RING FRAMES

(PART 2)

MANAGEMENT OF SPINNING ROOMS

CALCULATIONS FOR RING FRAMES

DRIVE

1. The driving of a spinning frame is accomplished through ordinary tight and loose pulleys that are mounted on the cylinder shaft w shown in Fig. 1, which also shows the gearing of a spinning frame. The loose pulley is usually made slightly smaller in diameter than the tight pulley, in order to relieve the strain on the belt when not driving the frame. To facilitate shifting the belt from one pulley to the other, the face of the tight pulley is beveled on the side next to the loose pulley. The shaft w also carries the cylinder n that drives the spindles through the bands n_1. Situated at the driving end of the machine and mounted on the shaft w is the gear w_1 of 42 teeth driving the gear w_2 that is compounded with the gear w_3; this gear drives the gear w_4 compounded with the gear w_5, which through the carrier w_6 drives the gear w_7 on the front roll shaft w_8. Since on spinning frames there are two sets of drawing rolls, one on each side of the machine, it is necessary to introduce gearing that will drive the front roll shaft on the side of the frame opposite that where the shaft w_8 is located. This is accomplished by having the gear w_6, in addition to meshing with w_7, drive the

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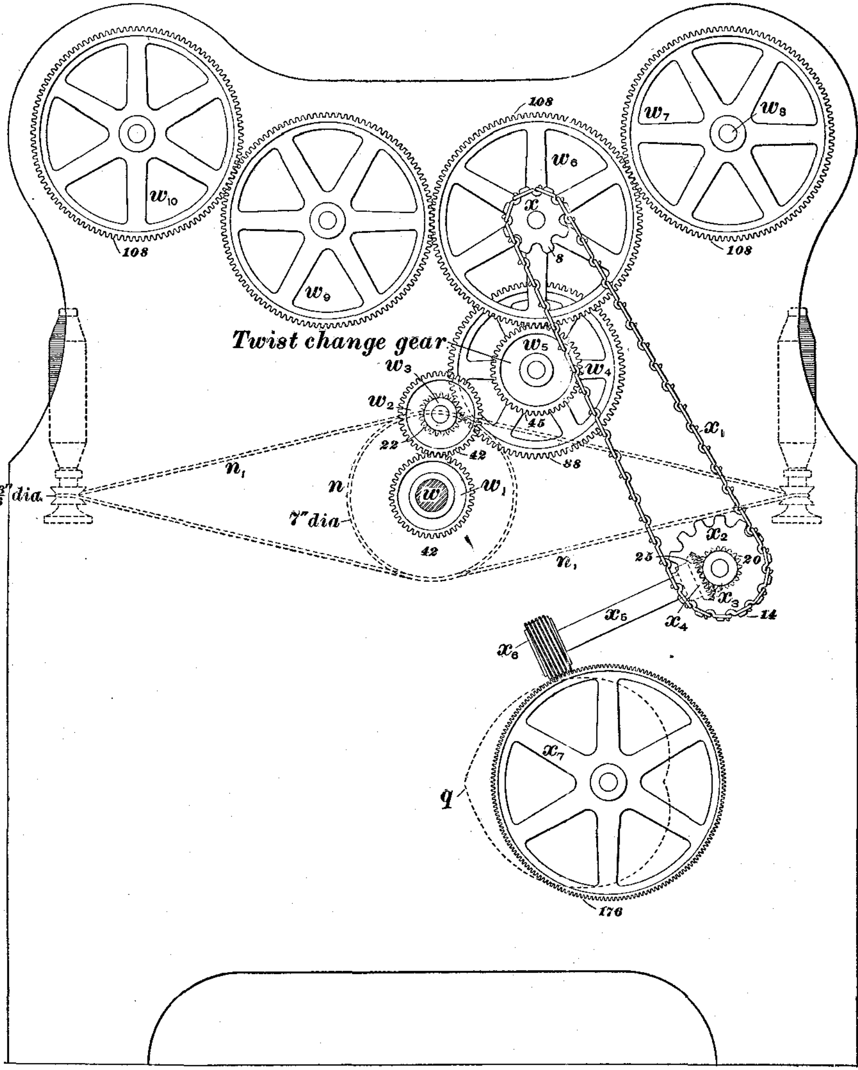
108
108
108
108
w_{10}
w_9
w_6
w_7
w_8
x
8
Twist change gear
w_5
w_4
w_3
w_2
45
22
42
88
x_1
n_1
$\frac{13}{16}$" dia.
n
w
w_1
7" dia.
42
x_2
25
20
n_1
x_3
x_5
x_4
14
x_6
x_7
q
176

