Sept. 23, 1958 R. HELL 2,853,551

PAGE PRINTER FACSIMILE RECEIVER

Filed Aug. 8, 1956 2 Sheets-Sheet 1

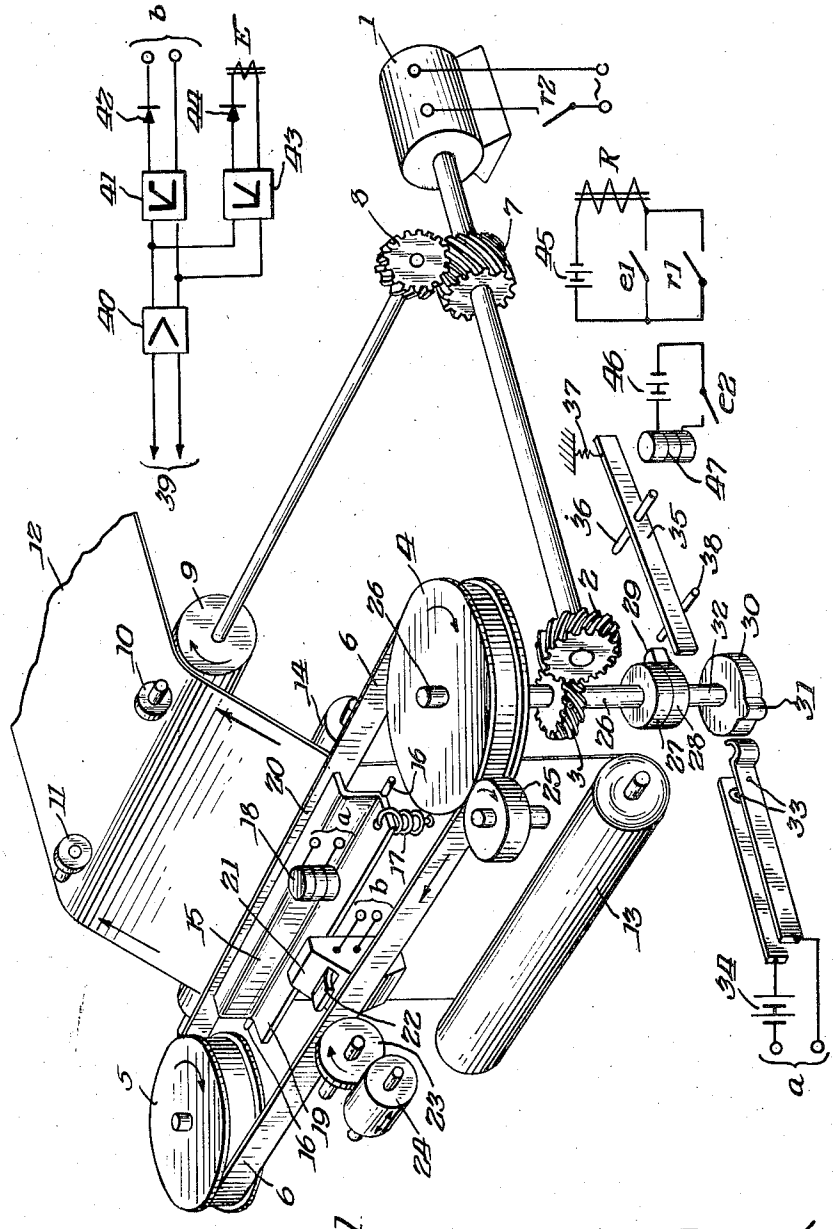


Fig. 1

Inventor.
Rudolf Hell.
By
Attys.

