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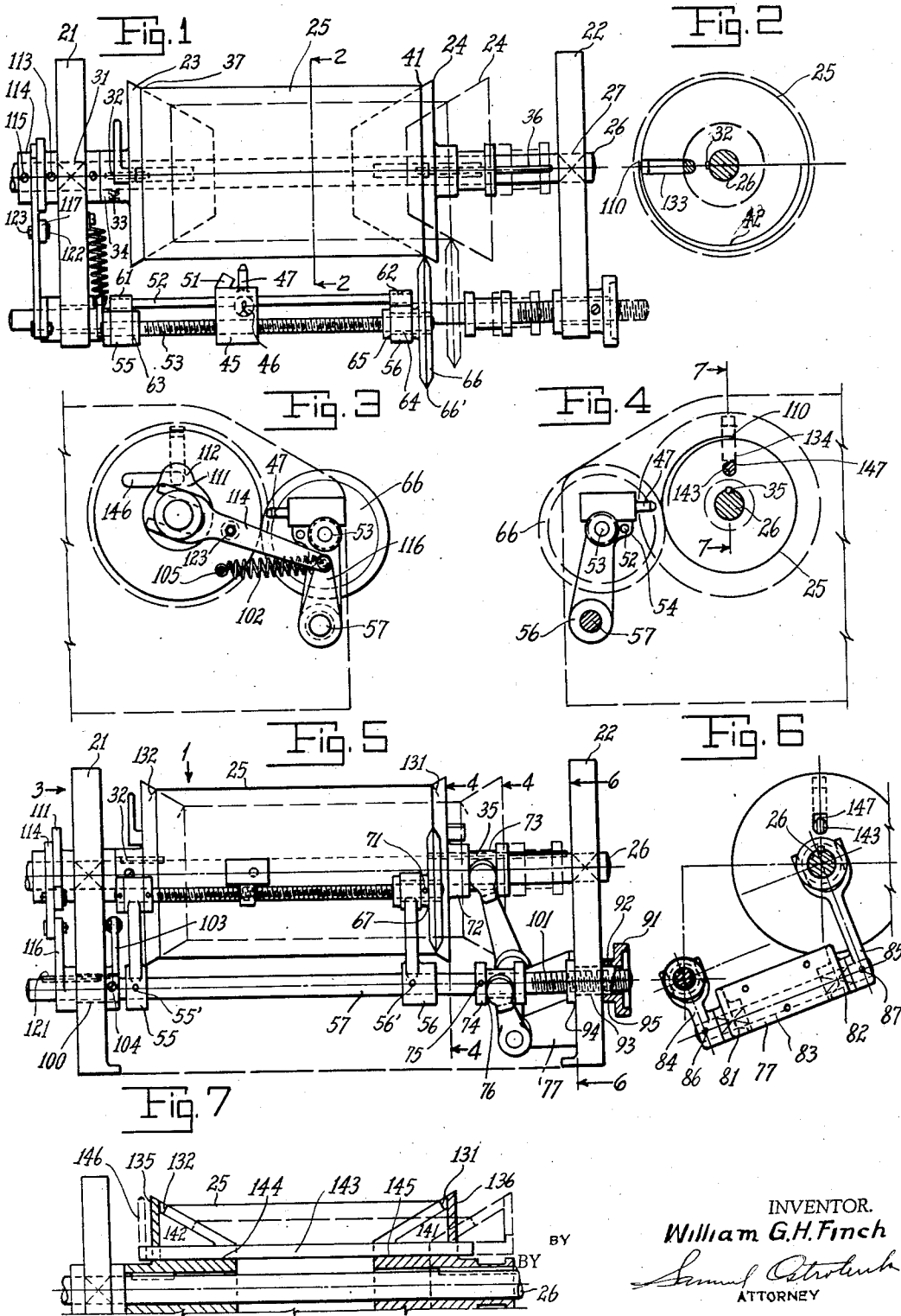
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2,447,473

