No. 776,723. PATENTED DEC. 6, 1904.

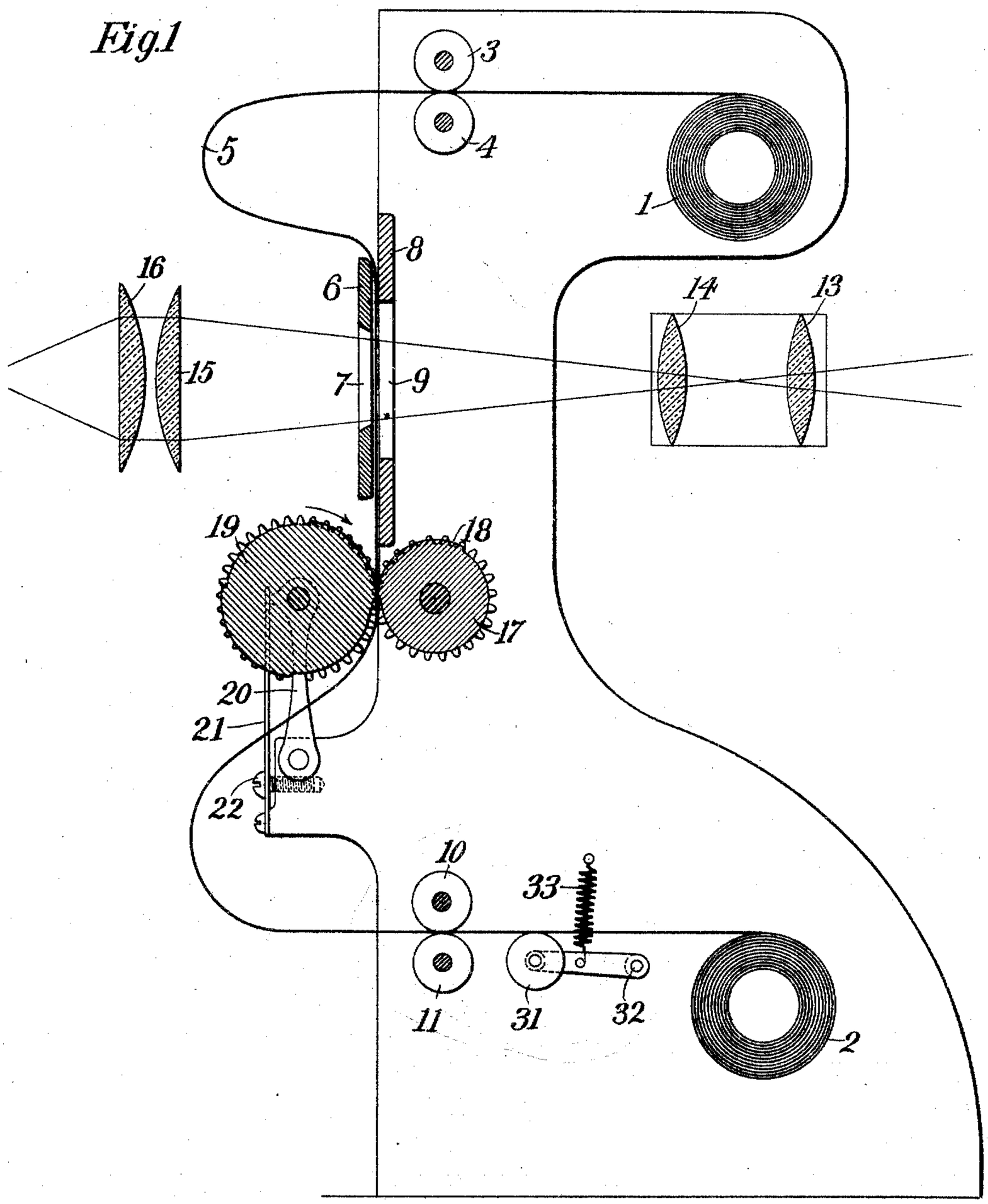
H. CASLER.

STRIP OR BAND FEEDING DEVICE.

APPLICATION FILED MAY 25, 1904.

NO MODEL. 3 SHEETS—SHEET 1.

Fig.1



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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2a

