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A Camera Stand

FIELD OF THE INVENTION

The invention relates to a camera stand and a method of assembling a stand.

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BACKGROUND

There are in general two types of multiple perspective capturing systems. The first is a single-camera capture system where a subject is placed on a turntable to be turned and imaged by the camera. In the absence of a turntable, a movable
10 camera may be used instead.

The second type is a synchronized multiple camera capture system that is arranged around the subject. Such systems presently mount cameras onto a mounting jig taking the form of a track or cage. Cameras are mounted at fixed
15 positions on the jig. When mounting the cameras, the cameras have to be level, be of an appropriate distance from the subject, and the angular separation of each camera with the next has to be carefully controlled. Manual adjustment may be involved to mount each camera on the jig and this may make installation and/or repositioning of the cameras a difficult and time consuming task.

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SUMMARY OF THE INVENTION

In general terms the invention relates to a camera stand with an easy to assemble, modular assembly, with a large number of flexible mounting locations



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for each camera, resulting in a low tolerance installation requiring minimal manual adjustment.

In a first specific expression of the invention there is provided a stand for a
5 synchronised multiple perspective camera system as claimed in claim 1. This
may have the advantage of allowing cameras to be easily relocated and may
maintain the precision of the plurality of camera locations.

In a second specific expression of the invention there is provided a method for
10 assembling a stand as claimed in claim 13. This may have the advantage of
assembling a stand that allows for the easy but precise relocation of cameras.

A camera stand and/or a method of assembling a stand according to one or more
of the embodiments may have one or more advantages including:

- 15 - providing flexibility in the arrangement and rearrangement of the
cameras;
- being modular in design, thus allowing individual modules to be
integrated with other modules in order to form a larger system;
- being quicker and easier to reassemble or reconfigure;
- 20 - reducing assembly time by reducing the tolerances available for the
connecting of the modules of the stand;
- allowing the stand to be disassembled for transportation, then rapidly
reassembled after transportation;

- being adaptable to form different shooting setups capable of accommodating different subjects; and/or
- allowing cameras to be repositioned easily.

5 BRIEF DESCRIPTION OF THE DRAWINGS

One or more example embodiments of the invention will now be described, with reference to the following figures, in which:

Figure 1a is a photograph showing a stand according to an example embodiment with a plurality of cameras mounted;

10 Figure 1b is a photograph showing a close up view of a portion of the stand of Figure 1a;

Figure 1c is a photograph showing a close up view of the stand of Figure 1a without the plurality of cameras mounted;

15 Figure 2 is a photograph showing a plurality of unassembled modules of the stand of Figure 1a;

Figure 3a is a photograph showing an upper surface of a platform of Figure 1a;

Figure 3b is a photograph showing an installation of a locating pin on the upper surface of Figure 3a;

20 Figure 4 is a photograph showing a camera seat of Figure 1a holding a camera;

Figure 5a is a photograph showing a camera being mounted onto the camera seat of Figure 4;

Figure 5b is a photograph showing a camera seat being mounted onto the

platform of Figure 1a;

Figure 6a is a photograph showing an outer housing partially removed to expose part of the camera seat and camera of Figure 4;

Figure 6b is a photograph showing the outer housing of Figure 6a
5 completely installed; and

Figure 7 is a schematic drawing of a method of assembling the stand of Figure 1a.

DETAILED DESCRIPTION

10 A stand 100 according to an example embodiment is now described with the aid of Figures 1a, 1b and 1c. Figure 1a shows the stand 100 mounting thirty two equally spaced cameras 110. Figure 1b is a close up view of a portion of the stand 100 of Figure 1a. Figure 1c is a close up view of the stand 100 of Figures 1a and 1b without the plurality of cameras 110 mounted. The stand 100 includes
15 an annular platform 130 supported by ten legs 120. The annular platform 130 may be used for a synchronised 360 degree camera capture system. The cameras 110 are mounted on the platform 130 via respective camera seats 190.

Turning now to Figure 2, Figure 2 shows the components of each module before
20 assembly. The platform 130 includes 8 arcs 132 which bolt together using high precision hex or allen bolts 160, 180. Each arc 132 is precision machined using a CNC machine to give a platform diameter of 3 meters across. Each modular arc 132 represents a 45 degree segment of the annular platform 130. Accordingly, should a user prefer using a platform 130 that is only 90 degrees or 180 degrees,

the user may respectively connect 2 or 4 arcs 132 to form the platform 130.

Each leg 120 is bolted to a junction 150 which in turn is bolted underneath a junction between two arcs 132 using high precision hex or allen bolts 160, 180.

5 Adjacent legs are braced with crossbars 140 and each leg has a tripod 122, to improve horizontal rigidity of the stand 100. The length of each leg 120 may be adjusted by rotating a jackscrew 124 at the base of each leg 120.

Figures 3a and 3b show an upper surface 300 of the platform 130. The upper
10 surface 330 has a large number of location holes 310 machined into the platform 130. Each pair of these location holes 310 represents an engagement portion for a camera seat 190. The platform 130 thus has 144 engagement portions, each of which represents a possible camera location. These engagement portions are equally spaced (2.4° angular displacement) around the platform 130.

