March 3, 1936. W. G. H. FINCH 2,032,558

IMAGE BROADCASTING SYSTEM

Original Filed March 26, 1934 5 Sheets-Sheet 1

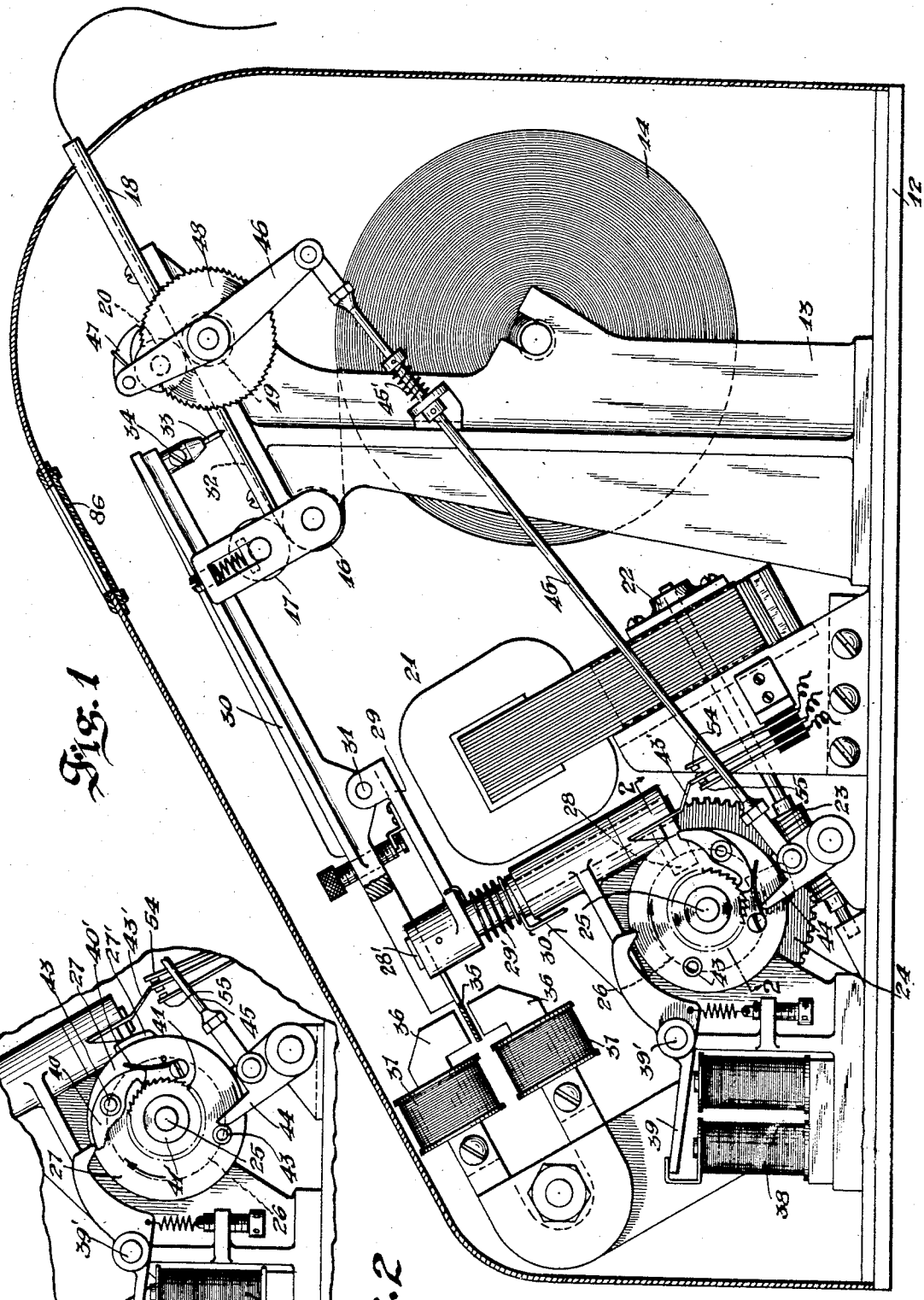


Fig. 1

Fig. 2

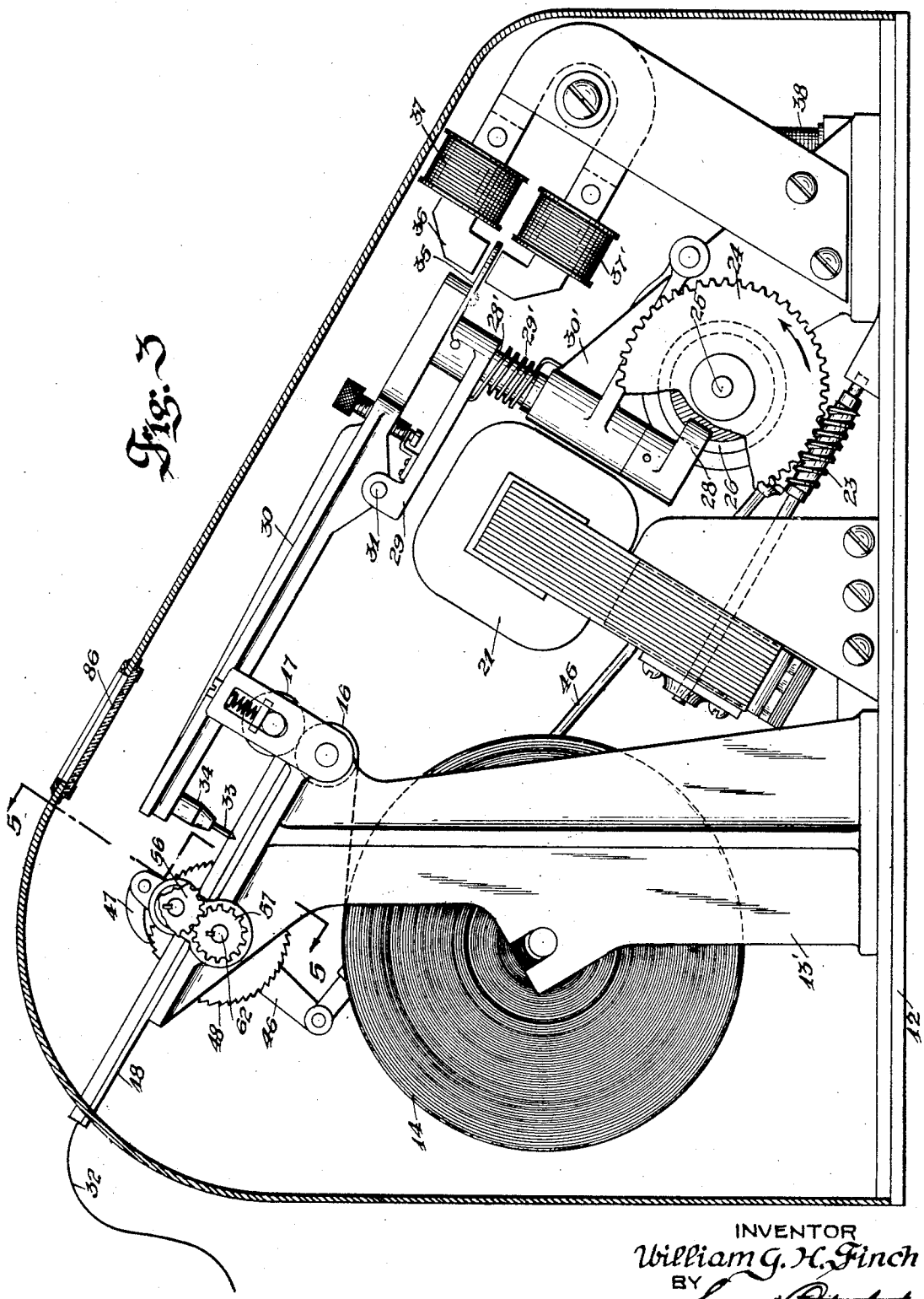
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March 3, 1936. W. G. H. FINCH 2,032,558

IMAGE BROADCASTING SYSTEM

Original Filed March 26, 1934 5 Sheets-Sheet 2

Fig. 5



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March 3, 1936. W. G. H. FINCH 2,032,558

