FLY FRAMES

(PART 3)

MANAGEMENT OF FLY FRAMES

CALCULATIONS

1. In connection with fly frames there are numerous calculations that it is necessary to understand. Many of these refer to speeds and drafts, on which general information and rules have been given in dealing with mechanical and draft calculations; examples of all necessary calculations are given in this Section, but the rules dealing with speeds and drafts are omitted. The examples apply to the gearing shown in Fig. 1, and to a bobbin-lead type of frame.

EXAMPLE 1.—Find the speed of the jack-shaft when the main shaft makes 300 revolutions per minute and carries a 20-inch pulley driving a 16-inch pulley on the jack-shaft.

SOLUTION.— $\frac{300 \times 20}{16} = 375$ rev. per min. of jack-shaft. Ans

EXAMPLE 2.—Find the revolutions per minute of the top-cone shaft when the jack-shaft makes 375 revolutions per minute and carries a 38-tooth twist gear driving a 48-tooth gear on the top-cone shaft.

SOLUTION.— $\frac{375 \times 38}{48} = 296.875$ rev. per min. of top-cone shaft. Ans.

EXAMPLE 3.—Find the revolutions per minute of the front roll when the top-cone shaft makes 296.875 revolutions per minute and carries an 86-tooth gear driving a 120-tooth gear on the front-roll shaft.

SOLUTION.— $\frac{296.875 \times 86}{120} = 212.76$ rev. per min. Ans.

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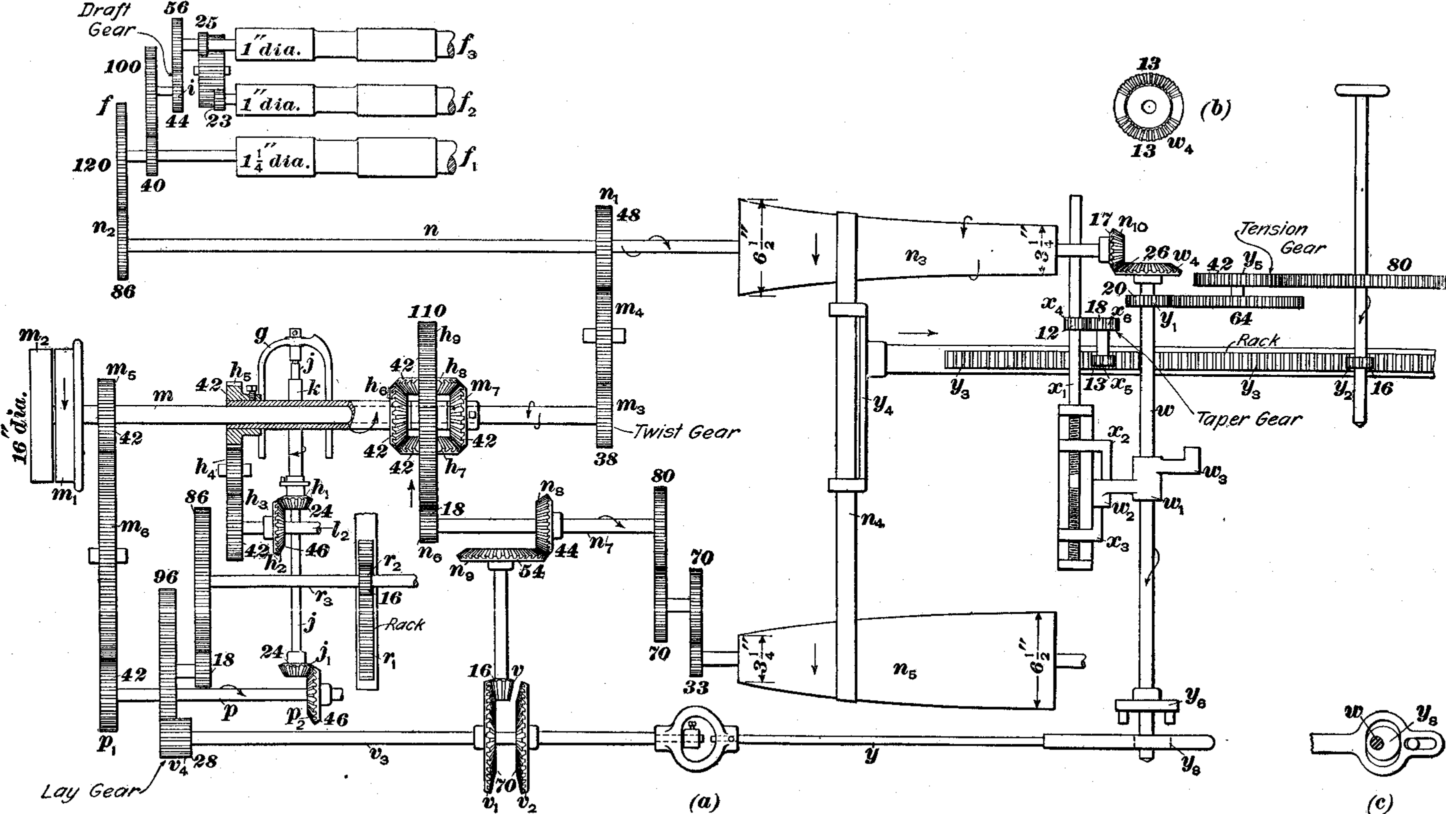
Draft Gear
Tension Gear
Taper Gear
Twist Gear
Lay Gear
Rack
Rack
1" dia.
1" dia.
1¼" dia.
16" dia.
(a)
(b)
(c)