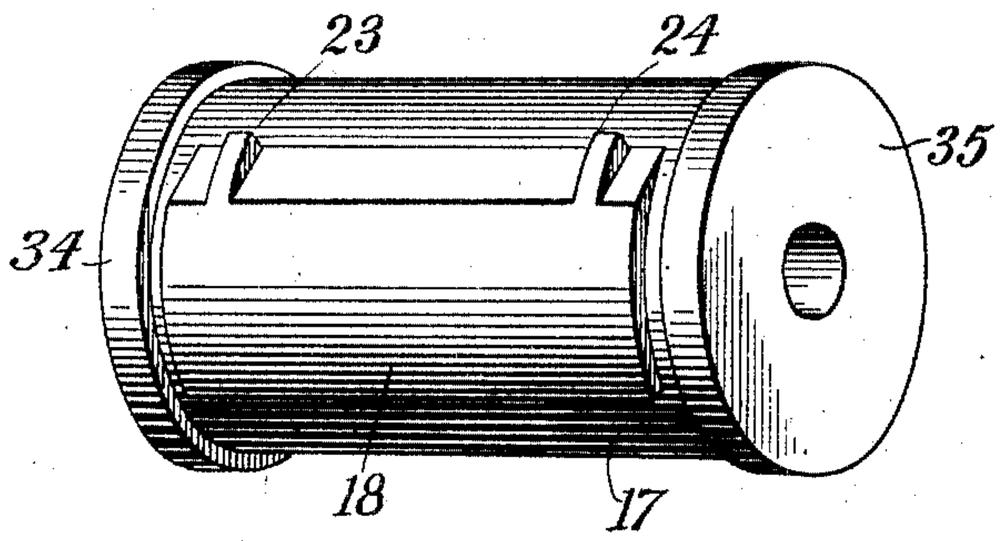


Fig. 3

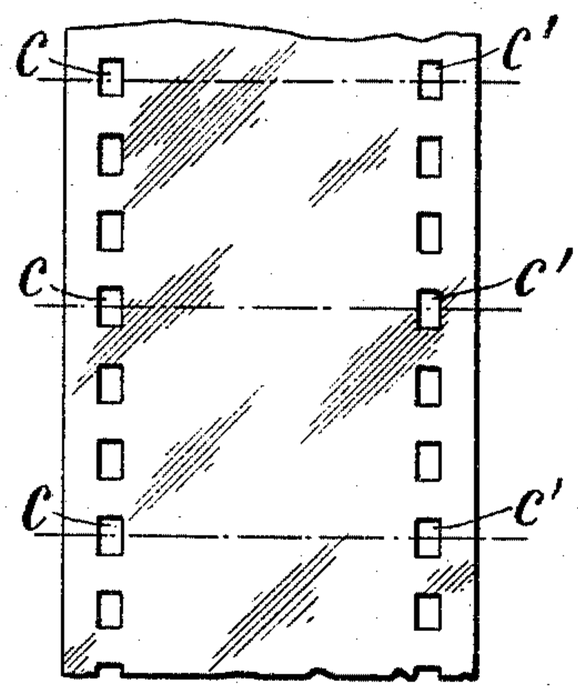


Fig. 2

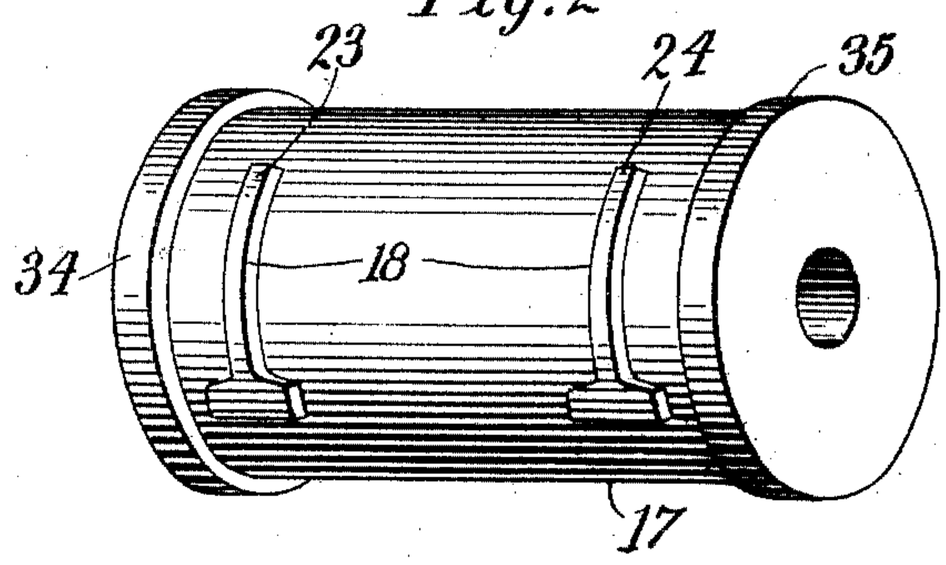


Fig. 4

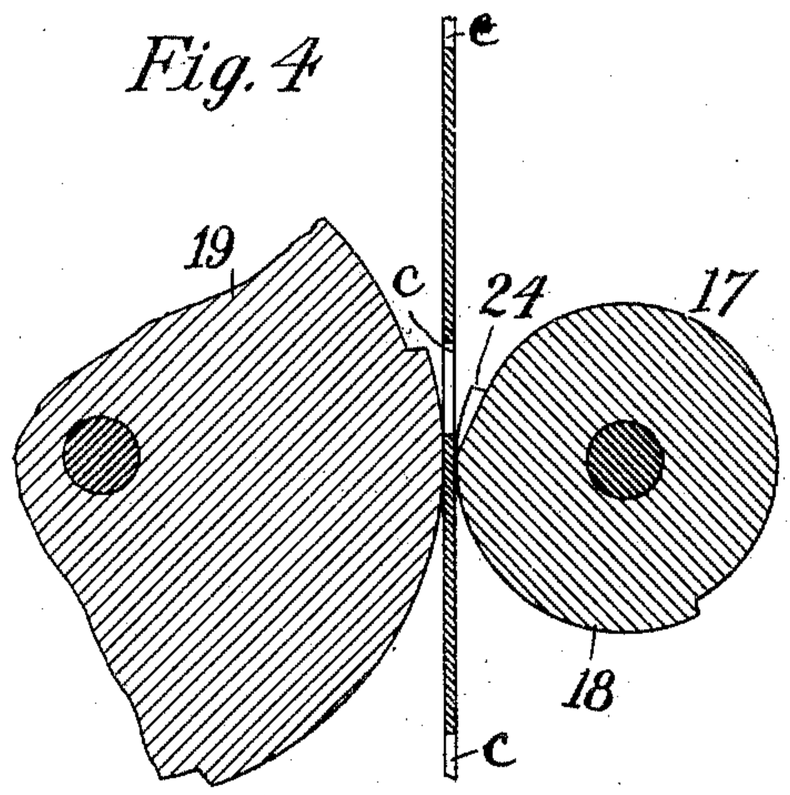
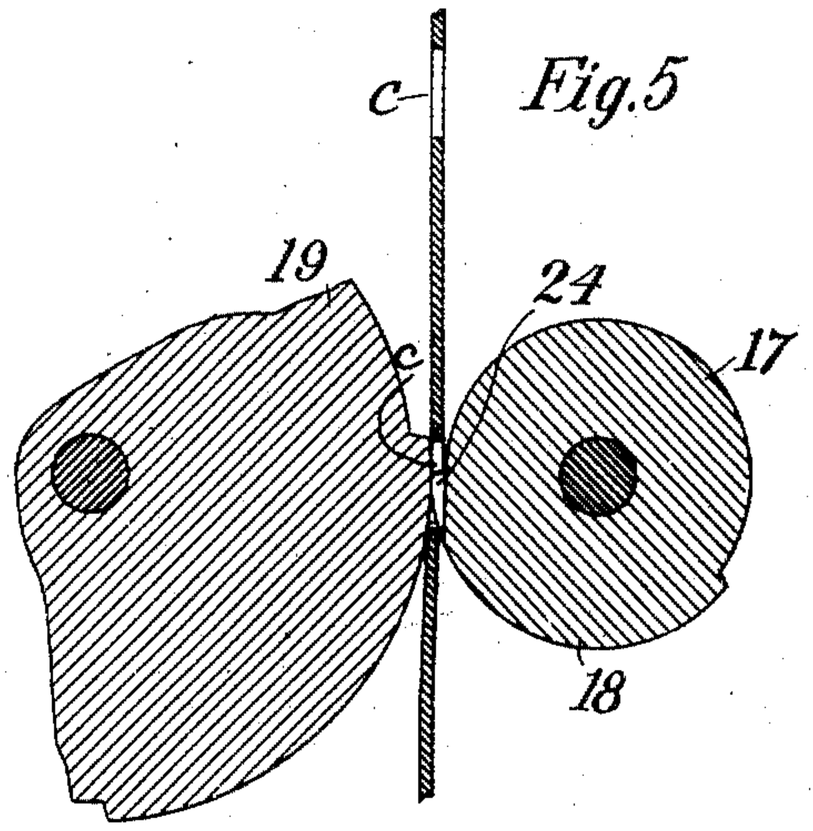


Fig. 5



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No. 776,723. PATENTED DEC. 6, 1904.

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STRIP OR BAND FEEDING DEVICE.

APPLICATION FILED MAY 25, 1904.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 7

