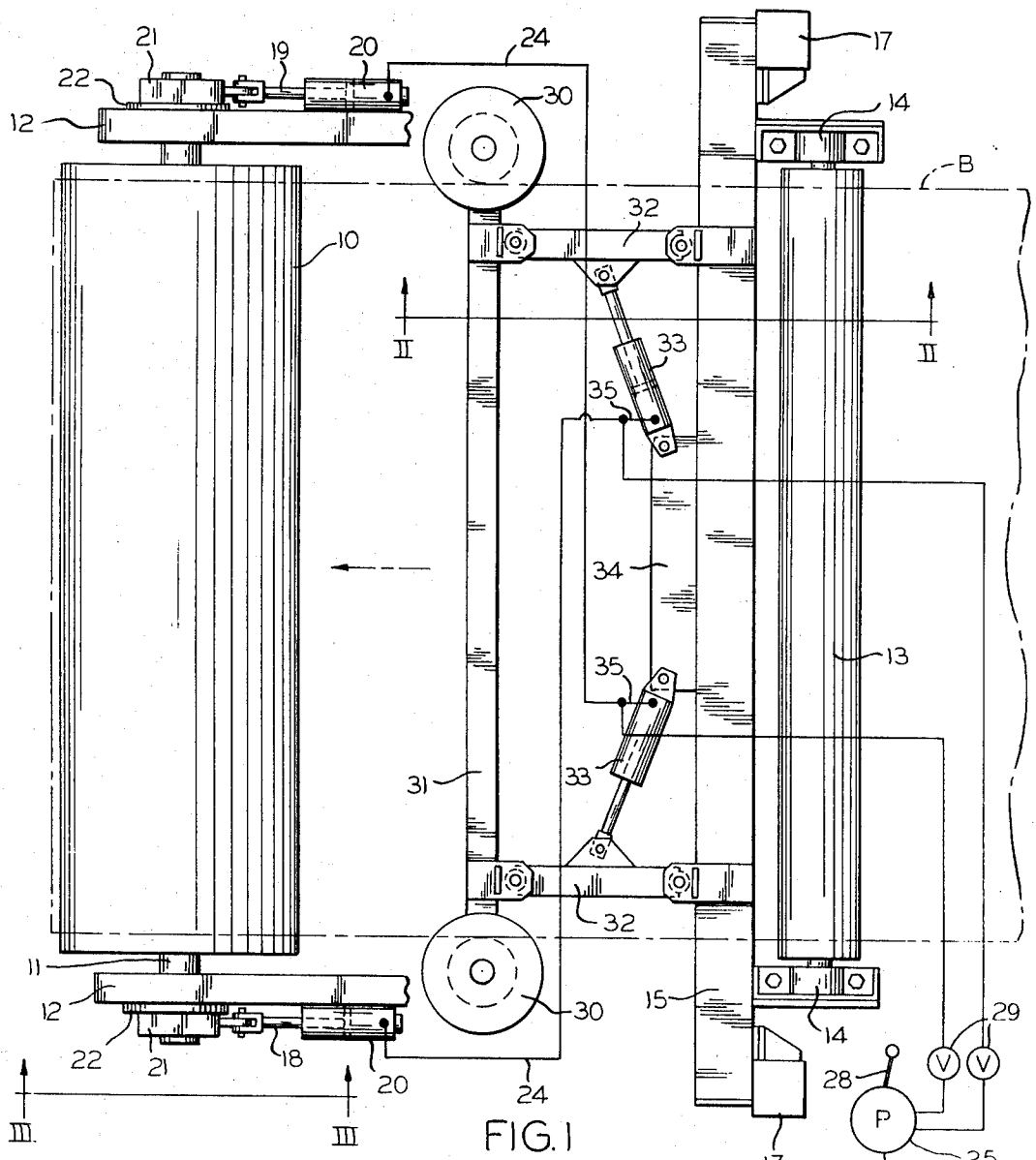


FIG. 1

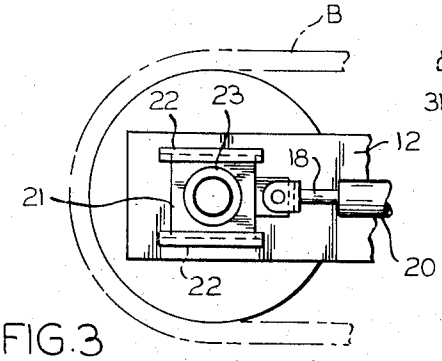


FIG. 3

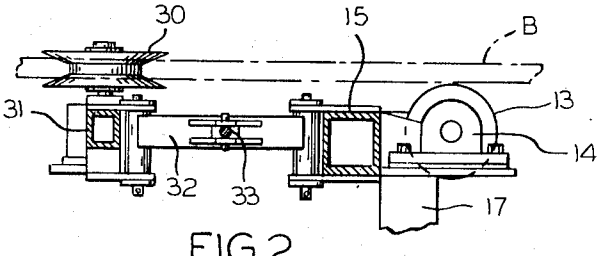


FIG. 2

INVENTORS
FRED T. SMITH
HARRY A. BARBER
BEN J. ZINK

BY Hill, Sherman, Meroni, Gross & Simpson

ATTORNEYS

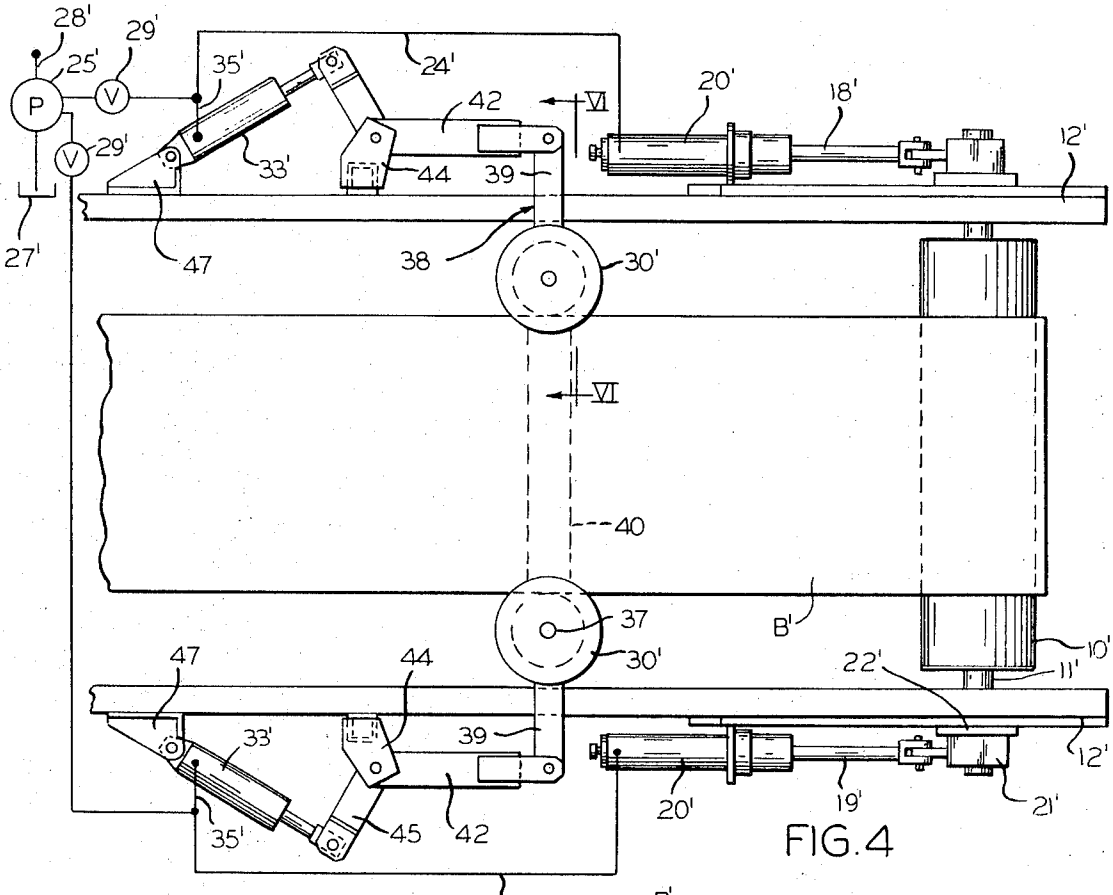


FIG.4

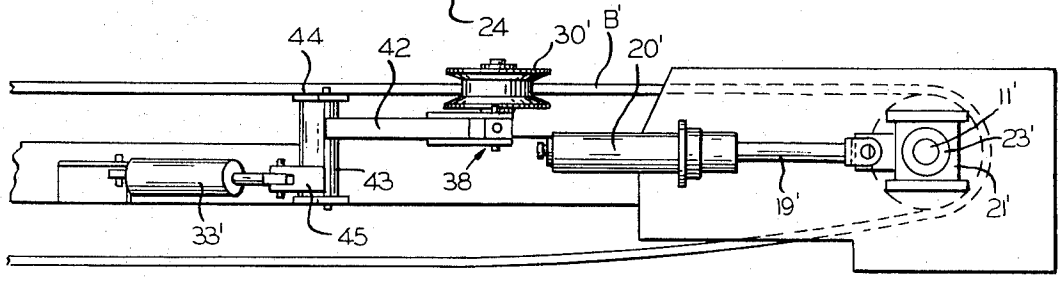