Sept. 23, 1958 R. HELL 2,853,551

PAGE PRINTER FACSIMILE RECEIVER

Filed Aug. 8, 1956 2 Sheets-Sheet 2

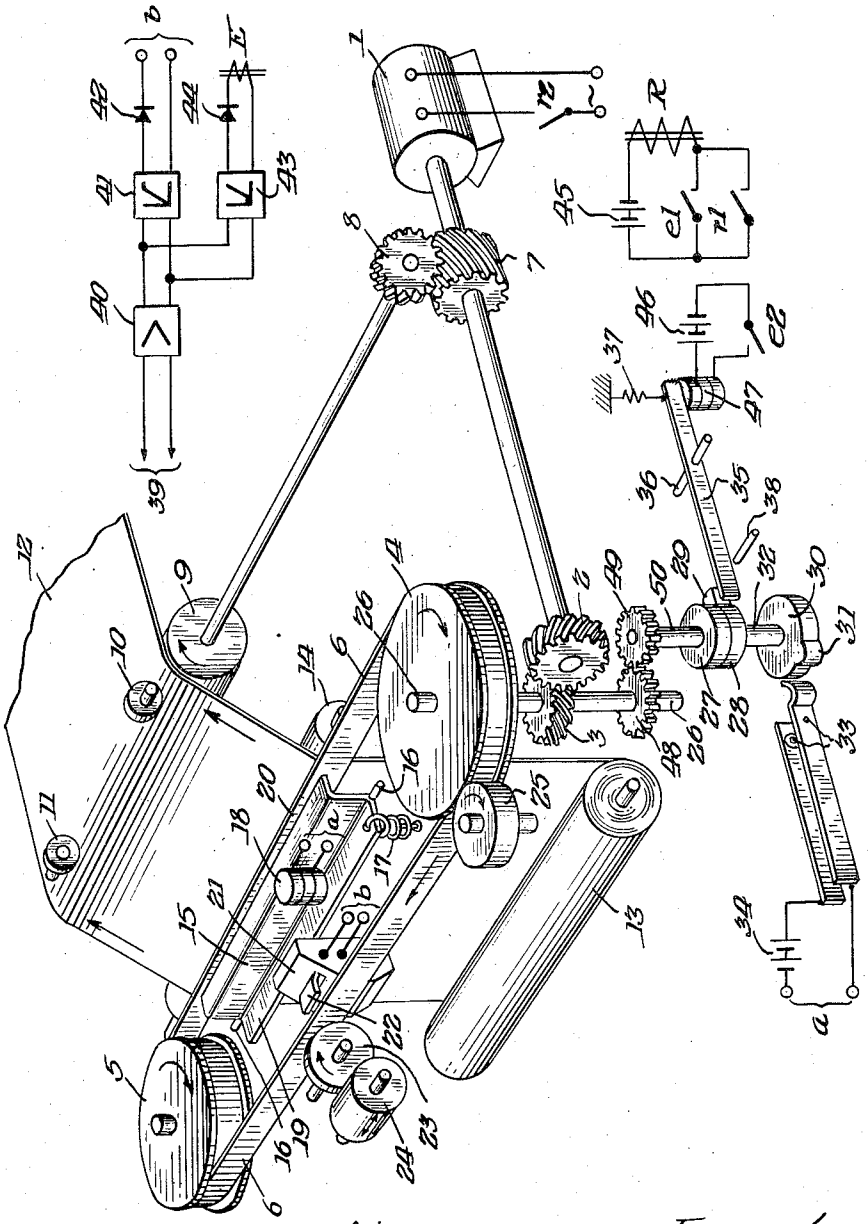


Fig. 2.

Inventor.
Rudolf Hell.
By
Atty

United States Patent Office 2,853,551
Patented Sept. 23, 1958

2,853,551

PAGE PRINTER FACSIMILE RECEIVER

Rudolf Hell, Kiel, Germany, assignor to Dr.-Ing. Rudolf Hell K. G., Kiel-Dietrichsdorf, Germany, a German company

Application August 8, 1956, Serial No. 602,890

Claims priority, application Germany July 28, 1955

15 Claims. (Cl. 178—11)

This invention is concerned with a page printer facsimile receiver and a method of operating it.