VARIABLE DRUM FACSIMILE SCANNING MECHANISM

Filed Aug. 26, 1944

2 Sheets-Sheet 1



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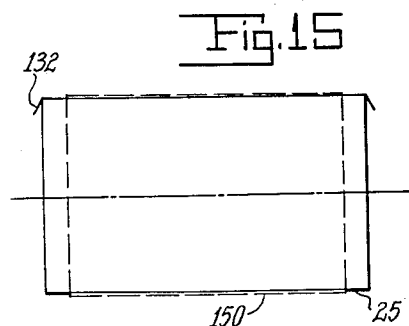
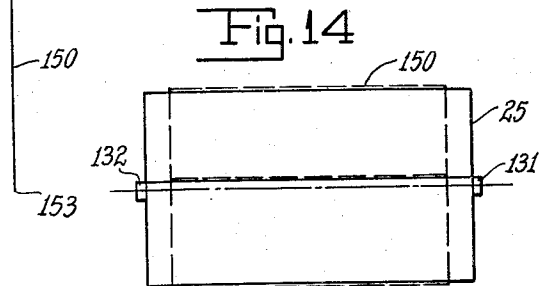
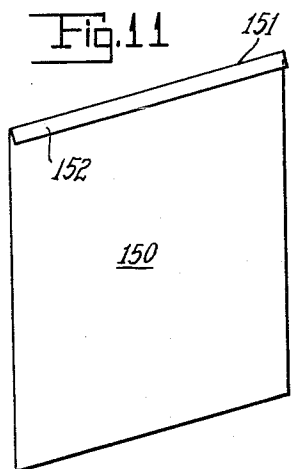
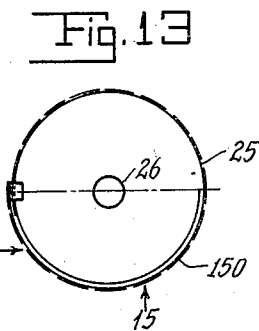
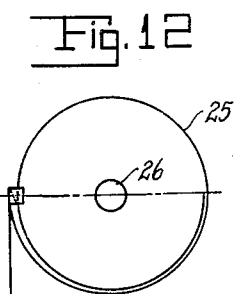
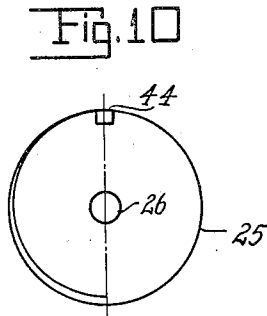
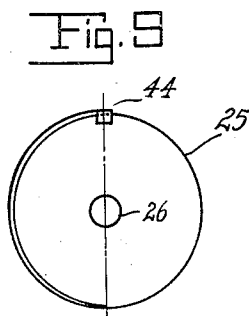
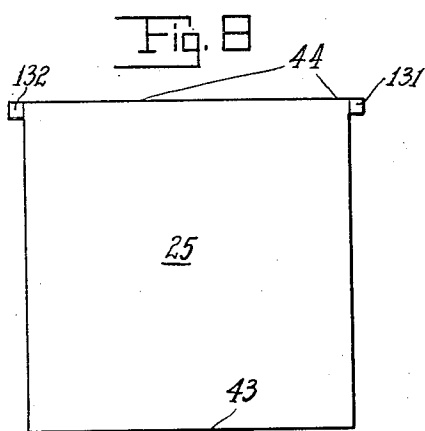
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2,447,473

VARIABLE DRUM FACSIMILE SCANNING MECHANISM

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2 Sheets-Sheet 2



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VARIABLE DRUM FACSIMILE SCANNING
MECHANISM

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Application August 26, 1944, Serial No. 551,337

2 Claims. (Cl. 178—7.6)

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My invention relates in general to the field of picture transmission and reception and more particularly concerns a novel and improved scanning mechanism adaptable to both picture transmission and reception apparatus.

In a facsimile system, the picture to be transmitted is supported upon a platen and is scanned generally by optical apparatus which focuses a beam of light to a point upon the surface of the image. The image and the spot of light are moved relative to each other so that the spot scans individual lines of the image. The light reflected from the image is impinged upon a photoelectric cell which converts the light variations into correspondingly fluctuating electrical currents; thereafter amplified and transmitted in any suitable manner to a remotely disposed receiver.

At the receiver, the signals are amplified and impressed upon a recording stylus which reproduces the original lights and shades. The recording stylus may in one form be a conductive element traversing the electrochemically sensitized sheet which discolors upon the passage of currents or may be a light spot similar to that utilized at the transmitter which traverses a sheet of photographic film to produce an image.

In one form of facsimile transmitter the platen employed to support the image to be transmitted is a rotatable drum. The scanning apparatus is arranged to move axially with respect to the drum while the drum rotates and thus a spot of light traces a helical path about the surface of the drum.

Heretofore in facsimile transmission, the transmitted pictures were necessarily reproduced, at the receiver, the same size as the image at the transmitter or a greater or smaller size which bore an invariable ratio with respect to the image size at the transmitter. If, for instance, a rotatable drum were utilized at the transmitter and a similar drum were utilized at the receiver for supporting the recording sheet, the image recorded would be equal to the size of the image transmitted.

If on the other hand the recording drum were twice the diameter of the transmitting drum, then the image would be recorded upon the sheet having substantially twice the linear dimensions of the image to be transmitted and an image of twice the original size would be produced.

This form of facsimile transmission and reception had various inherent disadvantages, the most notable being the inefficient utilization of the recording sheet at the receiver. Thus, it is

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obvious that if the image to be transmitted was relatively small and covered only a small area of the transmitting drum, the resulting image at the receiver would cover a corresponding proportion of the area of the recording sheet. This would result in a recorded image, first, of small dimensions and, second, of small area relative to the area of the recording sheet employed to reproduce the image.

Another disadvantage which follows directly from the constant ratio of image size at transmitter and receiver was the decided loss of detail in the reproduced image. It has been well recognized that dry recording paper of the electromechanically sensitized type, for example, cannot reproduce the fine details of an image with the fidelity that the photoelectric cell currents at the transmitter follow the lights and shades of the original image.

This has been true since an optical type scanner at the transmitter could focus a beam of light to a spot upon the image of the order of $1/1000''$ in diameter, if properly corrected lenses were utilized, whereas a recording conductive stylus of the order of $1/100''$ in diameter has normally been required for the scanning of a chemically sensitized recording sheet.

Also, on chemically sensitized recording paper, there is a tendency for the electrical currents impressed thereupon by the conductive stylus to "bleed," that is, flow radially outward from the point of contact between the stylus and paper. This phenomenon of course would lower the resolving power of the recording unit.