FIG.5

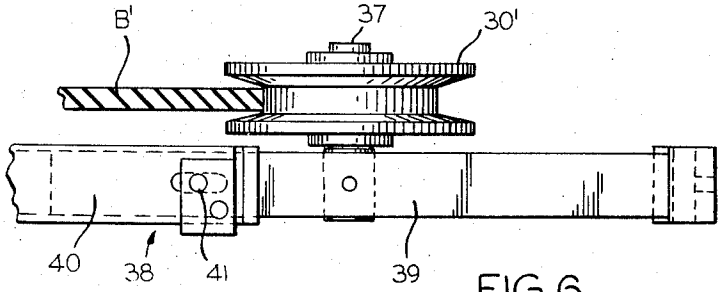


FIG.6

INVENTORS
FRED T. SMITH
HARRY A. BARBER
BEN J. ZINK

Hill, Sherman, Meroni, Gross & Simpson

BY ATTORNEYS

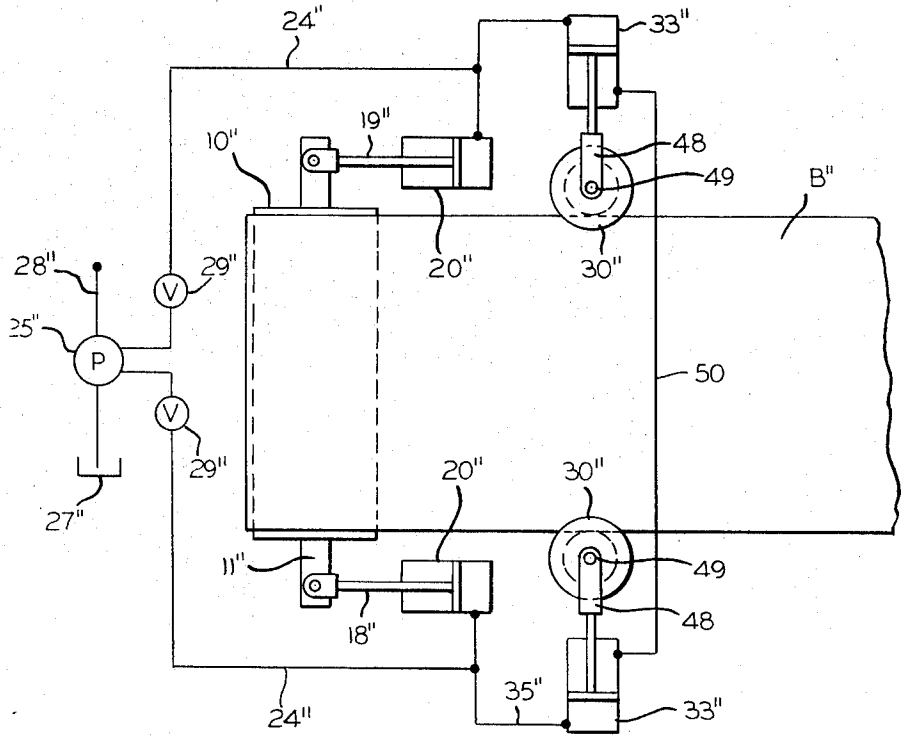


FIG.7

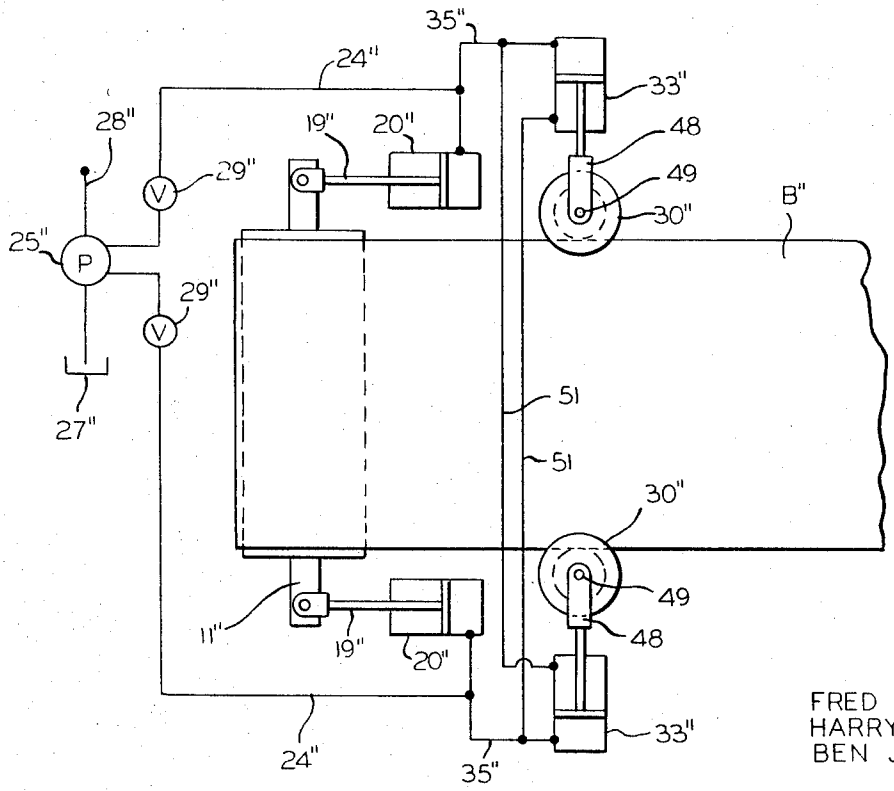


FIG.8

INVENTOR
FRED T. SMITH
HARRY A. BARBER
BEN J. ZINK

Hill, Sherman, Meroni, Gross & Simpson

BY ATTORNEYS

AUTOMATIC BELT CENTERING METHOD AND APPARATUS

This invention relates to automatic belt-centering method and apparatus, and more particularly concerns maintaining a belt in substantially centered running alignment with a pulley by correctional action of the pulley when offcenter shifting of the belt occurs.

