

June 28, 1960

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2,943,141

AUTOMATIC BASEBALL UMPIRE OR THE LIKE

Filed Jan. 7, 1955

3 Sheets-Sheet 1

FIG. 1.

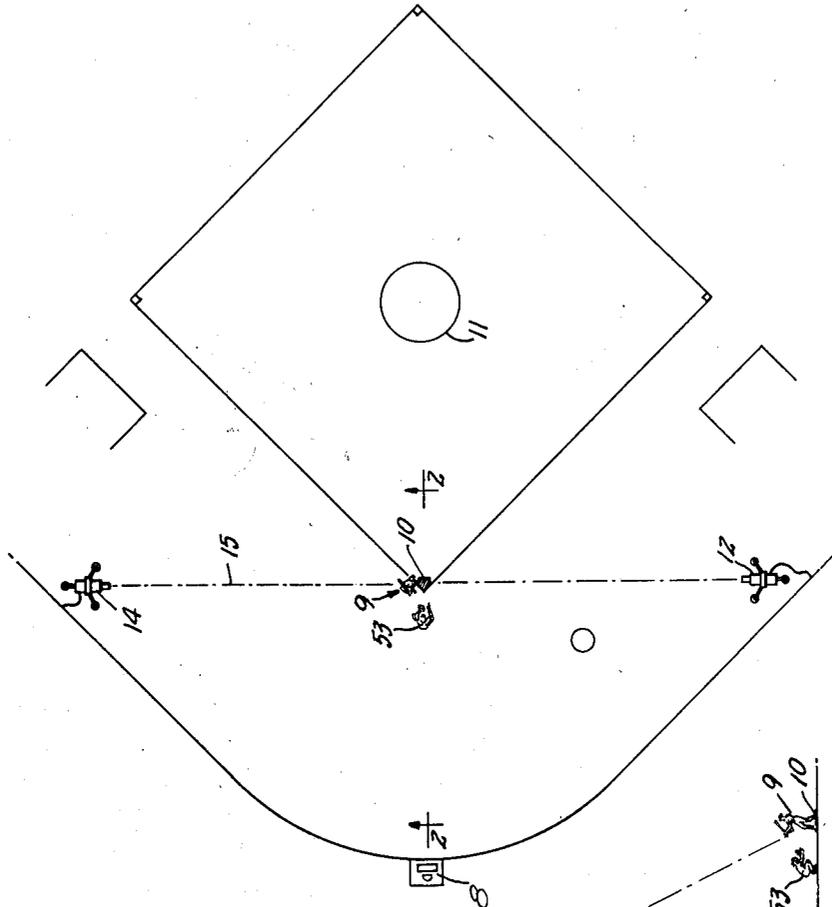
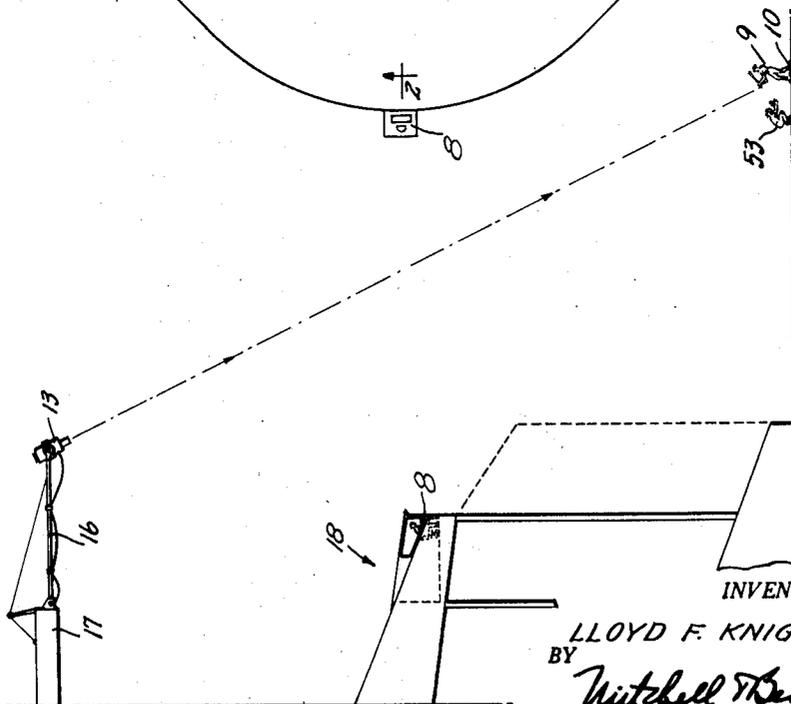


FIG. 2.



