Oct. 15, 1968

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3,405,878

INFINITE RATIO DRIVING INTERLOCK FOR SPOOLING DRUMS OF A YARDER

Filed June 27, 1966

3 Sheets-Sheet 1

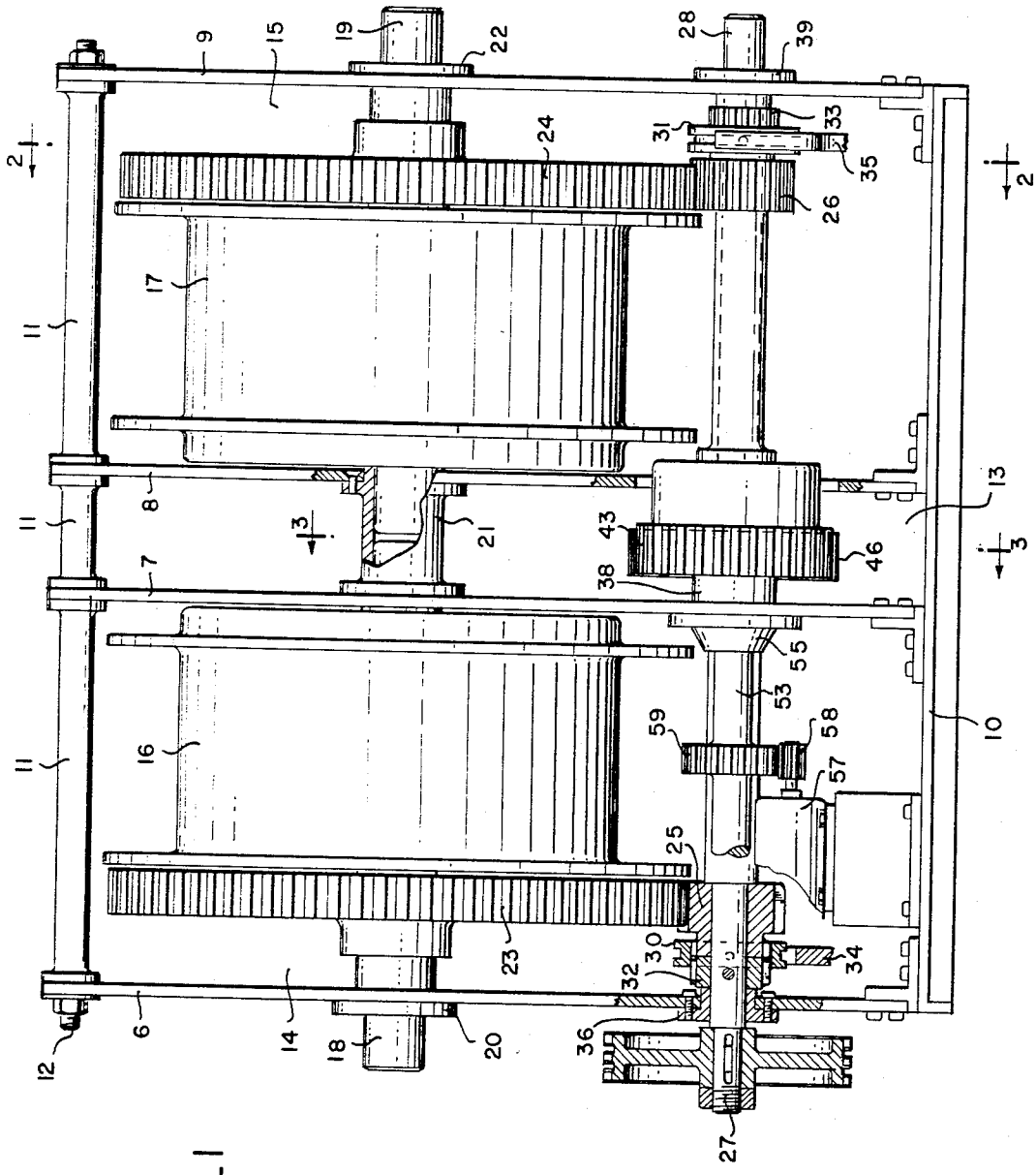


FIG. 1

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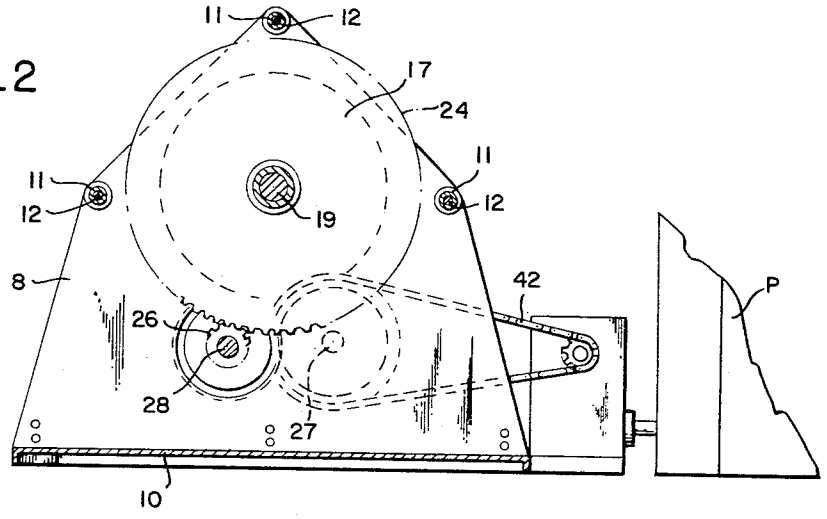
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FIG 2