FIG. 1

gear w_{10} through the carrier w_9. The gear w_{10}, being on the front roll shaft situated on this side of the machine, imparts motion to the second set of rolls. By introducing the carrier w_9 the direction of motion of the gear w_{10} is opposite to that of the gear w_7; this is necessary, since the rolls on the two sides of the frame must revolve in opposite directions in order to deliver the stock to their respective sides. Compounded with

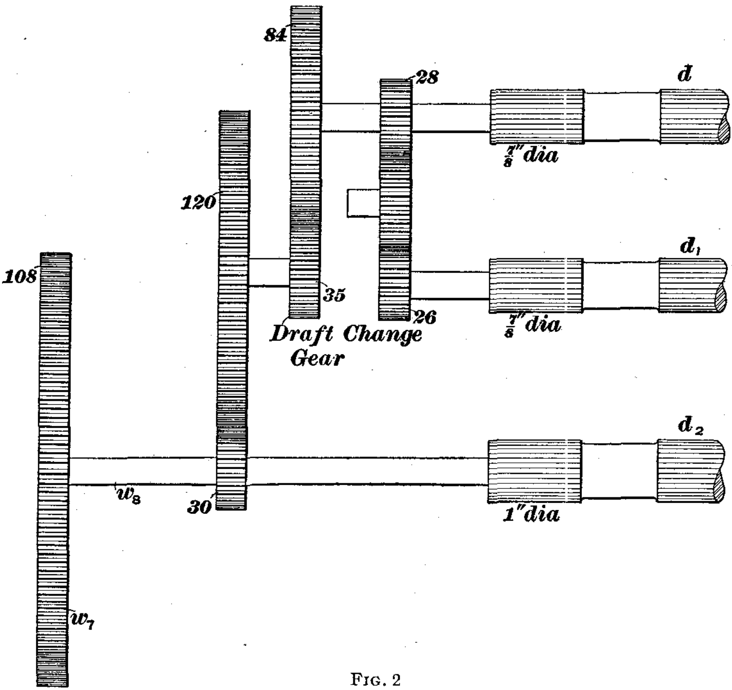

FIG. 2

the gear w_6 is a sprocket gear x that drives, by means of the chain x_1, the sprocket gear x_2. Compounded with x_2 is a bevel gear x_3 meshing with the bevel gear x_4 on a short shaft x_5. This shaft carries at its opposite end the single worm x_6 gearing into the worm-gear x_7, which is on the shaft with the cam q of the builder motion.

Referring to Fig. 2, the gear w_7, also shown in Fig. 1, that is on the front roll shaft w_8, imparts motion to the front roll d_2. A small gear of 30 teeth on the shaft w_8 drives, through suitable gearing, the back roll d, while a gear of 28 teeth on the back roll shaft drives, through a carrier, the gear on the shaft of the middle roll d_1.

SPEED CALCULATIONS

2. As rules and explanations for performing speed and draft calculations have been given in previous Sections, no rules will be given in cases where such subjects are here dealt with, but examples are given of all the calculations met with in connection with spinning frames. It should be noted that while the calculations in the succeeding examples have been carried to three decimal places, this does not signify that these decimal figures are absolutely necessary. On the contrary, they might have been omitted without invalidating the accuracy of the answers, as the available data as to diameters of cylinder and whorls and the amount of slippage are not reliable. They have been retained in order to preserve a certain uniformity in the answers.

EXAMPLE 1.—Find the speed of the cylinder n, Fig. 1, when the driving shaft makes 400 revolutions per minute and carries a 30-inch pulley that drives a $10\frac{3}{4}$-inch pulley on the cylinder shaft w.

SOLUTION.—

$$\frac{400 \times 30}{10\frac{3}{4}} = 1{,}116.279 \text{ rev. per min. Ans.}$$

EXAMPLE 2.—If the cylinder n, Fig. 1, makes 1,116.279 revolutions per minute, find the speed of the front roll shaft w_8.