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3 Sheets-Sheet 2

FIG. 3.

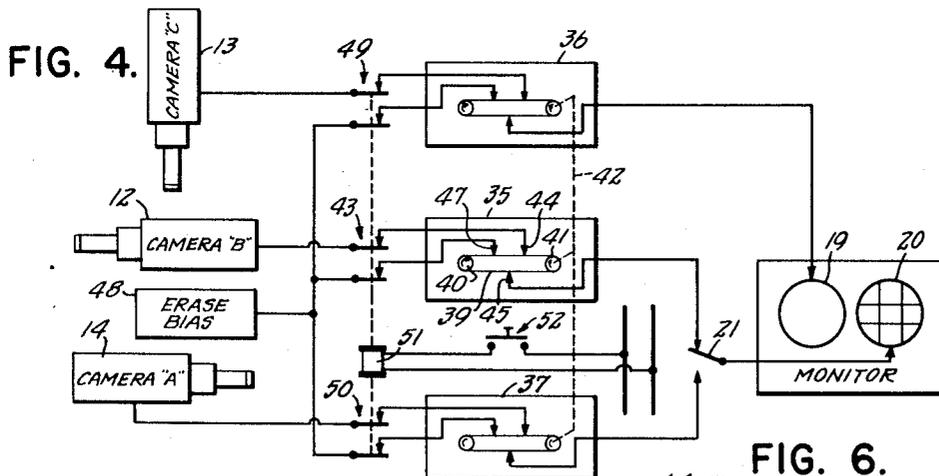
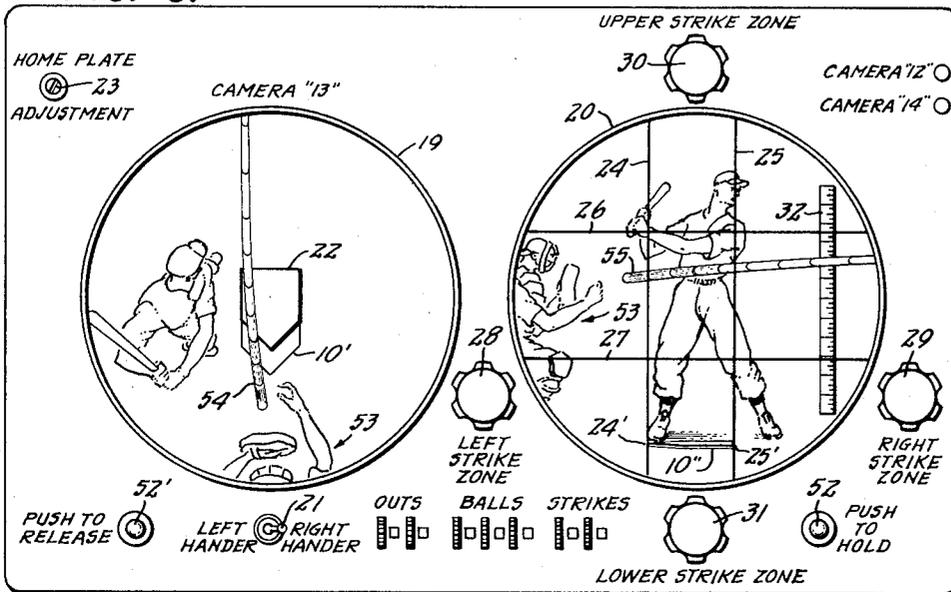


FIG. 5.

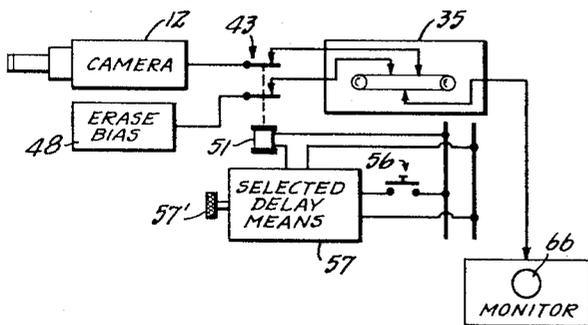
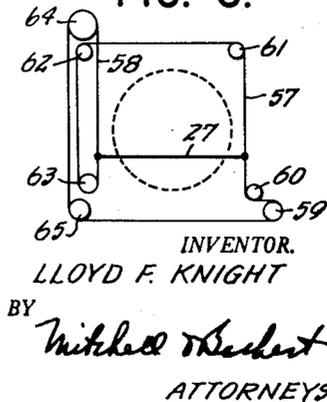


FIG. 6.