EXAMPLE 4.—Find the length of roving delivered per minute by the front roll when it is 1.25 inches in diameter and makes 212.76 revolutions per minute.

SOLUTION.— $\frac{212.76 \times 1.25 \times 3.1416}{36} = 23.208$ yd. per min. Ans.

EXAMPLE 5.—Find the number of revolutions of the spindles to 1 revolution of the jack-shaft when the jack-shaft carries a 42-tooth gear driving a 42-tooth gear on the spindle-gear shaft, which carries a 46-tooth gear driving a 24-tooth gear on the lower end of the spindle.

SOLUTION.— $\frac{1 \times 42 \times 46}{42 \times 24} = 1.916$ rev. of spindles to 1 rev. of jack-shaft. Ans.

EXAMPLE 6.—Find the revolutions per minute of the spindles when the jack-shaft makes 375 revolutions per minute and the spindles make 1.916 turns to one of the jack-shaft.

SOLUTION.— $375 \times 1.916 = 718.5$ rev. per min. of spindles. Ans.

2. To find the twist, or turns, per inch:

Rule I.—*Divide the revolutions per minute of the spindles by the length of roving, in inches, delivered by the front roll in the same time.*

EXAMPLE 1.—Find the turns per inch being placed in the roving if the spindles make 718.5 revolutions per minute and the front roll delivers 23.208 yards per minute.

SOLUTION.— $23.208 \times 36 = 835.488$ in. per min.; $718.5 \div 835.488 = .859$ turn per in. Ans.

Rule II.—*Taking into consideration all the gears, with the exception of the carrier gears, from the front roll to the spindles, assume that the front-roll gear is a driver. Multiply together all driving gears and divide by the product of all the driven gears. Divide the quotient thus obtained by the circumference of the front roll.*

EXAMPLE 2.—Find the turns per inch being inserted in the roving with the following arrangement of gears: the front roll is 1.25 inches in diameter; front-roll gear has 120 teeth; gear on end of top-cone shaft, 86 teeth; top-cone gear, 48 teeth; twist gear, 38 teeth; jack-shaft gear, 42 teeth; spindle-shaft gear, 42 teeth, gear on spindle-shaft driving spindle, 46 teeth; gear on spindle, 24 teeth.

SOLUTION.— $\frac{120 \times 48 \times 42 \times 46}{86 \times 38 \times 42 \times 24} = 3.378$; $\frac{3.378}{1.25 \times 3.1416} = .86$ turn per in. Ans.

3. To find the constant for twist:

Rule.—*Apply rule II, in Art.* **2**, *for finding the twist, considering the twist gear as a 1-tooth gear.*

EXAMPLE—Find the constant for twist, using the train of gearing given in example 2 in Art. **2** for finding the twist.

SOLUTION.— $\frac{120 \times 48 \times 42 \times 46}{86 \times 1 \times 42 \times 24} = 128.372$; $\frac{128.372}{1.25 \times 3.1416} = 32.689$, constant dividend for twist. Ans.

The constant dividend divided by the twist gear equals the twist per inch; thus, $32.689 \div 38 = .86$, twist per in. Ans.