In the operation of endless belts they are generally trained over a roller, commonly referred to as a pulley, in the transition from the working or load-carrying run to the return run. Due to various causes such as variables in the belt itself, tolerances and wear in the running mechanism, unbalanced loading of the belt and the like, the belt may tend to shift offcenter relative to the pulley in operation with detrimental results. Especially in the material-handling industry, where short, wide belts are used, the problem has been difficult to overcome.

Accordingly, it is an important object of the present invention to provide a new and improved method and apparatus for centering endless belts.

Another object of the invention is to provide a new and improved automatic belt-centering method and apparatus.

A further object of the invention is to provide a new and improved method of and means for controlling a belt-tensioning pulley to maintain a substantially centered running alignment of an associated endless belt.

Still another object of the invention is to provide a new and improved combination endless belt-tensioning and centered running alignment maintaining method and apparatus.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an illustrative top plan view of apparatus embodying features of the invention;

FIG. 2 is a vertical sectional detail view taken substantially 6790103 along the line II–II of FIG. 1;

FIG. 3 is a side elevational view taken substantially in the plane of line III–III of FIG. 1;

FIG. 4 is a fragmentary top plan view of an endless belt installation embodying a modified belt-centering arrangement;

FIG. 5 is a side elevational view of the apparatus of FIG. 4;

FIG. 6 is a vertical sectional elevational detail view taken substantially along the lines VI–VI of FIG. 4;

FIG. 7 is a schematic plan view of another modified belt-centering arrangement; and

FIG. 8 is a schematic plan view of a further modification.

As shown in FIGS. 1—3, an endless material handling belt B of substantial width and which may be relatively short in relation to its width and of suitable substantial thickness for the intended purpose is trained over a pulley 10 carried by shaft 11 on which the pulley may be rotatably mounted or which may rotate with the pulley, as preferred. Support for the shaft 11 comprises suitable frame structure 12, shown as comprising respective longitudinally extending bars through which the opposite end portions of the shaft extend. Additional support for the upper or load-carrying run of the belt is provided by a roller 13, the shaft of which is supported by respective pillow block bearings 14 mounted on a frame bar 15 extending transversely under the carrying run of the belt and supported at suitable elevation by end posts 17.

Means are provided for operating the pulley 10 to tension the belt B. To this end, a hydraulic piston 18 is connected to one end portion of the shaft, herein at the left hand considered in respect to the direction of travel of the belt, and a hydraulic piston 19 is connected to the opposite end portion of the shaft. Each of the pistons has an associated hydraulic cylinder 20 which is mounted on the outer side of the associated frame bar 12. At its outer end, the rod of the piston in each instance is coupled to a longitudinally slideable shaft-carrying block 21 which is reciprocally mounted in suitable tracks 22 on the associated frame bar and mounts a swivel bearing or at least pivot joint 23 in which the end portion of the shaft 11 is operatively received.

Hydraulic pressure for powering the pistons 18 and 19 is supplied by fluid delivered to the rear end portions of the cylinders 20 by respective lines or conduits 24 which are separately connected to changing means such as a pressure source comprising a pump 25 connected to a sump 27. As shown the pump 25 is of the manual type having an operating handle 28, and it will be understood that it has suitable dump valve means such that for belt changes the hydraulic system may be unloaded and the pulley 10 backed off from its belt-tensioning relation to the belt. When the belt is to be tensioned, the pump 25 is operated to pressurize the cylinders 20 and thus hydraulically actuate the pistons 18 and 19 to drive the pulley into tensioning relation to the belt. To enable selective initial tensioning adjustment, each of the conduits 24 has a respective control valve 29 which may be manually operable to attain the desired result, and which, if desired, may be closed after the desired belt tensioning has been effected so as to relieve the pump and its valving of the static pressure to be maintained in the hydraulic system during normal operation of the belt.

Offcenter shifting of the belt relative to the pulley 10 should be avoided if optimum continuous efficiency is to be attained and undesirable edge drag and possibly damage to the belt edges and associated structure are to be avoided. According to the present invention, substantially centered alignment of the belt with the pulley is maintained by sensing offcenter shifting of the belt and skewing the pulley away from the shift to effect running return of the belt to the substantially centered running alignment. One manner of accomplishing this comprises having means in the form of respective sensors 30 for each edge of the belt B operable to control translation by a hydraulic servosystem of the information into correctional action of the pistons 18 and 19 to effect the skewing of the pulley 10 away from the sensed shift.