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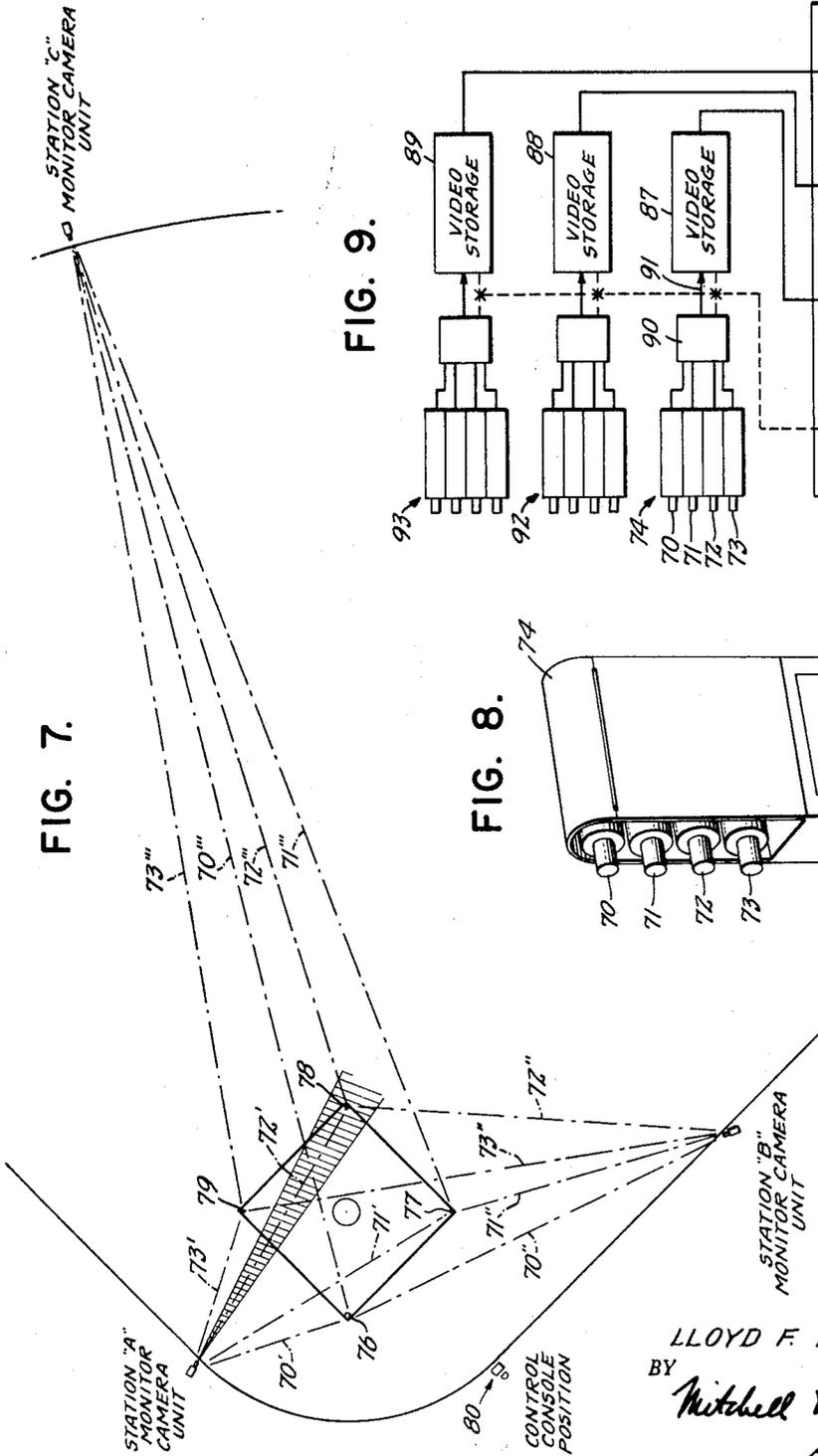


FIG. 7.

FIG. 9.

