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FACSIMILE TRANSMISSION

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Fig. 1

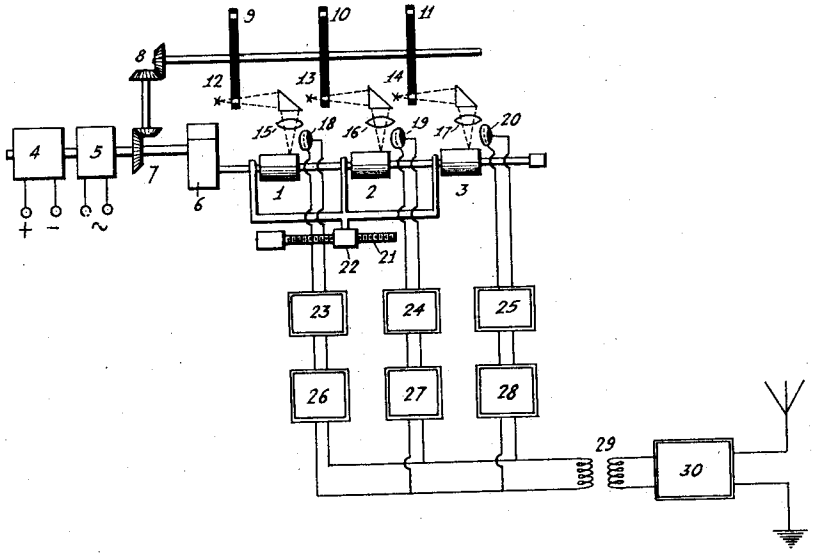
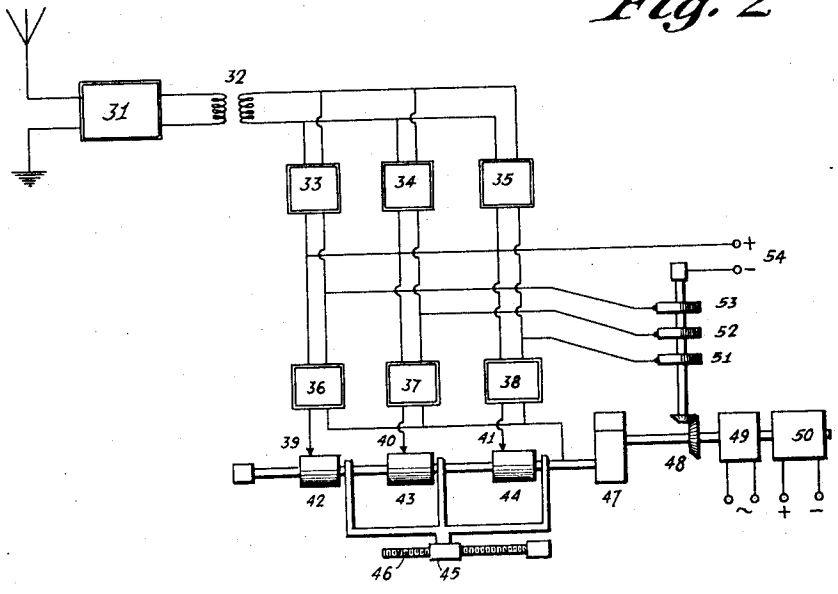


Fig. 2



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FACSIMILE TRANSMISSION

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Experience with short waves, particularly of the order of magnitude of 15 m. length, has revealed the fact that telegraphic signs of very short duration, for instance 1/1000 sec., do not always arrive at the receiver in a sharp condition, but are often widened. In addition there are other disturbing influences, for instance path changes of the wave travelling between transmitter and receiver, which cause temporal displacements in the reception of signals resulting, in the transmission of pictures, in a jagging or ravelling of smooth edges. These disturbing influences causing picture distortion constitute therefore a great handicap in the way of a rapid picture and facsimile telegraphy over short waves, inasmuch as it becomes necessary to reduce the rotating speed of the picture drum, hence the speed of transmission, to a degree which renders the widening or jagging harmless by diminishing them approximately to the width of a picture point.

This invention proposes a solution which does away with the described deficiency by adaptation to the peculiarities of short-wave transmission and permits an undiminished speed of transmission. To this end the news or documents to be facsimiled are mounted on a number of reduced-speed transmitting and receiving drums and to each combination of this kind is assigned a separate transmission channel with a frequency band of correspondingly diminished width; with this arrangement the total width of the frequency band employed is not greater than if a single drum were used at a correspondingly higher velocity, although the transmitting capacity, measured, for instance, in words per minute is not changed.

The separate transmission channels may consist in this case of frequency bands, limitable and separable by electrical filters and similar to those used in the A. C. multiple-telegraphy (sound telegraphy). Consequently the side band or bands of the usual carrier wave modulation of a transmitter would consist, in this case, of several sections and each section would be assigned a transmission channel. One might consider, however, in special cases, the possibility of employing several transmitters with different though nearly equal carrier waves, corresponding to the number of collaterally operating transmissions.

In the first-mentioned case it is of advantage to apply the one-sideband-method with suppressed carrier oscillation. In this case the total power given off by the transmitter is applied only to the frequencies needed for the transmission. If it were, for instance, necessary to reduce the speed of transmission, in view of the described disturbances to one-third of its present value, the transmitted band would have to consist of three sections, each containing the picture frequencies for one of the separate transmissions. Hereby only one-third of the transmitting power is given off through each channel, thus reducing the intensity of reception. However, on account of a corresponding reduction of the effective disturbing mirror ("Störspiegel") at the outlet of each receiver, caused by a narrowing of its frequency band, it is possible to apply a higher amplification which compensates the lower transmitting power available for each channel.