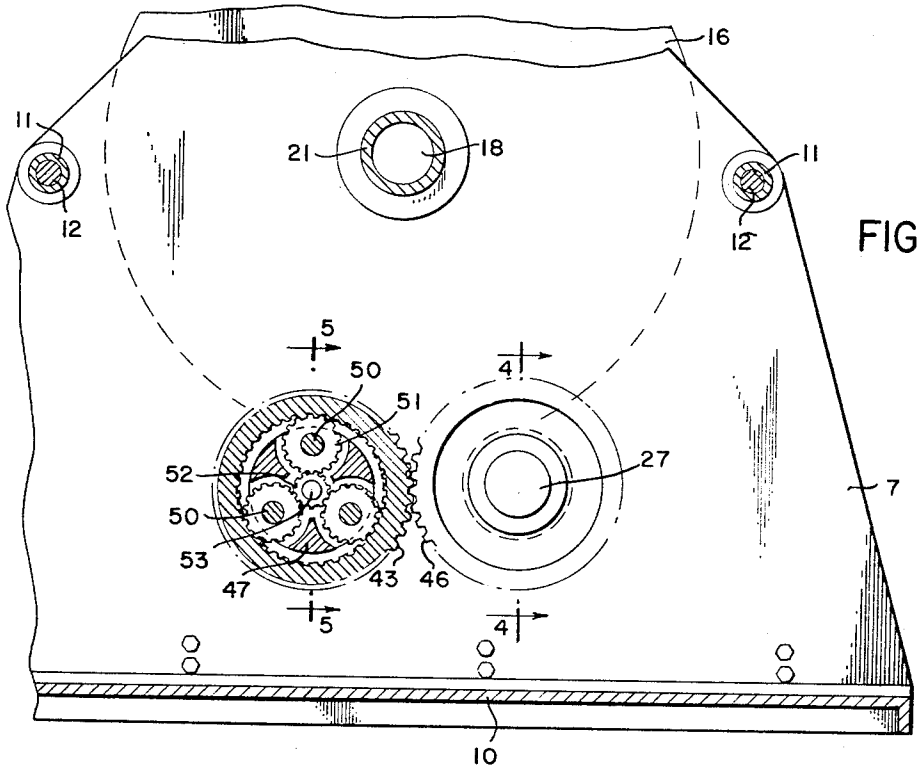


FIG 3

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INFINITE RATIO DRIVING INTERLOCK FOR SPOOLING DRUMS OF A YARDER

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FIG. 4

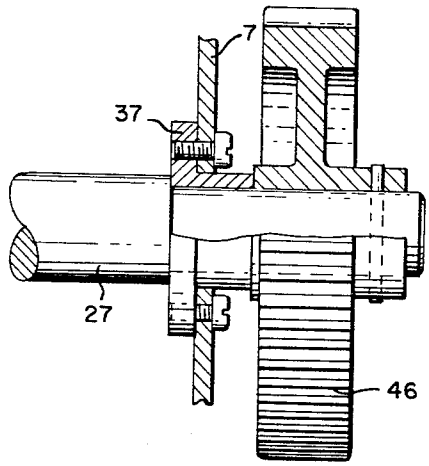
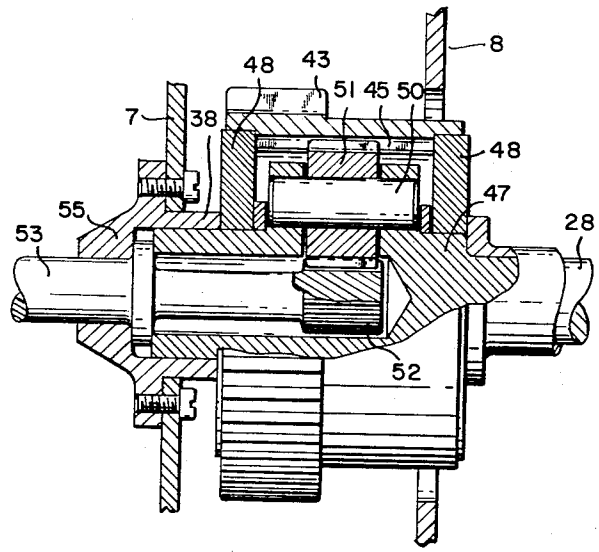


FIG. 5



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INFINITE RATIO DRIVING INTERLOCK FOR SPOOLING DRUMS OF A YARDER

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Filed June 27, 1966, Ser. No. 560,579
8 Claims. (Cl. 242—54)

ABSTRACT OF THE DISCLOSURE

An interlock connection, including an improved application of planetary gearing, between main and haulback drums of a logging yarder so that the ratio between the speed at which one drum turns to take in cable and that at which the other drum turns to pay out cable is made infinitely variable.

This invention relates to an infinite-ratio driving connection between two interlocked drums. Exemplifying the type of interlocked drums to which the invention lends itself are the main and haulback drums of a logging yarder. The function of these drums is to spool the main and the haulback ends of a log-hauling cable, the cable being strung between the yarder and a tail block located at the extreme outer limit of the area being logged. A choker string is attached to the log-hauling or "main" line of the cable, and as the main spooling drum is powered for the inhaul run of such main line the condition of the main drum changes from a bare to a full wrap. It is of course necessary that the cable be paid out from the other or haulback drum as it is taken in by the haulback drum and paid out from the main drum when obtaining an outhaul run of the cable's choker-carrying main section.