Consequently, if a small image were to be transmitted and if this image were reproduced without variation in dimension, the reproduction would suffer a distinct loss of detail even though currents corresponding to the finest details were originally generated at the transmitter.

Since at a facsimile transmitting station it is generally impossible to ascertain the size of the image, which will have to be transmitted, a compromise was necessarily effected between the invariable ratio of recorded image to transmitted image. In most cases, this ratio was one to one; in other cases the recording drum was of a somewhat greater diameter than the transmitting drum so that a larger image could be reproduced.

Various proposals have been made in the past to eliminate the aforementioned difficulties encountered when the image to be transmitted is not equal in size to that which may be accommodated by the transmitting drum.

It will be evident that the optimum size of

the image to be transmitted is that which exactly covers the surface of the platen or rotatable drum and accordingly one of the proposals was that the image to be transmitted be reduced in size or enlarged at the transmitter by a photographic process in order that the image cover the entire transmitting drum. Of course, such a proposal necessitates considerable labor and expense at the transmitter and even more important involves a considerable waste of time in carrying out the necessary photographic processes.

At the receiving end of a facsimile system, similar problems arise concerning the dimensions of the image received. Thus for certain applications, an image which is equal in size to the image transmitted will suffice, whereas for other applications a greater or reduced image may best be employed.

My invention contemplates, and has a primary object the provision of a facsimile scanning system of extreme flexibility which may be utilized at either end of a picture transmission system to effect a maximum efficiency in the utilization of recording paper and a maximum of efficiency insofar as the recording of the details of an image is concerned.

More specifically, my invention contemplates a facsimile image supporting means of a continuously variable dimension which is adjustable to any predetermined value, in order that pictures may be enlarged or reduced at will during the transmission. The novel scanning unit permits the application of heretofore conventional optical systems or conductive stylus arrangements at either the receiving or transmitting end and utilizes the conventional amplifiers and modulating equipment normally employed for the transmission of images.

In one embodiment of my invention I employ a rotatable drum of continuously variable diameter for supporting a sheet which may comprise either the image to be transmitted or the recording sheet at the receiver.

The drum is cylindrical as conventional and is formed from thin sheet metal spirally wound upon a pair of supporting conical members. The spacing between the conical members is variable so that the drum may assume any diameter between predetermined maximum and minimum limits.

If the variable diameter drum proposed is employed at the transmitter in conjunction with an electrooptical scanning unit, then it is obvious that if a relatively small image is to be transmitted, the diameter of the drum may be decreased so that the image completely encircles the drum.

If a drum of fixed diameter is employed at the receiving end and if the rotatable drums are maintained in synchronism by methods well known in the art, then a circular line about the periphery of the transmitting drum will correspond with a circular line about the periphery of the receiving drum. It is thus evident that as the drum at the transmitter is decreased in diameter to accommodate smaller images that the image will be enlarged in transmission in the dimension which corresponds to the circular trace about the drum.

In order to preclude distortion of the image at the recorder by enlarging a single dimension only, I propose to vary the number of scanning lines per inch covered by the scanner at the transmitter.

Accordingly, if the circumference of the drum at the transmitting end is decreased to one half

of its original size, I double the number of scanning lines per inch covered by the transmitting optical unit. In the novel transmitting drum which I have devised, I have simplified the determination of the number of scanning lines to be employed to correspond with the diameter of the drum by making the scanning unit driving members entirely automatic.

This is accomplished as will be understood by noting that the circumference of a circular drum will vary in a direct linear relation to its diameter. Thus I have arranged the scanning unit to be driven axially with respect to the drum at a rate which is proportional to the periphery of the drum.

Since the drum at the transmitter when varied in dimension automatically increases or decreases the number of scanning lines per inch depending upon whether the drum diameter has been decreased or increased respectively, the unit at the transmitter is entirely independent of any recording unit utilized. Thus, if one transmitter is energizing a plurality of recorders, it is obvious that the recorders may each employ a drum or platen of different dimension.

Similarly, I may utilize a variable diameter drum and correspondingly variable scanning feed mechanism at the recorder to adapt the recording unit to a recording sheet of any dimension. Thus, as previously mentioned, if a particular application demands a relatively large recording, the drum diameter may be increased to support a relatively large sheet thereabout.

While increasing the diameter of the drum, I automatically increase the rate at which the recording stylus will move axially with respect to the drum and thus preserve linearity between all the dimensions of the transmitted and recorded image.

The novel system of employing a variable diameter drum thus provides for a maximum effectiveness in the utilization of the transmission time in that there is no time during which blank areas not belonging to the image are being transmitted; except perhaps for the period corresponding to the overlap of the image.

At the receiver, the recorded image covers the full area of the recording sheet which may be made as large as desirable to permit proper recording; and at the transmitter, the scanning spot always traverses the image since the drum diameter is adjustable to permit the image to be transmitted to completely encircle the drum.

The novel variable diameter drum which I have devised greatly facilitates the support of the record thereupon. Thus since the drum is formed from a relatively thin sheet of material having an overlap, the image or the recording sheet may be supported thereupon by inserting the edges thereof under the overlap. Further, the drum members provide novel means for precluding the shift of the phase position of the overlap of the metallic members with respect to apparatus utilized for the generation of synchronizing signals.

Accordingly, it is an object of my invention to provide a means for enlarging or reducing images during the transmission thereof.