In one arrangement, the sensors 30 comprise rotary feelers in the form of grooved pulley wheels freely rotatably mounted on respective axes normal to the plane of the upper run of the belt B and closely engaging the associated edge of the belt within the groove. The sensor wheel shafts are mounted on opposite end portions of a crossbar 31 which is supported on a pair of links 32 pivotally connected to the frame bar 15 at one end and pivotally connected to the bar 31 at their opposite ends respectively adjacent to the feelers 30.

Attached to the links 32 and to the bar 15 are respective cylinder and piston hydraulic servomotors 33. In this instance, the respective piston rods of the servomotors are pivotally attached to the inner sides of the associated links and the piston ends of the cylinders of the servomotors are pivotally attached to a central mounting flange 34 on the bar 15. Respective hydraulic servoconnections 35 are provided between the respective hydraulic conduits 24 and the piston end portions of the cylinders of the servomotors 33. Through this arrangement, the servomotors 33 are loaded contemporaneously with the pulley-controlling pistons 18 and 19. Since it is a balanced hydraulic system in which the pistons and servomotors are thus connected, the servomotors tend to maintain the rotary sensors 30 yieldably in a centered running alignment relationship to the pulley 10 and by their guiding engagement with the belt edge normally assist in maintaining the belt B in such centered relationship.

Should the belt B drift or shift toward one side or the other while running, such as due to uneven loading of the belt, then the rotary sensors 30 are correspondingly shifted by force of lateral thrust by the belt in the direction of the offcenter shift, and since the servomotors 33 are connected in a closed hydraulic system with the hydraulic pistons 18 and 19, the pistons are activated to effect correctional skewing of the pulley 10 to return the belt to substantially centered running alignment therewith. For this purpose, the servomotor 33 which is nearest the right side of the belt is hydraulically connected with the piston 11 at the left side of the belt while the hydraulic servomotor 33 nearest the left-hand side of the belt is hydraulically connected to the right side of piston 19. Hence, should there be a shift of the belt B toward the left

side, the sensors translate such movement into contraction of the rightlhand servomotor **33** which causes the hydraulic fluid driven therefrom to correspondingly protract the piston **18**. At the same time the left-hand servomotor **33** expands and receives a corresponding volume of hydraulic fluid from the cylinder **20** of the piston **19**. As a result, the pulley **10** skews away from the belt shift, increasing the tension on the shifted side of the belt and correspondingly relaxing the tension on the opposite side of the belt so that the belt quickly returns to the substantially centered running alignment with the pulley. Synchronized with movements of the belt toward alignment is the return to normal centered relationship of the sensing system and a corresponding equalization through the servomotors **33** in the tensioning pistons **18** and **19** and therefore of the pulley **10**. Rightward shifting of the belt B has a corresponding effect, but in reverse, in the hydraulic system in respect to the pistons **19** and **18**, in that order. Therefore, the belt B is automatically maintained substantially centered in alignment with the pulley **10**.

In the arrangement of FIGS. **4—6**, much the same manner of automatic belt centering is accomplished, and primed reference numerals indicate substantial identity of the parts, having reference to the form of the invention depicted in FIGS. **1—3**. Thus, the endless belt B′ is trained over the pulley **10′** having its shaft **11′** with end portions thereof extending through frame bars **12′**. Respective left- and right-hand pistons **18′** and **19′** are controlled by cylinders **20′** mounted on the frame ba s and the outer ends of the piston rod are connected to respective longitudinally slideable journal blocks **21′** reciprocal in respective tracks **22′** and mounting swivel joints or swivel bearings **23′** carrying the respective shaft end portions. Hydraulic conduit lines **24′** connect the cylinders **20′** to a pump **25′** connected with a hydraulic fluid source sump **27′** and adapt to be operated manually through a handle **28′**, there being individual control valves **29′** in the conduits **24′**.

Means for automatically maintaining the belt B′ in substantially centered running alignment with the pulley **10′** comprise the rotary-grooved pulley, belt edge engaging, sensor feelers **30′** mounted on respective axles **37** located on axes normal to the plane of the load-carrying run of the belt B′ and mounted on a follower bar **38** which extends transversely under the upper run of the belt B′ and with its opposite end portions extending beyond and over the respective frame bars **12′**. For reasonably close belt size adjustment of the rotary sensor wheels **30′**, the bar **38** is constructed to enable adjustment of the wheels longitudinally therealong. For this purpose, each of the axles **37** is fixedly mounted on a respective relatively short end section **39** of the bar which is telescopically received in a central section **40** of the bar to enable relative adjustment of the sections longitudinally of the bar to effect relative adjustment of the sensor wheels **30′** relative to one another. A suitable releasable connection **41** comprising bolt and slot means on the sections **39** and **40** enables adjustments to be effected and to be maintained as desired.