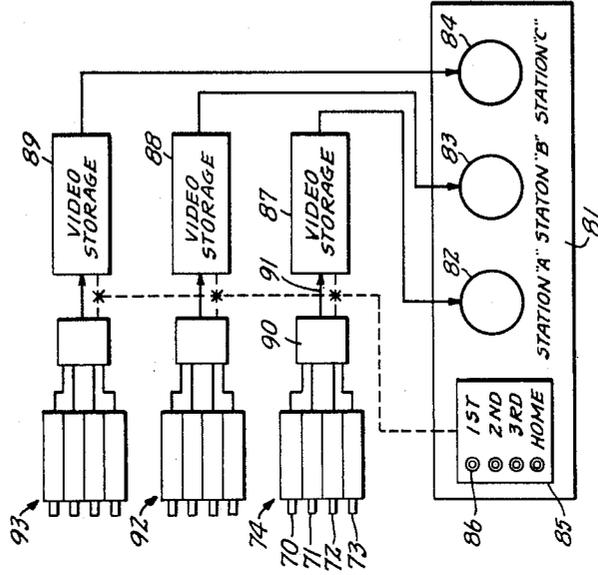
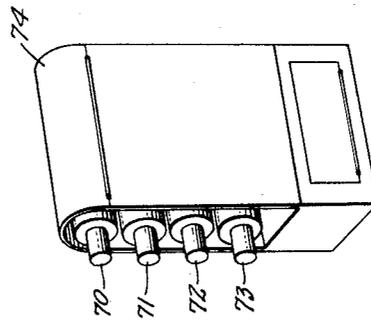


FIG. 8.



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**AUTOMATIC BASEBALL UMPIRE OR THE LIKE** 5

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Filed Jan. 7, 1955, Ser. No. 480,435 10

16 Claims. (Cl. 178—6.5)

My invention relates to an improved means to assist 15 in the umpiring of games, and in particular to the calling of balls and strikes, or to the calling of base plays, in a baseball game.

It is an object of the invention to provide an improved 20 means of the character indicated.

It is another object to provide a device capable of "freezing" a brief athletic or other action, as at the time 25 a pitched baseball traverses the strike zone, said device being inherently capable of continuously and repetitively redisplaying such action as long as called for.

It is further a specific object to provide an automatic 30 device for displaying and, when desired, for redisplaying in three coordinates the home-plate region of a baseball diamond, including the batsman, as well as the strike zone applicable to the batsman.

It is another specific object to provide an automatic 35 device for displaying and redisplaying base-play regions in a baseball diamond.

Other objects and further features of novelty and invention will be pointed out or will occur to those skilled 40 in the art from a reading of the following specification in conjunction with the accompanying drawings. In said drawings, which show, for illustrative purposes only, preferred forms of the invention:

Fig. 1 is a plan view of a baseball diamond and grandstand, showing preferred locations of equipment of the 45 invention;

Fig. 2 is a sectional view in the vertical plane of the pitch line, designated 2—2 in Fig. 1;

Fig. 3 is a front elevation of the display and basic control panel of a monitoring device for use by an umpire 50 in order to monitor plays with my equipment;

Fig. 4 is a block diagram schematically indicating interrelated components and functions of my equipment;

Fig. 5 is another block diagram illustrating a modification;

Fig. 6 is a simplified mechanical diagram of a control element in the monitor of Fig. 3;

Fig. 7 is a plan view of a baseball park, showing preferred locations of further equipment;

Fig. 8 is a perspective view of camera equipment for use in the arrangement of Fig. 7; and

Fig. 9 is a block diagram schematically illustrating components of the arrangement of Fig. 7.

Briefly stated, my invention contemplates the automatic umpiring of athletic events, such as balls and strikes or base-plays in a baseball game, by means of suitably placed and integrated television cameras or the like. For balls and strikes, two fixedly mounted cameras may be employed to continuously present the full three-dimensional analysis of the strike zone at the time of a pitch and, in accordance with the invention, means may be provided for effectively "freezing" the critical event which occurs when a pitched ball traverses or fails to traverse the strike zone. In application to the calling 60 of base-plays, similar cameras, similarly integrated, may

permit selective freezing of a plurality of aspects on a selected base zone.

In the particular form to be described, a storage or memory device stores video or other signals for substantially only the time interval of interest, and provision is made for automatically effectively "freezing" the action by repeatedly redisplaying only this limited period of action. For balls and strikes, reticules may be manually set appropriate to the strike zone for each individual 65 player, and maximum assistance is thus provided to the umpire in calling a play. The umpire may keep the display "frozen" until he is sure that there is no argument about his decision on the play. The device may then be released, in readiness to "freeze" the next action.