IMAGE BROADCASTING SYSTEM

Original Filed March 26, 1934 5 Sheets-Sheet 3

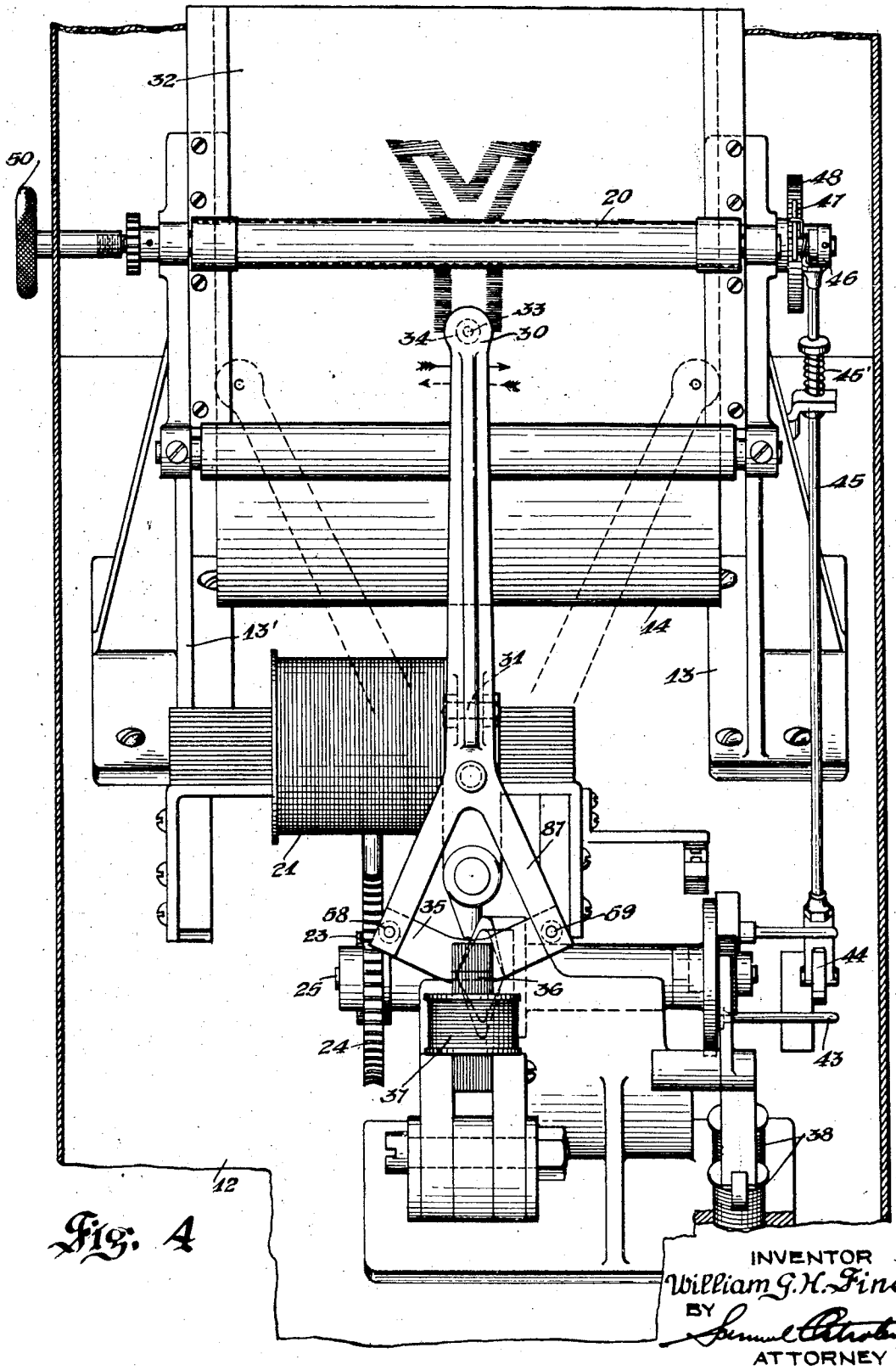


Fig. 4

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March 3, 1936. W. G. H. FINCH 2,032,558