The receiver may be of the kind which employs for the recording of received signals a rotatable drum carrying a single or multiple turn printing spiral. Slightly spaced from the drum is a knife-edge printing member extending perpendicular to the printing spiral so as to print upon a recording paper, disposed between the drum and the printing member, small symbol elements. The recording paper is a sheet which extends from a supply reel and which is stepwise or continuously advanced in a direction perpendicular to the axis of the drum. The spiral carried upon the drum is continuously inked by an ink roller; carbon paper disposed between the spiral and the recording paper or between the printing member and the paper may be used in place of the inking roller. The printing member, responsive to symbol impulses received, is actuated relative to the recording paper by electromagnetic or electrodynamic drive means, to press it against the paper and the latter against the printing spiral, thereby effecting printing of symbol elements upon the recording paper which appear thereon in lines of predetermined length.

Instead of using ordinary recording paper, paper impregnated with an electrolyte, so-called electrochemical paper may be used to produce thereon symbol element imprints responsive to passage of current between a point of the printing spiral and the knife-edge printing member. Special graphitized or metallized paper may also be employed to produce visible imprints thereon responsive to arcing between the printing spiral and the knife-edge printing member.

Other embodiments employ a pointed electrode in place of a printing drum, which is moved line-by-line crosswise in front of the sheetlike recording paper, to produce upon the paper visible recordings responsive to current flow or arcing between the electrode and the drum which is disposed in back of the paper.

The drawback of prior facsimile page printers requiring the use of electrochemically prepared or metallized or graphitized paper is, that the use of ordinary unprepared paper is excluded; and the drawback of prior page printers employing a printing spiral and movable printing members is, that they do not permit an increase of the recording speed due to inertia factors. However, users of facsimile page printers, especially for recording weather reports, increasingly demand apparatus in which ordinary paper can be used, noting that the use of expensive, particularly prepared special paper is annoying in view of the smoke and bad odor developed during operation and also in view of the necessity for moistening electro-chemical paper prior to operation and drying thereof after concluding the recording.

The drawback in connection with facsimile page printers adapted for using ordinary paper, being equipped with a printing spiral which is continuously inked, and having movable printing members for respectively selecting turns of the printing spiral is, that the electro-magnetically

controlled printing members are activated with the picture point frequency and, as a consequence, that the printing members due to their relatively great inertia, can be operated only in accordance with a relatively low frequency. The endeavors are, however, to increase the picture point frequency to about 1000 to 1500 cycles; page printers of the indicated type are unsuitable for the corresponding printing speeds.

The present invention proposes a new system for facsimile receivers, wherein received signals, resulting from scanning of symbol lines in the transmitter, are recorded successively in color upon an endless tape, by means of a printing system, and stored thereon at least for the length of a line, the tape being moved about two reels and serving as an intermediate record carrier. The individual stored lines are thereupon successively printed upon a paper sheet, phasally mutually correct, by means of a periodically momentarily effective printer mechanism which is actuated relative to the paper sheet in a direction perpendicular to the direction of advance motion thereof.

In a page printer according to the invention, provided with an intermediate record carrier, the printer mechanism is actuated in accordance with the line frequency which corresponds to a small fraction of the picture point frequency. There is provided a small printing roller for effecting the recording upon the intermediate record carrier, such roller operating with such a slight inertia that it can easily follow higher picture point frequencies of approximately 1000 to 2000 cycles.

The various objects and features of the invention will appear from the description which will be rendered below with reference to the accompanying drawings, in which

Fig. 1 shows a page printer receiver according to the invention which is synchronized with the transmitter only once, prior to effecting the transmission; and

Fig. 2 illustrates a similar page printer receiver which is synchronized in accordance with the start-stop principle, by a transmitter which transmits periodic line synchronizing signals respectively ahead of or at the end of each line.

