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GB 2219710 A **GB 2001250 A** **WO 97/38762 A1**
US 5615880 A

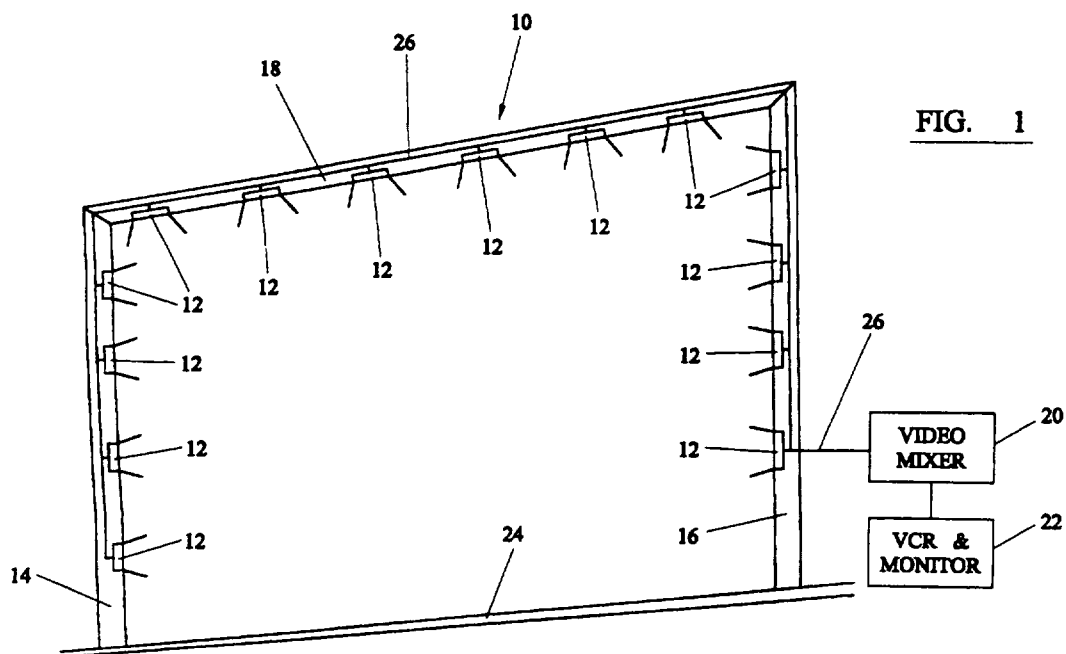
(58) Field of Search

UK CL (Edition Q) **A6D D11F**
INT CL⁶ **A63B 63/00 71/06**

(54) Abstract Title

Goal posts

(57) A goal post surveillance system 10 comprises a plurality of video cameras 12 mounted within the posts 14 and 16 and crossbar 18 of a set of goal posts. Each of the video cameras 12 is arranged to view the goal mouth. The output of the video cameras 12 is directed to a video mixer 20, which superimposes the images on each other and provides an output to a video recorder and monitor 22. The system is used to determine whether a football has crossed the goal line. Since the outputs of each of the video cameras 12 are mixed, at least one of the cameras should show whether a football has crossed the goal line in the event that one or more of the cameras 12 are obscured, by players for instance.