IMAGE BROADCASTING SYSTEM

Original Filed March 26, 1934 5 Sheets-Sheet 4

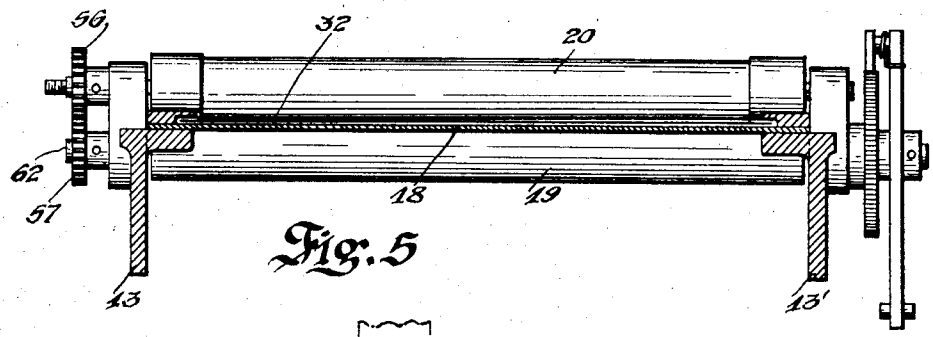


Fig. 5

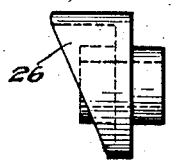


Fig. 7

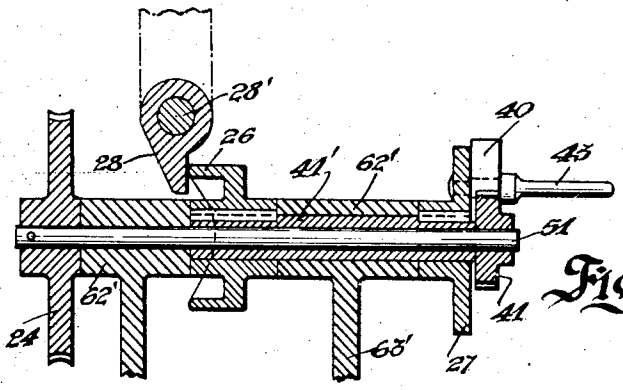


Fig. 6

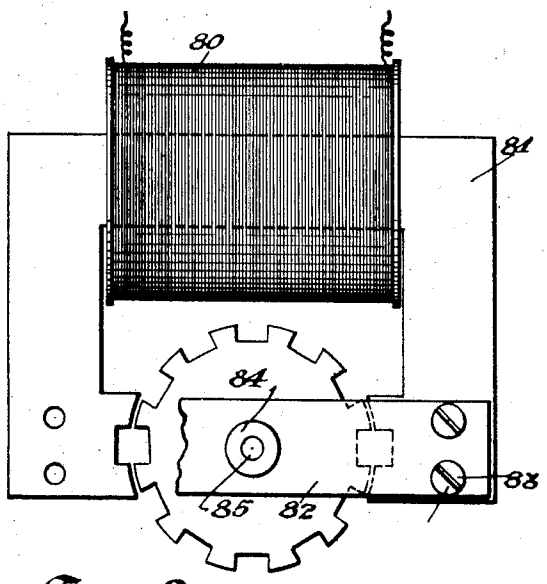


Fig. 9

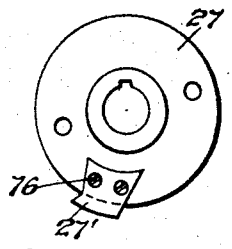


Fig. 8

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IMAGE BROADCASTING SYSTEM

