Oct. 28, 1941. A. G. COOLEY 2,260,511

SPACING CONTROL FOR TELEFACSIMILE SYSTEMS AND THE LIKE

Filed March 11, 1940 3 Sheets-Sheet 1

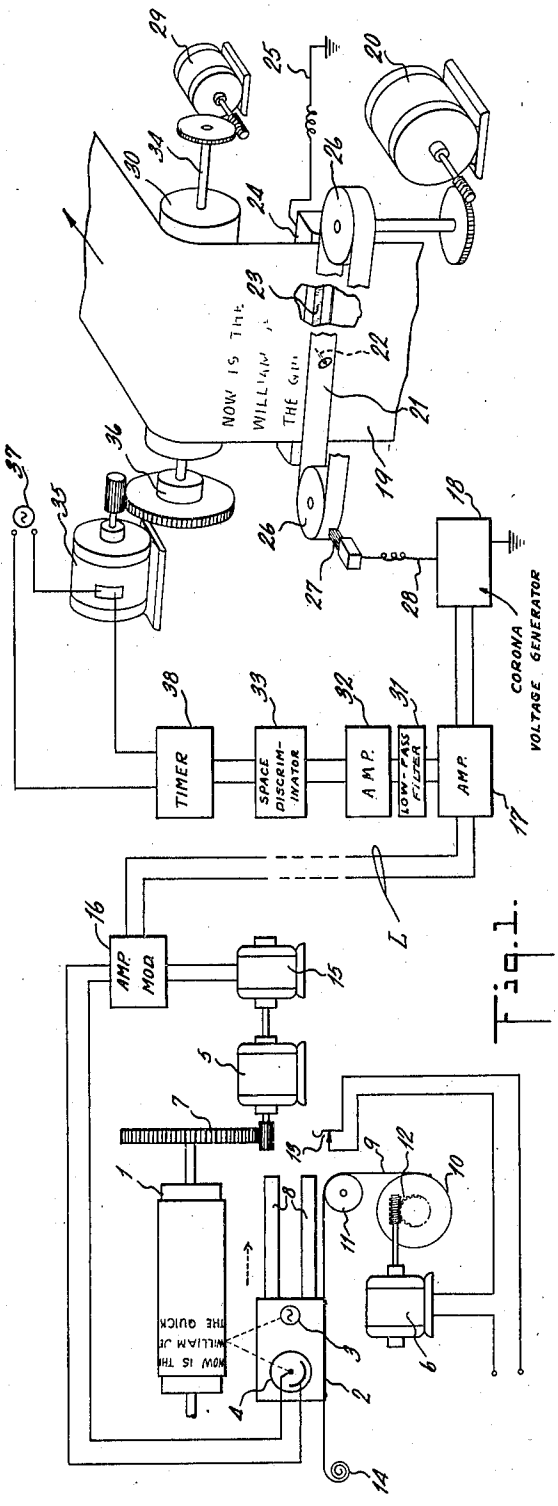


Fig. 1.

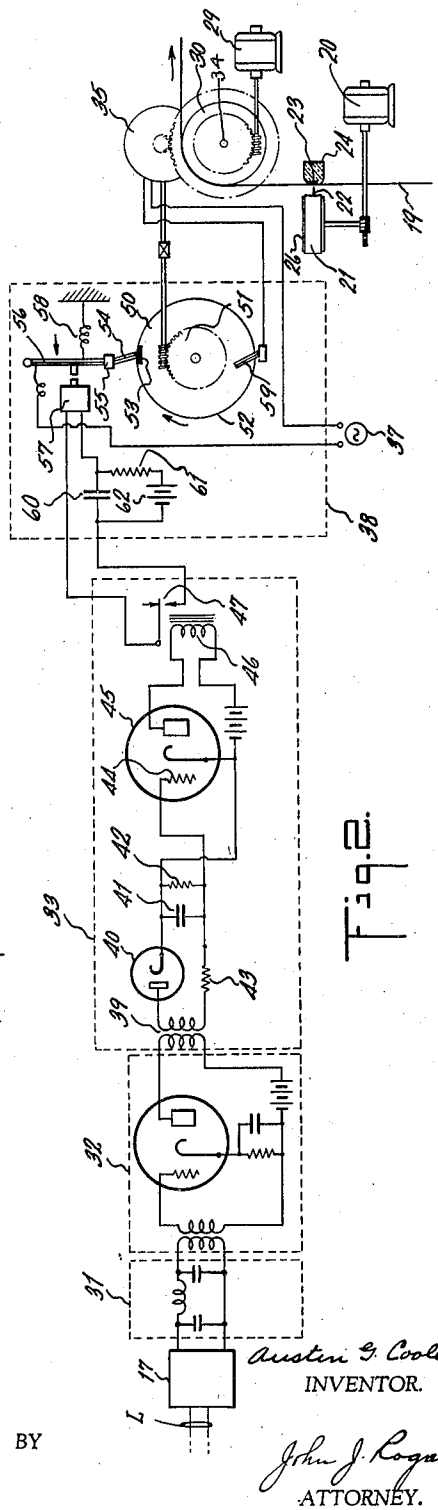

Fig. 2.

Austin G. Cooley
INVENTOR.

BY

John J. Rogan
ATTORNEY.

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SPACING CONTROL FOR TELEFACSIMILE SYSTEMS AND THE LIKE

Filed March 11, 1940 3 Sheets-Sheet 2

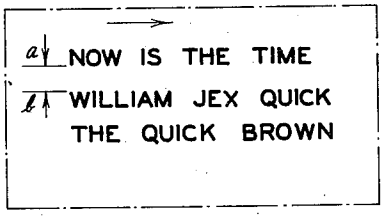


Fig. 1.A.