Referring to Figs. 1 and 2 of the drawings, my invention is shown in application to a baseball diamond, including a home plate 10 and a pitcher's box 11; a right-handed batsman 9 is shown at the plate 10. Three coordinates of the strike zone are continuously observed 70 by means of television cameras, as at 12—13—14. The cameras 12—14 are fixedly mounted substantially at ground level (preferably three to four feet above ground) and are shown on tripods and in alignment with each other on the axis 15; said axis passes through the home-plate zone 10 substantially perpendicular to the vertical plane of the pitch line, said plane being designated 2—2 in Fig. 1. The only reason for supplying two cameras 12—14 on the axis 15 is to provide selective availability of a frontal aspect on the batsman, whether he be right- or left-handed.

The third camera 13 is preferably mounted in the vertical plane of the pitch line and substantially above home plate. In the form shown, camera 13 is supported at the end of a boom 16 projecting from the upper roof 75 17 of the grandstand 18. It would, of course, be preferable to have the camera 13 mounted directly above home plate 10, but this is not permitted by current baseball rules, and so camera 13 is shown as far forward as permitted by the rules. Whatever the orientation of camera 13, whether it be directly above home plate (or substantially above, as shown), errors in interpretation through camera 13 may be of negligible proportions. My equipment may be monitored at press box 8, or at some other suitable location.

In Fig. 3, I show monitoring means for use by the umpire in calling plays based on observation through cameras 12—13—14. The output of the vertical camera 13 may be displayed on the face of the picture tube 19, and the output of one of the ground-based camera 12—14 may be displayed on the picture tube 20. Switch means 21 is provided for selection of one of cameras 12—14, depending upon whether the batsman is a right- 80 hander or a left-hander.

Because of the slant aspect of camera 13 on home plate, the depicted location 10' for home plate in the display 19 will be vertically depressed below that location at which the strike zone should be interpreted. For this reason, I show provision at 22 of a heavy and unmistakably clear outline of home plate, representing a corrected version, against which the strike zone is to be interpreted in the display 19. The outline 22 may be automatically superposed on the video signals for the display so as to be inherent in the display, but this is a relatively complicated procedure, and I prefer to employ a single transparent plate suitably engraved with the outline 22 and adjustably oriented over the face of the display 19, as by means of a screw-driver adjustment at 23. Once adjustment 23 has been set for a particular installation of camera 13, there should be no further need to make the adjustment, as will be understood.

In order to aid evaluation of the strike-zone components depicted in display 20, I show provision of

reticules 24—25 and 26—27. The reticule lines 24—25 are parallel and are pre-set to identify the longitudinal limits 24'—25' of the display 10" of home plate; independent adjustments of these limits for lines 24—25 are available at manual control knobs 28—29. In like manner, independent adjustment is available by means of knobs 30—31 for controlling the elevation of the horizontal strike-zone lines 26—27. Ordinarily, the latter zone lines will have to be vertically re-established for each new batsman. The umpire may visually align reticules 26—27 with the armpits and knees of the batsman through his own personal observation; or, by means of a scale 32 (at one side of the display 20), the umpire may set lines 26—27 against particular inscribed markings on scale 32, as derived from published physical dimensions of each batsman.

Operation of my automatic umpire will best be understood by reference to Fig. 4, in which I show, for the video output for each of the cameras 12—13—14, separate video storage devices 35—36—37. The storage devices may be of various types, but I schematically indicate, as for the device 35, the employment of a continuously moving drum or belt 39 of magnetic storage material. The belt 39 may be endless and stretched between spaced pulleys 40—41, and a synchronizing connection 42 may hold all storage devices in step. Normally, control contacts of a relay 43 may connect the video output of a camera, such as the camera 12, to recording means 44 for impressing the video on the storage medium 39. A pick-up head 45 may continuously transcribe the stored video for relay to the appropriate monitor display 20. In Fig. 4, it will be seen that the selector switch 21 has determined the connection of camera 12 to the display 20. Elements of suitable magnetic recording and reproducing mechanism for storage and playback of television signals are set forth in a paper delivered at the IRE National Convention, March 1954, entitled "A System for Recording and Reproducing Television Signals," published in Transactions of the IRE, November—December, 1954.

In the normal operation of the storage device 35, the relay contacts at 43 are closed so as continuously to apply fresh video to the means 39 and to erase, by means of head 47, that video which is stale by substantially the storage capacity of the device 35. An erasing-bias signal is continuously available for this purpose, as from a supply 48 connected in common to all storage devices 35—36—37.

Contacts of a relay 49 and of a relay 50 are shown in controlling relation with the input video and bias signals for the respective storage devices 36—37. These sets of contacts may be operated by separate solenoids, but in the form shown a single solenoid 51 is energized as by actuation of switch or push-button means 52 whenever a stored video signal is to be preserved.