It is important that little or no slack be permitted in the trailing portion of the cable, whether such be the haulback section or the main section. If the cable is pulling a log or logs to the landing yard, a tight haulback section keeps contact between log and ground at a minimum, and in any downhill travel prevents the log from running and becoming unhooked from the choker. If the main section is trailing, i.e. travelling its outhaul run, a tight line minimizes liability of the butt rigging and chokers becoming entangled with down logs and stumps.

The purpose of the interlock between the two drums is to obtain for each drum at all times a speed which, reflecting the condition of its own wrap by comparison with the other drum's wrap, gives to both drums substantially the same rim speed for the then-existing spooling surface. Some yarders govern the relative speeds of their main and haulback drums by means of "braking" clutches used in association with reduction gearing, and the operator selectively slips the clutches in the degrees necessary to maintain a taut cable. Other yarders, looking to an elimination of the clutches, have interlocked the drums by a system which includes a planetary gear set, and as an adjunct to the planetary gear set provide a power source, independent of the power which drives the drums, as a means of increasing or decreasing at will the ratio between driving and driven ends of the planetary gear set.

The yarder of the present invention is of the latter character, and as one of its objects the invention aims to perfect a yarder of this type.

More particular objects and advantages will appear in the course of the following description and claims, the invention consisting in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

Description of drawings

In the accompanying drawings:

FIGURE 1 is a fragmentary side elevational view illustrating a yarder constructed to embody preferred teachings of the present invention, and with parts broken away and shown in section.

FIG. 2 is a transverse vertical sectional view drawn to a reduced scale on line 2—2 of FIG. 1.