Mounting of the bar **38** to enable following by the sensors **30′** of lateral shiftings of the belt B′, comprises pivotal attachment of the respective outer ends of the bar sections **39** to respective supporting links **42** which are rigid with respective hubs **43** pivotally mounted on respective brackets **44** carried fixedly on the respective frame bars **12′**.

Automatic belt-centering responsiveness of the hydraulic pistons **18′** and **19′** to shifting movement of the sensing means with the belt B′ comprise hydraulic piston servomotors **33′** but in this instance, the servomotors **33′** which serve the respective pulley-controlling, belt-tensioning piston is mounted on the same side as the piston which it controls. To this end, each of the servomotors **33′** has its piston rod pivotally connected to an arm **45** which is rigid on the hub **43** in bellcrank relation to the link arm **42** and angled away from the associated frame bar **12′** while the piston end of the servomotor cylinder is pivotally connected to a mounting bracket flange **47** on the frame bar. Through this arrangement, there is a direct translation, through its hydraulic connection **35′** to a the associated piston **18′** or **19′** as the case may be, upon sensing of a shifting of the belt B′ toward the side under the control of that piston. Namely, should the belt B′ shift offcenter toward the piston **18′**, the servomotor **33′** will be compressed, in the closed hydraulic system, to actuate the piston **19′** in belt-tensioning direction while concurrently the servomotor **33′** extends and draws hydraulic fluid from the cylinder **20′** of the piston **19′**. Thereby the pulley **10′** is skewed away from the belt shift and the belt is returned to its substantially centered running alignment with the pulley. The reverse action takes place when the belt shifts toward the side of the piston **19′**. Thereby the belt is maintained automatically in the substantially centered running alignment with the pulley.

In FIGS. **7** and **8**, schematic arrangements are depicted in which hydraulic linkage of the sensors is effected instead of the mechanical linkage arrangements of the FIG. **1** and FIG. **4** forms of the invention. In these hydraulic linkage arrangements, the endless belt B″ is trained over the pulley **10″** which has its shaft **11″** connected at its left-hand end to the piston **18″** and at its right-hand end to the piston **19″** with the respective cylinders **20″** hydraulically connected by the respective conduit lines **24″** to the pump **25″** operatively connected with a hydraulic fluid source sump **27″** and operable as by means of a manual lever **28″**, there being respective valves **29″** in control of the conduits **24″**. Belt-tensioning and back off, as desired of the pulley **10″** are accomplished in the same manner as described in connection with the pump **25** in FIG. **1**.

Instead of having the rotary sensor feeler wheels **30″** which engage the respective opposite edges of the belt B″ connected by a follower bar, the wheels **30″** are independently mounted and instead of connected by linkage means to their respective servomotors **33″**, the servomotors are connected in a direct response relationship operatively with the sensor wheels. For this purpose, the piston rods of the servomotors **33″** are connected in direct response relationship operatively with the sensor wheels. For this purpose, the piston rods of the servomotors **33″** are connected in direct linear responsive relation to the respective sensor wheels **30″** by means of rigid connector extensions **48** which may be yokes to which the wheels are mounted by respective axle pins **49**. It will be understood that in such an arrangement the cylinders of the servomotors **33″** are mounted in suitable manner on the frame of the apparatus. In this manner, any edgewise shifting of the belt B″ toward one of the sensor wheels **30″** causes direct compression of the associated servomotors **33″** and thus translation of such response by way of its piston end cylinder hydraulic connection **35″** with the associated cylinder **20″** to actuate the hydraulically connected piston **18″** or **19″**, as the case may be, for effecting belt-centering correctional skewing of the pulley **10″**.

To effect hydraulic balance between the servomotors **33″** in FIG. **7**, a hydraulic link connection **50** between the piston rod ends of the servomotor cylinders is provided, substantially as shown. Thereby, as either of the servomotors is compressed, the other is expanded with corresponding action in the associated cylinder **20″**. in the same manner and to the same effect as described for the servomotors **33** and the associated pistons in FIG. **1** and the servomotors and the associated pistons in FIG. **4**.

In FIG. **8** a possibly faster response is attained by connecting the servomotors in a booster hydraulic linkage relation with respect to each other and the hydraulic pistons of the pulley. To this end, respective hydraulic linkage lines **51** connect the piston rod ends of the servomotor cylinders with the hydraulic connection **35″** of the other servomotor cylinder. As a result, in a belt shift response of the sensors, the respective pressure fluid-dispensing ends of the servomotor cylinders are connected to the cylinder of the piston which is projected to skew the pulley **10″** at the side of the belt toward which the shift has occurred, while the suction ends of the servomotor cylinders receive hydraulic fluid from the cylinder of the piston which is retracted in the same action.