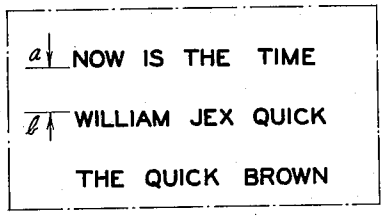


Fig. 1.B.

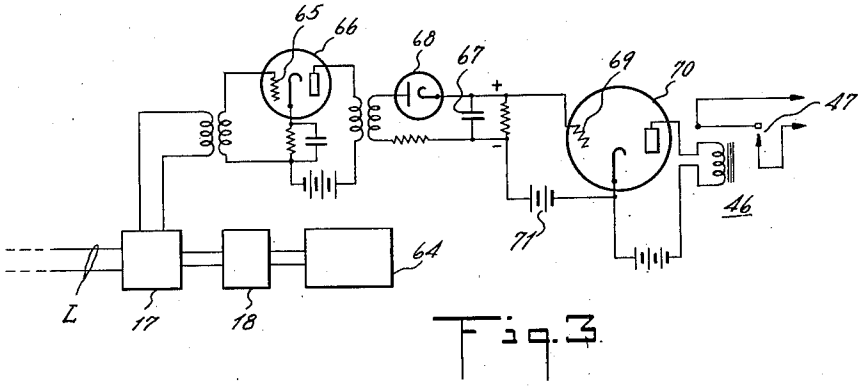


Fig. 3.

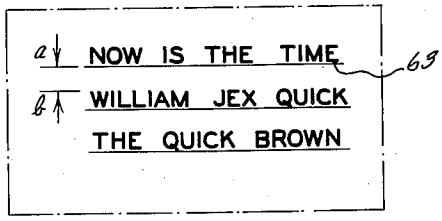


Fig. 4.A.

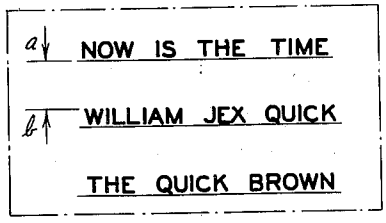


Fig. 4.B.

Austin G. Cooley
INVENTOR.

BY

John J. Regan
ATTORNEY.

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SPACING CONTROL FOR TELEFACSIMILE SYSTEMS AND THE LIKE

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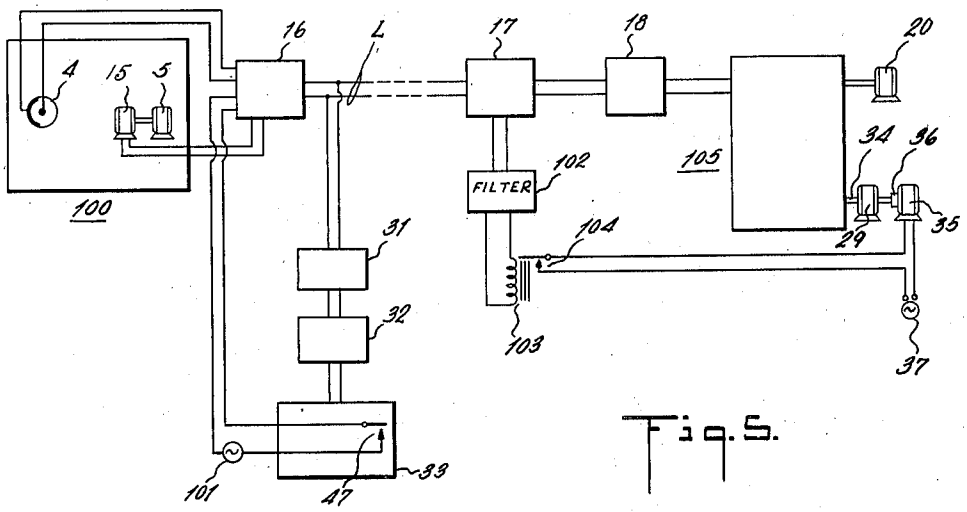


Fig. 5.

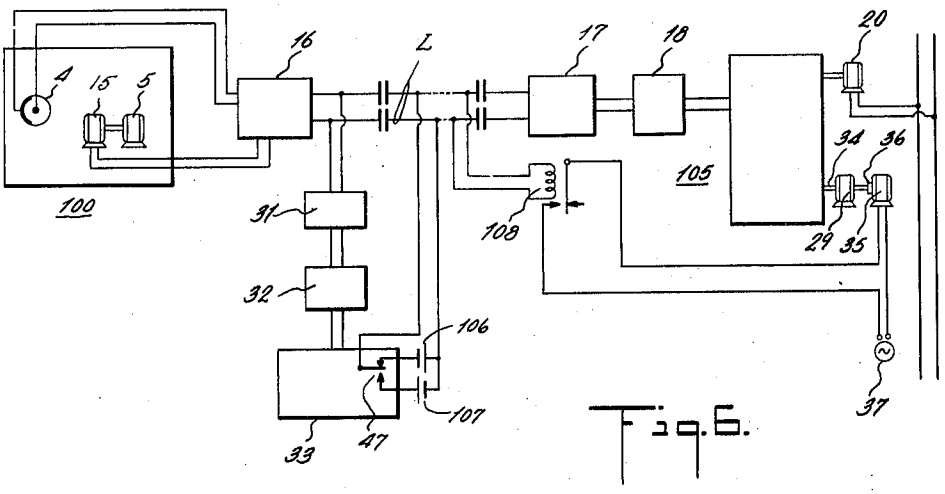


Fig. 6.