FIG. 3 is a fragmentary transverse vertical sectional view on line 3—3 of FIG. 1.

FIG. 4 is a fragmentary longitudinal vertical sectional view on line 4—4 of FIG. 3; and

FIG. 5 is a fragmentary longitudinal vertical sectional view on line 5—5 of FIG. 3.

Description of invention

In said drawings there is illustrated a frame for the yarder comprised of a set of four plates 6, 7, 8 and 9 resting upon a bed member 10, and secured in paralleling spaced relation by struts and ties 11–12 to provide a center compartment 13 intervening between a pair of drum stalls 14 and 15. A main drum 16 occupies the stall 14 and a haulback drum 17 occupies the stall 15, with each said drum providing the usual spooling surface lying between end flanges. Shafts 18 and 19 on which said drums are fixedly mounted have their ends journaled in bearing boxes 20, 21 and 22 secured to the frame plates. The axes about which said drums rotate desirably coincide.

A respective one of two gear wheels 23 and 24 also occupies each drum stall and is pinned or otherwise fixed to the related drum shaft. Each gear wheel is meshed by a respective pinion 25 and 26. These pinions are each mounted upon a respective live spindle, as 27 and 28, and by suitable means such as the indicated runners 30 and 31 may be coupled to or uncoupled from the spindles at will, such runners being splined upon collars 32 and 33 pinned to the respective spindles and shifted into and out of coupling positions by forked levers 34 and 35. In the normal operation of the drums the same are coupled to the spindles. The two spindles each receive a journal from a respective pair of bearing blocks 36–37 and 38–39, and each has an outer end projecting beyond the frame and an inner end projecting into the center compartment 13. The axes about which the spindles turn parallel the axis of the drum shaft and are spaced apart within the arc of a circle having said axis of the drum shafts as its center.

The two spindles are interlocked in a manner hereinafter to be described, and the outer exposed end of the spindles is driven by a drive chain 42 in either rotary direction at variable speeds from a suitable power plant P. A. straw drum (not shown) is or may be mounted on the exposed outer end of the other spindle.

Within the center compartment 13 a ring member formed with both external teeth 43 and internal teeth 45 is journaled for rotation upon the inner end of one spindle 28 and has its external teeth 43 meshing the teeth 46 of a gear wheel which is keyed or otherwise fixed to the inner end of the spindle 27. These meshing teeth 43 and 46 produce the interlock between the two live spindles.

Said inner end of the spindle 28 presents an annular hub 47 with neck sections fore and aft, and the ring member surrounds the hub and receives its journal from two discs 48 which are fitted on the neck sections.

Hub 47 functions as a planet carrier, giving support to pins 50 for the planet gears 51 of a planetary gear system having the internal teeth 45 of the ring member as its ring gear. The sun gear 52 for the planetary gear system is formed upon the inner end of a governor spindle 53 extending co-axially of the live spindle 28 in a direction opposite thereto. The governor spindle receives support at

one end from a bearing carried by the plate **6** and at the other end from a bearing **55** formed integral with the bearing **38**.

A suitably powered variable-speed reversible motor **57**, here shown as electric, acts through meshed gears **58** and **59** to rotate the governor spindle and by such rotation govern the ratio, with selective superiority, at which live spindles **27** and **28** turn. The spooling drums perforce reflect this ratio.

It is believed to be apparent that when the governor spindle is held motionless, the speed at which haulback drum **17** turns in relation to the main drum **16** reflects the gear ratios between the meshing teeth **43–46** and the meshing teeth of the planetary gear system. This ratio is desirably so engineered that when the wraps of cable upon the two drums are more or less at a midpoint between the two extremes of a full drum and a bare drum, the drums cause cable to be paid out from one and drawn to the other at approximately the same line speed.

In the present structure the operator, through control of the direction and the speed at which the motor **57** turns the sun gear **52**, is enabled to produce at will infinite ratios between the speed at which the main drum turns and that at which the haulback drum turns. Assuming that the live spindle **27** is turning in a counter-clockwise direction, considered from the vantage point of FIG. 3, which acts through the meshed teeth **43–46** to turn the planet carrier **47** in a clockwise direction, the speed of the haulback drum is increased relative to the speed of the counter-turning main drum by operating the motor **57** in a direction causing the sun gear to turn clockwise. The relative speed is decreased causing the sun gear to turn counter-clockwise. The faster this clockwise or counter-clockwise motion, as the case may be, of the sun gear, the greater is the increase or decrease, respectively, in the speed of the haulback drum relative to the main drum.