It is another object of my invention to provide an image supporting means having a continuously variable dimension.

Another object of my invention is to provide a drum of continuously variable diameter to support either an image to be transmitted or a recording sheet.

A further object of my invention is to provide for a facsimile drum which provides integral means associated therewith for supporting a sheet thereupon.

Still a further object of my invention is to provide for a facsimile drum of continuously variable dimension having an overlap therein which maintains a constant phase position with respect to the supporting shaft.

A further object of my invention is to provide for a facsimile scanning unit having a platen of continuously variable dimension and automatic means for adjusting the number of scanning lines traversed per inch.

A still further object of my invention is to provide for a facsimile image supporting drum of continuously variable dimension and automatic means for maintaining a light spot focussed thereupon.

These and other objects of my invention will now become apparent from the following specification taken in connection with the accompanying figures, in which:

Figure 1 is a plan view of a partially assembled facsimile scanning unit embodying the principles of my invention.

Figure 2 is an end cross sectional view of a continuously variable diameter facsimile drum.

Figure 3 is an end view of the facsimile scanning unit illustrated in Figure 5 taken in the direction of arrowhead 3.

Figure 4 is an end cross-sectional view of the facsimile apparatus illustrated in Figure 1.

Figure 5 is a front view of the facsimile apparatus illustrated in Figure 1, completely assembled.

Figure 6 is a fragmentary cross-sectional view taken along lines 6—6 of Figure 5 and illustrates the novel method of automatic adjusting the diameter of the drum.

Figure 7 is a cross-sectional view taken along line 7—7 of Figure 4 and illustrates the novel image supporting means incorporated into the drum.

Figure 8 is a developed plan view of the sheet material utilized for the continuously variable diameter drum of Figure 2.

Figure 9 is an end view of the variable diameter drum and illustrates the position of the edge when open for the reception of paper.

Figure 10 is an end view of the sheet material utilized for the drum surface and illustrates the paper supporting edge in a closed position.

Figure 11 is a perspective view of a sheet of paper or the like preformed for application to the novel variable diameter drums and the associated supporting means.

Figure 12 is an end view of the variable diameter drum and the sheet illustrating one phase of the mounting of the sheet.

Figure 13 is an end view of the novel drum illustrating the record sheet supported thereupon.

Figure 14 is a plan view of the drum illustrating the paper supported thereupon and

Figure 15 is a side view of the drum and illustrates the means for maintaining the drum at a fixed phase position.

The general arrangement of the scanning unit for transmitting enlarged or reduced images is indicated in the plan and front views of Figures 1 and 5 respectively and reference is now made thereto.

The rotatable and otherwise movable members of the scanning unit are most suitably supported in a frame or bracket having end walls 21 and 22

provided with openings to permit the passage of the rotatable members.

Essentially, my novel supporting drum comprises a pair of oppositely disposed conical shaped members 23 and 24 and the drum surface 25 which is cylindrical and of variable diameter as determined by the axial spacing of the conical members 23 and 24. The drum surface 25 is formed from a sheet material such as spring steel or the like and is rolled or otherwise curved so that the resulting sheet has a natural tendency to curl into a relatively small diameter cylinder. This cylinder is supported upon the conical members 23 and 24 and the diameter thereof determined by the axial spacing of the conical members 23 and 24.

The exact functions of the drum sheet 25 and the method of varying the spacing of the conical members 23 and 24 will be discussed in a later paragraph. A shaft 26 is rotatably supported within bearings 27 and 31 in the frame of the unit and in turn supports the conical members 23 and 24.

The conical member 23 is fixed with respect to the shaft 26 by means of a key 32 as indicated in Figures 1 and 5. This key 32 is carried in suitable key ways in the conical member 23 and in the shaft 26.

In order to preclude lateral displacement of the conical elements 23 upon the shaft 26, a set screw 33 is threaded into a suitable opening in the hub 34 extending from the conical member 23. The other conical member 24 is slidably secured to the shaft 26, by a key 35 (Figure 4) which is press fitted into a keyway 36 (Figure 1) of the shaft 26.

A corresponding keyway in the conical members 24 permits axial slidable motion with respect to the shaft while precluding rotation thereabout. The keys and their corresponding keyways described in connection with the conical members are also clearly shown in the cross-sectional view of Figures 2 and 4.

The drum surface 25 comprises a substantially rectangular sheet of metal such as illustrated in Figure 8. This sheet is preformed by rolling or any similar process so that it tends to curl to a cylinder of relatively small diameter which is preferably equal to the minimum diameter drum to be employed. This metal cylinder is then positioned about the tapering portions of the conical members 23 and 24 to form the drum as indicated.

The edges 37 and 41 (Figure 1) of the drum surface 25 thus bear against the tapering portions of the conical members 23 and 24 which, as illustrated, are truncated right circular cones.

It is obvious therefore from Figures 1 and 5 that axial movement of the conical member 24 will cause corresponding variations in the diameter of the drum cylinder 25.

The sheet of material 25 is, of course, of sufficient length to provide an underlap 42 as indicated in Figure 2 to permit increase in the diameter of the drum over that illustrated in Figure 2.

In order that the underlap 42 of the drum sheet 25 avoid interference with the edges 37 and 41 of the sheet which rests upon the surface of the conical members, the drum sheet 25 illustrated in Figure 8 is preferably of trapezoidal form so that the edge 43 is somewhat narrower than the edge 44 thereof. Accordingly, the tapering drum sheet will spiral about the conical elements 23 and 24 to form a substantially circular cylinder as illustrated in Figure 2.