In both FIG. 7 and FIG. 8 forms of the invention, it will be observed that the servomotor cylinders are of the double-action cylinders of the type as compared to the single-acting cylinders of the servomotors in the FIG. 1 and FIG. 4 forms of the invention. It will be understood, of course, that in the pulley-actuating piston motor cylinders and in the servomotor cylinders of FIGS. 1 and 4, the piston rod ends of the cylinders are vented with suitable breather openings or orifices, as is usual, and these may be adjustable, as preferred.

In all forms of the invention smooth automatic substantially centered running alignment of the belt with the pulley is maintained.

It will be understood that variations and modifications may be effected without departing from the spirit and scope of the novel concepts of this invention.

We claim:

1. In apparatus of the character described for maintaining an endless belt in substantially centered running alignment with a pulley over which it is trained:
- opposed wheels engaging opposite edges of the belt; and
- hydraulically operated means providing substantially equalized yieldable belt-centering thrust to said wheels.

2. Apparatus according to claim 1, having hydraulic belt-tensioning means connected with said pulley, said hydraulically operated means being yieldable in offcenter shifting of the belt, and means hydraulically connecting said hydraulically operated means with said hydraulic belt-tensioning means to translate offcenter shifting of said wheels through said hydraulically operated means acting as servomotor means to effect correctional action of said belt-tensioning means on said pulley to return the belt to substantially running alignment with the pulley.

3. In a conveyor including a pair of rollers and an endless belt trained thereover, the improvement of an apparatus for maintaining the belt in a desired relationship relative to at least one of the rollers and comprising:
- first means cooperable with opposite edges of the belt;
- second means providing substantially equalized yieldable belt-centering thrust to said first means;
- said second means being yieldable and offcentering shifting of the belt; and
- third means hydraulically connecting said first and second means to translate offcenter shifting of said first means to effect correctional action on the roller to return the belt to the desired alignment on the roller.

4. In a method of maintaining an endless belt in substantially centered running alignment with a pulley over which it is trained:
- normally yieldably guiding said belt along its edges for substantially centered running alignment with the pulley;
- sensing an offcenter shift of the belt; and
- skewing the pulley away from the shift and effecting running return of the belt to said substantially centered running alignment.

5. In a method of maintaining an endless belt in substantially centered running alignment with a pulley over which is trained and wherein respective fluid-actuated piston and cylinder devices are connected to the ends of the pulley, respective belt misalignment sensors engage opposite edges of the belt, respective servomotors are connected to said sensors, and said cylinder and piston devices and said servomotors are interconnected in a pressure fluid system:
- pressurizing said system to load said devices said servomotors;
- through the loaded devices thrusting said pulley in belt-tensioning direction;
- closing the pressurized circuit to provide a static closed system;
- transmitting to said servomotors deviations of the belt from centered alignment with said pulley;
- translating the belt misalignment information transmitted to the servomotors by the sensors into unbalancing and correctional action of the devices and thereby effecting a skewing of the pulley away from the deviation; and
- as centered running alignment of the belt with the pulley is resumed translating that information from the belt through the servomotors and effecting a balanced condition of said devices.

6. A method according to claim 5, comprising acting on said sensors through said servomotors to maintain the sensors yieldably in a centered running alignment relationship to the pulley and thereby assisting in maintaining the belt in centered running alignment relationship with the pulley.

7. In apparatus for maintaining an endless belt in substantially centered running alignment with a pulley over which it is trained:
- means for sensing an offcenter shift of the belt;
- means responsive to said sensing means for skewing the pulley away from the shift and effecting running return of the belt to said substantially centered running alignment; and
- said sensing means including means operative to guide the belt along side edges thereof yieldably in the substantially centered running alignment with the pulley.

8. Apparatus according to claim 7, said means operative to guide the belt including servomotors having fluid interconnection with one another.

9. Apparatus according to claim 7, said means for sensing comprising an individual sensor in engagement with the side edges of the belt and separate servomotors acting on said sensors to effect said yieldable guiding of the belt.

10. Apparatus according to claim 7, said means for sensing comprising respective sensors in guiding engagement with the belt along said side edges, individual servomotors operative on and by said sensors, said means for skewing the pulley comprising respective piston and cylinder devices operatively attached to respective opposite ends of the pulley, and a closed pressure fluid system interconnecting said devices and servomotors.

11. In apparatus for maintaining an endless belt in substantially centered running alignment with a pulley over which it is trained:
- a follower bar extending transversely relative to the
- rotary feeler wheels mounted on said bar and engaging side edges of the belt for sensing an offcenter shift of the belt;
- means responsive to movements of the follower bar reflecting offcenter shifting of the belt sensed by said wheels for skewing the pulley away from the shift and effecting running return of the belt to said substantially centered running alignment; and
- links connected to said bar, and respective servomotors connected to said links and connected to said means for skewing the pulley.

12. Apparatus according to claim 11, said skewing means comprising hydraulic devices, said servomotors being hydraulically operative, and closed hydraulic circuitry connecting and maintaining said servomotors and devices hydraulically loaded.