Austin G. Cooley
INVENTOR.

BY

John J. Logan
ATTORNEY.

Patented Oct. 28, 1941

2,260,511

# UNITED STATES PATENT OFFICE

2,260,511

## SPACING CONTROL FOR TELEFACSIMILE SYSTEMS AND THE LIKE

Austin G. Cooley, New York, N. Y., assignor, by mesne assignments, to Times Telephoto Equipment Inc., New York, N. Y., a corporation of New York

Application March 11, 1940, Serial No. 323,366

28 Claims. (Cl. 178—7.6)

This invention relates to telefacsimile systems and more especially to methods and means for automatically controlling spacings between successive portions of a subject matter to be reproduced.

In certain applications of telefacsimile methods, for example in transmitting typewritten, printed or similar graphical representations, it is highly desirable to be able to vary the spacing between successive reproduced lines independently of the character or size of the actual transmitted graphic matter. Thus in the case of matter transmitted for newspaper work or the like, it is very desirable to have the successive lines of the subject matter at the transmitting scanner as close as possible so that unnecessary line time may not be consumed in scanning the blank spaces between lines. In the case of typewritten or printed subject matter to be transmitted, the message or other subject matter is preferably imprinted with "single space" between successive lines. However, at the receiver, such single spacing may not be desirable, especially where the subject matter is to be edited directly from the reproduced copy. Accordingly, the present invention provides methods and apparatus whereby typewritten, printed or similar subject matter can be scanned in the normal way at a transmitter, and at the receiver the spacings between successive lines or portions of the reproduced subject matter are automatically controlled so as to provide double, triple or other desired spacing.

The invention is in the nature of an improvement on the system disclosed in my prior Patent No. 1,719,392. The system disclosed in said patent requires the provision of special marks in the space between successive messages or subject matters to be transmitted, whereby a special spacing signal of a predetermined frequency is transmitted. It is one of the principal objects of the present invention to effect the automatic spacing at the receiver without requiring a special frequency signal and without requiring a tuned relay or the like at the receiver. In accordance with this object, it is not necessary to employ special markings or scanning arrangements at the transmitter.

A feature of the invention relates to a facsimile reproducing mechanism which effects any desired spacing between successive portions such as those between successive typewritten or printed lines, and without requiring a special arrangement at the transmitter.

Another feature relates to a method of facsimile transmission of graphical subject matter such as writings, printings, etc., whereby the subject matter may be scanned with single spacing between successive lines and reproduced at a receiver with double, triple or other desired spacing without affecting the size or character of the actual reproduced subject matter.

A feature of the invention relates to a special form of "spacing discriminator" circuit which may be used with a facsimile receiving or reproducing machine to control automatically the spacing between successive portions of an originally transmitted subject matter.

Another feature relates to a facsimile reproducing machine having paper or web-feeding mechanisms of different throws or indexing ratios, one of said mechanisms being effective to advance the web normally at an elemental scanning line unit speed in a direction substantially perpendicular to the transverse scanning motion of the reproducing scanner; and the other mechanism being automatically effective to advance the web a distance corresponding to a number of elemental line scanning units when no facsimile signals are being received.

A further feature relates to a novel form of timing relay for use in conjunction with a motor driven web-feeding mechanism of a facsimile machine.

A further feature relates to an automatic spacing mechanism for use with a telefacsimile receiving machine, which mechanism does not depend upon a special frequency signal for controlling it. As a result, the possibility of false operation of the automatic spacing mechanism is reduced, especially where the machine is to be operated over a telegraph or telephone line.

A still further feature relates to the novel organization, arrangement and relative location and interconnection of parts which consitute an improved automatic spacing control for telefacsimile receivers or the like.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following detailed descriptions and the appended claims.

In the drawings which represent certain preferred embodiments of the invention,

Fig. 1 is a schematic diagram of a telefacsimile system embodying features of the invention.

Fig. $1^A$ represents a typical subject matter as scanned at the transmitter of Fig. 1.

Fig. $1^B$ shows the telefacsimile reproduction of Fig. $1^A$ in accordance with the invention.

Fig. 2 is a schematic wiring diagram of the

receiver of Fig. 1 embodying features of the invention.

Fig. 3 shows an alternative form of spacing control circuit that may be used in the system of Fig. 1.

Fig. $4^A$ shows an alternative form of original subject matter which may be used in practicing the invention.

Fig. $4^B$ shows the telefacsimile reproduction of Fig. $4^A$ in accordance with the invention.

Figs. 5 and 6 show two additional modifications of the invention.

While the invention will be described herein as embodied in one particular form of telefacsimile system, it will be understood that in certain of its aspects the several features of the invention are applicable to other systems.

