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Lehmann

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[54] **METHOD AND APPARATUS FOR MORE SLOWLY TELECASTING LIVE SPORTS EVENTS INSTANTLY AS THEY TAKE PLACE**

[76] Inventor: **Herbert G. Lehmann**, 5 Kent Road, Easton, Conn. 06612

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[52] **U.S. Cl.** ..... **178/6.6 A**, 178/6.6 FS

[51] **Int. Cl.** **H04n 5/84**

[58] **Field of Search** ..... 178/6.6 A, 6.6 FS, 178/6.7 A; 176/DIG. 3

[56] **References Cited**

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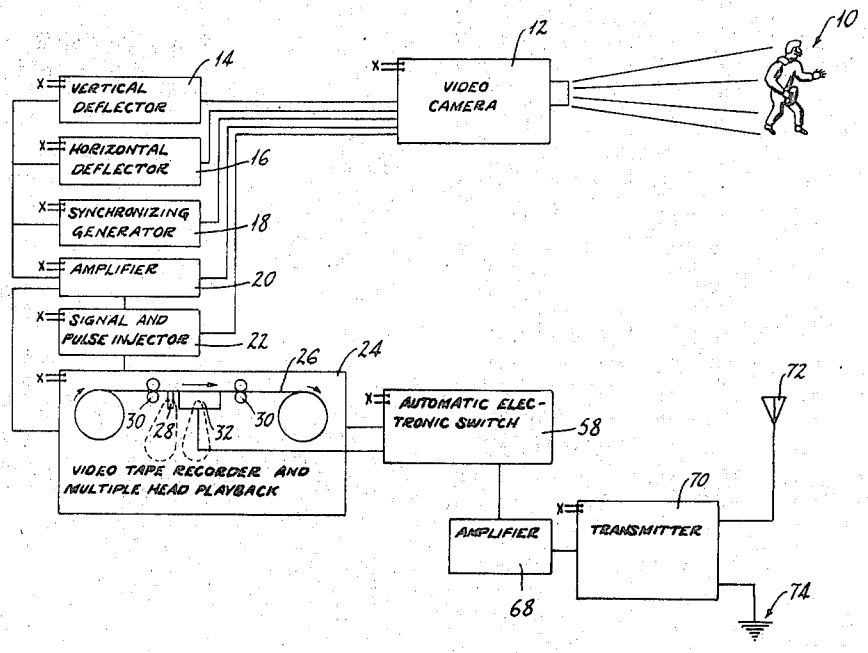
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Primary Examiner—James W. Moffitt
Attorney—H. Gibner Lehmann

[57] **ABSTRACT**

A method and apparatus by which actual live action plays, as for example football plays starting from the line-up at the line of scrimmage and calling of the signals, and ending with the termination of the scrimmage and blowing of the official's whistle (which grounds the ball), are semi-automatically telecast in slower motion during the actual time the play is occurring. In the case of a football play, the last portions of small groupings (seven frames) of the slower motion telecast which occur during the period that the players are active are discarded and therefore not telecast; instead the undiscarded portions are spread over substantially the entire period of time that is consumed by the line action. The apparatus involves making a record or storing information, as on video tape of a recorder or else on a record disk, and substantially simultaneously playing back the stored information in a manner to produce a large number of small intervals of slower action than the actual live action. The playback information is modified but is still compatible with the television H.F. transmitter and with the synchronization of the telecasting and receiving equipment, as by relating picture portions of the video tape information to a suitable composite wave or to command and synchronizing pulses, erase or blanking pulses, etc. some of which are of the type utilized for a normal or conventional telecast to thereby maintain receiver synchronization. In the illustrated embodiment of the invention, the slower-action is obtained by the use of multiple play-back heads which are arranged to give the effect of physical displacement at uniform intervals "upstream" of the initial playback head, in conjunction with electronic switching of the heads under the control of "command" pulses added to the video tape.