SOLUTION.—

$$\frac{1{,}116.279 \times 42 \times 22 \times 45}{42 \times 88 \times 108} = 116.279 \text{ rev. per min. Ans.}$$

EXAMPLE 3.—If the cylinder n, Fig. 1, is 7 inches in diameter and makes 1,116.279 revolutions per minute, find the speed of the spindles if the whorl around which the band passes is $\frac{12}{16}$ inch in actual diameter.

NOTE.—In connection with finding the speed of spindles a question arises as to where the diameter of the whorl should be taken. It is customarily taken at the bottom of the groove, although theoretically the diameter should be considered a little larger than this, in order to allow for the thickness of the spindle band; consequently, the calculation should be made with the diameter taken at the center of the band, about $\frac{1}{16}$ inch being added to the diameter of the whorl in order to make allowance for this, this dimension being termed the *working diameter*.

SOLUTION.— $\frac{12}{16}$ in. + $\frac{1}{16}$ in. = $\frac{13}{16}$ in., working diameter of whorl.

$$\frac{1{,}116.279 \times 7}{\frac{13}{16}} = 9{,}617.172 \text{ rev. per min.}$$

NOTE.—The question of slippage also arises in connection with the speed of the spindles. This is a variable quantity, depending on the tension of the bands, the oiling of the spindles, the number of the yarn being spun, the weight of the travelers, and other factors. The loss from the calculated speed of the spindles, due to slippage, will vary from 5 to 10 per cent., but as 5 per cent. is the customary allowance it will be adopted in these calculations. Making this allowance, example 3 would be completed as follows:

100 per cent. − 5 per cent. = 95 per cent., or .95.
9,617.172 × .95 = 9,136.313 rev. per min. Ans.

3. To find the speed of the traveler when the speed of the spindle, the speed of the front roll, and the diameter of the bobbins are known:

Rule.—*Find the number of revolutions per minute of the bobbin necessary to take up the amount of yarn delivered per minute by the front roll. Subtract this number of revolutions per minute of the bobbin from the revolutions per minute of the spindle.*

EXAMPLE.—If the spindles make 9,136.313 revolutions per minute and the front roll delivers 365.302 inches per minute, what is the speed of the travelers when the bobbins are $\frac{7}{8}$ inch in diameter?

SOLUTION.— $\frac{365.302}{\frac{7}{8} \times 3.1416} = 132.890$, the rev. per min. of bobbins necessary to take up amount delivered by front roll.

9,136.313 − 132.890 = 9,003.423 rev. per min. of traveler. Ans.

TWIST CALCULATIONS

4. To make an absolutely accurate calculation of the twist, i. e., the number of turns per inch being placed in the yarn, it would be necessary to find the actual number of revolutions of the traveler in a certain period, say 1 minute, and the actual length, in inches, of yarn delivered during that period. The turns per inch would then be found by dividing the speed of the traveler by the length of yarn.

There are certain difficulties that present themselves in finding this data. For instance, if the circumference of the front roll is multiplied by its revolutions per minute, it gives the distance traveled in 1 minute by a point on its circumference, which corresponds to the length of untwisted yarn delivered from the front roll; but this does not accurately represent the amount of yarn spun, for as the twist is inserted in the stock, it contracts slightly, and the actual length of yarn is usually assumed to be about 5 per cent. less than the delivery of the front roll, although this varies according to the number of the yarn, the twist per inch being inserted, and other conditions that make an arbitrary allowance impossible. It is sufficient to say, however, that if the calculations were made on the basis of the length of roving delivered by the front roll, assuming this to be the length of the yarn, the result would not accurately represent the turns per inch, which would be greater in practice than the calculations would show.

Difficulties also arise in the calculation of the actual speed of the traveler. In calculating this from the speed of the cylinder, two difficulties that are met with have already been mentioned; namely, the question as to what diameter should be taken for the whorl, also the amount of slippage between the cylinder and the spindle band, and between the spindle band and the whorl. Even if the speed of the spindle were accurately found, another difficulty would be met with in making the proper deduction from this speed to obtain the speed of the traveler. This allowance varies in case of a filling wind according to whether it is taken at the small or the large diameter at each end of the traverse or at an intermediate point. In case of a warp wind, as the bobbin becomes larger the speed of the traveler is gradually being increased, since with each layer wound on the bobbin a smaller difference in speed between the spindle and the traveler is required for winding the yarn.