Referring to Fig. 1, there is represented a drum 1 carrying the various subject matters to be transmitted. Associated with drum 1 is any well-known form of telefacsimile scanning mechanism diagrammatically represented as being mounted on a carriage 2, including amongst other things, a light source 3 and a light-sensitive cell 4. The light cell and light source are arranged to be moved as a unit transversely of the drum in the direction of the dotted arrow, under control of a motor 6, while motor 5 rotates the drum 1 through suitable gears 7. As a result the lights and shades of each elemental area in successive elemental scanning lines of the subject matter on drum 1 are translated into corresponding electrical potentials by cell 4 as is well-known in the facsimile art. During the scanning of each elemental transverse linear element of the subject matter, the carriage 2 is advanced by motor 6 in the direction of the dotted-line arrow a unit distance substantially equal to the width of an elemental scanning line. Thus, if the subject matter is scanned by the light 3 in transverse lines of approximately 0.01 inch width, the drum 1 is advanced by motor 5 approximately 0.01 inch per revolution. Preferably, although not necessarily, the carriage 2 is mounted for sliding movement on a pair of fixed parallel rails or guides 8, and has fastened thereto a flexible metal or fabric band 9 which has the other end fastened to a drum or wheel 10, after passing around the idler roller 11. Wheel 10 is driven at the required speed by motor 6 through a suitable worm and wormwheel 12 or other speed reducing mechanism. When the carriage 2 has reached the end of its travel in the direction of the arrow, it causes a pair of contacts 13 to be automatically opened to break the power circuit to motor 6. A spring 14 has one end fastened to carriage 2 and the other end fastened to a fixed support so that when the motor circuit is broken, the said spring returns the carriage to its initial position in readiness for the next transmission. If desired, one or both of the rails 8 may be in the form of a rack, and a pivoted pawl may be carried by carriage 2 as to prevent any accidental return movement of carriage 2 during scanning. When the carriage has completed its scanning movement, the pawl may be released manually or automatically by engagement with a suitable stop whereby the spring 14 effects the carriage return. It will be understood of course, that any well-known feed mechanism may be employed for moving the carriage between each line scanning.

The motor 5 which controls the scanning drum 1 also drives an A. C. generator 15 which therefore supplies a sustained carrier wave, for example 1800 C. P. S. to the amplifier-modulator 16 which is also excited under control of cell 4. Consequently, when the subject matter is being scanned, there is impressed upon the line L, an alternating current of substantially constant frequency which is modulated by the facsimile signals from cell 4.

At the receiving station, the modulated carrier is amplified and demodulated in any suitable arrangement 17, whereby the original facsimile signals are reproduced. The facsimile signals are then amplified in the high voltage generator 18 as described in Patent No. 1,702,595, the output of which is used to control a recording lamp or to energize a recording stylus or needle which forms part of the facsimile recording scanner mechanism. This mechanism may be of any well-known type arranged to be moved transversely of the recording web 19 by a motor 20, which is synchronized in any well-known manner with motor 5, so that the drum 1 rotates in synchronism with the movement of the recording needle transversely of web 19. As shown in the drawings, the scanning mechanism may be in the form of a flat endless metal band 21 carrying one or more pointed electrodes or needles 22, the point of which is in close proximity to the recording web 19. Mounted on the opposite side of web 19 in alignment with the moving needle 22, is a continuous conductive strip 23 extending the width of web 19. Preferably, although not necessarily, the web 19 bears against the surface of electrode 23 which is mounted in a suitable insulating support 24 as shown whereby it is insulated from the metal parts of the machine to prevent undesirable sparking. Electrode 23 is provided with a conductor 25 which may be connected to ground or other suitable steady base potential. One of the rollers 26 is driven from the motor 20 through a suitable speed reduction gearing such as the worm and wormwheel as shown. A suitable brush 27 makes contact with the band 21 and is connected to the conductor 28 which is connected to the output of high voltage corona generator 18. Thus the high voltage signals impressed on needle 22 cause a minute corona discharge of corresponding intensity to be produced at the point thereof which discharge acts on the successive elemental areas of web 19 in the manner described in my prior Patent No. 1,702,595. In order to advance the web 19 in the direction of the full-line arrow, there is a motor 29 connected through suitable gears to the drum or platen 30 which supports the web 19. It will be understood that suitable spring-pressed friction rollers maintain the web 19 in frictional engagement with platen 30. For a detailed description of another web-feeding arrangement, reference may be had to said Patent No. 1,719,392.

From the foregoing description, it will be seen that the subject matter will be reproduced line for line, consequently if the successive lines of the original subject matter are single spaced, as represented by the spacing *a*—*b* of Fig. $1^A$, then they would ordinarily be reproduced with a similar single spacing. However, if it is desired to reproduce the lines with double spacing or any other multiple spacing as represented by *a*—*b* of Fig. $1^B$, a portion of the incoming currents, after passing through low-pass filter 31 are amplified in amplifier 32 and then impressed upon a "space discriminator" 33. As will be described below,

the device 33 is of such a character that when no letters or similar subject matter are being transmitted for a certain length of time, a special spacing impulse is derived locally at the receiver, whereby the web 19 is advanced automatically a double or multiple space as desired. For this purpose, the platen shaft 34 is coupled to an auxiliary motor 35 through a clutch 36, and motor 35 is energized from the local supply source 37 to advance the recording web the required distance. Preferably, in order to control the auxiliary spacing operation more accurately, the "space discriminator" means has associated therewith a timing arrangement to time the duration of the spacing operation. This special timing arrangement is indicated schematically by the block 38.

Referring to Fig. 2, there is shown in schematic form, a space control arrangement corresponding in general to the portions 31 to 38 of Fig. 1. The received facsimile signals in the form of a modulated audio frequency carrier current are received from line L, and after amplification in device 17, are passed through the low-pass filter 31 and thence to the amplifier 32. The low-pass filter distinguishes the low frequency facsimile signals from the steady state carrier so that the amplifier 32 is excited substantially only by the said low frequency facsimile signals. Consequently, as long as the transmitter is scanning a line of subject matter having shade variations in successive elemental areas, the output of amplifier 32 consists of a rapid succession of relatively low frequency signals representing the original scanned areas. The output of amplifier 32 is transferred by transformer 39 to a rectifier circuit including rectifier 40, condenser 41, resistor 42 and resistor 43. Resistor 43 serves to retard the charging of condenser 41 so that said condenser is not charged to the desired control level by one, or a few single or miscellaneous impulses. However, when an elemental line of subject matter such as that shown in Fig. 1A is being scanned, the tube 40 will be subjected to a relatively great number of successive impulses representing the shade values of the successive elemental areas of the scanned line. Under this condition, condenser 41 receives a charge of the desired level and thereby maintains a suitable bias on the control-grid 44 of a space discharge tube 45, whereby anode-cathode current is prevented from flowing. Consequently, so long as a variable shade subject matter is being transmitted, insufficient current exists to energize relay winding 46, with the result that the timer 38 is ineffective and the web 19 (Fig. 1) is advanced during each scanned line the normal distance corresponding to the width of a scanning line under control of motor 29.