The above described method may be applied to facsimile telegraphs using drums as well as to continuous picture carriers in the form of a film (band). An example of an arrangement for drum-operated devices is pictured in the attached drawing by which Fig. 1 illustrates the transmitting and by which Fig. 2 illustrates the receiving device. Three picture drums 1, 2, 3, driven by the same operating mechanism and covered with the documents to be transmitted are spotted, that is, scanned over by a spot-photographing device. The driving force may be furnished by an electro-motor 4, directly coupled to a synchronous motor 5 of constant speed, supplied with a current of normal frequency. This speed is reduced by means of a system of gears 6 to the value desired for the drums 1, 2, 3. The same mechanism drives, by means of the bevel gears 7, 8, the perforated disks 9, 10, 11 provided with a varying number of holes. The purpose of these disks is to interrupt the spotting light at various frequencies. The perforated disk 9 may generate a light

frequency of, say 1500 per second, disk 10—a frequency of 3000, and disk 11—a frequency of 4500. A light source is provided in the form of three lamps 12, 13, 14 whose rays are refracted and concentrated into luminous points of the magnitude of a picture element on the drums 1, 2, 3, by the optical means 15, 16, 17, respectively. The light, upon refraction from the drums, is intercepted by three photo cells 18, 19, 20 whose function it is to transform the light oscillations in a known manner into electric modulations. In order to secure a helical scanning or spotting of the drums 1, 2, 3 the latter are, during the rotation, gradually advanced along their axis by means of a worm gear 21, 22.

With this spotting arrangement the input tubes of the three amplifiers 23, 24, 25 are subjected to modulated oscillations of a carrier frequency of 1500, 3000 and 4500 periods, with side bands whose width depends on the spotting velocity and on the distribution of light and darkness on the documents to be transmitted. By regulating the spotting velocity the modulation width is kept within the permissible limits for each channel. Beyond the amplifiers 23, 24, 25 filter chains or filter circuits 26, 27, 28 are provided, each of which has to transmit only one side band of the modulation of the three carrier frequencies. For instance, filter 26 may transmit the frequency band 1500 to 2500, filter 27—the band 3000 to 4000, filter 28—the band 4500 to 5500. In certain cases it is, however, more convenient to transmit both side bands of the carrier oscillation, provided they may be limited to such an extent as not to interfere with the neighboring transmission channel. This could be accomplished, f. i., in case the modulation width of the mentioned carrier oscillations does not exceed 600 periods per second. The filters 26, 27, 28 would then have to transmit, say, the frequency bands of 900 to 2100, 2400 to 3600, 3900 to 5100. The transmitted frequencies act upon the modulating arrangement of the short-wave transmitter 30, by way of a common transformer 29. The detailed construction of this transmitter, of the aerials, etc., is of no importance here.

The high frequency received by the short-wave receiver 31 is at first demodulated in a known manner and the amplified low frequency, which is a combination of the three transmission-frequency bands, is filtered by way of three filters 33, 34, 35. If both side bands of each carrier oscillation are passed by the filters 33, 34, 35, it is only necessary to effect by rectification a second demodulation in the amplifiers 36, 37, 38 in order to obtain directly the picture-recording frequency. If, however, only one side band of each perforated-disk frequency is transmitted to the receiver, while the carrier oscillation is suppressed, it is necessary to generate these perforated-disk frequencies artificially. To this end frequency generators are provided, of known constrction, f. i., the interrupters 51, 52, 53, which are included in the circuit of a D. C. source 54 and are driven at constant speed over a bevel gear by a synchronous motor set 49, 50 corresponding to the set 4, 5 at the transmitting end. The picture frequencies obtained at the outlet of the amplifiers 36, 37, 38 are now transmitted to three separate recording devices. For the sake of simplicity the recorder in this case is assumed to consist of an electro-chemical recording device, three recording points 39, 40, 41 gliding along a moistened, specially prepared paper which is mounted on the three receiving drums 42, 43, 44. For this purpose it is, of course, necessary to rectify the picture frequencies. This may be effected by means of the amplifiers 36, 37, 38. The amplifiers thus serve the double purpose of re-establishing and rectifying the picture frequencies. The three drums 42, 43, 44 are driven by means of a system of gears 47 at a proper speed and advanced axially by means of a worm gear 45, 46 similar in construction to the operating mechanism at the transmitting end.

Instead of the electro-chemical picture recording method one may obviously apply the photographic method. In this case the recording points are replaced by three light relays of known construction.

Having now described my invention, what I claim and desire to secure by Letters Patent is the following:

A system for simultaneously transmitting a plurality of picture record messages which comprises a plurality of supporting carriers for carrying said messages, a single driving element for rotating said carriers at identical speeds relative to predetermined points positioned in like relationship with respect to each record carrier, means for illuminating related elemental areas of each of said record carriers from a plurality of light sources, means for interrupting the light from each of said light sources directed toward said record carriers at different frequencies bearing pre-established relationship one with the other, light translating means associated with each of said record carriers for converting the varying intensities of light and shadow thereon as illuminated by said light sources into proportionately modulated electric current impulses of different frequencies, means for combining the output energies of all of said light translating elements, a transmitter for transmitting said signals, means for modulating said transmitter simultaneously by all of said signals, receiving means, and means at the point of reception for separating said received signals one from the other for reproducing a plurality of images corresponding to the records carried by each record carrier.

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