7 Claims, 3 Drawing Figures



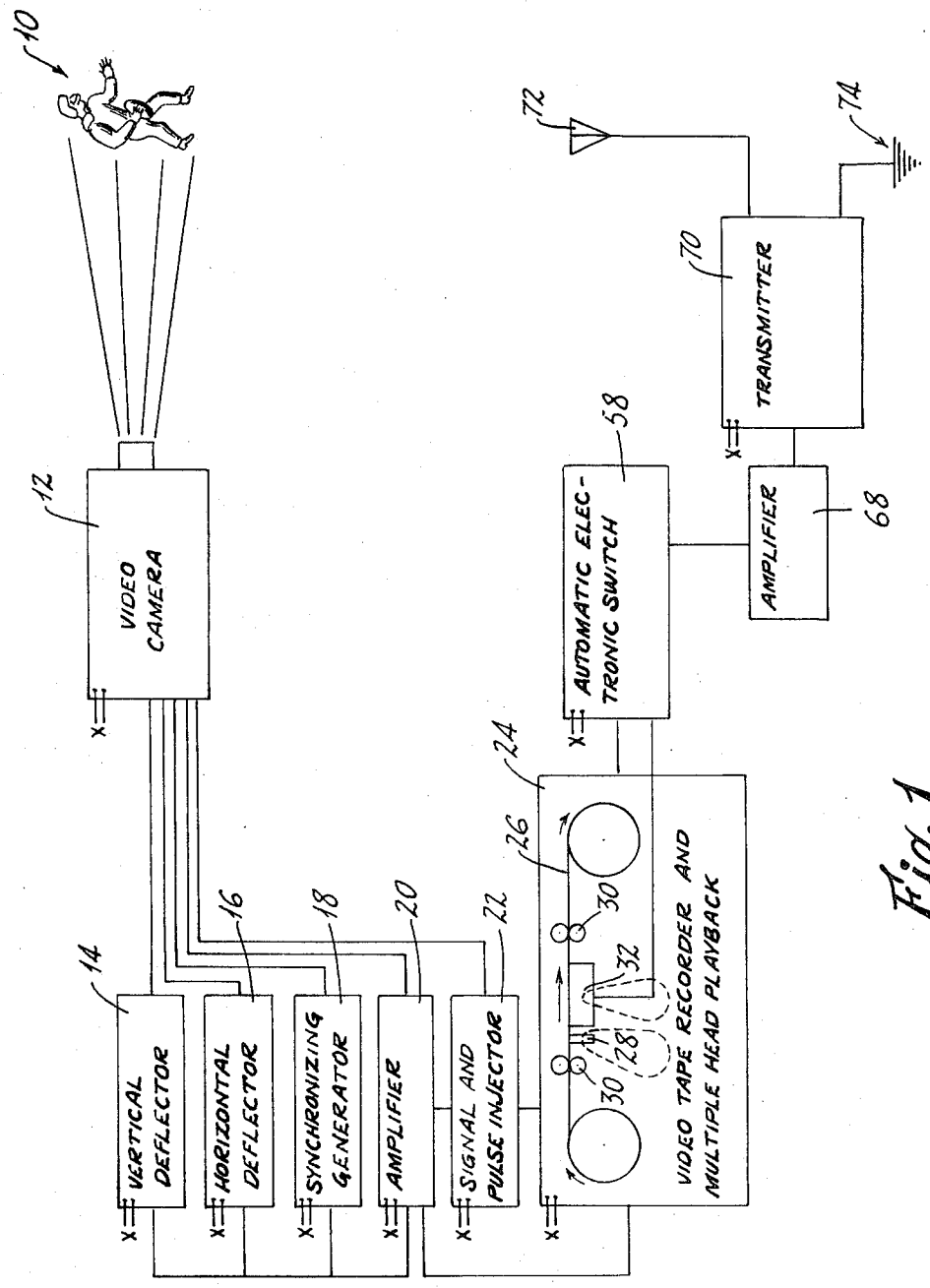


Fig. 1

INVENTOR
HERBERT G. LEHMANN
BY
N. Gilbner Lehmann
AGENT

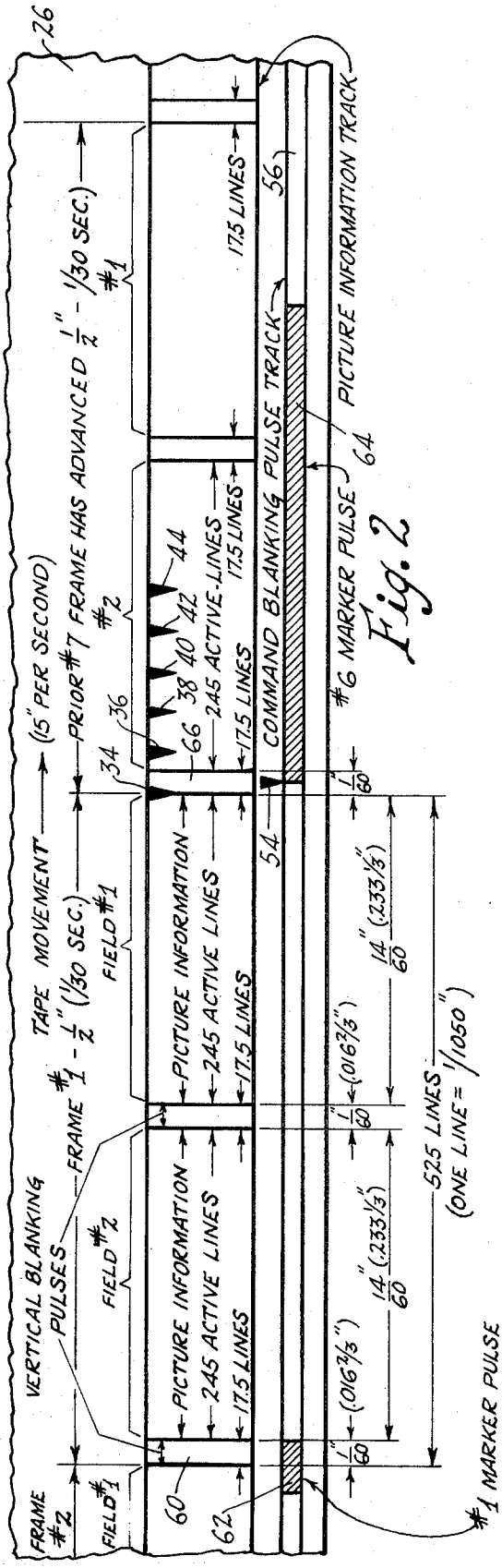


Fig. 2

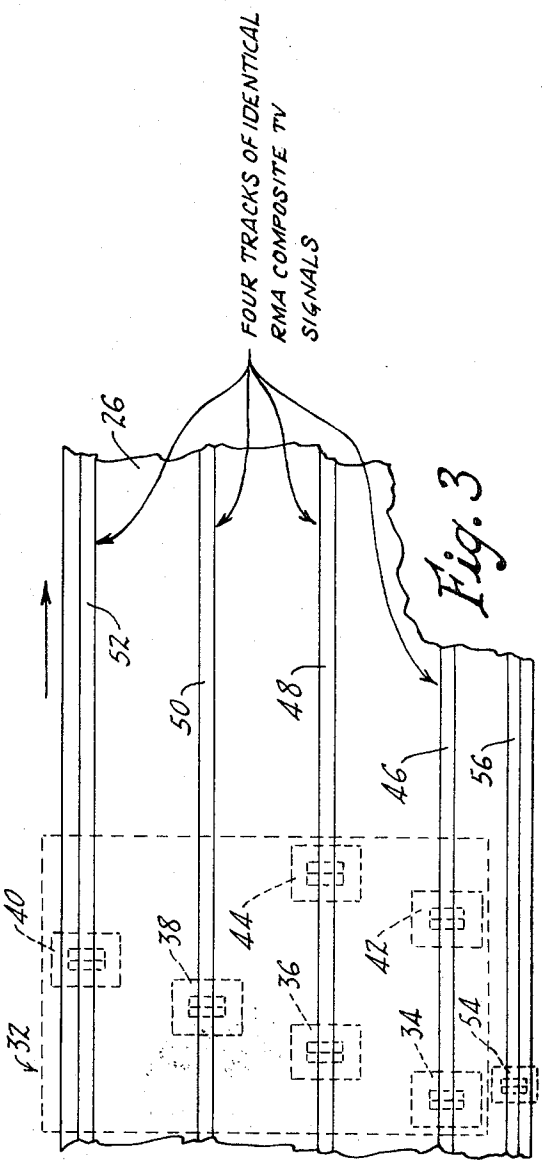


Fig. 3

INVENTOR
HERBERT G. LEHMANN
BY
H. Gilner Lehmann
AGENT

METHOD AND APPARATUS FOR MORE SLOWLY TELECASTING LIVE SPORTS EVENTS INSTANTLY AS THEY TAKE PLACE

BACKGROUND

This invention relates specifically to the telecasting of sports events, and more particularly to the telecasting of live action plays of event such as football games, track meets or the like, as well as other athletic activities, although the invention has relevance in connection with any kind of action scenes.

Often the live action in a football game, comprising the time interval beginning with the instant that the players line up at the line of scrimmage and ending with the termination of the play and blowing of the official's whistle to ground the ball, can occur with such speed that the television audience has difficulty following the various moves of the players and the travel of the ball. This is no doubt due to the well-known principle expressed by the saying that "the hand is quicker than the eye." In order to remedy this drawback of prior telecasts, it is common practice to replay at a later time, or "play back" certain portions of the action, particularly those including isolated players who are especially involved with the movement of the ball, this being done after the live action has been terminated. In