However, when the space *a*—*b* (Fig. 1A) between successive lines of subject matter is being scanned, the incoming currents from line L will be substantially a uniform amplitude audio frequency current with the result that no impulses will be produced in the rectifier circuit and the charge on condenser 41 will leak off, thus removing the blocking bias from control grid 44 and allowing the plate current of tube 45 to close the contacts 47 of relay 46. If desired, the closing of contacts 47 may complete a power circuit directly to the auxiliary motor 35 which is coupled through clutch 36 to the shaft 34. Motor 35 is so geared to shaft 34 that when it is operated, it feeds the web 19 a distance which is a multiple of the distance *a*—*b* (Fig. 1A), and preferably in the same time that is required for scanner 2 to scan the space *a*—*b* at the transmitter. Instead of using a motor to effect the multiple or rapid spacing of the web 19, the relay contacts 47 may control a suitable ratchet and pawl combination coupled to shaft 34.

Preferably however, where the spacing is effected by auxiliary 35 motor, there is provided a timing relay circuit 38. The shaft of motor 35 in addition to being coupled to shaft 34 through the clutch 36, is also provided with a worm 50 which drives a wormwheel 51 to which is fastened the circular metal disc or drum 52. Member 52 has an insulator segment 53 set in its periphery, and cooperating with said periphery is a shiftable brush 54 mounted in a brush-holder 55 which is controlled by the pivoted armature 56 associated with an operating magnet 57. Normally, magnet 57 is deenergized so that the retractile spring 58 maintains brush 54 in engagement with the insulator segment 53. Associated with disc 52 is another wiper brush 59, whereby the circuit from power source 37 can be completed through motor 35. The completion of this circuit is controlled by relay 46 which in turn responds to the scanning of a continuous space at the transmitter, for example that corresponding to the space *a*—*b* (Fig. 1A). While contacts 47 are open, condenser 60 charges through resistance 61. The power for operating the armature 56 is supplied primarily by the charge on condenser 60. In other words, the armature 56 is operated by the magnet 57 only when facsimile signals are not transmitted for a predetermined length of time, corresponding for example to the time required to scan one revolution of the drum 1. As soon as most of the power is absorbed from condenser 60, magnet 57 is deenergized sufficiently to allow the spring 58 to retract the armature 56 and brush 54. The resistor 61 is proportioned so as to limit the current from battery 62 tending to flow through winding 57, thus providing an appreciable time interval after the closure of the D. C. circuit through winding 57 before the condenser 60 attains the desired operating potential.

Brush 54 is arranged with respect to segment 53 so that when armature 56 is retracted by spring 58, it is normally insulated from disc 52. However, when magnet 57 operates, brush 54 is moved sufficiently to cause it to engage the conducting periphery of disc 52, thus completing the circuit to motor 35. After disc 52 has made a complete revolution, it will then come to rest because the segment 53 will engage brush 54 and break the motor circuit. The rotational speed of disc 52 is proportioned to the capacity of condenser 60 so that by the time the disc has made a complete revolution, the condenser is almost entirely discharged and armature 56 is retracted, consequently the disc 52 remains in its normal position as shown, even though relay 46 is still in its operated condition. The motor 35 therefore remains stationary until the next line of printed or other subject is scanned. As soon as the next succeeding line of subject matter is so scanned, relay contacts 47 are opened thus restoring the timing circuit to a condition to be reset when the next space between lines is scanned. When such next space is scanned, relay contacts 47 again close and the timer 38 goes through the same cycle of operation as above.

While in the foregoing description of Fig. 2, the multiple spacing is controlled by the existence of a space between the successive lines, it will be understood that a similar result can be obtained by employing a substantally uniform

shade between the lines. In other words, the spacing control unit of Fig. 2 discriminates between substantially continuous signal impulses corresponding to a uniform shade across the web as distinguished from irregular impulses corresponding to subject matter being scanned. Instead of relying upon this method of discrimination, the space indicator unit **33** may be designed so as to distinguish between a continuous positive signal and a continuous negative signal or between a continuous strong signal and a continuous weak signal. In order to effect this result, the space between successive lines may be divided transversely into two sections, one of which consists of a continuous black strip and the other of a continuous white strip. One practical way of achieving this result is shown in Fig. 4A, wherein the original subject matter is provided with black underlinings **63**. Consequently the space between successive lines of printing may be considered as divided into two continuous shade areas, one of which is black or nearly black as represented by the underlining **63**, and the other of which is white or nearly white as represented by the space between the line **63** and the beginning of the next line of printing. The underlining **63** may be effected automatically at the same time that the subject matter is being printed or typewritten. Thus in the case of typewritten subject matter, the individual character and space slugs on the typewriter printing bars may have set into them beneath the characters, individual underscoring marks so that as each character is typewritten, a simultaneous underscoring is applied resulting in a continuous underscoring across the sheet. It will be understood of course, that the subject matter may be typewritten or printed in the conventional way and the underscoring may be applied in a separate operation by an underscoring key or the like.