Original Filed March 26, 1934 5 Sheets-Sheet 5

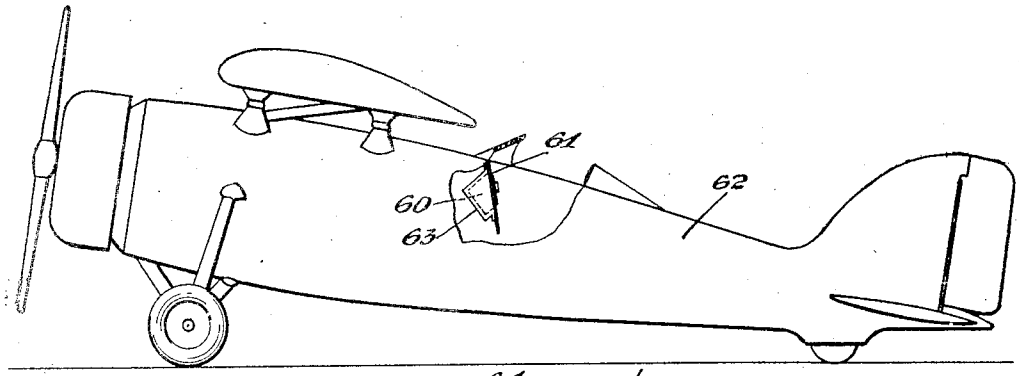


Fig. 10

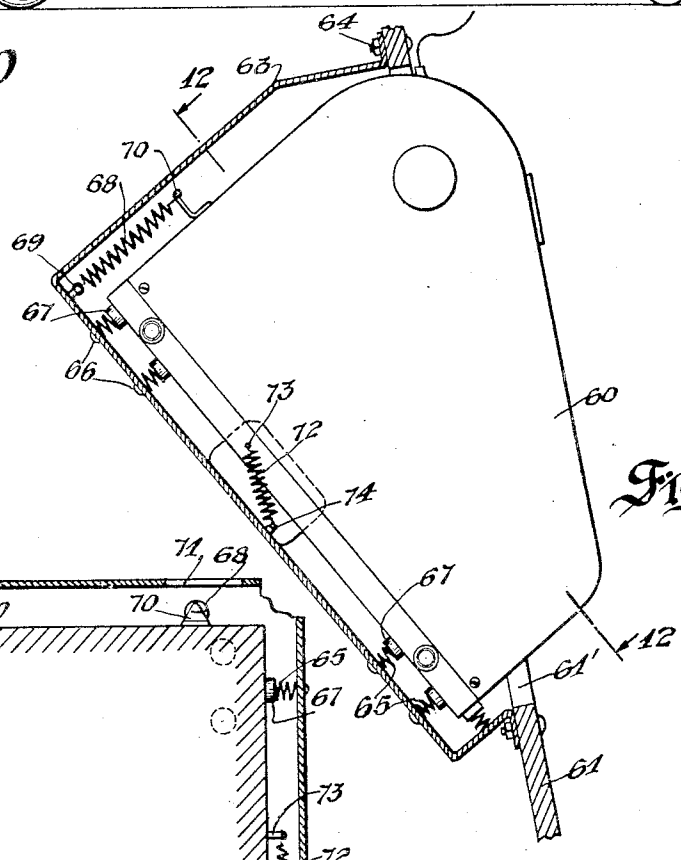


Fig. 11

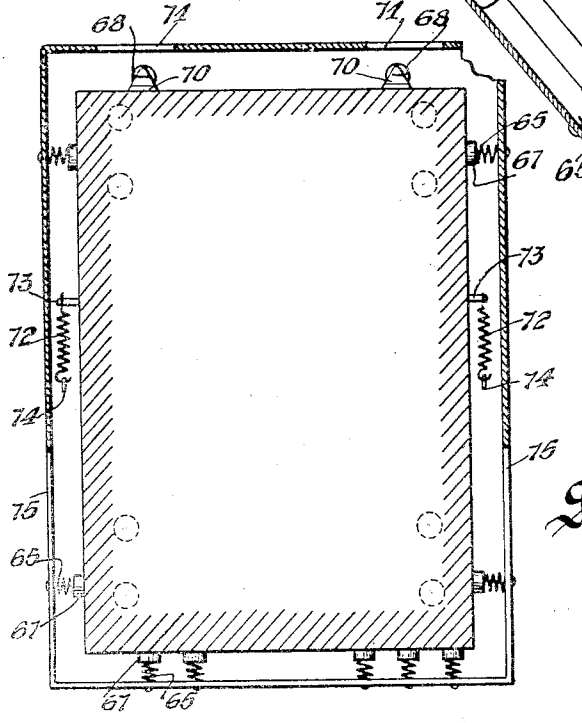


Fig. 12

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Patented Mar. 3, 1936 2,032,558

UNITED STATES PATENT OFFICE

2,032,558

IMAGE BROADCASTING SYSTEM

William G. H. Finch, New York, N. Y.