some instances the playback involves a split screen by which two different areas of the playing field are shown simultaneously, to give the television audience a simultaneous viewing of both the passer and receiver, in the circumstance where a forward pass is being thrown.

While such techniques have enhanced the interest in football and the enjoyment of the game by the television audience, and have improved the ability to comprehend the action, it is still difficult to clearly follow all of the players' movements when an especially rapid play occurs.

SUMMARY

These disadvantages and drawbacks of present day telecasts are obviated by the present invention, which has for one object the provision of an improved method and apparatus for semiautomatically effecting a slower-motion telecasting of live action plays, such as football plays, high jumps, pole vaults and the like, all while the action is taking place. A supplemental object of the invention is the provision of a novel semi-automatic slower-play method and apparatus with an improved automatic control to effect the shutting-off of the slower-action playback at the proper time, whereby all the necessary movement is portrayed, with no undesired prolongation. The above objects are accomplished by a unique semi-manual, semi-automatic method and apparatus involving the recording of the live play action on a storage device and the substantially simultaneous playing back of the recorded information on multiple-head playback equipment which is so constituted that it produces a slower action than the live action that is taking place. The multiple heads and the video tape are so located and arranged, and the heads are so automatically sequentially switched that the effect is had of increasing that time interval between frames which is normally devoted to vertical retrace, whereby the frames are separated timewise without altering the tape speed and scanning speed. At certain predetermined, repeated intervals a frame is dropped out, without noticeable impairment of the received picture. The output of the playback equipment optionally can be processed to separate out any undesired pulses or other information which is no longer useful because of the slower-action nature of the playback. The taken-off image or picture information is or can be made compatible with the standard telecast transmitting and receiving equipment, as by combining it with a synchronizing and pulse train having incorporated the various, necessary pulses such as the horizontal synchronizing pulse, the erase pulses, vertical blanking pulses and the like, whereby the resultant wave form is suited to modulate a high frequency television transmitter so that it can be broadcast. Command pulses are added to the storage device or tape, to effect the desired switching and blanking. Controls are provided, which can effect a manually initiated slow-action operation of the playback equipment and an automatic prolongation of the slower-action playback for the necessary additional time after the cessation of the live action.