The original subject matter of Fig. 4A is scanned by the transmitter of Fig. 1 and the printed subject matter is reproduced at the receiver of Fig. 1 in the form illustrated in Fig. 4B. However, in order to utilize the underscoring **63** to control the spacing discriminator, the latter may be of the type shown in Fig. 3. The signals representing the printed subject matter are received from the line L and passed through the amplifier **17** and the high or corona voltage generator **18** to control the recording mechanism **64** similar to that already described in connection with Fig. 1. When the continuous black line **63** is scanned, a corresponding continuous strong signal is applied to the grid **65** of amplifier tube **66** resulting in the building-up of a corresponding charge on storing condenser **67** which is connected in circuit with the rectifier tube **68**. The polarity of this charge as applied to the control grid **69** of tube **70** is such as to cause sufficient plate current to flow through said tube **70** to operate the contacts **47** of the relay **46**. Normally the control grid **69** is biased close to plate current cut-off by means of the bias battery **71** so that as long as printed subject matter or the like is being scanned, relay contacts **47** remain open. However, as a result of the scanning of line **63** as above described, the negative bias on grid **69** is overcome by the positive charge built-up condenser **67**, causing contacts **47** to close. Contacts **47** may control a timing arrangement similar to the arrangement **38** of Figs. 1 and 2. In the embodiment of Fig. 3, since the discrimination is effected mainly by signal level, no low-pass filter corresponding to the filter **31** of Figs. 1 and 2 is required. It will be understood of course that the constants of the rectifier and condenser charging circuits are so chosen that when printed or similar subject matter is being scanned, there is insufficient positive charge built-up on condenser **67** to overcome the cut-off bias on grid **69**.

It will be understood of course that in the foregoing arrangement particularly where the subject matter being transmitted is single space copy that it is necessary to mount the sheet or other subject matter on drum **1** at the transmitter so that the individual lines and spaces surround the drum so that the boundaries of the line spaces are located in planes perpendicular to the drum's rotational axis. In other words so that the beginning and end of each line are in circumferential alignment around the drum **1**.

Various changes and modifications may be made in the several embodiments without departing from the spirit and scope of the invention. Thus, while the original subject matter of Fig. 4A is provided with a continuous underlining **63**, this underlining may consist of a series of spaced dashes or dots which are of regular spacing so as to control the production of the necessary positive grid bias applied to grid **69** by condenser **67** (Fig. 3).

Furthermore, while Fig. 1 shows a scanning system at the transmitter wherein the subject matter is wrapped around the scanning drum **1**, it will be understood that an endless belt scanner may be employed as disclosed in said Patent No. 1,719,392. Furthermore, while the "space discriminator" **33** is shown only at the receiver, a similar arrangement may be used at the transmitter to control an auxiliary line feed motor and clutch arrangement (not shown) similar to motor **35** and clutch **36** (Fig. 1).

Likewise, while the signals have been described as transmitted by means of an audio frequency carrier, they may also be transmitted as modulations of a radio frequency carrier or if desired they may be transmitted directly without a carrier.

Referring to Fig. 5, there is shown a modification of the invention wherein the "space discriminator" arrangement is located at the transmitter, in order to reduce the cost of the receiving equipment. This is of importance where a central transmitter is employed feeding a plurality of separate receivers. In Fig. 5, the parts which correspond to those of Figs. 1 and 2, bear the same designation numerals. The facsimile transmitting scanning mechanism similar to that of Fig. 1, is designated generally by numeral **100**, and while only the light-sensitive cell **4** and the drum-driving motor **5** and carrier generator **15** are shown, it will be understood that it includes other parts corresponding to those designated **1** to **15** in Fig. 1. The low frequency facsimile signals from cell **4** are impressed upon the amplifier-modulator **16** as above described. A portion of the output of amplifier **16** is fed through a low-pass filter **31** and an amplifier **32** to a "space discriminator" **33** similar to that of Figs. 1 and 2. Only the contacts **47** of the relay **46** are shown. Contacts **47** are normally open so long as variable shade subject matter such as printed matter is being scanned. However, when a line space has been scanned, relay contacts **47** close as described above under control of elements **40** to **45** inclusive. These contacts connect a source **101** of low frequency alternating current to the modu-

lator 16. Thus, when a line space is being scanned, the current on line L will consist of an 1800 C. P. S. signal modulated by the low frequency signal e. g., 300 C. P. S. from source 101. The 300 cycle signal is received and amplified in the device 17 associated with the receiver and is passed through a low-pass filter 102 to operate contacts 104 of the tuned relay 103. Contacts 104 complete the circuit from the power source 37 to the auxiliary motor 35 which is coupled through a clutch 36 to the shaft 34 of the platen feed motor 29. The facsimile signals are also received and amplified in device 17 and are applied to the high or corona voltage generator 18 associated with the reproducing scanning equipment 105 similar to that of Fig. 1. The motor 20 for operating the recording needle is also shown in Fig. 5. With the arrangement of Fig. 5, the recording web is advanced in synchronism with the transmitter, but when a line space is being scanned at the transmitter, the motor 35 takes control to feed the web a multiple spacing distance as above described.