4. To find the speed of the bobbins:

Rule.—*Find the amount of roving wound on the bobbins per minute and divide by the circumference of the bobbin. Add the result thus obtained to the speed of the spindles per minute, and the answer is the speed of the bobbins per minute.*

EXAMPLE 1.—Find the speed of the bobbins at the beginning of a set when the diameter of the bobbin is 1.75 inches; the speed of the spindles, 718.5 revolutions per minute; and the front roll delivers 835.488 inches per minute.

SOLUTION.— $\frac{835.488}{1.75 \times 3.1416} = 151.967$ rev. per min. of bobbins over speed of spindles. Speed of the spindles, 718.5 rev. per min.; speed of bobbins over that of the spindles, 151.967. $718.5 + 151.967 = 870.467$, speed of bobbins at beginning of set. Ans.

EXAMPLE 2.—Find the speed of the bobbins at the finish of a set when the diameter of the full bobbin is 6.125 inches; the speed of the spindles, 718.5 revolutions per minute; and the front roll delivers 835.488 inches per minute.

SOLUTION.— $\frac{835.488}{6.125 \times 3.1416} = 43.419$ rev. per min. of the bobbins over the spindles. The number of revolutions per minute of the spindles is 718.5; the speed of the bobbins over that of the spindles is 43.419. $718.5 + 43.419 = 761.919$ rev. per min. of bobbins at the finish of a set. Ans.

The reduction of the speed per minute of the bobbins from an empty bobbin to a full bobbin in the above case is $870.467 - 761.919 = 108.548$ revolutions.

5. Drafts.—The draft of a fly frame is calculated in the usual manner.

EXAMPLE 1.—Find the total draft of the rolls shown in Fig. 1, using a 44 draft gear.

SOLUTION.— $\frac{1.25 \times 100 \times 56}{40 \times 44 \times 1} = 3.977$, total draft. Ans.

The constant for draft is found in the same manner as the total draft, except that the draft gear is considered as a 1-tooth gear.

EXAMPLE 2.—Find the draft constant for the rolls shown in Fig. 1.

SOLUTION.— $\frac{1.25 \times 100 \times 56}{40 \times 1 \times 1} = 175$, constant. Ans.

EXAMPLE 3.—Find the draft between the second and third rolls.

SOLUTION.— $\frac{1 \times 25}{23 \times 1} = 1.086$, draft between second and third rolls. Ans.

EXAMPLE 4.—Find the draft between the front and second rolls if the draft gear contains 44 teeth.

SOLUTION.— $\frac{1.25 \times 100 \times 56 \times 23}{40 \times 44 \times 25 \times 1} = 3.659$, draft between front and second rolls. Ans.

6. Change Gears.—In addition to the calculations given there are several in connection with fly frames that apply particularly to the gears that should be used to produce satisfactory work. It will readily be understood that if a frame is running on a certain hank roving and it is desired to change to a different hank, certain gears must be changed in order that correct results may be obtained. In changing from one hank to another some or all of the following gears must be altered (the reference letters apply to Fig. 1): (1) the twist gear m_3, which alters the speed of the rolls and regulates the turns per inch placed in the roving; (2) the tension gear y_5, which regulates the movement of the belt along the cones; (3) the draft gear i, which alters the hank of the roving delivered; (4) the taper gear x_6, which alters the taper of the bobbin; (5) the lay, or traverse, gear v_4, which alters the speed of the traverse of the carriage.

These are the American names for these gears; the English builder motion is different from the American and the English name for tension gear is rack wheel, for taper gear is taper wheel, and for lay gear is lifter wheel.

The most important change to make is in the draft change gear, which regulates the size of the roving. It is generally customary at the same time to change the twist gear, because this should vary with every change in the hank of the roving. The tension gear is also frequently changed. It is not customary, however, to change the lay gear unless the change in the hank of the roving is extensive. If the slubber roving is changed .3 hank, the first intermediate roving .5 hank, the second intermediate roving .75 hank, or the finished roving a whole hank, the lay gear will ordinarily be changed.

It is seldom that the taper gear is changed in the mill, since the gear that is placed on the frame by the builders usually serves for the range of different hank roving that the frame is intended to make.

It is important to bear in mind whether an increase or decrease in the size of a gear must be made to produce certain results. On the usual construction of American-built frames, in making a change to produce finer work the draft gear, the twist gear, the lay gear, and the tension gear would be changed to smaller gears; on the other hand, if the frame must be changed to make coarser work, they would be changed for larger gears, if required to be changed at all.