In actual practice, with the arrangement shown in Fig. 4, the umpire need only push the button 52 at the instant a ball is caught by the catcher 53 (Figs. 1 and 2) in order to preserve the video for the most recent critical instant during which the ball traversed or failed to traverse the strike zone. The push button 52 in Fig. 4 will be understood as purely schematic and as suggesting a preferred version, in which, once button 52 is actuated, solenoid 51 continues to hold open all sets of contacts 43—49—50; these contacts may remain open until operation of another push button 52', to release the "frozen" function. Until the button 52' releases this function, the ball will be seen repeatedly to traverse the display areas or fields of view of tubes 19 and 20.

If the ball passes within the area defined at 22 and also within the area defined between lines 24—25—26—27, then clearly there has been a strike, and the umpire may hold the action pending settlement of any dispute over his calling the action a strike. In Fig. 3, the trajectory of the ball is shown by the blurred lines 54—55 in displays 19—

20, and a clear strike is indicated. The ball trajectory may be emphasized by employing screen material of greater-than-usual persistence at tubes 19—20, as will be understood.

In Fig. 5, I show a slight modification applicable to the arrangement of Fig. 4, and for the case in which it may be preferred to initiate the "freezing" action prior to the ball entering the home-plate area. Thus, with the arrangement of Fig. 5, the button 56 may be manually actuated, as at the instant of release of the ball by the pitcher, as determined visually by the umpire. Delay means 57 may respond to action of button 56 to delay the actuation of solenoid 51. The functioning of the remaining parts may be as described in connection with a typical camera and display of Fig. 4. Corresponding parts have, therefore, been given the same reference numerals.

In Fig. 6, I show a mechanical detail of means for adjusting one of the reticule lines, such as the line 27 over-riding the display 20. The line 27 may be a straight wire or link connected between similarly elevated portions of opposed stretches 57—58 of an endless cable. The cable is wrapped around the hub 59 of the lower strike-zone-adjustment knob 41 and is played over suitable pulleys 60—61—62—63—64—65, in order that the opposite stretches 57—58 may raise and lower in unison. The same basic mechanism may be employed also for actuation of the other reticule lines 24—25—26, upon setting knobs 28—29—30, respectively.

As indicated generally above, my invention has further specific application to the calling of base-plays in a baseball game, and in Figs. 7 to 9, I show means for accomplishing this. In the ball park of Fig. 7, my preferred arrangement is seen to include three monitor stations, designated Station A, Station B, and Station C. Each station is preferably elevated somewhat off the ground and includes a battery of four cameras, such as the cameras 70—71—72—73 for the station unit 74 of Fig. 8. The cameras are preferably each of long focal length, to provide extreme directivity, unique for a particular base zone. Thus, for the case of Station A, which may involve the unit 74 of Fig. 8, the camera 70 may be directed on the axis 70' toward the home-plate zone 76. The camera 71 may be directed on the axis 71' toward the first-base zone 77; the camera 72 may be directed on the axis 72' toward the second-base zone 78 (a typical field width is shown by shading, for the axis 72'); and the camera 73 may be directed on the axis 72' toward the third-base zone 79. In like manner, similar cameras at Station B may be directed on axes 70''—71''—72''—73'' toward the respective base zones; and, for the case of Station C, the cameras may be directed on axes 70'''—71'''—72'''—73'''.

The monitoring console may be installed to one side of the field limits, as at 80, and may include a display panel 81 (Fig. 9), with means for selecting and displaying particular stored aspects of plays at a selected base. The monitor 81 may have a single display tube with appropriate selection means for deriving the best aspect at the desired base; however, in the form shown, I provide three picture tubes 82—83—84 for simultaneously displaying and redisplaying all the A—B—C station aspects, respectively, on a particular base zone. Thus, the monitor may include a selector panel 85 having push buttons, as at 86, for selection of a first-base play.

Separate video-storage devices, as described at 35—36—37, may be employed for each of the cameras at each of the stations, meaning that twelve video-storage devices might be needed. However, in the form shown, I economize on the video-storage devices by employing only three, at 87—88—89, there being thus one video-storage device for each monitoring station. The selector-switch means may be provided between the cameras and the storage device for each station. In the case of the camera battery 74, a switch unit 90 responds to selection, as at button 86, to apply the selected-camera output, such

as the output of camera 71, to the single channel 91 feeding the video-storage device 87. The mechanism within storage device 87 and the means for its operation may resemble that described in connection with Fig. 5 so that, once the button at channel 85 is depressed, the video stored at 87 will continue to load the device 87 until the lapse of a predetermined delay interval, at which time said video will be "frozen" for as long as desired. The operation of a control button at 85 will be understood to disable any previous push-button selection so as immediately to enable the storage of the desired new video. Operation of the cameras 92-93 at the remaining two stations may be as described for the cameras 74, so that there may be displayed at 82-83-84 only the three aspects on the currently selected base zone.