Other features and advantages of the invention reside in the provision of an improved method and apparatus as above set forth, which is especially simple, foolproof and reliable in operation, convenient to use, and capable of being operated by personnel which do not possess highly technical skills.

Still other objects and advantages of the invention will hereinafter appear.

In the drawings:

FIG. 1 comprises a diagrammatic representation or block diagram of telecast equipment as provided by the invention, with certain portions being shown schematically.

FIG. 2 is an enlarged diagrammatic fragmentary representation of a portion of tape, especially simplified to better explain the invention and showing in simplified, audio-style format two consecutive frames and also related command pulses.

FIG. 3 is a diagrammatic showing, especially simplified for explanatory purposes, of a larger portion of the tape, revealing multiple picture tracks.

Referring to FIG. 1, the subject which is being televised is illustrated as a football player, being designated by the numeral **10**. A video or scanning camera **12** is shown focused on the player **10**, such camera being connected to usual equipment including a vertical deflector (oscillator) **14**, horizontal deflector (oscillator) **16**, synchronizing generator **18**, and amplifier **20**. The equipment numbered **12** through **20** can be constructed and operated in accordance with well-known procedures and techniques in the telecasting art. The output of the amplifier unit **20** is fed to a signal and pulse injector **22**, which in turn feeds a video tape recorder **24** which can have a standard fixed or normal synchronous speed, as well as various other speeds.

For the purpose of simplifying the explanation of the invention, it can be assumed that the video tape travels at 15 inches per second whereby signal information is uniformly placed on a magnetic tape **26** by means of recording heads **28**. The tape could have other speeds, as for example 9.6 ips, and the heads **28** could be of the helical scan type to provide a writing speed of 1,000 ips. However, to simplify the following explanation, the tape **26** will be treated as if it were ordinary audio tape

which does not require high writing speeds as demanded by video frequencies and band widths. After the following simplified explanation involving low relative speeds and stationary heads is grasped, it will be understood that air film helical scan heads or drums and 1 inch wide video tracks on wider tape can be utilized, as might be required to handle black and white as well as color TV signals involving 1,000 ips writing speed formats and frequency responses from 30 Hz to 4.2 MHz. Helical scanning, with a tape speed of 9.6 ips and a writing speed of 1,000 ips is known in the commercially produced "Ampex" (trademark) Model VR-7800 Professional Videotape Recorders. The tape **26** can be advanced by synchronous power-driven capstans **30**, in conjunction with a synchronous motor (not shown), all as well known. With suitable supplemental equipment, variable tape speed can be resorted to.

The simplified showing of the invention as depicted in FIG. **1** shows that, directly adjoining the recorder heads **28** there is provided a bank **32** of playback heads. In the illustrated simplification of the invention the bank **32** of playback heads comprises a total of six, numbered respectively **34, 36, 38, 40, 42** and **44** in FIGS. **2** and **3**. In these figures the data on the tape is shown as a straight-line projection, to effect a simplification in the explanation. This type of track is typical of audio tape, not of helical-scan video tape; however, it is used herein to simplify the explanation of the invention, with the understanding that the principle can be embodied in helical-scanned tape when carrying out an actual embodiment for commercial use. The tape **26** is shown, in the simplification of the figures, as having four identical video tracks **46, 48, 50** and **52**, with the direction of movement being from left to right as indicated by the arrow. The heads **34, 36, 38** and **40** respectively read out the tracks **46, 48, 50** and **52**, each head being displaced "upstream" or to the right from the preceding head by a distance equal to one-sixteenth the length of a frame on the tape. With a tape speed of 15 inches per second, and with 30 frames per second, in the illustrated simplification the distance taken by one frame becomes one-half inch. The displacement of each head from its preceding head thus is ½ × 1/16 or 1/32 inch. The playback head is displaced one thirty-second of an inch upstream from the head **40**, and reads out on the track **46**. Likewise, the head **44** is displaced one thirty-second of an inch upstream from the head **42**, and reads out on the track **48**. The tracks **46–52** contain identical video signals, which are identically placed thereon by four (vertically stacked, as illustrated) recording heads, these being indicated by the block having the numeral **28** in FIG. **1**. In addition to the playback heads **32–44**, there is a read out head **54**, which in the simplification is displaced upstream one one-hundred twentieth of an inch from the head **34**, and which reads on a command pulse track **56** provided on the tape. In FIG. **2**, the heads **34–44** and **54** are shown and positioned diagrammatically, with respect to the tape **26**, in keeping with the simplification.