Original application March 26, 1934, Serial No. 717,034. Divided and this application December 19, 1934, Serial No. 758,210

12 Claims. (Cl. 178—11)

My invention relates to novel apparatus for and methods of transmitting signals and more particularly relates to novel apparatus for and methods of visual broadcasting.

In the transmission of facsimile signals it has heretofore been the practice to employ a cylindrical member on which the picture or object to be transmitted by facsimile was mounted. The cylinder was scanned by rotating the cylinder past a pointer and at the same time moving the cylinder with respect to the pointer in a longitudinal direction by means of a worm mounting. An electrical contactor mounted on a stylus was employed for detecting the light variations of the image on the cylinder.

The obvious defect of such a system was that it could transmit only the image mounted on the cylinder and was not adapted for the continuous transmission of messages.

For the purpose of transmitting any relatively long messages by facsimile, it has been proposed to oscillate an arm carrying a stylus over a moving sheet on which the message which is to be transmitted by facsimile is recorded. In this type of arrangement no practical photoelectric cell arrangement which is operated in accordance with variations of the image for transmitting facsimile signals has heretofore been developed, nor has it been possible in the systems heretofore used to employ the same system and apparatus for the transmission either of black and white pictures or half tones, as desired.

Moreover, the mechanisms proposed were complicated, requiring many parts which were heavy and no practical construction has been suggested for facsimile transmission which would be adaptable for mobile use, as on automobiles, airplanes, ships and the like.

I have invented a novel facsimile system and simple synchronizing arrangement, requiring a transmitting receiving mechanism light in weight, inexpensive and easy to operate for the broadcasting of images, the apparatus being operated either by wire or by radio.

A need has especially arisen for a mobile image broadcast receiver mounted on devices such as automobiles, busses, airplanes, and sea vessels, etc. Heretofore it has been the practice to receive messages on such devices by telephone. This had the defect of being costly, leaving no record of the receipt of such message, and involving the human error in reception.

To overcome these defects, I have invented a mobile printer which makes a permanent record of the message received, is inexpensive and sufficiently light to be practical for mobile purposes. This forms the subject matter of my Patent 1,932,579, granted October 31, 1933 and my copending application S. N. 695,740 filed October 31, 1933.

As a complement to the printer described in the patent and application referred to above, a receiver for the reception of broadcast images is also required. Heretofore, it has been found necessary to provide heavy, complicated and costly equipment for such reception. This retarded its more general use and made its use for mobile purposes practically out of question.

I have developed a receiver of broadcast images which is primarily inexpensive and light, so that it can be used as a mobile device for reception.

Accordingly, an object of my invention is to provide novel apparatus for and methods of transmitting and receiving pictures.

A further object of my invention is to provide novel methods of and apparatus for transmitting either black or white pictures, as desired.

Still a further object of my invention is to provide novel apparatus for and methods of synchronizing an image broadcasting system.

Another object of my invention is to provide a novel image broadcasting system which may be operated either by radio or by wire circuits.

Still a further object is to provide a novel mobile image broadcasting system adapted for use in automobiles, airplanes, ships and the like.

Still another object is to provide a simple, rugged image broadcasting receiver that may be operated directly from a radio receiver.

A further object is to provide novel synchronizing means whereby the same signal channel is empoyed for the image and the synchronizing signals.

In the operation of facsimile systems heretofore, the rate at which words could be sent was so much lower than the rate of transmitting by telegraphy that the use of facsimile for such purposes has been impractical.

In one application of my system I contemplate employing the standard radio receiver now found in most homes for the reception of broadcast images.

Heretofore it has been impossible to transmit messages for recording because the printers or facsimile receivers proposed were too expensive, large and cumbersome for home use.

I have discovered that with my novel broadcast image receiver it would now be possible for a newspaper to supply a news service by broadcasting illustrated news bulletins with my novel image

broadcasting system. Connected in the output of the usual radio receiver, it would be possible with my novel image receiver and recorder to receive and record such messages.

My invention contemplates that the owner of a radio receiver could, whenever he desires, switch the output of his receiver circuit to my image receiver for the reception of image or facsimile signals. Such a subscriber would, when he is about to turn off the radio at night, merely switch his circuit to the image recorder. During the night illustrated news bulletins, advertising, etc. would be transmitted and received on his radio receiver and in the morning would be available fully recorded.

In the present broadcast system, the programs are hampered by the inability to present a clear picture of the scene at the broadcasting studio, television still being a thing of the future. In accordance with my invention, each broadcast program could be preceded by or interspersed with a vision broadcast to provide the "listener" with some picture of the scene from which the broadcast occurs.

Accordingly an object of my invention is to provide novel apparatus for and methods of broadcasting images in conjunction with present audible programs.

A further object of my invention is to provide novel apparatus for and methods of broadcasting and receiving illustrated news bulletins on a regular sound radio receiver.

Still a further object of my invention is to provide a novel image receiving apparatus having considerable flexibility and operable from a standard sound radio receiver.