The sheet member 25 forming the cylindrical

drum is schematically illustrated in the section Figure 2 as a spiralling line. However, it is obvious that since the sheet material must have some thickness and thus the edges 37 and 41 thereof are rounded to preclude binding between the edges and the surface of the conical elements.

Accordingly, this smoothing of the edges minimizes the frictional forces which are encountered when the conical elements 24 are displaced axially in the manner to be described.

A scanning member 45 is disposed adjacent the surfaces of the drum 25. The scanning member may, as illustrated in Figures 1 to 5 comprise a lamp 46 for projecting a beam of light through optical system 47 and focussing this beam to a spot upon the surface of the drum 25.

Light reflected from the spot is conducted through optical system 51 and impinged upon a photoelectric cell (not illustrated) which converts the varying intensity light into correspondingly fluctuating currents.

The scanning unit illustrated is of a type which might be used at a transmitter for generating currents corresponding to the lights and shades of the lines of an image. If the scanning unit is to be used at a recorder it may comprise first a light beam apparatus for impressing a spot of light upon the surface of a photographic film of the type illustrated or may comprise a conductive stylus which bears against a surface of an electrochemically sensitized sheet carried by the drum illustrated.

Thus the form of scanning unit illustrated in the accompanying figures is merely indicative of a scanning unit which may assume any of the well known forms.

The scanning unit is carried upon two shafts 52 and 53. The shaft 52 is smooth and acts merely as a guide for the scanning member 45. As illustrated in Figure 4, the shaft 52 slidably passes through a corresponding opening in an extension 54 of the scanner. The shaft 52 and the shaft 53 are supported by a pair of levers 55 and 56 which are in turn carried upon and fixed to a floating shaft 57 (Figure 4).

The members 55 and 56 have axially aligned openings 61 and 62 for supporting the shaft 52 which may be non-rotatably fastening within the openings 61 and 62 by means of a set screw or the like. The shaft 53 (Figure 1) is threaded and is rotatably supported at one end in the bearing 63. At the other end of the shaft 53, a bushing 64 having a shoulder 65 is secured thereupon and a wheel 66 having a hub 67 as indicated in Figure 5 is slipped over the bushing 64.

The pin 71 as indicated in Figure 5 passes through the hub 67 of the wheel 66, the bushing 64 and the shaft 53 and thus secures each of these members to each other. The bushing 64 is rotatably supported in a suitable opening in the member 56 and the shoulder 65 and the hub 67 preclude axial movement of the threaded shaft or feed screw 53.

The feed screw 53 engages corresponding threads upon the scanning member 45 and thus rotation thereof will cause the axial displacement of the scanning member.

In the manner well known in the facsimile art, the engagement between the threads on the scanner 45 and the threads on the feed screw 53 may at any time be released and the scanner reset to its original position at one end of the drum.

In the novel facsimile scanning apparatus illustrated, the scanning member 45 is driven axi-

ally with respect to the drum at a rate which corresponds with the diameter of the drum. The system illustrated for the scanning unit is entirely automatic in that a variation in the diameter of the drum 25 will correspondingly cause the necessary variation, in the rate at which the scanning member 45 is displaced axially.

In facsimile apparatus of the type disclosed, a source of mechanical power such as an electric motor not shown continuously drives the shaft 26 to cause the rotation of the conical elements 23 and 24 which in turn cause the rotation of the drum sheet 25. The frictional forces between the sheet material 25 and the conical members 23 and 24 will provide the necessary force for transmitting the motion thereto. However, additional means are provided as will be described in a later paragraph.

Rotation of the feed screw is accomplished by means of the wheel 66 which has an edge 66' thereof in constant engagement with the edge 41 between the surface of the drum 25 and the conical member 24. This engagement is maintained as will be described for all variations in drum diameter possible and since the circumference of the edge 41 varies directly with the diameter thereof, the angular velocity of the feed screw 53 varies accordingly.

Thus it may be seen that as the diameter of the drum 25 is decreased by displacing conical element 24 to the right as viewed in Figure 1, the angular velocity of feed screw 55 will decrease in the same proportion. Hence for a given angular velocity of the drum 25 as determined by the driving motor, a decrease in the drum diameter will cause a corresponding increase in the number of substantially circular lines scanned per inch by the scanner 45; that is to say a decrease in the pitch of the helical line scanned.

Referring now to Figure 5, the hub 72 of the conical member 24 contains a circular depression 73 therein. A pulley 74 is nonrotatably secured to floating shaft 57 by a pin 75 which passes therethrough. The pulley 74 has a reduced diameter section 76 similar to the reduced diameter section 73 in the hub 72.

A bracket 77 illustrated in Figures 5 and 6 is rigidly secured to the end wall 22 of the facsimile frame and contains a pair of axially aligned bearings 81 and 82 through which a rotatably positioned shaft 83 passes.

Bifurcated members 84 and 85 are secured by means of pins 86 and 87 respectively to the ends of the shaft 83. These bifurcated members as illustrated in Figures 5 and 6 engage within the reduced diameter sections 73 and 76 of the hub 72 and the pulley 74.