The playback heads **34–44** are automatically sequentially switched or rendered operative one after another, each remaining operative long enough to scan one (successive) frame on the tape. After the first six frames are scanned respectively by the six heads **34–44**, the seventh frame is discarded, and the six playback heads repeat their sequential scanning, starting now with frame number eight. This process is then repeated, resulting in general in the following pattern, according to the simplification:

In the first three seconds, 26 frames per second are played back; in the fourth second, 25 frames are played back; in the next 2 seconds, 26 frames per second are played back; in the seventh second, 25 frames are played back. Starting with the eighth second, the above playback sequence repeats itself, and so on. The net result is a large number of small frame groupings each showing a slower-action playback of portions of a scene while the movement therein is occurring. If the actual movement of the scene consumes 8 seconds, the recorded frames that were involved would be eight times 30, or 240. Considering the above playback rate, in eight seconds only 206 frames would be played back. The ninth second would add 26 frames, bringing the total to 232 frames, and the remaining eight frames would be played back in three-tenths of the 10th second.

The discarding of every seventh frame is not noticeable by the television viewing audience. The switching from one head to the next should be done in less than 19/7200 of a second, according to the simplification, which then is the interval between the ending of one frame and the beginning of the next frame for playback heads which are displaced one thirty-second of an inch from each other. (1/120 inch + 1/32 inch = 19/480 inch; 19/480 × 1/15 = 19/7200 sec.) 19/7200 is roughly slightly less than 1/360 of a second.

After the last head **44** has been switched on, the first head **34** is again utilized, and so forth, the automatic switching continuing so long as the slow-action playback is desired. The switching time between decommissioning the number six head and commissioning the number one head should be less than 341/14,400 of a second. (1/120 inch + 1/10 of 3 15/32 inch (scale distance times scale of 10 to 1) = 1/120 inch + 111/320 inch = 8/960 inch + 333/960 or 341/960 inch; 341/960 × 1/15 (sec./inch) = 341/14,400 sec.; roughly 0.02368 sec., or about 1/40 sec.) It will be understood that the foregoing figures apply only to the simplification, wherein an audio or low frequency type tape is used as an example to facilitate illustration and explanation. For video signals, the simple audio-type scanning would be replaced by video-type scanning to give a writing speed of 1,000 ips.

The automatic switching of the playback heads as above set forth is accomplished by an electronic switch **58** which is controlled by the command head **54** and the command pulse track **56** on the tape **26**, and also by the playback heads **34–44** and pulses on the tracks **46–52**. The electronic switcher can include virtually-instantaneous action solid state switching devices such as transistors, and can have diodes as well, to effect the desired switching with the least amount of transients, as directed by the command track **56**. The switching is made to occur during the vertical retrace and blanking intervals, at which times the receiving set pictures are normally turned off, and can be understood by referring to the simplified "low frequency" or audio showing of FIG. **2**. In FIG. **2** the tape **26** has been expanded