There are other objects of my invention which, together with the foregoing, will appear in the detailed description which is to follow in connection with the drawings in which:

Figure 1 is a right hand side elevation of the receiver;

Figure 2 is a detailed view of synchronization mechanism;

Figure 3 is a left hand elevation of receiver;

Figure 4 is a top view of receiver;

Figure 5 is a detailed drawing of roller mechanism;

Figure 6 is a section through the main shaft of the receiver;

Figure 7 is a detailed view of the receiving cam;

Figure 8 is a detailed view of the synchronous disc;

Figure 9 is the synchronous motor;

Figure 10 is a side plan view of an airplane in which my novel receiver is mounted;

Figure 11 is a side elevation showing the details of mounting my receiver; and

Figure 12 is a cross section elevation taken at 12—12 of Figure 11.

In my application, Serial No. 717,304 filed March 26, 1934 for Image broadcasting systems, issued as Patent No. 1,985,654, dated Dec. 25, 1934, of which this application is a division, I have shown a complete transmitter system with which the present receiver may be used.

Referring now to Figures 1 and 2, I have shown the right hand side elevation of the receiving unit employed in my system. This consists of a base 12 upon which are mounted a pair of uprights, one of which is shown at 13. A roll of paper 14, coated with a substance which is to be described hereinafter, is free to rotate around shaft 15. Said paper passes between rollers 16 and 17 over platen 18 and under feed rollers 19 and 20. A synchronous motor 21, similar to that described in detail in connection with the transmitter in the parent application, is provided with an armature 22, which drives the worm 23, meshing with gear 24, which is secured to and drives shaft 25. Motor 21 is in mesh with worm gear 24 by means of worm 23. Shaft 25 also carries a cam 26 identical to the cam of the transmitter unit and a synchronization disc 27 which revolves in the direction shown by the arrow.

As in the case of the transmitter, cam 26 actuates cam follower 28 which is secured to and rotates the shaft 28'. Secured to and rotatable with shaft 28' is arm 29. A spring 29', one end of which engages the arm 29, the other end of which engages the standard 30', normally holds the cam follower 28 against cam 26, as shown in Figure 3, imparting to shaft 28' and to arm 29 an oscillatory motion synchronous with that of arm 29 at the transmitter. The arm 29 carries in its motion the stylus 30 which is pivoted at 31 for a second rocking movement to and from the place of the paper 14.

At one end of the stylus 30, a suitable marker 33 is fastened into retainer 34 while at the other end an iron segment 35 passes between the poles of a polarized magnet 36 whose winding is shown at 37 and 37'.

Figure 2 is a detailed view of the synchronization mechanism and it is shown in the position which the machine will assume when the transmitter ceases to function at the transmitting end. For the sake of simplicity, in Figure 2 the worm 23 and the worm gear 24 are not shown. Upon the same disc paper feed pins 43 are diametrically located so as to engage at every revolution an arm 44 which in turn feeds the paper out by means of connecting rod 45, rocker 46, pawl 47 and ratchet wheel 48. By referring to Figure 2, it will be noted that as soon as the synchronization magnet 38 is energized, its pawl 39, pivoted at 39' will release pawl 40 which in turn under control of spring 40' will move its tooth to engage a tooth of ratchet wheel 41 which, being fastened to shaft 25, is revolving in the direction shown by the arrow.

It is to be understood that in the receiver mechanism, synchronization disc 27 is not secured to shaft 25, but by means of a hollow shaft 41', loosely mounted and revolving around shaft 25, is connected to cam 26, thereby arresting the motion of cam 26 when the receiver assumes the position shown in Figure 2.

In the same Figure 2, an insulating projection 27' is secured at the periphery of synchronization disc 27, causing switch arm 43 to close either its right or left hand contact 54 and 55 respectively. In Figure 2 the right hand side contact 54 is closed and by referring to Figure 2 of the parent application it will be noted that the first impulse that will be received will be switched to magnet 38, thus releasing pawl 40 and causing stylus 30 to oscillate over the specially prepared paper. It is to be noted that one of the pins 43 serves as the pivotal support for the pawl 40 on synchronization disc 27. This is better shown on Figure 6 and it is therefore evident that at each half revolution of synchronization disc 27, arm 44 will be acted upon, thus imparting an intermittent rotating motion to ratchet wheel 48, advancing the paper an amount equal to that in the transmitter. It will be understood that the reciprocating motion of link 45 for oscillation arm 46 is accomplished by the movement of arm 44 together with the compressor 45', in the man-

ner described in detail in connection with the transmitter.

As a result of pawl 40 being enmeshed by ratchet wheel 41, the synchronization disc 27 will revolve in the direction indicated by the arrow, and inasmuch as projection 27' will not be opposite switch arm 43', the latter will close its left hand contact 55 deviating all incoming facsimile signals into magnets 37 and 37', as diagrammatically shown in Figure 1 of the parent application.

It is now evident that facsimile signals received while the stylus arm 30 is sweeping over its arcuate path, are switched to act upon magnets 37 and 37', and armature 35 will cause the stylus to move up and down about pivot 31, bringing the marking point 33 in contact with the specially treated paper passing over platen 18. Assuming the stylus is in a position corresponding to the position of the transmitter scanner, and the signals of the proper amplitude and timing, they will produce markings upon the specially treated paper at a corresponding portion thereon of a length equal to the image at that point, thus reproducing the original picture in the form of dashes closely together, which will form an image similar to the one transmitted. In Figure 3 I show the left hand elevation of the receiver where a clear understanding of the respective position of synchronous motor 21 worm 23 and worm gear 24 may be seen.