Even if reasonably accurate data could be ascertained, so as to make suitable allowances for the various losses mentioned, local or temporary conditions, such as changes in the atmospheric conditions, in the humidity of the room, variations in the stock, or unevenness of the roving, would render the conclusions inaccurate; it is therefore customary for practical millmen to consider that the increase in the number of turns per inch above the calculated number produced by contraction of the stock as it is being made into yarn about compensates for the reduced speed of the traveler as compared with that of the spindle and the other losses named.

For all practical purposes, it is considered sufficiently accurate to divide the length of stock delivered by the front rolls into the calculated speed of the spindle, making no allowance for slippage, and accept the result as representing the actual turns per inch that may be expected to be obtained.

The following calculations are made on this basis. To find the turns of twist per inch being placed in the yarn:

Rule I.—*When figuring from the gears, consider the gear on the end of the front roll as a driver. Multiply all the driving gears and the diameter of the cylinder together and divide by the product of all the driven gears, the working diameter of the whorl, and the circumference of the front roll.*

EXAMPLE 1.—What is the twist per inch that is being placed in yarn spun on a frame geared as shown in Fig. 1 if the diameter of the front roll is 1 inch, the cylinder 7 inches, and the working diameter of the whorl $\frac{13}{16}$ inch?

SOLUTION.—

$$\frac{108 \times 88 \times 42 \times 7}{45 \times 22 \times 42 \times \frac{13}{16} \times 3.1416 \times 1} = 26.326, \text{ turns per in. Ans.}$$

Rule II.—*In case the speed of the spindles and the number of inches of yarn delivered by the front roll are known, divide the speed of the spindles, without any allowance for slippage, by the inches delivered per minute by the front roll.*

EXAMPLE 2.—What is the twist per inch that is being inserted in yarn if the spindles make 9,617.172 revolutions per minute and the front roll delivers 365.302 inches per minute?

SOLUTION.— $9{,}617.172 \div 365.302 = 26.326$, turns per in. Ans.

5. To find the constant for twist from the gears:

Rule.—*Consider the gear on the end of the front roll as a driver and the twist gear as a 1-tooth gear. Multiply together all the driving gears and the diameter of the cylinder and divide by the product of all the driven gears, the working diameter of the whorl, and the circumference of the front roll.*

EXAMPLE.—What is the constant for twist with the frame geared as shown in Fig. 1 if the diameter of the front roll is 1 inch, the cylinder 7 inches, and the working diameter of the whorl $\frac{13}{16}$ inch?

SOLUTION.—

$$\frac{108 \times 88 \times 42 \times 7}{1 \times 22 \times 42 \times \frac{13}{16} \times 3.1416 \times 1} = 1{,}184.697, \text{ constant. Ans.}$$

6. To find the twist per inch when the constant for twist and the twist gear are known:

Rule.—*Divide the constant by the number of teeth in the twist gear.*

EXAMPLE.—What is the twist per inch that is being inserted in yarn if the constant for twist is 1,184.697 and the twist gear contains 45 teeth?

SOLUTION.— 1,184.697 ÷ 45 = 26.326, turns per in. Ans.

7. To find the necessary twist gear to give a required number of turns per inch when the constant is known:

Rule.—*Divide the constant by the twist required.*

EXAMPLE.—If the constant for a train of gears is 1,184.697, what size twist gear will be required to give 20 turns per inch in the yarn?

SOLUTION.—

1,184.697 ÷ 20 = 59.2, or a 59-tooth gear (practically). Ans.

The calculations given in connection with twist make no allowance for any slippage that may occur, or for any loss caused by the traveler speed being slightly less than the spindle speed. These points are sometimes taken into consideration, although the contraction of the yarn, due to the twist inserted, generally compensates for any loss due to these causes.

8. In determining the amount of twist to be placed in either warp or filling yarn spun on a ring frame, a constant is used that multiplied by the square root of the counts gives the required number of turns per inch. For ordinary warp yarn spun on ring frames the constant is usually 4.75, but for filling it is 3.25. These figures, however, are varied according to the twist required, the quality of the yarn to be made, or the kind of stock being used. Long stock does not require so much twist in proportion as short stock. Filling yarn from carded stock requires, as a rule, from $1\frac{1}{2}$ to $2\frac{1}{2}$ turns per inch more twist than the square root of the counts multiplied by 3.25. On combed stock the standard number of turns is sufficient, since combed stock does not require so much twist for the same numbers as carded stock.