longitudinally 10-fold, whereby a single frame which normally would measure one-half inch according to the simplification, is shown as covering a distance of 5 inches. The playback heads are shown to have an illustrated spacing of five-sixteenths inch, which corresponds to their actual spacing of one thirty-second inch. Legends have been copiously employed in FIG. 2, to facilitate the explanation and understanding of the invention. Starting with the first head 34 in commission, traversal of frame No. 1 will take place as the tape 26 moves from left to right. When the second vertical blanking pulse 60 advances halfway past head 34, the No. 1 marker pulse 62 on the command track 56 will reach the command head 54, thereby maintaining a vertical blanking pulse in the transmission. When the second vertical blanking pulse 60 leaves the head 34, the latter can be switched off by the electronic switcher 58 and the second playback head 36 switched into commission. As the vertical blanking pulse 62 leaves the command head 54 the receiving sets will be ready to trace horizontally, and scanning of frame No. 2 will take place by head 36. In a like manner the scanning of frames 3, 4, 5 and 6 will be done by the heads 38, 40, 42 and 44 respectively. The command markers which succeed the marker 62 on the tape 26, and especially the trailing edges thereof, will be successively displaced downstream by exactly the amount of the upstream displacement of the playback heads 34–44 to effect this. The lengths of these command markers, except for the sixth command pulse (a preceding sixth pulse being indicated at 64) will be all equal. The sixth pulse 64 can be about 9 ⅛ times the length of the other pulses, or about 111/320 inch by which it discards frame No. 7 from the transmission. After this occurs, the head 44 is decommissioned and the head 34 recommissioned so that the latter can commence scanning the new frame No. 1 which follows the discarded frame No. 7. Thus, the command markers appear in sets of six (five short and one long), and the frames are considered in sets of seven (six scanned and transmitted, and the seventh discarded). The command marker head 54 is indicated in FIG. 2 as being at the center of the vertical blanking pulse 66 whereby it is upstream of the first playback head 34 by 1/120 of an inch.

The video frames in FIG. 2 are for convenience of illustration indicated by rectangles, this being true of the command markers; actually the frames and markers have wave shapes all of which include the necessary horizontal synchronizing pulses to maintain receiver synchronization during blanking, retrace, switching of heads and discarding of No. 7 frames; and helical scanning to achieve 1,000 ips writing speed will result in a different visual concept, not as simple as the illustration herein, this being well understood in the art. The normal (two) vertical retraces in a frame occupy an interval of about 35 lines total, and the picture information of a frame occupies about 490 lines total, divided into two fields of about 245 lines each, as shown. Each frame takes one-half inch on the tape at a tape speed of 15 inches per second according to the simplification. The frame thus is scanned in one-thirtieth of a second.

Referring back to FIG. 1, the outputs of the playback heads 34–44 are fed from the electronic switch 58 to an amplifier 68 and thence to a transmitter 70 having antenna 72 and ground 74.

As already stated, the foregoing is a simplification using a low frequency or audio tape example instead of actual video or high frequency tape and helical scanning to achieve high writing speeds, as 1,000 ips. The simplified illustration makes it easier to understand the invention; one skilled in the video tape and broadcasting art can readily apply the principles to helical scan heads and frequencies of from 30 Hz to 4.2 MHz as used in the VR 7800 Recorder mentioned above. Also, scanning drums and 1 inch wide video tracks employing variable slow motion, covering from 1 to 100 fields per second can be utilized, based on a tape speed of 9.6 ips.

The playback heads 34–44 and 54 can be helical scan heads, as can the recording heads in the block 28. The tracks 46–52 can be on 1 inch wide sections of the tape, and will not be straight as shown, but instead when greatly enlarged will have a configuration in outline as determined by the helical scan heads.

From the foregoing it will be seen that the live action being recorded by the video camera 12 and placed on the magnetic tape 24 can be virtually immediately played back while the action is still continuing, but with a slower-action effect by means of the bank 32 of playback heads. Such playback is compatible with the telecast system, and is used to modulate the transmitter whereby the television viewers will receive the action in a slower motion. The television audience will see the commencement of the action essentially at the time that it has actually started, and will also see the end of the action essentially at the actual termination of the live action. Upon the slower telecasting of the live action terminating, the telecast can as usual show the unscrambling of the players after they have piled up immediately proceeding and following the blowing of the official's whistle which grounds the ball.