Since the member 74 is rigidly secured to the shaft 57 it may be seen that axial displacements of the shaft 57 will cause corresponding displacements of the conical element 24 through the agency of bifurcated member 84, shaft 83 and bifurcated member 85. As previously mentioned, shaft 57 is floating, that is slidably and rotatably supported within bearings in the frame walls 21 and 22.

The shaft 57 may be manually displaced by the operator of the facsimile unit by means of the hand wheel 91 or the like. The hand wheel 91 is secured by means of set screw 92 to a bushing 93 which is rotatably supported within the wall 22 of the facsimile apparatus.

This bushing has a section 94 of enlarged diameter which coacts with the hub 95 of the

hand wheel 91 to rotatably secure the units 93 and 91 to the frame.

The inner surface of the bushing 93 is threaded to engage corresponding threads 101 on the floating shaft 57 and hence rotation of the hand wheel 91 will cause the axial displacement of the shaft 57. The shaft 57 is rotatably supported and is constantly biased by means of a spring 102 towards clockwise rotation as viewed in Figure 6.

The spring 102 is secured at one end to a lever arm 103 which is secured by means of set screw 104 to a bushing 100 which in turn is secured to the shaft 57 by a key 121. The other end of the spring 102 is secured by screw 105 to the frame as illustrated in Figure 3. However, the rotational motion of shaft 57 under the influence of spring 102 is limited by the engagement between wheel 66 and the conical member 24 along the edge 41 since the supporting members 55 and 56 are non-rotatably secured to the shaft 57 by the pins 55' and 56' as indicated in Figure 5.

As illustrated in Figures 1 and 5, the conical members 23 and 24 are right circular cones which have a semi-vortex angle of 30° and a base angle of 60°. For a cone of these proportions and for the variable diameter drum sheet 25, the edge 41 will be displaced towards the right as indicated by the dashed lines in Figures 1-5, one-half the distance of the displacement of the conical member 24 to the right.

Thus when effecting an increase or a decrease in diameter of the drum sheet 25 by displacing the single element 24, it is necessary to have the wheel 66 move one-half of the cone displacement in order to maintain engagement at the overlapping edge between the sheet member 25 and the conical element 24 as indicated in Figure 1.

This adjustment may be accomplished in various manners and as illustrated, the bifurcated members 84 and 85 are in the ratio of 1 to 2 in length measured from the center of shaft 83 (Figure 6.) Hence a displacement of shaft 57 to the right or to the left by means of the rotation of the hand wheel 91 will cause a displacement of conical member 24 which is twice as great as the displacement of wheel 66 in the same direction. This ensures contact between wheel 66 and the surface of the conical member 24 at an edge which at all times corresponds to an edge of the sheet 25.

Hence the angular speed of the feed screw 53 will be determined directly by the diameter of the drum 25. It is of course possible to utilize various other arrangements for causing the rotation of the feed screw at a rate which corresponds to the diameter of the drum as, for instance, by means of a belt which encircles the surface of the drum and engages a pulley secured to the shaft 53. The system illustrated, however, provides an extremely flexible method of simultaneously varying the drum diameter and varying the rate of rotation of the feed screw 53.

As previously described, the diameter of a light spot at the transmitter may be made extremely small by the use of proper lenses and the like. Accordingly, if a relatively small image is to be transmitted, the drum 25 is decreased in diameter by rotating hand wheel 91 so that an edge of the picture to be wrapped about the drum is equal to the circumference thereof. The sheet is then secured to the drum in a manner to be described and rotation of the drum is caused by rotating shaft 26.

The feed screw mechanism 53 will rotate at a speed which is determined by the diameter of the drum and thus will scan a number of lines which will produce a recorded image having the same dimensions as the original image. It is to be noted that no particular diameter drum need be specified so long as the ratio between the pitch of the feed screw and the diameter of the drum remains constant for the transmitter and recording units.

This, however, is a comparatively simple arrangement and in itself is no limitation upon the transmission of images. The drum illustrated may, of course, be utilized at the recording end of the facsimile system. If thus utilized, the scanning member 45 will comprise a variable intensity light beam or a conductive stylus. The recording sheet of whatever dimension available is supported upon the drum, the diameter of which is adjusted to accommodate the paper, and the recording begun.

The length of the recorded line of the picture will correspond to the periphery of the drum since the length of a transmitted line corresponds with the periphery of the transmitting drum and since the transmitting recording drums are maintained in synchronism with each other. The exact methods of maintaining synchronism between transmitting and recording units are well understood in the art of facsimile transmission and constitute no part of the present invention since any of the known methods may be employed.

If the unit illustrated is to be employed at a recorder utilizing a conductive stylus which traverses the recording sheet, then it may be desirable to provide means for precluding interference between the stylus and the overlap 110 of the sheet 25 as illustrated in Figures 2 and 4.

Also, a means for precluding interference between an optical scanning unit of the type disclosed in copending application Ser. 352,938 filed August 16, 1940, now abandoned, and the overlap 110 would be desirable.

In this application, the optical unit provides integral means extending therefrom for precluding the entrance of the room illumination. This means comprises a flange which is adjacent the surface of the drum.

As illustrated in the Figures 1, 3 and 5, a cam 111 having a raised portion 112 is secured by means of set screw 113 to the shaft 26. A bifurcated member 114 is supported at one end between the cam 111 and a bushing 114 also secured to the shaft by a set screw 115. The other end of the bifurcated member 114 is pivotally secured to a lever 116 which in turn is non-rotatably fixed to the shaft 57 by the key 121.