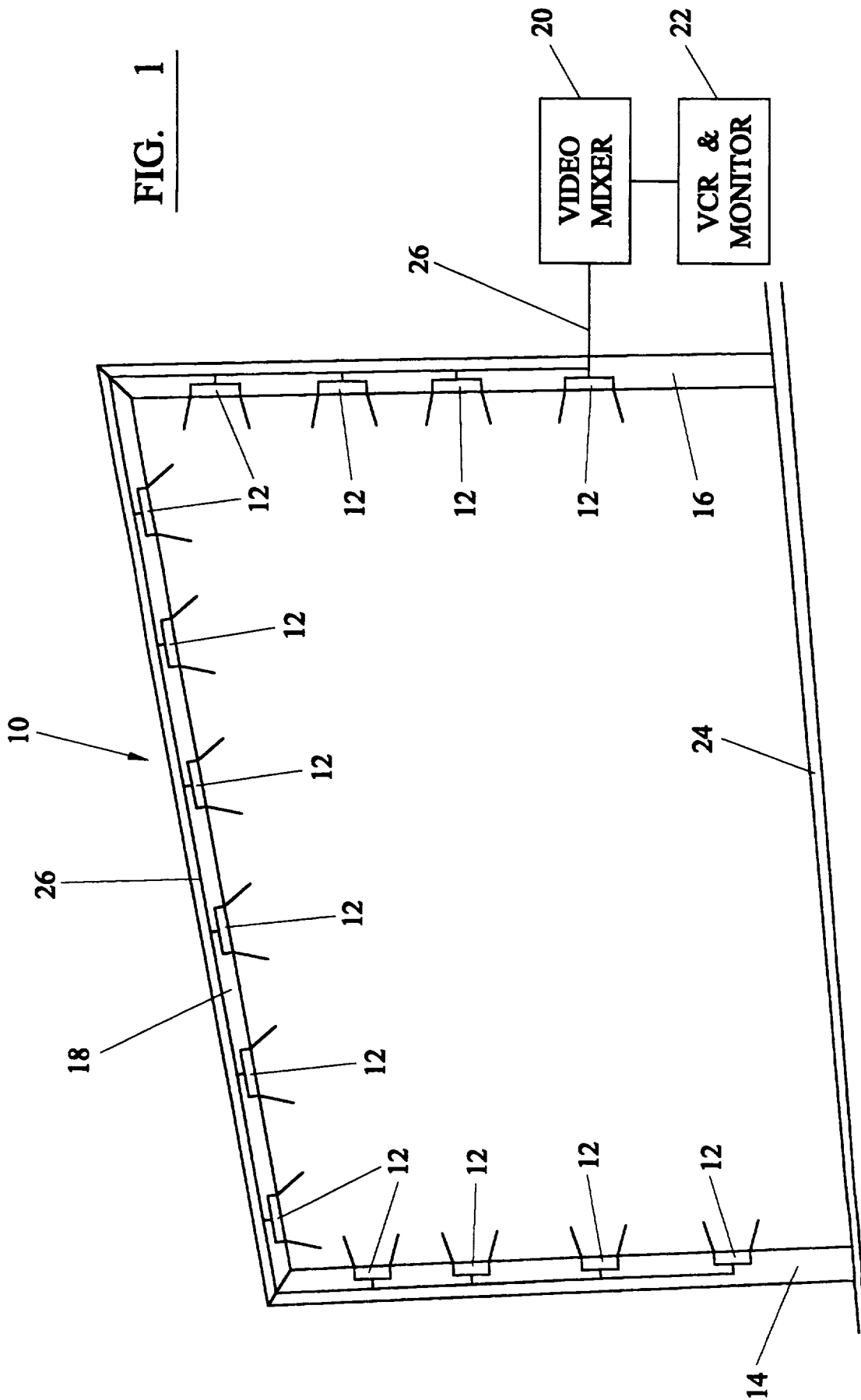


At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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FIG. 1



-2/2-

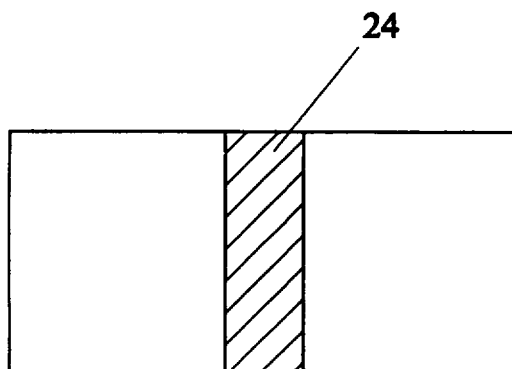


FIG. 2A

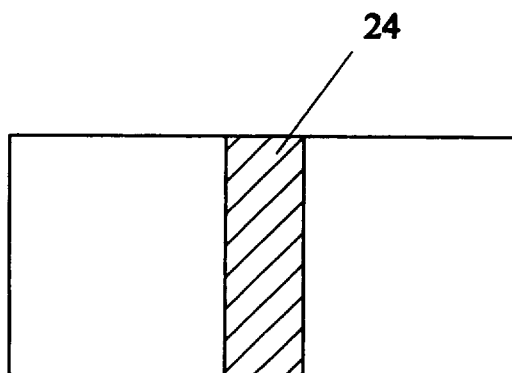


FIG. 2B

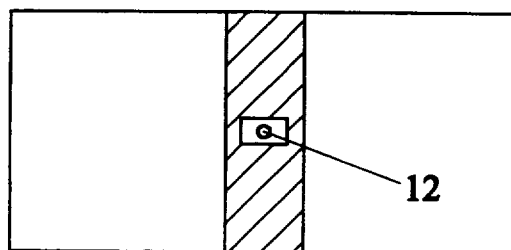


FIG. 2C

GOAL POSTS

This invention relates to a goal posts surveillance system and to a method of surveying goal posts.