Instead of employing a low frequency alternating current to control the motor 37 (Fig. 5), a direct current may be employed for the purpose. Such an arrangement is shown in Fig. 6 wherein the parts corresponding to those of Fig. 5 are designated by the same numerals. The relay contacts 47 in this embodiment instead of applying a low frequency control signal to the modulator 16, serve as a reversing switch for applying oppositely polarized currents to the line L. Thus when printed subject matter is being scanned, relay contacts 47 connect the positive battery 106 to the line, but when contacts are operated as a result of a line space being scanned, the negative battery 107 is connected to the line. This negative battery operates the polarized relay 108 at the receiver which thereupon closes the circuit for the spacing motor 35.

What I claim is:

1. In a system for transmitting visible representations to a distance, a transmitting scanner for scanning subject matter arranged in transverse bands with successive bands spaced a certain distance from each other to transmit electric signals representing said bands, means controlled by said signals to reproduce said bands, and means controlled by the absence for a predetermined time of signals representing said bands for spacing the reproduced bands a distance which is greater than said first-mentioned distance.

2. In a system for transmitting visible representations to a distance, a transmitting scanner for scanning subject matter arranged in transverse bands with successive bands spaced a certain distance from each other to produce facsimile signals representing shade variations of successive elemental areas in said bands, means controlled by said signals to reproduce said bands, and means to vary the spacing of the reproduced bands with respect to the spacing of the original bands, the last-mentioned means including a control device which responds selectively to the absence for a predetermined length of time of signals representing subject matter in said bands.

3. In a telefacsimile system, means to scan a subject to produce facsimile signals representing spaced lines of variable-shade subject matter each line representing a relatively great number of shade transitions over its length, said means also producing other signals representing spaces between said lines, said spaces having relatively few shade transitions over their length, means controlled by the first-mentioned signals to reproduce said lines with spaces therebetween, and means to vary the width of said reproduced spaces, the last-mentioned means being selectively responsive to said other signals.

4. In a telefacsimile system, facsimile transmitter means to scan a subject having spaced lines of subject matter to produce corresponding facsimile currents, said transmitter including a line feed arrangement which is operable at a substantially uniform rate when the lines and spaces are being scanned, and facsimile receiver means controlled by said currents to reproduce said lines but with a different line spacing from the original subject, the last-mentioned means including reproducing scanner means and line feed means and a device local to the receiver and selectively responsive to the scanning of the spaces at the transmitter for varying the operation of said line feed means at the receiver with respect to the line feed means at the transmitter.

5. In a system for transmitting visible representations to a distance, means for scanning a subject having spaced transverse lines to produce facsimile signal currents, wherein the scanned lines are represented by current modulations and the scanned spaces are represented by the absence of current modulations, telefacsimile recording means controlled by said current modulations to reproduce said lines and spaces, and means selectively responsive to the scanning of said spaces for varying the spacing of the reproduced lines with respect to the original line spacing.

6. In a telefacsimile system, means to scan a subject comprising transverse bands of variable shade areas, and an intervening band of substantially uniform shade areas to produce corresponding facsimile current signals, facsimile recording means to reproduce said subject under control of said signals, the last-mentioned means including a recording web, means to feed said web normally a distance corresponding to the width of an elemental scanning line, a space discriminator control arrangement for controlling the feeding of said web a distance different from said normal distance and means responsive to the scanning of said intervening band for producing therefrom a substantially steady state signal of sufficient predetermined minimum duration to control said space discriminator arrangement moving said web a distance which is greater than the width of said intervening band.

7. In a telefacsimile system, means to scan a subject having a transverse band of variable shade areas and a band of substantially uniform shade areas to produce corresponding facsimile current signals, the widths of said bands having a fixed ratio, facsimile reproducing means controlled by said signals to reproduce said bands with the ratio of widths of the variable shade bands and the uniform shade bands different from the first-mentioned ratio, the last-mentioned means including a device selectively responsive to a substantially steady state spacing-control signal produced by the scanning of said uniform shade band.

8. The method of telefacsimile transmission of subject matter with transverse bands of close spacing between bands, which includes the steps of scanning the transverse bands, scanning the space between bands, electrically reproducing the bands in successive linear elements transversely

of a recording medium, automatically increasing the space between the recorded bands as compared with the space between the bands of the original and under control of a substantially steady state signal condition produced by the scanning of said spacing in the original subject matter.

9. The method of reproducing a printed or similar subject matter by point-by-point scanning and with different line spacing in the reproduction as compared with the line spacing in the original, which includes the steps of scanning the lines and spaces at a transmitter, and locally at the receiver detecting the reception of a substantially steady state signal condition produced by the scanning of an interline space of said subject matter, reproducing the lines by point-by-point scanning and varying the spacing between the reproduced lines under control of said detected steady state condition.

10. The method of reproducing a "single space" printed or similar subject matter by telefacsimile with different line spacing from the original, which includes the steps of scanning the lines and spaces to produce corresponding signal currents, and automatically controlling the width of the line spacing at the receiver substantially independently of the line spacing at the transmitter by transmitting a substantially steady state signal produced by the scanning of the said interline space.

11. In a telefacsimile system, means to set up in a receiver variable-condition signals corresponding to variable shade areas of an original subject matter to be reproduced and other substantially steady condition signals representing spacing between portions of said subject matter, and means to translate both said signal conditions into a reproduction of said original subject matter, the last-mentioned means including an arrangement which is selectively responsive to said steady condition signals to vary the size of the reproduced spacing with respect to the spacing in said original subject matter.

12. A telefacsimile system according to claim 11 in which the said translating means includes a recording web having means to feed the web at a uniform line scanning rate so long as said variable condition signals are being set up, and other means to feed said web at a different rate when said uniform condition signals are being set up.