When electrically driven the governor spindle is equipped with an electrically operated brake, which brakes automatically when the motor is de-energized. It is here noted that the employment of a hydraulically driven rather than the indicated electrically driven motor permits the brake to be dispensed with in that a hydraulic lock can then be established to hold the sun gear in an arrested condition when it is desired to run with the normal ratio which the gears **43–46** and those of the planetary system prescribe.

It is thought that the invention will have been clearly understood from the foregoing detailed description of my now-preferred illustrated embodiment. Changes in the details of construction may be resorted to without departing from the spirit of the invention and it is accordingly my intention that no limitations be implied and that the hereto annexed claims be given the broadest interpretation to which the employed language fairly admits.

What is claimed is:

1. In a yarder, structure for use with a tail block for spooling interconnected main and the haulback cables strung through the block, and comprising: a respective spooling drum for each of said cables, a power plant, a planetary gear system having as its components (1) a gear wheel, (2) a sun gear, (3) planet gears in mesh with the gear wheel and the sun gear, and (4) a carrier for the planet gears, two driving couples each operatively connecting a respective one of the two spooling drums one with the gear wheel component and the other with the carrier component of said planetary gear system, a driving connection from the power plant to one of said driving couples controlled as to speed and direction of rotation, and power-driven means interconnected to the sun gear component of said planetary gear system and controlled independently of the control for said controlled

driving connection for rotating the sun gear in either direction and at selectively variable speeds at which the two drums turn.

2. A yarder as claimed in claim **1**, the spooling drums being journaled for rotation about a coinciding axis, said driving couples providing respective spindles drivingly connected with the drums and each journalled for rotation about an axis paralleling said drum axes, one spindle having the planet carrier formed as a hub thereon, the other spindle having a gear wheel fixed thereto and meshing with the gear wheel component of the planetary gear system.

3. A yarder as claimed in claim **2** in which the driving connection between the spindles and the drums comprises gear wheels fixed to the drums and pinions meshed thereby and rotating in concert with the spindles.

4. A yarder as claimed in claim **2** in which the axes of the drums coincide and wherein the driving connection between the spindles and the drums comprises, for each drum, a gear wheel fixed to the drum and a pinion meshed thereby and rotating in concert with the related spindles, two stalls being provided separated by a compartment, the spooling drums each occupying a respective one of the two stalls, the planetary gear system being housed in the compartment.

5. A yarder as claimed in claim **2** in which the driving connection between the spindles and the drums comprises, for each drum: a gear wheel fixed to the drum, a pinion in mesh therewith journaled for free rotation upon the related spindle and having an externally splined neck section, a collar pinned to the spindle and formed with external splines matching the splines of said neck section, and a runner fitting said splines of the collar and slidable thereon into and out of a coupling position in which it is also splined to the neck section.

6. A yarder as claimed in claim **2** wherein the ratio between the meshed gear is such that when the sun gear is in an arrested condition the two spindles rotate at substantially the same speed.

7. Mechanism for governing the ratio at which two live rotary shafts turn and comprising, in combination with the shafts and with a power plant: a planetary gear system providing (1) a ring gear, (2) a sun gear, (3) planet gears in mesh with the ring gear and the sun gear, and (4) a carrier for the planet gears, a driving connection between the ring gear and one of said live rotary shafts, a driving connection between the carrier and the other of said live rotary shafts, a driving connection from the power plant to one of said live rotary shafts controlled as to speed and direction of rotation, and power-driven means interconnected to the sun gear component of said planetary gear system and controlled independently of said controlled driving connection for rotating said sun gear in either rotary direction and at selectively variable speeds so as to responsively govern at will the ratio between the speeds at which the two live rotary shafts turn.

8. Mechanism as claimed in claim **7** having two spooling drums, and wherein each of the live rotary shafts is drivingly connected with a respective one of said two drums.

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