However, the key 121 is slidable within the corresponding keyway in the lever 116 so that the shaft 57 may be displaced axially in the manner heretofore described. A roller 117 is rotatably supported upon the bifurcated member 114 by a shoulder bolt 122 and an associated nut 123. As may be seen from Figure 3, the protrusion 112 on cam 111 will cyclically contact the roller 117 and cause the corresponding displacement of the bifurcated member 114 and the motion of lever 116 which causes rotation of shaft 57 against the influence of spring 102 to remove the scanning unit from close engagement with the surface of the drum. If a conductive stylus is employed to record upon dry

instantaneous type recording paper, then the position of the cam 112 may be made to correspond with the overlap 110 of the drum sheet as illustrated in Figure 2 to preclude interference therebetween.

An important feature of the drum arrangement illustrated in the accompanying figures is that if a light spot scanner is utilized, the spot will automatically remain in focus upon the drum independently of the diameter of the drum and thus will obviate the need for constant refocusing when varying the drum diameter to suit the needs of a particular picture. This is a result of the fact that the scanner 45 is maintained at a constant distance from the surface of the drum, this distance being determined solely by the diameter of the wheels 66.

It is to be noted that the scanner 45, as illustrated, will move on a circular arc about shaft 57 as the diameter of the drum is increased or decreased. Since this arc is not a straight line in towards the center of the drum, the spot may be defocused slightly during the movement thereof. However, it is important to note that since the scanner may be made to move upon the arc of a relatively large circle, and since the total inward and outward movement is not considerable, the degree of focus of the spot will remain substantially correct for all practical applications thereof.

If the need for a more accurately automatically focused spot is apparent, then the scanner 45 may, by means of a suitable mechanical linkage be made to move along a radial line with respect to the center of drum 25. However, to repeat, for all practical purposes, the constancy of the focus obtained by means of the arrangement illustrated is sufficient if the lever arms 55 and 56 are relatively long.

Hence it may be seen that the rotation of the hand wheel 91 will simultaneously increase or decrease the diameter of the drum, vary the angle of speed of the feed screw 53 in a linear relation with respect to the diameter of the drum and adjust the optical mechanism at a distance from the drum which maintains a constant focus of the light spot.

Of course, if the unit illustrated is utilized at a recorder, the conductive stylus engaging a recording sheet upon the surface of the drum 25 will maintain proper contact with the drum surface for all diameters thereof.

The rotatable drum in addition to providing all of the novel features hereinabove specified concerning the transmission or reception of enlarged or reduced pictures, provides novel means for supporting the image to be transmitted or the sheet upon which the image is to be recorded and novel means for maintaining the overlap 110 of the drum sheet 25 in a constant phase position with respect to the shaft 26.

The maintenance of this constant phase position is essential in order that proper phase synchronism may always be maintained between transmitting and recording units. Thus, in facsimile transmission units, the synchronizing signals are normally transmitted during the overlap periods of the drum so that the scanning trace will begin at one end of the record sheet and end at the other end whereas no picture is recorded or transmitted as the styli at the transmitter and receiver pass over the paper overlap.

Hence it becomes essential that the phase position of the overlap at the transmitter remain constant with respect to the means for gener-

ating synchronizing signals or the driving shaft. Since it is normally preferable to generate synchronizing signals by utilizing a cam operative from a drum driving shaft the proper phase synchronism may be maintained if the overlap 110 is maintained in a constant phase position with respect to shaft 26.

This is accomplished in a novel manner as will now be described. In Figure 8 there is shown a blank of sheet material which essentially is a form utilized for the drum 25. The blank of material for reasons hereinabove set forth may be trapezoidal if the blank is of appreciable thickness. However, in addition to the general rectangular outline of the blank, a pair of projecting ears or lugs 131 and 132 are formed thereupon and are bent as indicated in Figure 5 and Figure 7. These lugs are then positioned within a corresponding pair of slots 133 and 134 in the conical members 23 and 24 respectively, as indicated in Figures 2 and 4. These slots are triangular as indicated in Figure 7 and are machined so that the walls 135 and 136 of the conical elements form an enclosure therefor.

Hence the positioning of the lugs 131 and 132 within the slots 134 and 133 respectively will preclude rotation of the edge 44 of the drum with respect to the conical members 23 and 24 when the conical members 24 are displaced to the right as viewed in Figures 1 and 5. Consequently, the phase position of the edge 44 of the sheet material 25 will remain fixed with respect to the shaft 26.

As previously mentioned, the drum provides integral means for supporting the image to be recorded or a recording sheet thereupon and obviates the need for additional mounting plates or rubber bands or the like for supporting a sheet. In Figure 9 the edge 44 of the drum material 25 is indicated as being raised above the normal surface of the drum and in Figure 10 the edge 44 is indicated as being in juxtaposition with the surface of the drum material 25.

Again as previously mentioned, the drum blank illustrated in Figure 8 is rolled prior to mounting upon the conical elements so that the natural tendency is to curl into a cylinder of a diameter smaller than the minimum diameter drum to be utilized for facsimile transmission and reception. Hence the natural tendency of the edge 44 will be to assume the position illustrated in Figure 10. Accordingly, I provide means as indicated in Figures 4, 6 and 7 for raising the edge 44 of the drum to the position indicated in Figures 9 and 12 to permit the insertion of a record sheet as will be described.