In the various units shown, the terminals marked X represent 60 cycle commercial power input, synchronized countrywide.

It will now be understood from the foregoing that I have provided a novel and improved method, apparatus and control for slower telecasting of live football plays or other sports action, by utilizing video tape recorder and playback units, and by discarding small intervals of time normally not considered essential. Thus the audience has the advantage of viewing the live action at a somewhat slower rate whereby the details of the plays can be followed more easily and closely.

The various units illustrated in the drawing are shown as interconnected for synchronizing purposes, and as having terminals labelled X, signifying that these units are supplied from a common source of 60 cycle power which is synchronized with the commercial power supplies utilized by the television audience.

The novel method of the invention involves recording a live action play or scene, sports or otherwise on video tape and immediately playing back the information on the tape in a manner to produce a slower action, all while the live action scene is still occuring. The method discards minute intervals during the live action scene, to effect a slower-action telecast picture.

The method of the invention covers, as well, other species as for example the use of but a single playback head which is shifted minute distances upstream during the vertical retrace and blanking intervals, in place of the switching upstream of multiple stationary heads as

disclosed herein. The single head would be advanced by an intermittently actuated mechanical device, and would be working against the relatively slow tape speed, being moved for example, by increments on the order of 0.015 inch. Thus a mechanical system (not shown) for effecting the method would be well within the boundaries of feasibility. At the end of a playback action, the single mechanically advanced head would be snapped back to its starting position in readiness for the next play.

Variations and modifications are possible without departing from the spirit of the invention.

I claim:

1. The method of telescasting live action which includes the steps of converting light signals of an action scene instantly into electronic signals, instantly storing said electronic signals in sequence in a storage device in the form of frames at a fixed rate while the scene is occurring and simultaneously with the action thereof, converting to signals substantially instantly from said storage device the first of said frames and converting to signals the remainder of said frames from said storage device except for predetermined individual uniformly spaced apart frames which are discarded and which occur at regular intervals, said converting occuring in the same sequence as the storage thereof but at a timing slower than said fixed rate, and immediately transmitting said converted signals, into the ether.

2. The method of claim 1, and including the further step of converting electrical signals into magnetic signals, said electronic signals including both said electrical and magnetic signals.

3. The method of claim 1, and including the further step of relating command pulses to said electric signals in the storage device.

4. Apparatus for telecasting live action at a slower rate while the action is occurring, comprising, in combination:

a. means for instantly converting light signals of an action play into electronic signals,

b. means for instantly storing said electronic signals in sequence in a storage device in the form of frames at a fixed rate while the action is occurring and simultaneously therewith,

c. means for substantially instantly converting to signals the first of said frames from said storing means, and converting to signals the remainder of said frames from said storing means except for predetermined individual uniformly spaced apart frames which are discarded and which occur at regular intervals, said converting occurring in the same sequence as the storage thereof but at a timing slower than said fixed rate, and

d. means for transmitting said converted signals into the ether.

5. Apparatus as in claim 4, wherein:

a. the means for storing said electronic signals comprises a recording head,

b. said storage device comprising a video tape, and

c. the means for converting to signals the frames of said storage device comprises a plurality of playback heads respectively located consecutively greater distances upstream from the recording head.

6. Apparatus as in claim 5, wherein:

a. the playback heads are spaced upstream from each other an amount less than 1/10 the length of a frame on a tape.

7. Apparatus as in claim 6, wherein:

a. the playback heads are spaced upstream from each other an amount equal to one-sixteenth the length of a frame on a tape,

b. said means for converting the frames to signals including means for blanking, in said transmission, the information contained in every seventh frame.

* * * * *