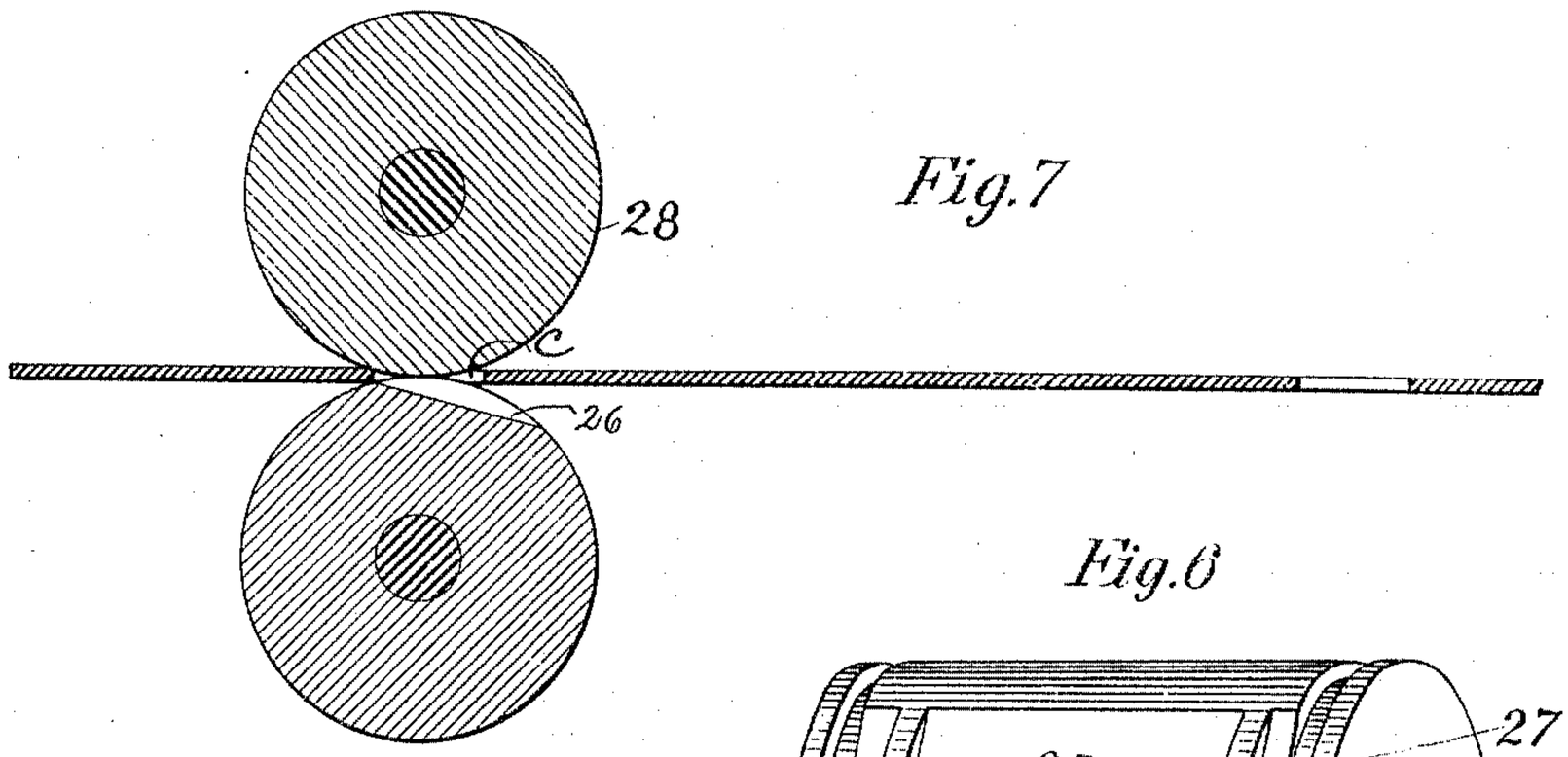


Fig. 6

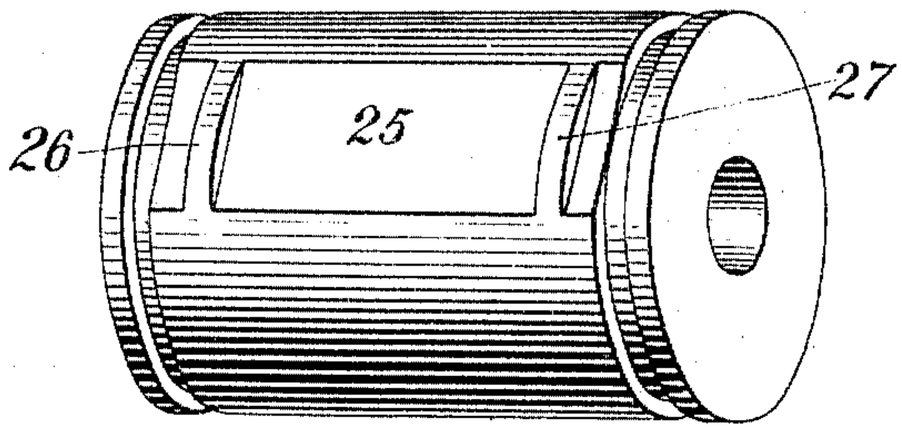


Fig. 9

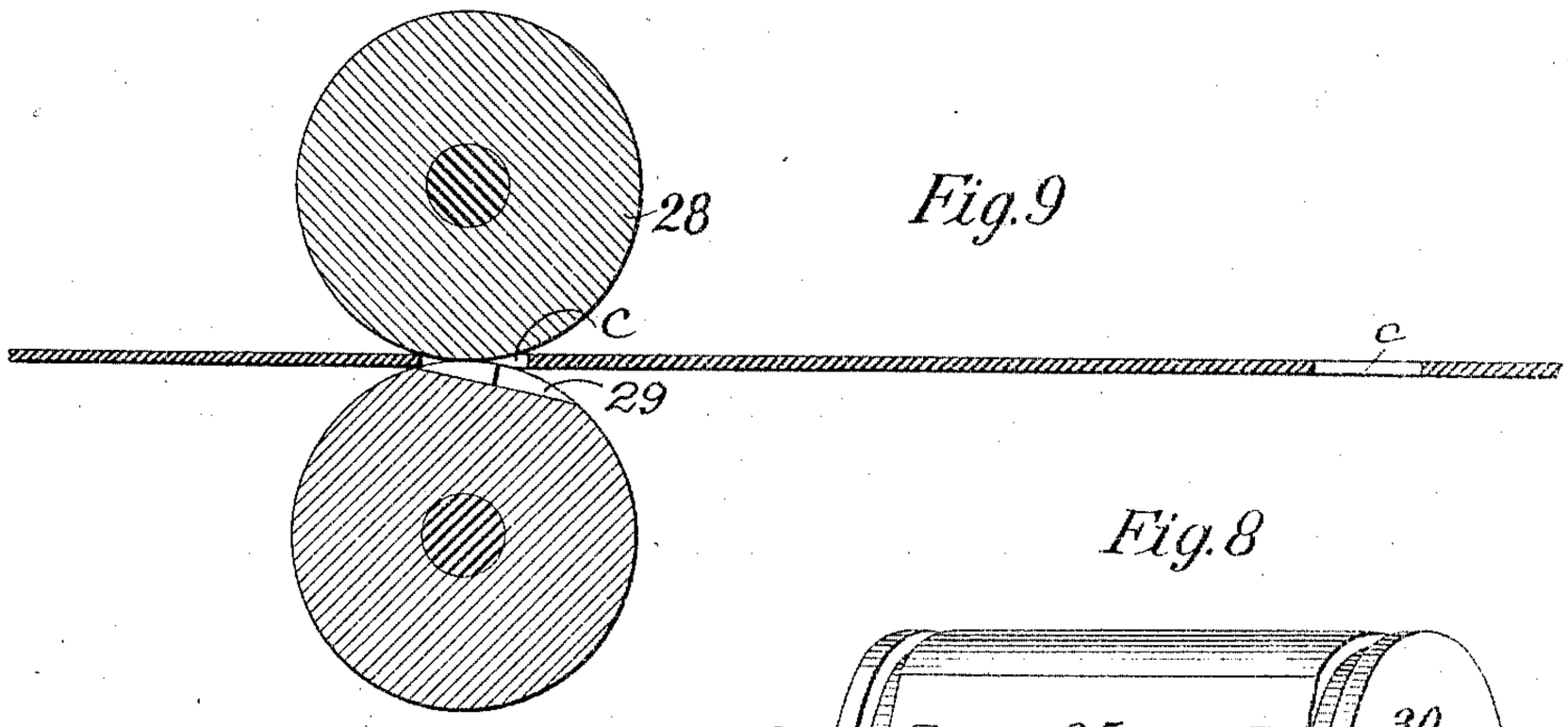
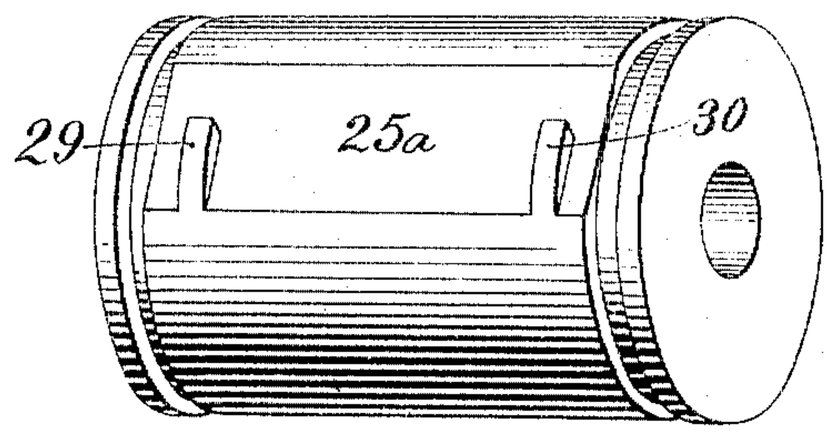


Fig. 8



Witnesses:
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No. 776,723. Patented December 6, 1904.

UNITED STATES PATENT OFFICE.

HERMAN CASLER, OF CANASTOTA, NEW YORK, ASSIGNOR TO AMERICAN MUTOSCOPE & BIOGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

STRIP OR BAND FEEDING DEVICE.

SPECIFICATION forming part of Letters Patent No. 776,723, dated December 6, 1904.

Application filed May 25, 1904. Serial No. 209,675. (No model.)

To all whom it may concern.

Be it known that I, HERMAN CASLER, a citizen of the United States, residing at Canastota, in the county of Madison and State of New York, have invented certain new and useful Improvements in Strip or Band Feeding Devices, of which the following is a specification, reference being had to the drawings accompanying and forming part of the same.