Referring now to Figures 4, 6 and 7, there is shown a pair of triangular members 141 and 142 slidably positioned within the slots 134 and 133 respectively. These wedge shaped members 141 and 142 are maintained within the slots first by the walls 135 and 136, of the conical elements, and then by the ears or lugs 131 and 132. Accordingly the wedge shaped members 141 and 142 cannot fall from their corresponding slots after being positioned therein.

In the normal position of the wedges 141 and 142, the edge 44 of the drum blank assumes the position indicated in Figure 10. However, as illustrated in Figure 7, a cam rod 143 slidably extends through openings 144 and 145 in the conical members 23 and 24 and has a hand lever 146 secured thereto at one end. The rod 143 as illustrated in cross-sectional view Figures 4 and 6, comprises essentially a square rod which has

been rounded at three corners thereof and provides a single right angled corner 147.

Hence upon rotation of the rod 143 from the position indicated in Figure 4, through 45° to the position indicated in Figure 6 will cause the wedge shaped members 141 and 142 to rise within the slots and accordingly through the agency of lugs 131 and 132 raise the edge 44 to the position indicated in Figure 9.

Upon the repositioning of hand lever 146 so that rod 143 is in the position indicated in Figure 4, the natural tendency of the inwardly pressing lugs 131 and 132 will be to maintain this position of the rod 143. Of course, since the drum sheet provides considerable pressure upon the wedge shaped members 141 and 142 the effects of centrifugal force resulting from the drum rotation will not in any way cause the wedge shaped members 141 and 142 to move from their normal position.

Accordingly, a sheet may be mounted upon the drum by first folding it as indicated in Figure 11. Normally since an image to be transmitted may assume any particular form, the sheet will have to be folded by the operator along the edge 151 as indicated in Figure 11.

However, at the recorder, the recording sheets may be prefabricated to include the fold line 151 and the fold indicated in Figure 11. Thus subsequent to the folding of the recording sheet 150 at 151, the bent portion 152 is inserted under the edge 44 of the drum as indicated in Figure 12. This operation is, of course, preceded by rotation of the lever 146 so that the wedges 141 and 142 are raised to correspondingly lift the edge 44.

The sheet is then wrapped about the drum as indicated in Figures 13, 14 and 15, and the edge 153 thereof is inserted under the edge 44 of the drum material as indicated. The lever 146 is then reset to the position indicated in Figure 4 to provide a secure clamp for the paper which is supported about the drum as indicated in Figure 14.

Thus when it is desired to transmit a picture for example, the sheet carrying the image to be transmitted is first folded along an edge 151 which edge is inserted under the edge 44 of the drum blank 25. The operator then utilizes the hand wheel to vary the diameter of the transmitting drum so that the circumference thereof corresponds exactly with the circumference of the sheet and so that the sheet may be supported thereupon as indicated in Figure 13. Then by merely operating the hand lever 146, the paper is clamped to the drum which has automatically been adjusted to the proper diameter while simultaneously adjusting the speed of rotation of the feed screw and the focus of the light spot.

Similarly, at the receiving end, the operator first decides the size of the recording sheet to be utilized to record the particular transmission and then after inserting the fold 151 under the edge 44 as indicated in Figure 12, adjusts the diameter of the drum to correspond with the record sheet being employed.

It is thus evident that the full transmission time is utilized to transmit images and to record images (except for that short period utilized for synchronization) and that no time is wasted in the transmission of blank portions.

Thus this provides a means for taking a relatively small image at the transmitter and enlarging it to any desired size during transmission while improving the overall efficiency of the operation of the facsimile unit.

In addition, the novel drum disclosed provides means integrally associated therewith for supporting the sheet to be transmitted and the recording sheet. It is obvious that many modifications of the present invention will be apparent to those skilled in the art of facsimile transmission and reception and other allied fields.

It should be noted that the variable diameter drum disclosed is merely one modification of a variable dimension platen for supporting an image to be transmitted. Thus if various other types of facsimile transmitters and recorders are employed, namely the oscillating arm or high speed multistylus recorder, that the platen by merely mechanical modifications may be made to correspondingly vary in dimension while the scanning rate varies to preclude distortion in one dimension only.

Furthermore, the system disclosed herein may of course be utilized for enlarging or reducing photographs or the like, whenever scanning operations are employed. Accordingly, I prefer that the spirit and scope of my invention be defined not by the hereinabove described specific disclosures, but only by the appended claims.

I claim:

1. In a facsimile system, a drum for supporting an image-carrying sheet, means for scanning the image on said image-carrying sheet, means for varying the diameter of said drum comprising a pair of conical members, the ends of said drum fitting over the cone surface of said conical members, means for varying the spacing between said conical members so that said drum assumes any diameter between maximum and minimum limits, and means simultaneously controlled with said drum-varying means for varying the number of scanning lines scanned as the diameter of the drum is changed.

2. In a facsimile system, a drum for supporting an image-carrying sheet, means for scanning the image on said image-carrying sheet, means for varying the diameter of said drum to accommodate images of varying size which may take up the full diameter of said drum, and means simultaneously controlled with said drum-varying means for varying the number of scanning lines scanned as the diameter of the drum is changed.

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