13. A telefacsimile system comprising a telefacsimile transmitter, a telefacsimile receiver having means to reproduce printed or similar subject matter with different line spacing as compared with the original, the last-mentioned means including a space discriminator comprising a signal storing arrangement, a line feed arrangement, and circuit arrangements for operating said line feed only when the said storing arrangement receives a substantially continuous signal for a predetermined duration.

14. A telefacsimile system according to claim 13 in which the signal storing arrangement comprises a condenser and rectifier operated under control of said signal.

15. A telefacsimile system according to claim 13 in which the said storing arrangement controls a grid-controlled discharge tube having its control grid normally biassed to plate current cut-off under control of said storing arrangement.

16. A telefacsimile system comprising a telefacsimile transmitter, a telefacsimile receiver having line feed means operable at two different rates, and means responsive to the scanning of a spacing between lines of printed or similar subject matter at the transmitter for selectively operating said feed means at a different rate from its normal line feed scanning rate, the last-mentioned means including space discriminator means to detect signal conditions corresponding to the scanning of said spaces at the transmitter and a grid-controlled discharge tube which is biased to plate current cut-off when printed or similar subject matter is being scanned but which passes plate current under control of said space discriminator means.

17. A system according to claim 16 in which said detecting means includes a condenser for controlling the bias on said grid, and a resistance in circuit with said condenser for preventing said bias being reduced to a predetermined level except when a substantially continuous line spacing has been scanned at the transmitter.

18. A system according to claim 16 in which said detecting means includes a rectifier energized by the signals from the transmitter and a condenser which is connected to said rectifier to maintain said grid bias when printed or similar subject matter is being scanned.

19. A telefacsimile system comprising a telefacsimile transmitter, a telefacsimile receiver controlled by said transmitter and having means to produce different line spacing as compared with the line spacing of the original subject matter at the transmitter, the last-mentioned means including normal scanning-line feed mechanism and auxiliary inter-line space feed mechanism, a space discriminator for detecting a signal condition corresponding to an interline space, means controlled by said discriminator for controlling said auxiliary feed mechanism, and a timer device for rendering said auxiliary feed mechanism ineffective until said signal condition persists for a predetermined minimum time interval.

20. A system according to claim 19 in which the said discriminator is selectively responsive to the scanning of an inter-line space of the original subject matter as compared with the scanning of the subject matter proper, and said timer includes a device which is set into operation only when said signal condition persists for said predetermined minimum time interval.

21. A line feed arrangement controlled by received facsimile signal currents for controlling the automatic line feed mechanism of a telefacsimile receiving machine, comprising a motor for operating said mechanism, a power circuit for said motor, a rotatable timing member driven by said motor, and means selectively responsive only to the receipt of line feed signals beyond a predetermined minimum time interval to close the circuit of said motor under control of the timing member.

22. A timer according to claim 21 in which the rotatable timing member is in the form of a commutator, and said selective means includes a shiftable brush which is arranged to be operated to close the motor circuit through said commutator after said predetermined time.

23. A timer according to claim 21 in which said selectively responsive means includes a relay having its winding connected in circuit with a condenser, and a selectively operable switch is provided for discharging the condenser through said winding upon receipt of spacing signals.

24. A space control arrangement for tele-

facsimile receiving machines, comprising a grid-controlled tube, a condenser connected to the grid of said tube to bias it to plate current cut-off so long as printed or similar subject matter is being scanned at the transmitter, a switch operated by said plate current, a line feed mechanism for effecting spacing at the receiver, means to operate said mechanism at a normal rate corresponding to the width of successive elemental scanning lines and for operating said mechanism at a different rate of speed corresponding to inter-line spacings of subject matter, a timing control for determining the operation of said mechanism for inter-line spacing, a switch for controlling said timing control, a normally charged condenser, and a discharge circuit for said condenser including contacts of the first-mentioned switch and the winding of the second-mentioned switch, said switch being energized under the control of the discharge of said condenser.

25. A space control arrangement according to claim 24 in which the charging circuit of the second-mentioned condenser includes a resistance having a value which is correlated to the discharge time of the first-mentioned condenser whereby said line feed mechanism is rendered effective only when a line spacing has been scanned at the transmitter.

26. The method of reproducing "single space" printed or similar subject matter by telefacsimile with different line spacing from the original, which includes the steps of providing the space between the lines of the original with two sharply contrasted transverse bands, scanning said bands to produce corresponding spacing control signals of contrasting characteristics and of substantially steady state character, and selectively controlling the on and off condition of a line feed mechanism at the receiver under control of said signals.

27. The method of reproducing "single space" or similar subject matter by telefacsimile with different line spacing from the original, which includes the steps of providing the space between the lines of the original with two sharply contrasted transverse bands, scanning said bands to produce corresponding spacing control signals of contrasting characteristics and of substantially steady state character, applying said signals to control the charge and discharge of a condenser, and thereby to control the on and off condition of a line feed mechanism.

28. A telefacsimile system comprising a telefacsimile transmitter having output terminals and means to scan printed or similar subject matter to produce facsimile signals and impress them on said terminals, a space discriminator local to the transmitter which responds selectively to the scanning of spaces between lines of subject matter, said discriminator including a device which is maintained in one condition so long as said subject matter is being scanned and in another condition when a space between lines of subject matter is being scanned, a source of spacing control signal having a characteristic which is different from that corresponding to the scanning of said subject matter, means controlled by said discriminator to connect said source into circuit whereby said line-feed signal is impressed on said terminals, a telefacsimile receiver having line feed mechanism including means to advance a recording medium at one rate as long as said subject matter is being reproduced and at a different rate when line spacing is to be effected, the last-mentioned means being selectively responsive to said line feed control signal.

AUSTIN G. COOLEY.