In Fig. 1, a motor 1 drives over a worm 2 and worm wheel 3 a reel 4 to move an endless band or tape 6 which is also supported by reel 5 uniformly in the direction of the arrow shown on the frontal flight of the tape. The motor 1 rotates at the same time a worm 7 to rotate a worm wheel 8 for the purpose of driving the paper advance drum 9, thereby uniformly moving the record-receiving paper 12, taken from a supply 13, in the direction indicated by arrows. Numerals 10 and 11 indicate idler pressure rollers for the paper 12. The paper 12 is advanced between the tape 6 and a pressure roller 14 which is closely adjacent thereto. The gear ratios between the worm 2 and worm wheel 3 and between the worm 7 and the worm wheel 8 are such, that the record-receiving paper 12 moves during the interval required for the motion of the tape 6 for the length of a printing line, by an amount corresponding to the spacing between two transmitter scanning lines. Numeral 15 indicates a cross-sectionally S-shaped bar which is rotatably journalled about an axis 16. The printing bar 15 is held in normal position, in which it is not pressed against the tape 6, by means of a spring 17. The length of the printing bar corresponds to that of a printed line. Numeral 18 indicates a printer magnet for attracting, upon energization thereof, the lower leg 19 of the printing bar 15, thereby rotating the bar clockwise about the axis 16 and pressing the knife-edge 20 thereof against the tape 6 and the latter against the recording sheet 12 which is in engagement with the pressure roller 14.

Numeral 21 indicates an electromagnetic printing system which is controlled by the transmitter. This system is provided with a member 22 having a knife-edge. Upon energization of the system responsive to a signal impulse received from the transmitter, the knife-edge 22 will press the tape 6 against the knife-edge of a slowly rotating inking wheel 23. The inking of the wheel 23 is accomplished by a slowly rotating and periodically axially moving inking roller 24. Numeral 25 indicates a slowly rotating felt roller which rotates in a direction opposite to the direction of rotation of the reel 4. The felt roller 25 cancels the symbol elements impressed upon the tape 6 after a line thereof has been printed on the record-receiving paper 12. The tape 6 is made of rubber cloth or a foil of synthetic material adapted to accept color imprints and transfer them to the record-receiving sheet 12. The shaft 26 for the reel 4 and the worm wheel 3 carries one part 27 of a slip clutch, the other clutch part 28 carrying a cam 29 being carried by a shaft 32 to which is fastened a cam disk 30 having a rise 31. The cam 31 upon rotating effects periodic closure of contacts 33 for momentarily energizing the printer magnet 18 by current from a battery 34. Numeral 35 indicates a detent lever which is biased counterclockwise by a spring 37 with its left hand end in engagement with a stop 38, thereby limiting the stroke of the corresponding end of the lever.

Numeral 39 indicates a transmission line to which is connected a receiver amplifier 40, followed by an amplitude filter 41 acting as a maximum value limiter to keep from the printing system 21 the phase signal and the synchronizing signals, respectively. The incoming symbol signals are rectified in the rectifier 42 and reach the printing system 21. An amplitude filter 43 is provided in parallel with the maximum value limiter 41, acting as a minimum value limiter, and connected to the output of the amplifier 40. The limiter 43 keeps symbol signals of smaller amplitude from a receiver relay E which is connected thereto by way of a rectifier 44. The relay for starting the operation of the receiver is shown at R.

Responsive to release of a start signal by the transmitter, relay E will energize and contacts e_1 will be closed to close a circuit for relay R from a battery 45, relay R closing a holding circuit for itself at contact r_1. At r_2, relay R closes a circuit for the motor 1. At contact e_2, relay E connects current from a battery 46 to energize the holding magnet 47 which attracts the right hand end of the detent lever 35, thereby rotating such lever clockwise to position its left hand end in front of the cam 29 of the lower part 28 of the slip clutch 27—28, thus holding the lower part 28 of the slip clutch and therewith the cam disk 30 in a definite start position.

This start or initial position is such as to cause energization of the printing magnet always at the instant when the beginning of a line of symbol elements imprinted and stored upon the tape 6 has reached the right hand end of the printing bar 15. The transmitter and the receiver motors must with this single phase-correction at the beginning of transmission operate in synchronism for the duration of signal transmission so as to assure that the start and the end of all lines are exactly in alignment.