The same statement is correct with regard to English-built frames, or American-built frames having an English type of builder, with the exception of the tension gear, which in case of changing the frame finer, would be changed to a gear having a larger number of teeth, or in case of changing the frame coarser, to a gear having a smaller number of teeth.

The following rules apply to the method of figuring the different change gears when the gears that are on the frame and the hank roving being produced are known. From the calculations previously given it is possible to obtain the draft and twist gears without this data, but for the tension and lay gears this data is always necessary, since the correct gear for starting up a frame was obtained by the builders largely by experiment and not by calculation. Even when the gear to use for a certain hank roving is known, the calculated gear for another hank does not always give satisfactory results, since the changing of these gears is largely a matter of experience and observation, owing to a number of different points affecting the results produced by them, such as the amount of twist put in the roving, the condition of the cone belt, the number of times that the roving is wound around the presser on the flyer, and so forth.

7. To find the draft gear to be used for a certain hank roving when the draft gear that is on and the hank roving that it produces are known:

Rule.—*Multiply the draft gear being used by the hank roving that it produces, and divide the result by the hank roving that is to be made.*

EXAMPLE.—If 4-hank roving is being produced with a 32-tooth draft gear, what draft gear will a 6-hank roving require?

SOLUTION.— $32 \times 4 = 128$; $128 \div 6 = 21.333$, or practically a 21-tooth draft gear. Ans.

8. To find the twist gear to be used for a certain hank roving when the twist gear that is on and the hank roving that is produced are known:

Rule.—*Multiply the square root of the hank being made by the twist gear, and divide by the square root of the hank required.*

In examples in which the diameter of the roving affects the size of the gear to be used it is necessary to consider the square roots of the hanks, since the diameters of rovings vary inversely as the square roots of their hanks.

EXAMPLE.—If .36-hank roving is being made with a 54-tooth gear, what twist gear is required for a .64-hank?

SOLUTION.— $\sqrt{.36} = .6$; $\sqrt{.64} = .8$; $.6 \times 54 = 32.4$; $32.4 \div .8 = 40.5$. Either a 41-tooth or a 40-tooth gear may be used. Ans.

9. To find the tension gear to be used for a certain hank roving when the tension gear that is on and the hank roving that is produced are known, the frame having the American type of builder:

Rule.—*Multiply the square root of the hank being made by the tension gear, and divide by the square root of the hank required.*

EXAMPLE.—If .36-hank roving is being made with a 50-tooth tension gear, what tension gear is required for a .64-hank?

SOLUTION.— $\sqrt{.36} = .6$; $\sqrt{.64} = .8$; $.6 \times 50 = 30$; $30 \div .8 = 37.5$. Either a 37-tooth or a 38-tooth gear may be used. Ans.

To find the tension gear to be used for a certain hank roving when the tension gear that is on and the hank roving that is produced are known, the frame having the English type of builder:

Rule.—*Multiply the square root of the hank required by the tension gear, and divide by the square root of the hank being made.*

EXAMPLE.—If .36-hank roving is being made with a 20-tooth tension gear, what tension gear is required for a .64-hank?

SOLUTION.— $\sqrt{.36} = .6$; $\sqrt{.64} = .8$; $.8 \times 20 = 16$; $16 \div .6 = 26.666$. A 27-tooth gear would be used. Ans.

10. To find the lay gear to be used for a certain hank roving when the lay gear that is on and the hank roving that is produced are known:

Rule.—*Multiply the square root of the hank being made by the lay gear, and divide by the square root of the hank required.*

EXAMPLE.—If .36-hank roving is being made with a 33-tooth gear, what lay gear is required for a .64-hank?

SOLUTION.— $\sqrt{.36} = .6$; $\sqrt{.64} = .8$; $.6 \times 33 = 19.8$; $19.8 \div .8 = 24.75$. A 25-tooth gear should be used. Ans.

11. Production.—To find the production of a fly frame, in pounds:

Rule.—*Multiply the hanks per spindle, as indicated by the hank clock, by the number of spindles, and divide by the hank roving.*

EXAMPLE.—A clock on a 72-spindle frame registers 75 hanks of .5-hank roving turned off in a week. What is the production in pounds?

SOLUTION.— $\frac{75 \times 72}{.5} = 10{,}800$ lb. production. Ans.