In use, the umpire can foresee the base for which a close play is likely and can therefore push the correct button at 85, just before the play occurs. This assures not only correct camera channeling to all video-storage devices but also starts the delay interval to control the length of the "frozen" recordings. Tubes 82-83-84 will continuously redisplay the play until the next actuation of a button at 85.

It will be seen that I have described an ingenious means for the more accurate evaluation of baseball plays. With my device, arguments about the calling of balls and strikes or of base-plays should be reduced to an absolute minimum. Operation of the device will not hold up the game because the "frozen" action may be immediately killed, to permit a successive "freezing" action merely upon the pushing of button 52'. The appearance of "frozen" action may be enhanced by employing cathode-ray display tubes of relatively long-persistence character, and in certain applications the persistence alone may provide sufficient "freezing," without recourse to other memory techniques.

My device has been described particularly with calling baseball events; the basic unitary device, as shown for example in Fig. 5, is, however, applicable to the study of plays in other sports. For example, a pole-vaulting athlete wishing to improve upon his form may employ the camera 12 of Fig. 5, properly oriented to display his field of action; and, merely by pushing the button 56 and suitably adjusting at 57' the delay at 57, he may make his jump, and then refer to the monitor 66 in order to analyze repeated displays of his jump.

While I have described the invention in detail for the preferred forms shown, it will be understood that modifications may be made within the scope of the invention as defined in the claims which follow.

I claim:

1. An automatic baseball umpire, comprising two fixedly mounted continuously scanning cameras in face-to-face relation at substantially ground level and aligned with each other and with home plate and substantially transverse to the pitching line to home plate, a third continuously scanning camera substantially in the vertical plane including said pitching line and substantially above and directed at home plate, a first continuously recycling memory device, means for selectively connecting the output of one of said first two cameras to said device, a second continuously recycling memory device connected to said third camera, each of said memory devices including means continuously accepting fresh input video signal and recording the same and storing the same for a given relatively short interval and for continuously erasing that stored video which is stale for said length of time, and monitor means including separate display devices connected respectively to the outputs of said memory devices, each said memory device further including means for continuously picking off the currently stored video signal for supply to said monitor means, said monitor means including manually operable means for substantially simultaneously disabling both said recording means and said erasing means, whereby upon actuation of said manual means the stored video for a given event of said time dura-

tion may be continuously and repetitively displayed at said monitor means.

2. An automatic baseball umpire, comprising two fixedly mounted continuously scanning cameras in face-to-face relation at substantially ground level and aligned with each other and with home plate substantially transverse to the pitching line to home plate, a third continuously scanning camera substantially in the vertical plane including said pitching line and substantially above and directed at home plate, a first continuously recycling memory device, means for selectively connecting the output of one of said first two cameras to said device, a second continuously recycling memory device connected to said third camera, each of said memory devices including means continuously accepting fresh input video signal and recording the same and storing the same for a given relatively short interval and for continuously erasing the stored video which is stale for said length of time, and monitor means including separate display devices connected respectively to the outputs of said memory devices, each said memory device further including means for continuously picking off the currently stored video signal for supply to said monitor means, and manually operated means including a time-delay mechanism of duration approximating the time-handling capacity of said storage means and effective upon expiration of said delay to substantially simultaneously disable both said recording means and said erasing means, whereby upon actuation of said manual means the stored video for a given event of said time duration may be continuously and repetitively displayed at said monitor means.

3. In combination, a television camera producing a continuous video output, continuously operative video-storage means having a relatively short-time handling capacity, means continuously applying said video signals to said storage means, said storage means including means for continuously erasing stored video which is stale to the extent of substantially the time-handling capacity of said storage means, said storage means including a pick-up continuously transcribing the stored video signal, monitoring means including a display responsive to the picked-up stored video, and manual means for substantially simultaneously disabling both said recording means and said erasing means, whereby upon operation of said manual means just following an event to be analyzed, such event may be continuously and repeatedly displayed at said monitoring means.