5

In a game of football, a goal has only properly been scored if all of the football crosses the plane formed by the goal line, goal posts and cross bar. It is often difficult to determine if the football has crossed that plane since the event may happen very quickly and/or the referee's view may be obscured by the presence of one or more players.

10 The use of video cameras located on the perimeter of a football pitch assists in determining whether a goal has been scored, but disadvantages arise because there are typically a number of players very close to the ball, which frequently results in the view of the referee and the cameras being obscured.

15 It is an object of the present invention to address the above mentioned disadvantages.

According to a first aspect of the present invention a goal posts surveillance system comprises at least one imaging device, which imaging device is operable to capture an image having a view substantially along the plane of a mouth of the goal posts.

20

The or each imaging device may be located substantially within the plane defined by the mouth of the goal posts. The or each imaging device may be located within a goal post or a cross bar of the goal posts may be recessed into the goal line. The or each imaging device may be associated with an opening in the goal posts. The opening may be on an
25 internal face of the mouth of the goal posts.

Preferably, the surveillance system comprises a plurality of imaging devices, which may be video cameras.

Each imaging device may be operable to capture an image having a view substantially along a portion of the plane defined by the mouth of the goal posts. Said portion may be a strip or sector of the plane.

- 5 The images from the imaging devices may, in use, show overlapping portions of the plane. The imaging devices may be operable to capture images in different directions along the plane. The imaging devices may be operable to capture said different images at substantially the same instant.
- 10 The imaging devices may be operable to capture a set of images having views substantially along all of the plane defined by the mouth of the goal posts. The imaging devices may be arranged, in use, such that each part of the plane of the goal mouth is in the view of at least one imaging device.
- 15 The images captured, in use, by the imaging devices may each show a boundary of the goal mouth located opposite a particular imaging device. The boundary may be a goal post, or may be a goal line on the ground.

20 An imaging device located in a goal post may be operable to capture an image of an opposite goal post. An imaging device located in a cross bar of the goal posts may be operable to capture an image of the goal line.

Each of the images, in use, captured by the imaging device may have the boundary of the goal mouth centrally located in said image.

25

The images from the imaging devices may, in use, be fed to a recording device for subsequent play back and/or fed to a viewing device.

30 The images from the imaging devices may be combined. The images may be combined by superimposing each of the images from a particular instant to form a composite. When so combined, an object crossing the plane of the goal mouth will appear on the

combined image by virtue of it being included in at least one of the images captured by the imaging devices. When so combined the resulting image may comprise a single, preferably centrally located, object, said object being the opposite goal post or goal line.

5

The system may be operable to provide a series of combined views from consecutive instants. The system may be operable to provide a time series of combined images.

In use, when assessing whether an object, which may be a ball, has completely crossed the plane of the goal mouth, the combined image may show the object even when one or more of the imaging devices show a view obscured by another, undesired, object, by virtue of an unobscured image of the object from another of the imaging devices.

The images may be combined by a mixer, which may be a video mixer.

15

The combined images may be stored by recording means.

The system may include automatic image recognition means, which may be operable to automatically process the or each image from the or each imaging device and detect when a ball has crossed the front plane of the goal mouth. The system may include alarm means, which may be operable to indicate, preferably by wireless audio link, to a referee that the ball has crossed the goal line.

According to a second aspect of the present invention, a method of surveying goal posts comprises capturing an image with an imaging device said image having a view substantially along the plane of a mouth of the goal posts.

The or each imaging device may be located substantially within the plane defined by the mouth of the goal posts.

30

The method may include capturing a plurality of images having different views along the plane of the goal mouth at substantially the same instant. The views may be in different directions along the plane. The views may be views of portions of the plane of the goal mouth. The views may be overlapping views.