I have cut a portion of the worm gear 24 in order to show follower 28 bearing against cam 26.

In order to secure a positive motion of the sensitized paper, the rollers 19 and 20 are positively drawn by pinions 56 and 57, the latter being mounted in rotatable relation with the shaft 62 which carries ratchet wheel 48.

In Figure 4 I show a top view of the complete receiver. The stylus 30 is shown in a central position and the dotted lines indicate the maximum swing from side to side. It will be noted that this member is forked at one end 37 in order to accommodate armature 35 to which it is secured by rivets 58 and 59.

As the stylus arm 30 sweeps over the sensitized paper 32, armature 35 will oscillate between the pole pieces of the polarized magnet 36. Inasmuch as stylus arm 30 is also pivoted at 31 and is free to move in an upward and downward motion, it is evident that any signal received by said polarized magnet 36 will act upon stylus 30, forcing the marking point 33 (Figure 1) to bear down on the sensitized paper, thus causing a marking similar in length to the one appearing in the film 40 of the transmitter.

This sensitized paper may be wax covered, carboned, photographic light sensitive, chemically treated, or any other well known type, and I do not wish to be restricted by the type to be used.

When a record is made on carbon, waxed paper and the like, provision is made for rendering the record immediately visible. This I accomplish by the transparent glass window 80' placed in the receptacle, so that an observer can immediately see the record.

In order to simplify the operation of reading the sensitized paper under the various rollers, I have provided a knurled knob at 50 which may be revolved by hand, thus causing any amount of paper to be drawn from the paper supply.

Figure 5 is a section taken at 5—5 on Figure 3. In this drawing I show the section through the uprights 13 and 13' supporting the platen 18 over which the sensitized paper 14 is carried forward by rollers 19 and 20, moved together by pinions 56 and 57.

Figure 6 is a cross section through the main shaft 51 of the receiver. Upon this shaft the worm gear 24 and the ratchet wheel 41 are secured and the entire assembly rotates in bearing 62' formed on bracket 63'.

A hollow shaft 41' rotates freely around main shaft 51 and has keyed thereon at one end, the receiving cam 26 and the synchronous disc 27 at the other.

Figure 7 is a detailed drawing of the receiver cam 26 which is identical with Figure 5 of the parent application, showing the transmitting cam 10.

Figure 8 is a detailed view of the rear of the synchronization disc 27 showing the switch actuating projection 27', securely fastened to it, by means of screws 76 and located so that it projects beyond the periphery of the disc itself.

Figure 9 is an assembly drawing of the single phase synchronous motor which I prefer to use. This motor consists of a coil 80 mounted over a core 81 substantially of the design shown in this figure. A non-magnetic bridge 82 is secured to the core 81 by means of screws 83 and forming at 84 a bearing for the motor shaft 85.

While I show a simplified form of a synchronous motor, it is understood that one employing a self-starting principle such as single phase motors employing shading coils may be used, provided they do maintain a constant synchronous speed if not over-loaded.

In Figures 10 to 12 I have disclosed a method of mounting my vision recorder on an airplane.

In Figure 10 the receiving instrument 60 is mounted on the instrument board 61 of the airplane 62. As shown in Figure 11, an opening 61' is provided in the instrument board 61 in which the instrument 60 is set. Secured to the instrument board 61 by bolts through the compression springs 65 which are riveted at one end to the casing 63 by rivets 66 and are mounted at its other end in the bearing caps 67.

At the rear of the instrument I have provided tension springs 68 with the anchors 69 and 70.

As shown in Figure 12 hand holds 71 are provided in the casing 73 to enable the mounting of the springs 68. Tension springs 72 are also provided for preventing upward movement, the tension springs 72 being mounted in the anchors 73 and 74. A hand hold 75 enables the mounting of the springs 72. By this arrangement the shocks and jars to which the airplane is subjected are not transmitted to the instrument which in effect floats in position by reason of the several spring mountings.

Although I have illustrated my invention as applied to the general transmission of vision, I also intend it for other uses to which it is especially adapted.

It will be obvious from this that my invention may take several forms and I do not wish to be limited except as set forth in the appended claims.

What is claimed is,

1. In a facsimile receiver, a polarized signal responsive magnet having a pair of opposed pole faces, a scanner mechanism pivoted in two planes at right angles to each other and having a magnetic portion which moves between said pole faces and is variably operated in accordance with signals energizing said signal responsive magnet to rock said scanner mechanism about one pivot, a source of motive power, a

positive drive from said source of power to said scanner mechanism for rocking it about its other pivot, a synchronizing magnet and means controlled by said synchronizing magnet for disconnecting the positive drive from said source of power and said scanner in the event the receiver is not in synchronism with the received signals.

2. In a facsimile receiver, a scanner, a source of motive power, a cam, a pawl and ratchet connection from said source of power to said cam, a cam follower and means controlled by said cam follower for oscillating said scanner and a signal responsive magnet having a pair of opposed pole faces between which said scanner extends and is variably operated in accordance with received picture signals as said scanner is oscillated to successive points of the image to be recorded.