My invention relates to devices for intermittently feeding a band or strip for various purposes, though more particularly for use in animated-picture apparatus both for taking and projecting pictures of an object in motion and in photographic-printing machines. Of the devices now commonly employed for intermittently feeding a band or strip in such apparatus those with which I am familiar have been more or less unsatisfactory in practice. A common way of effecting the movement of the band is to engage the same with coacting friction-rollers. The chief disadvantage in this method is that the thickness of the band or film affects the feed, so that if a band be employed of a different thickness from that for which the mechanism is adjusted or the machine be run at a different speed the feed will not be the same, but instead the band will move by a longer or shorter step, as the case may be. The result is that the pictures or spaces on the band do not register with the aperture or space which they should occupy. This necessitates frequent rectification in order to get good results from the machine. A more common method, however, is to provide the band or film with one or more longitudinal series of perforations—as, for example, a row near each edge—which are engaged by the teeth of one or more sprocket-wheels. This method does not possess the objectionable "creeping" of the friction-feed; but since the band is usually made of fragile material, such as celluloid or paper, it is liable to be torn or have its perforations so enlarged by the pressure of the sprocket-teeth on the edges of the same that the accuracy of the feed is impaired. The present invention, however, combines the advantages of the friction-feed in its less injurious effect on the band with the accuracy of the sprocket-feed. For this purpose I propose to use a perforated film of the ordinary type or specially perforated, if desired; but I do not feed the band by means of the perforations. The feed is always effected by frictional devices, and I employ the perforations only to determine the extent of the frictional feed.

My invention includes another valuable feature in respect to the speed of the band. As is well understood, it is desirable that the substitution of one picture or picture-space for another in the field should be quick. This requirement is not always easy to meet satisfactorily where large or heavy films are used, since the force necessary to start the same from rest is considerable and is therefore particularly liable to rupture the material or wear the sprocket-holes, as before described. With the present invention, however, the period of substitution may be shortened without liability of injury to the band.

Of the invention itself, which consists of the novel features, combinations of elements, and arrangements of parts hereinafter described, and more particularly pointed out in the claims, a convenient embodiment is typically illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic side elevation of the same. Fig. 2 is a perspective view of one of the friction-rollers for feeding the band or film. Fig. 2ª shows an alternative form of the same. Fig. 3 shows a portion of a perforated band or film such as is now commonly used. Figs. 4 and 5 are detail views of the feed-rollers and band, showing the operation of the devices. Fig. 6 is a perspective view of a modified form of feed-roller, and Fig. 7 is a detail view showing the operation of the same. Fig. 8 is a perspective view of another modification in the feed-roller, and Fig. 9 is a view showing its operation.

In Fig. 1, 1 represents the supply-reel of film, and 2 the receiving or storing roll, which takes the band or film drawn from the former.

3 4 are rollers which engage the band and draw the same from the supply-reel to maintain a loop 5 between the supply-roll and the step-by-step feeding devices. 6 is a mat having an opening 7, yieldingly held in any suitable manner against the frame 8, which also has an opening 9. The purpose of these parts is to keep the band taut and flat and prevent displacement during the time the band is not engaged by the step-by-step feeding devices. 10 11 indicate rollers which take up the film or band from the intermittent devices and deliver the same to the storing-roll 2. When the latter is frictionally driven, the rollers 10 11 serve to maintain a loop or a certain amount of slack between the receiving-roll and the intermittent-feeding mechanism. The lenses 13 14 15 16 represent any suitable optical system, the nature of which will depend upon the purpose of the apparatus, whether for taking, printing, or projecting pictures. It should be understood, of course, that the devices above mentioned are merely indicative of convenient devices for the purpose, which may be individually or collectively varied indefinitely without affecting my invention.

The invention itself relates to the mechanism for imparting a step-by-step or intermittent movement to the band and is typically embodied in the devices shown. Of the latter, 17 indicates in section a roller which in the operation of the apparatus is continuously rotated by any convenient means and at any desired speed. It is a friction-roller and engages the band by frictional contact. Its curved surface is generally cylindrical, but is provided with one or more raised or projecting surfaces or contacts, as 18. Coacting with this roller is another, 19, preferably carried in pivoted arms, one being shown at 20, which are engaged by one or more springs 21, so as to press the second roller yieldingly against the first or the band which lies between the two. A screw or screws 22 or other suitable device permits a regulation of the tension of the springs, and consequently the pressure of one roller upon the other or the intervening band. The second roller also has a raised contact or contacts, preferably a plurality of such, substantially the same in size as those on the other. The second may, however, be perfectly cylindrical—that is, it may have no raised portions—depending upon the result which is desired, as will appear more clearly hereinafter.

In the devices shown in the drawings the circumference of roller 19 is one and one-third times greater than that of roller 17. In other words, the circumference of rollers 17 and 19 are proportioned as three is to four, and they are so geared. The contact-surface 18 occupies substantially one-third, or one hundred and twenty degrees, of the circumference of roller 17.