Upon conclusion of the start signal from the transmitter, the detent magnet 47 will be deenergized, releasing the lever 35 to permit instant rotation of the cam disk 30. The recording starts now and the printer mechanism 15—18 is controlled in phase.

It is not necessary that the tape speed of the page printer corresponds to the scanning speed of the transmitter; the first may indeed be higher or lower than the second. If the advance speed of the recording sheet is in the same ratio increased or decreased relative to the advance speed of the transmitter scanning device, magnified or reduced documents can be received with the

page printer. This is of significance, for example, in the case of facsimile transmitters for large weather charts which have to be received on a smaller scale with small telegram size page printers. It is for this purpose necessary, outside of the correct phase position of the received image lines, that the ratios between tape and scanning speed on the one hand and between the advance speeds on the other hand, are constant and one corresponding to the other, so as to obtain a document in the receiver which corresponds geometrically to the transmitted document.

It will be seen from the foregoing explanations that a phase correction takes place in the arrangement according to Fig. 1, controlled by the receiver, only once upon beginning of the transmission. In the arrangement according to Fig. 2, there is a periodically recurring phase correction respectively ahead of or at the conclusion of each image element line, the facsimile transmitter being assumed to transmit periodic line synchronizing signals.

The advantage of line synchronization is, that complete synchronism between the transmitter and receiver motors is not necessary; it is sufficient if synchronism exists for the relatively short interval of scanning and recording a single line. The R. P. M. of the two drive motors may mutually differ to some extent during the transmission of the document to be recorded and synchronizing means for the drive motors can therefore be dispensed with.

An example of line synchronization is shown in Fig. 2, the details of which correspond largely to those shown in Fig. 1. Corresponding parts are similarly referenced.

The difference as compared with Fig. 1 resides in deriving rotation of a shaft 50 from the rotation of shaft 26 by means of different gear wheels 48 and 49. The shaft 50 drives over the slip clutch 27—28 the shaft 32 carrying the cam disk 30. Depending on fluctuations in the R. P. M. of the drive motor 1, the shaft 50 will be rotated somewhat faster than the shaft 26. In accordance with the start-stop principle, the periodic line synchronizing impulses from the transmitter will correct the phase correct position of the cam disk 30 periodically, respectively ahead of and at the conclusion of each line. The cam disk 30 accordingly does not rotate with constant R. P. M. but intermittently. The detent magnet 47 is momentarily energized responsive to each incoming synchronizing impulse, whereupon the detent lever 35 frees the cam disk for one revolution. Upon conclusion of one revolution, the cam disk 30 is held by the releasing detent lever 35 until the next synchronizing signal arrives. The operation is thereupon repeated.

Changes may be made within the scope and spirit of the appended claims.

I claim:

1. A page printer facsimile receiver comprising an endless tape operating as an intermediate record carrier, a record-receiving sheet, means for moving said intermediate record carrier, means for moving said record-receiving sheet in a direction perpendicular to the direction of motion of said intermediate record carrier, operating means for continuously successively recording in color upon said intermediate record carrier symbol elements corresponding to incoming signals received from a transmitter and belonging to successive lines of symbols to be recorded upon said record-receiving sheet, a printing mechanism, control means for periodically actuating said printing mechanism for the purpose of simultaneously printing on said record-receiving sheet groups of symbol elements recorded upon said intermediate record carrier and belonging respectively to successive lines, and means for cancelling symbol elements recorded upon said intermediate record carrier after printing thereof line for line on said record-receiving sheet.

2. Apparatus according to claim 1, comprising means for periodically actuating said control means responsive to phase signals received from the transmitter.