5

The images may be combined, preferably by superimposing views from separate imaging devices. The combined views may be captured at substantially the same instant.

10 The method may include the provision of a time series of combined images.

The images may be recorded by recording means.

15 All of the above aspects may be combined with any of the features disclosed herein, in any combination.

A specific embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

20 figure 1 shows a schematic prospective view of a goal posts surveillance system;

figure 2a shows a schematic representation of an image captured by a video camera mounted on the cross bar of the goal shown in figure 1;

25 figure 2b is a view similar to that shown in figure 2a, but from another video camera mounted on the crossbar; and

figure 2c shows a schematic representation of an image captured by a video camera mounted on one of the goal posts of the goals shown in figure 1, looking towards the
30 opposite goal post.

A goal post surveillance system 10 comprises a plurality of video cameras 12 mounted within the posts 14 and 16 and crossbar 18 of a set of goal posts. Each of the video cameras 12 is arranged to view the goal mouth. The output of the video cameras 12 is directed to a video mixer 20, which superimposes the images on each other and provides an output to a video recorder and monitor 22. The system is used to determine whether a football has crossed the goal line. Since the outputs of each of the video cameras 12 are mixed, at least one of the cameras should show whether a football has crossed the goal line in the event that one or more of the cameras 12 are obscured, by players for instance.

10

In more detail, the video cameras on the crossbar 18 are positioned to capture a picture in which the goal line 24 is centrally located (see figures 2a and 2b). Consequently, as shown in figures 2a and figures 2b, the picture from each of the video cameras 12 located on the crossbar 18 will be substantially identical, with the goal line 24 having the same appearance in each of the pictures.

15

Each of the video cameras 12 located in the goal posts 14 and 16 is positioned to show the opposite goal post in the centre of the captured picture (see figure 2c). The video cameras 12 are arranged so that the whole of the goal mouth is covered by the combined images. Some parts of the goal mouth may be covered by more than one camera.

20

As can be seen from a comparison of figure 2c with figures 2a and 2b, the pictures captured by the video cameras 12 will be substantially identical. The only difference being that the cameras 12 located in the goal posts 14 and 16 will show at least one of the video cameras 12 located on the opposite post. However, since the appearance of the goal line 24 and the goal posts 14, 16 will amount to a centrally located white strip, the difference between the pictures is negligible.

25

The images from each of the video cameras 12 are then passed down cabling 26 to the video mixer 20, which may be remotely located in a commentary box, or for view by a

30

match official for instance. The mixed video signal is then displayed on a monitor and simultaneously recorded on a video recorder 22 for subsequent playback.

5 When no objects are located in the plane of the goal mouth the mixed video signal will show an image which is substantially the same as that from any of figures 2a to 2c.

10 In football, in order for a goal to be properly scored, all of the football must cross the goal line. Consequently, with the goal post surveillance system 10 disclosed herein, a decision as to whether a goal has been properly scored can be made by using the output of the video mixer 20 in the following way.

15 When a football is in the vicinity of the plane of the goal posts, at least one of the video cameras 12 will, in most circumstances, capture an image of the ball. The mixed video image will show the ball crossing, or not crossing, the plane of the goal posts, whichever is the case. There may be some blurring of the football image in the vertical direction shown in figures 2a-2c if the vertical position of the football relative to one video camera 12 is not the same vertical position as that shown by another video camera 12. However, this will not affect the determination of whether or not the ball has crossed the line, since there will be very little in the way of blurring in the horizontal direction in figures 2a-2c because each of the cameras is located in the same plane, with no difference in horizontal position out of the plane.

25 If one or more of the images from the video cameras 12 is obscured by the presence of a player or goal keeper within the goal, then this is unlikely to have a negative affect on the operation of the goal post surveillance system since one or more of the other video cameras should capture a clear image of the ball when it is in the vicinity of the goal mouth.

30 If it is initially unclear whether the football has crossed the goal mouth, then by use of the video recorder, the images may be played back either frame by frame or in slow

motion to make a more accurate determination of whether or not a goal has been scored.

5 Alternatively or additionally, image recognition software may be used to process the signals from the video cameras to recognise the presence of a football and to determine when the football has crossed the front plane of the goal mouth. In order to do this the software program must recognise that there is a separation between the detected football image and the goalpost/cross bar, thus indicating that the football has crossed the goal line.