13. In apparatus for maintaining an endless belt in substantially centered running alignment with a pulley over which it is trained:
- means for sensing an offcenter shift of the belt comprising rotary sensor feeler wheels engaging opposite edges of the belt;
- means responsive to said sensing means for skewing the pulley away from the shift and effecting running return of the belt to said substantially centered running alignment; and
- servomotors connected to said wheels and to said skewing means and comprising hydraulic cylinder and piston devices having pistons directly attached to said wheels.

14. An apparatus according to claim 13 means hydraulically linking said devices.

15. In apparatus for maintaining an endless belt in substantially centered running alignment with a pulley over which it is trained, and wherein the pulley has a shaft having end portions at opposite ends of the pulley:
- respective fluid-operated piston and cylinder devices operatively attached to the respective end portions of the pul-

ley shaft and operative when pressurized to thrust the pulley in belt-tensioning direction;

respective sensors in engagement with respective opposite edges of the belt;

each of said sensors having operatively connected thereto a pressure fluid-operative servomotor;

pressure fluid connections between said devices and said servomotors; and

means for effecting contemporaneous static pressure fluid loading of said devices and said servomotors whereby to effect tensioning thrust by said devices to said shaft and thus to the pulley to tension the belt and to enable translation of belt-shifting movement through said sensors and the servomotors to said devices for skewing the pulley away from the shift whereby to effect running return of the belt to a centered running alignment relation to the pulley.

16. Apparatus according to claim **15**, said sensors comprising grooved wheels in running engagement with the edges of the belt, a bar mounting said wheels freely rotatably and connecting the same and extending transversely to the belt, a stationary frame bar spaced from said wheel supporting bar, respective links connecting said bars adjacent to said wheels and enabling lateral shifting movement of said wheel-supporting bar with shifting movements of the belt, said servomotors comprising piston and cylinder devices respectively connected at one end to said stationary bar and at their opposite ends to their respective links.

17. Apparatus according to claim **15**, including frame structure supporting said pulley shaft, a follower bar extending transversely to the belt and the frame structure, said sensors comprising freely rotatable wheels on said bar, bellcrank devices pivotally connected to said frame structure and to said bar, said servomotors comprising piston and cylinder devices at one end attached to a respective bellcrank device and at the other end to said frame structure.

18. Apparatus according to claim **15**, said servomotors comprising respective piston and cylinder devices, said sensors comprising freely rotatable wheels, and means connecting said wheels to respective pistons of such devices.

19. Apparatus according to claim **18**, said servomotors having a pressure fluid connection therebetween such that there is equal movement of the wheels in the shifting movements of the belt.

20. Apparatus according to claim **19**, said fluid connection being between the respective same sides of the pistons.

21. Apparatus according to claim **19**, said fluid connection being between respective opposite sides of the pistons of the servomotors.

22. In apparatus for maintaining an endless belt in substantially centered running alignment with a pulley over which it is trained:

a follower bar extending transversely relative to the belt;

rotary feeler wheels mounted on said bar and engaging side edges of the belt for sensing an offcenter shift of the belt; and

means including servomotors responsive to movements of the follower bar reflecting offcenter shifting of the belt sensed by said wheels and operative to skew the pulley away from the shift for effecting running return of the belt to said substantially centered running alignment.

23. A method of maintaining an endless tensioned belt in substantially centered running alignment with a pulley over which it is trained and with respect to which the belt is liable to shift offcenter, comprising:

by the force of lateral thrust of the belt in the direction of offcenter shifting driving motor means to effect skewing of the pulley from a normal running axis and away from the shift;

by said skewing effecting running return of the belt to said substantially centered running alignment; and

by force of lateral thrust of the belt returning to centered running alignment correspondingly operating said motor means for returning the pulley to said normal running axis.

24. A method according to claim **23**, comprising operating servomotors by the force of said lateral thrust of said belt in either thrusting direction and thereby controlling operations of said motor means.

25. Apparatus for maintaining an endless tensioned belt in substantially centered running alignment with a pulley over which it is trained and with respect to which the belt is liable to shift offcenter;

motor means operative to effect skewing of the pulley from a normal running axis thereof;

means directly responsive to the force of lateral thrust of the belt in the direction of an offcenter shift to operate said motor means to skew the pulley away from the shift;

said skewing of the pulley effecting running return of the belt to said substantially centered running alignment; and

means operative to return the pulley to said normal running axis thereof.

26. Apparatus according to claim **25**, in which said means operative to return the pulley include a servomotor responsive to lateral thrust of the belt in the direction of running return thereof.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,545,599 Dated Dec. 8, 1970

Inventor(s) Fred T. Smith, Harry A. Barber & Ben J. Zink

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

Column 2, line 70, after "servomotor" read --33--; column 3, line 28, for "ba s" read --bars--; column 4, line 1, omit "a"; column 5, lines 2 and 3 for "double-action cylinders the" read --double-acting--, line 64, after "devices" insert --a column 6, after "the" in line 39, insert --belt;--.

Signed and sealed this 26th day of October 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Pat