4. In combination, a television camera producing a continuous video output, continuously operative video storage means having a relatively short-time handling capacity, means continuously applying said video signals to said storage means, said storage means including means for continuously erasing stored video which is stale to the extent of substantially the time-handling capacity of said storage means, said storage means including a pick-up continuously transcribing the stored video signal, monitoring means including a display responsive to the picked-up stored video, and manually operated means including a time-delay mechanism of duration approximating the time-handling capacity of said storage means and effective upon expiration of said delay to substantially simultaneously disable both said recording means and said erasing means, whereby upon operation of said manual means just following an event to be analyzed, such event may be continuously and repeatedly displayed at said monitoring means.

5. A baseball umpire according to claim 1, in which the display device for the selected one of said first two cameras includes two substantially parallel reticule lines horizontally oriented and respectively aligned with the upper and the lower strike-zone limits of a batsman on the scale of said display.

6. A baseball-monitoring device according to claim 1, in which said third camera is elevated substantially above home plate with a relatively steep slant aspect of said

third camera on home plate, whereby by reason of said slant aspect there is an error in the display of home plate with relation to the true strike zone, and means apart from said camera for displaying on said slant-aspect display device an outline of home plate in corrected relation to the strike zone.

7. A device according to claim 5, and including separate manual adjustment means for said respective reticule lines for separately vertically displacing the same so that the display may be correct for the strike zone unique to each successive batsman.

8. A device according to claim 5, and including manual adjustment means for one of said reticule lines, said adjustment means comprising an endless strip, pulley means supporting said strip with two substantially parallel stretches running in the same direction, and a reticule element connected transversely between said stretches.

9. A device according to claim 6, in which said last-defined means includes a reticule overstanding the slant-aspect camera display.

10. A device according to claim 9, in which said last-defined means includes a vertically adjustable reticule overstanding the slant-aspect camera display.

11. In combination, two viewing stations for viewing two spaced zones of action, two television cameras at each station, one camera at each station being trained on one of said zones, the other camera at each station being trained on the other of said zones, monitoring means including a display device, continuously operative video-storage means having a relatively short time-handling capacity, said storage means including means for continuously erasing stored video which is stale to the extent of substantially the time-handling capacity of said storage means, said storage means including a pick-up continuously transcribing stored video signals, selector means for selectively connecting the video output of one of said cameras to said display device via said storage means, and delay-operated means for effectively simultaneously disconnecting said one camera from said storage means and for disabling said erasing means.

12. A baseball base-play monitoring device, comprising two television-camera stations at spaced locations on the field limits, four separate television cameras at each station and directed at the respective bases of the baseball diamond, a plurality of continuously operative video-storage devices having a relatively short time-handling capacity, said storage means including means for continuously erasing stored video which is stale to the extent of the time-handling capacity of said storage means, each storage means including a pick-up continuously transcribing stored video signals, two display devices, and manual means selectively connecting corresponding-base cameras at said stations to said display devices via separate video-storage devices, said manual means including means for effectively simultaneously disconnecting cameras from said storage devices and for disabling said erasing means.

13. A baseball base-play monitoring device, comprising three television-camera stations at spaced locations on the field limits, four separate television cameras at each sta-

tion and directed at the respective bases of the baseball diamond, a plurality of continuously-operative video-storage devices having a relatively short time-handling capacity, said storage means including means for continuously erasing stored video which is stale to the extent of the time-handling capacity of said storage means, each storage means including a pick-up continuously transcribing stored video signals, three display devices, and manual means selectively connecting corresponding-base cameras at said stations to said display devices via separate video-storage devices, said manual means including means for effectively simultaneously disconnecting cameras from said storage devices and for disabling said erasing means.

14. A device according to claim 13, in which there are three video-storage devices continuously connected to said display devices, and in which said manual means determines camera connection to said video-storage devices.

15. A device according to claim 13, in which said stations are located respectively at right- and left-field limits near the diamond and near the far center-field limit of the park.

16. In combination, two spaced-apart viewing stations for viewing two spaced zones of action that are spaced from said stations, two television cameras at each station, one camera at each station being trained on one of said zones, the other camera at each station being trained on the other of said zones, monitoring means including two display devices, continuously operative first and second like television video-storage means each having relatively short time-handling capacity, each said storage means including means for continuously erasing stored video which is stale to the extent of substantially the time-handling capacity of said storage means, each said storage means including a pick-up continuously transcribing stored video signals, selector means having a first operative condition separately connecting only said respective one camera to said respective display devices via said respective storage means, said selector means having a second operative condition for separately connecting only said respective other cameras to said respective display devices via said respective storage means, and delay-operated means for effectively isolating both said storage means from input video signals and for simultaneously disabling said erasing means.

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