10

An alarm may also be provided to indicate to a referee automatically that a goal has been scored. The alarm may be triggered by the software on detection of a goal and the alarm signal may be transmitted by wireless link to the referee, preferably to give an audio signal in a headset worn by the referee, to give an audio indication of a goal
15 being scored.

The goal post surveillance system described herein provides a compact and easy to use system for determining whether a football has completely crossed the goal line. The use of a video mixer to combine the images from a plurality of video cameras provides
20 significant advantages in that the amount of displaying and recording equipment is greatly reduced from that which would otherwise be necessary. Also, it is only necessary to view a single time-series of images to determine whether or not a goal has been scored.

25 Although the goal post surveillance system has been described in relation to football, the system can equally be used in other sports, such as hockey.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application
30 and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such
5 features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless
10 expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed
15 in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS:

1. A goal posts surveillance system comprises at least one imaging device, which imaging device is operable to capture an image having a view substantially
5 along the plane of a mouth of the goal posts.
2. A goal posts surveillance system as claimed in claim 1, in which the or each imaging device is located substantially within the plane defined by the mouth of the goal posts.
- 10 3. A goal posts surveillance system as claimed in either claim 1 or claim 2, in which the or each imaging device is located within a goal post or a cross bar of the goal posts.
- 15 4. A goal posts surveillance system as claimed in any preceding claim, in which the or each imaging device is associated with an opening in the goal posts, which opening is on an internal face of the mouth of the goal posts.
- 20 5. A goal posts surveillance system as claimed in any preceding claim, in which the surveillance system comprises a plurality of imaging devices, with each imaging device being operable to capture an image having a view substantially along a portion of the plane defined by the mouth of the goal posts.
- 25 6. A goal posts surveillance system as claimed in claim 5, in which the images from the imaging devices, in use, show overlapping portions of the plane.
7. A goal posts surveillance system as claimed in either claim 5 or claim 6, in which the imaging devices are operable to capture images in different directions along the plane.

8. A goal posts surveillance system as claimed in any one of claims 5 to 7, in which the imaging devices are operable to capture a set of images having views substantially along all of the plane defined the mouth of the goal posts.
- 5 9. A goal posts surveillance system as claimed in any one of claims 5 to 8, in which the images captured, in use, by the imaging devices each show a boundary of the goal mouth located opposite a particular imaging device.
- 10 10. A goal posts surveillance system as claimed in any one of claims 5 to 9, in which each of the images, in use, captured by the imaging device has the boundary of the goal mouth centrally located in said image.
11. A goal posts surveillance system as claimed in any one of claims 5 to 10, in which the images from the imaging devices are combined.
- 15 12. A goal posts surveillance system as claimed in claim 11, in which when the images are combined, an object crossing the plane of the goal mouth appears on the combined image by virtue of it being included in at least one of the images captured by the imaging devices.
- 20 13. A goal posts surveillance system as claimed in any preceding claim, in which the system includes automatic image recognition means, which are operable to automatically process the or each image from the or each imaging device and detect when a ball has crossed the front plane of the goal mouth.
- 25 14. A goal posts surveillance system as claimed in claim 13, which includes alarm means, which are operable to indicate through a referee that the ball has crossed the goal line.

15. A method of surveying goal posts comprises capturing an image with an imaging device, said image having a view substantially along the plane of a mouth of the goal posts.
- 5 16. A method as claimed in claim 15, in which the or each imaging device is located substantially within the plane defined by the mouth of the goal posts.
17. A method as claimed in either claim 15 or claim 16, which includes capturing a plurality of images having different views along the plane of the goal mouth at
10 substantially the same instant.
18. A goal post surveillance system substantially as described herein with reference to the accompanying drawings.
- 15 19. A method of surveying goalposts substantially as described herein with reference to the accompanying drawings.



Application No: GB 9922981.7
Claims searched: 1 to 19

Examiner: Alan Blunt
Date of search: 19 November 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.Q): A6D (D11F)
Int Cl (Ed.6): A63B 63/00, 71/06
Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2219710A (TECHNO-TIP) - page 2 lines 3 to 5	1 to 10, 15 to 17
A	GB 2001250A (PRECITEC) - whole document	
A	WO 97/38762A1 (CRAIG) - whole document	
A	US 5615880 (BOOTH) - whole document	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.