Fig. 1 shows contact-surface 18 at the beginning of engagement with one of the contact-surfaces of the roller 19, the rolls being so timed that the contact-surfaces will coincide. Starting from the position shown in Fig. 1 the contact 18 in engagement with the first contact on the other roll will feed the band a certain distance. The lower or cut-away surfaces of the rollers will then come opposite each other, and the band will therefore not be moved. When the raised surface 18 next comes to the engaging position, the roll 17 will have made one complete revolution and roll 19 will have made three-fourths of a revolution, which will bring a cut-away portion on roll 19 opposite or coincident with the contact-surface 18, thereby rendering roller 17 ineffective until it has made another revolution, when surface 18 will be brought in contact with the second surface on roll 19 and the band will again be engaged and advanced. The band is therefore moved only in alternate revolutions of the smaller roller, and by reason of this fact a high speed of rotation is permitted. Hence the band when it does move moves with corresponding speed, making the period of change or substitution of pictures or spaces very short—a desirable effect, as before stated. With the devices constructed in the relative proportions mentioned the period of substitution or change is one-sixth and the period of rest five-sixths of the time required for two revolutions of the first roller. Roller 19 may be made perfectly cylindrical and of any convenient diameter, and with roller 17 having approximately one-third of its surface raised, as in Fig. 1, the period of substitution or change would be one-third and the period of rest two-thirds. These periods may be increased or decreased absolutely or relatively, or both, at will by varying the proportions of the operative parts, as will be readily understood.

Fig. 3 shows a portion of "sprocket-film" ordinarily used, and it will be seen that there is a certain number of perforations for each picture or space. My apparatus, however, is primarily intended (when constructed as illustrated) to make use of only those at points *c c'*, and the intermediate ones may therefore be dispensed with. In Figs. 4 and 5 the latter are omitted and the dimensions of the others exaggerated.

Fig. 2 shows the form of raised portion 18, and in practice it is made of such a length that a band having no perforations would be fed slightly more than the length of a picture-space by the rotation of rolls 17 and 19. To prevent overfeeding of the band, the raised portion 18 is reduced to narrow terminal points 23 and 24, Fig. 2, which are narrow enough to pass through the perforations *c c'*, Fig. 3, and are located in line with these perforations.

The operation of the feeding device can now be clearly illustrated by Figs. 4 and 5.

The sectional view of rolls 17 and 19, Fig. 5, shows the position of the band during the period of rest. As soon as the surface 18 comes in contact with the second raised surface on roll 19 the band will be fed forward by friction and but for the perforations in the band and terminals 23 and 24 would be fed too far. Fig. 4 shows the position of rolls and band just before the feed is completed, and as roll 17 continues its movement the narrow tongues 23 and 24 will pass through the perforations, as shown in Fig. 5, when the operative engagement with the band will no longer exist and the latter will cease to move. It will therefore be seen that the stopping of the band depends upon the position of the perforations and that the friction devices will continue to engage and move the band until a perforation arrives at the exact point necessary to bring a picture or space into proper register with the field of projection or exposure. Any slight slippage that might occur from time to time by reason of lack of tension or thickness of the band is compensated for by the slight excess of length given to contact 18, which in such cases is available to bring the band to the position shown in Fig. 5.

In a construction shown in Fig. 1, in which the diameter of roller 19 is one and one-third times greater than 17, I prefer to make these rollers of sufficient size to allow both the raised and cut-away portions on roller 19 to exceed in length the raised portion 18 on roller 17. This is desirable, as it gives sufficient length of contact-surface on 19 to overcome the necessity for close adjustment or timing of the driving-gears and also provides clearance-space for the band while the raised portion 18 is opposite a cut-away surface on roller 19, thereby preventing displacement of the band during the period of rest. It will therefore be seen that practical embodiments may depart considerably from strict theoretical proportions without departing from the actual spirit and scope of the invention.

It is necessary that the forward end of the contact—that is, the end which first comes to the engaging position—be slightly wider than the perforations for the purpose of starting the film. Otherwise the contact would pass the operative position idly without engaging the band at all, as will be readily seen. In fact, it is desirable to extend the contacts practically the entire width of the band, as in Fig. 2ª, except the ends 23 24, which of course must be left narrower than the width of the perforations. With such construction the friction on the band is increased and the same is more firmly engaged during its movement. It will be seen also that but one contact might be used, either at one side or in any other position. In the latter case the film used would of course have to have its row of perforations properly located in line with the contact. When one or two ribs are employed each narrower than the width of a perforation, there should be no perforations in the band except those which determine the limit of its movement. Otherwise there might be a momentary or complete interruption of the movement of the band whenever an intermediate perforation reached the point where the two rollers come in contact, as will be readily understood.