3. In a facsimile receiver, a signal responsive magnet having a pair of opposed pole faces, a scanner mechanism pivoted in two planes at right angles to each other and having a magnetic portion which moves between said pole faces and is variably operated in accordance with signals energizing said signal responsive magnet to rock said scanner mechanism about one pivot, a source of motive power, a cam, a pawl and ratchet connection from said source of power to said cam, a cam follower and means controlled by said cam follower for oscillating said scanner mechanism about its other pivot.

4. In a facsimile receiver, a signal responsive magnet having a pair of opposed pole faces, a scanner pivotally supported for movement in one direction under control of said signal responsive magnet and pivotally supported for movement in a direction at right angles to the first direction, one end of said scanner moving between said pole faces, and means for oscillating said scanner on the second mentioned pivot.

5. In a facsimile receiver, a signal responsive magnet having a pair of opposed pole faces, a scanner pivotally supported for movement in one direction under control of said signal responsive magnet and pivotally supported for movement in a direction at right angles to the first direction, one end of said scanner moving between said pole faces, means for oscillating said scanner on the second mentioned pivot, and a source of motive power, said means including a positive drive from said source of power to said scanner.

6. In a facsimile receiver, a signal responsive magnet having a pair of opposed pole faces, a scanner pivotally supported for movement in one direction under control of said signal responsive magnet and pivotally supported for movement in a direction at right angles to the first direction, one end of said scanner moving between said pole faces, a source of motive power and a positive drive from said source of power to said scanner for oscillating said scanner about its second mentioned pivot.

7. In a facsimile receiver, a signal responsive magnet having a pair of opposed pole faces, a scanner pivotally supported for movement in one direction under control of said signal responsive magnet and pivotally supported for movement in a direction at right angles to the first direction, one end of said scanner moving between said pole faces, means for oscillating said scanner on the second mentioned pivot, a source of motive power, said means including a positive drive from said source of power to said scanner and a record sheet in operative relation with said scanner.

8. In a facsimile receiver, a signal responsive magnet having a pair of opposed pole faces, a scanner pivotally supported for movement in one direction under control of said signal responsive magnet and pivotally supported for movement in a direction at right angles to the first direction, one end of said scanner moving between said pole faces, means for oscillating said scanner on the second mentioned pivot, a source of motive power, said means including a positive drive from said source of power to said scanner, a record sheet in operative relation with said scanner and a feeder for said sheet.

9. In a facsimile receiver, a signal responsive polarized magnet having a pair of opposed pole faces, a scanner pivotally supported for movement in one direction under control of said signal responsive magnet and pivotally supported for movement in a direction at right angles to the first direction, one end of said scanner moving between said pole faces, a source of motive power, a positive drive from said source of power to said scanner for oscillating said scanner about its second mentioned pivot, a record sheet in operative relation with said scanner and a feeder for said sheet.

10. In a facsimile receiver, a picture signal responsive magnet having a pair of opposed pole faces, a scanner, one portion of which extends between said pole faces, said scanner being pivotally supported for movement in one direction under control of said picture signal responsive magnet in accordance with received picture signals and being pivotally supported for movement in a direction at right angles to said first direction, a source of motive power, a positive drive from said source of power to said scanner for oscillating said scanner in said direction at right angles to said first direction, a synchronizing magnet, an electrical circuit for said magnets, a switch for connecting said synchronizing and picture signal responsive circuit to said picture signal responsive magnet to receive picture signals, said switch operating periodically to connect said synchronizing magnet to said circuit to receive a synchronizing signal, means controlled by said synchronizing magnet for disconnecting said drive from said source of motive power and said scanner in the event the scanner is not in synchronism with the received signals.

11. In a facsimile receiver, a picture signal responsive magnet having a pair of opposed pole faces, a scanner, one portion of which extends between said pole faces, said scanner being pivotally supported for movement in one direction under control of said picture signal responsive magnet in accordance with received picture signals and being pivotally supported for movement in a direction at right angles to said first direction, a source of motive power, a positive drive from said source of power to said scanner for oscillating said scanner in said direction at right angles to said first direction, an electrical circuit, a switch for connecting said circuit to said picture signal responsive magnet to receive picture signals, a synchronizing magnet, a rotating cam for periodically operating said switch to connect said synchronizing magnet to said circuit to receive a synchronizing signal, and means controlled from said synchronizing magnet for disconnecting the positive drive from said source of power in the event the scanner is not in synchronism with the received signals.

12. In a facsimile receiver, a picture signal responsive magnet having a pair of opposed pole faces, a scanner, one portion of which extends between said pole faces, said scanner being pivotally supported for movement in one direction under control of said picture signal responsive magnet in accordance with received picture signals and being pivotally supported for movement in a direction at right angles to said first direction, a source of motive power, a recording sheet in operative relation with said scanner, a feeder for said sheet, a positive drive from said source of power to said scanner comprising a cam and a pawl and ratchet connection from said source of power to said cam for oscillating said scanner in said direction at right angles to said first direction, a reciprocating arm for operating said feeder, and a member driven by said source of power when said pawl engages said ratchet for reciprocating said arm once for each scanning cycle to feed said sheet to successive lines.

WILLIAM G. H. FINCH.