3. Apparatus according to claim 1, comprising two rotatable reels for movably supporting said endless tape constituting said intermediate record carrier, an electromagnetic recording system disposed relative to one flight of said carrier constituting said operating means, a rotatable roller disposed relative to the identical flight of said carrier constituting said cancelling means, a printing bar forming part of said printing mechanism disposed relative to the other flight of said carrier, the length of said printing bar corresponding to the length of a line of symbol elements to be printed on said record-receiving sheet, and an electromagnet also forming part of said printing mechanism for periodically actuating said printing bar to move the corresponding flight of said carrier against said record-receiving sheet for the purpose of printing thereon symbol elements recorded on said carrier.

4. Apparatus according to claim 3, comprising gear means for rotating one of said reels to move said intermediate record carrier, gear means for moving said record-receiving sheet, and motor means for actuating said gear means, the gear ratios of said gear means being such as to cause said intermediate record carrier to move at a speed which exceeds the speed of movement of said record-receiving sheet by an amount corresponding for each line length to the spacing between lines to be recorded on said sheet.

5. Apparatus according to claim 4, comprising contact means for governing the operation of said electromagnet, a cam for governing the actuation of said contact means, gear means including a friction clutch for operating said cam, and a device for governing the actuation of said friction clutch comprising a holding magnet controlled by signals received from the transmitter, said holding magnet being responsive to receipt of a signal effective to release said cam for one revolution to effect actuation of said contact means.

6. Apparatus according to claim 5, comprising a receiver relay, circuit means for receiving signals from said transmitter, said circuit means comprising two branches each containing an amplitude filter and a rectifier, means for connecting one of said branches with said operating means, and means for connecting the other branch with said receiver relay.

7. Apparatus according to claim 1, comprising a tape made of rubber cloth constituting said intermediate record carrier.

8. Apparatus according to claim 1, comprising a tape constituting said intermediate record carrier, said tape being made of synthetic foil material adapted to accept pigment and to transfer it unto said record-receiving sheet.

9. Apparatus according to claim 1, comprising electromagnetic means for actuating said printing mechanism.

10. Apparatus according to claim 1, comprising a common drive mechanism for said record-recording sheet and for said intermediate record carrier, respectively, and means controlled by said drive mechanism for periodically actuating said printing mechanism .

11. Apparatus according to claim 1, comprising an electromagnet for actuating said printing mechanism, contact means for controlling the operation of said electromagnet, and rotatable cam means for controlling the actuation of said contact means.

12. Apparatus according to claim 1, comprising an electromagnet for actuating said printing mechanism, contact means for controlling the operation of said electromagnet, rotatable cam means for controlling the actuation of said contact means, a slip clutch for rotating said cam means, detent means for controlling said slip clutch, a magnet for controlling said detent means, and circuit means controlled from a transmitter for controlling said magnet for causing said slip clutch to rotate said cam means into phasally correct start position.

13. Apparatus according to claim 1, wherein said means for periodically actuating said printing mechanism comprises a control element, a slip clutch, detent means for said slip clutch including a detent magnet, said drive mechanism comprising a drive motor, circuit means governed from a transmitter for transmitting synchronizing signals, means controlled by said drive mechanism for rotating said control element through the medium of said slip clutch at a speed of revolution which exceeds the maximal fluctuation in the speed of revolution of said drive motor as compared with the sequence frequency of said synchronizing signals, said detent magnet being operative to release said control element for one revolution responsive to each synchronizing signal and to arrest rotation thereof at the conclusion of each revolution for an interval until the next synchronizing signal is received.

14. Apparatus according to claim 1, wherein said intermediate record carrier is moved at a speed corresponding to the scanning speed of the transmitter, and wherein said record-receiving sheet is moved at a speed corresponding to the speed of scanning-advance of the transmitter.

15. Apparatus according to claim 1, wherein the ratios of the speed of said intermediate record carrier to the scanning speed of the transmitter and of the speed of advance of said record-receiving sheet to the scanning-advance speed of the transmitter are respectively constant and mutually identical.

References Cited in the file of this patent

UNITED STATES PATENTS

2,355,369	Finch	Aug. 8, 1944
2,353,982	Young	July 18, 1944
2,683,111	Greig	July 6, 1954