In Figs. 6 and 7 is shown a modification of the former structure. The former figure is a perspective view of the feed-rollers and the latter a section showing the devices in operation. In this case the raised contact on the primary roller 25 extends entirely around the roller, but is reduced to narrow tongues 26 27 in one part. The operation of this device is in general the same as described above. The feed of the band will continue until a perforation comes to the proper position, whereupon the tongues will project through the perforations and there will be a momentary interruption of the feed until the wider part of the contact again engages the film. The roller 28 may or may not be provided with a raised part or parts, as desired.

Fig. 8 shows a perspective of a further modification, and Fig. 9 a section of the devices in operation. Here the primary roller 25ª is similar to that just described except that the tongues 29 30 do not connect with the other end of the contact. In the two forms last described the period of rest will be quite short compared with the period of motion.

If desired, the rollers 10 11, Fig. 1, may also be constructed in any of these forms. In this case the roller 10 should be of such proportions that if the film had no sprocket-holes the rollers would not feed quite one picture per revolution. The take-up roll 2, which is frictionally driven in any well-known way, would then draw the film forward a slight amount between the rolls 10 11 whenever the tongues on 10 or 11 dropped into perforations in the film or band, thus correcting for the deficiency in the feed of such rollers. To further insure correction in the manner just described, I may provide a roller 31, carried on an arm pivoted at 32 and drawn upward by a spring 33 against the film, which is taut between the take-up 2 and the rollers 10 11. The roller 31 and its bearings are of light construction and would serve to "jump" the film or band along at every revolution of the roller 11, thus assisting the take-up 2 to overcome the resistance to the correcting-passage of the band through 10 and 11. This function is especially advantageous when the take-up is quite large by reason of the amount of film wound up on it, as near the end of the operation of the machine. At such time the frictional engagement of the roller 2 with its driving mechanism might not be sufficient to overcome the existence of the band, since the leverage of the latter is then so much greater on account

of the enlarged radius of the roll of film on the take-up 2.

The rollers 3 4, Fig. 1, which deliver film from the supply-reel to the intermittent-feed rollers, may also be of the same construction. In this case the rollers 3 4 should be so proportioned that they would feed a little more than one picture or space but for the perforations in the film or band. Of course these rollers, as well as 10 11, may be made to feed one, two, or more pictures per revolution, as desired, by enlarging their diameters and providing them with the proper number of contacts.

The flanges or treads—as, for example, those indicated by 34 35, Fig. 2—on the coacting rollers are of the same height as the raised contacts and serve to limit the approach of the rollers toward each other. If one or both of the rollers are made of yielding material, the flanges or treads would not usually be needed, as both the roller-shafts would then be mounted in fixed bearings.

Certain of the advantages of the invention have already been pointed out. It will be seen that the invention is capable of various embodiments and that its precise functions may also be varied. For example, by omitting the raised surfaces on the secondary roller the band will be fed forward at every revolution of the primary roller, thus shortening the period of rest or exposure. By varying the proportions of the operative parts the periods of rest and motion may be varied as desired, also the speed of the band or the quickness with which the change is effected. Exhaustive practical tests of the invention have demonstrated its practicability and efficiency.

What I claim is—

1. In an apparatus for feeding a band or strip having openings in definite relation to pictures or spaces thereon, the combination of devices for frictionally engaging the band and feeding the same until an opening therein reaches a given position, and means for actuating said devices, as set forth.

2. In an apparatus for feeding a band or strip having openings in definite relation to pictures or spaces thereon, the combination of a feed-roller engaging the band to feed the same, and becoming ineffective when an opening in the band reaches a given position, and means for actuating the feed-roller, as set forth.

3. In an apparatus for feeding a band or strip having openings in definite relation to pictures or spaces thereon, the combination of a feed-roller having one or more frictional surfaces to engage the band and feed the same and adapted to become ineffective when an opening in the band reaches a given position, and means for actuating the feed-roller, as set forth.

4. In an apparatus for feeding a band or strip having openings in definite relation to pictures or spaces thereon, the combination of a feed-roller having one or more frictional surfaces narrower at their terminations than the openings in the band, and means for actuating the feed-roller, as set forth.

5. In an apparatus for feeding a band or strip having a row or rows of openings in definite relation to pictures or spaces thereon, the combination of a feed-roller having a raised frictional surface and one or more tongues or ribs extending beyond said surface in line with the row or rows of openings in the band, and means for actuating the feed-roller, as set forth.

6. In an apparatus for feeding a band or strip, the combination of a feed-roller having a contact-surface of limited extent, a second roller having one or more contacts of different angular extent, and means for rotating the rollers with proportionate angular speeds, as set forth.

7. In an apparatus for feeding a band or strip, the combination of a feed-roller having a contact-surface occupying one-third of its circumference, a second roller in operative relation to the first and having a pair of symmetrically-arranged contact-surfaces each of substantially the same lineal extent and occupying one-fourth of the circumference, and means for causing the rollers to rotate with proportionate angular speeds, whereby the band will be operatively engaged in alternate revolutions of the first roller, as set forth.

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