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Having 144 possible camera locations may allow for considerable customisation of image capture.

The location holes 310 are precision machined in order to achieve a high degree
20 of accuracy and thus low error tolerance. The holes 310 may have an error tolerance of between 10 to 20 microns from specification.

When the locating pin 320 is inserted to its maximum extend into a location hole 310, part of the locating pin 320 is left protruding from the upper surface 330. The

locating pins 320 function as dowels suitable for engaging a respective camera seat 190 and thus indicates a camera position. Multiple locating pins 320 may be used to mark a single camera position in which case the collection of locating pins 320 for a camera position represents an engagement portion.

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The camera seat 190 which is used for mounting the plurality of cameras 110 onto the platform 130 will be described next with the aid of Figure 4. Figure 4 shows a camera seat 190 of the stand 100 of Figure 1. The camera seat 190 comprises a flatbed 410 upon which the camera 110 is mounted. The flatbed 410
10 has three guiding pins 420 protruding from the top surface which guide the camera 110 into place during installation. The guiding pins 420 have rounded ends in order to aid in the insertion of the camera 110.

Figure 5a shows the mounting of a camera 110 onto a camera seat 190 and also
15 shows the under surface of the camera seat 190. The camera 110 is fastened on the flatbed 410 using screws. The screws are inserted into threaded screw holes 520 present on the under surface of the camera seat and then tightened. The fastening surface of the camera has 3 screw holes which are each aligned with a respective threaded screw hole 520. Different camera manufacturers however
20 may produce cameras with different arrangements of screw holes on the fastening surface. The camera seat 190 thus may have a variety of screw holes 520 in order to accommodate the different hole arrangements of different manufacturers.

Figure 5b shows the mounting of the camera seat 190 on the platform 130. Two locating pins 320 fit into the location holes 310 in the upper surface 300 of the platform 130 as shown in Figure 3b. The locating pins 320 are designed to have a tight fit within the location holes 310. This low tolerance may allow for a greater precision. The under surface of flatbed 410 also has two receiving holes 510. The receiving holes 510 are in turn shaped to receive the locating pins 320. The layout of the receiving holes 510 is thus reciprocally arranged to the layout of the location holes 310.

10 The use of a large number of discrete camera locations allows more or less cameras to be located and/or to have the cameras concentrated in a particular zone if required. Further, the tolerance of the receiving holes 510 and the location holes 310 ensures that the camera is accurately orientated. The modularity allows easy installation with minimal manual adjustment.

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Figures 6a and 6b show an alternative embodiment 690 of the camera seat 190 of Figures 5a and 5b. The camera seat 690 further comprises an outer housing 692 that is placed over the camera 610. Figure 6a shows the outer housing 692 partially removed to expose part of the camera seat 690 and the camera 610.

20 Figure 6b shows the case where the outer housing 692 is installed over the camera 610, thus completely covering the camera seat 690 and the camera 610. The outer housing 692 embraces the camera 610 within the seat 690 and further secures the camera 610. The camera 610 may thus be shielded from its surroundings and be protected from accidental knocks, thus further preserving

the alignment of the camera 610 within the seat 690.

In a further alternative embodiment, the locating pins 320 are tamped into the receiving holes 510 of the camera seat 190. Part of the locating pins 320 thus protrudes from the under surface of the camera seat 190. When mounting a camera seat 190 onto the platform 130, the exposed portions of the locating pins 320 are then detachably mated with the location holes 310.

In a still further alternative embodiment, the camera seat 190 includes a jig upon which the camera 110 can be rotated. Fine positional adjustments may be made to the camera 110 within the seat 190. The jig may be motor controlled, or may be manually adjusted by a user. It may have one, two or 3 degrees of freedom.

A method 700 of assembling the stand 100 is described next with the aid of Figure 7. It is noted that because the stand 100 is designed to be modular in nature, parts of the stand 100 may be constructed independently from the other parts. Also, because of the simplicity of the modular system, the stand 100 may be easily dismantled after the cameras 110 are calibrated. The stand 100 when reassembled may not require further calibrations to the cameras 110 and the camera system may be installed quickly in a range of locations. Camera calibrations are performed to for example compensate for camera homography or optical distortions.

In 710, the modules of the stand 100 are connected together. Adjacent arcs 132

are bolted together using high precision hex or allen bolts 160, 180. Each leg 120 is bolted to a junction 150 which is in turn bolted underneath a junction between two arcs 132 using high precision hex or allen bolts 160, 180. Adjacent legs are braced using crossbars 140 which are clammed on to the legs 120. The tripod
5 122 at each leg is then deployed.

In 720, the "roundness" of the platform 130 is verified. This is done by using a laser displacement gauge. A first diameter of the annular platform 130 is measured at a first engagement portion on the platform 130. A second diameter
10 measurement is then made at a second engagement portion that is 90 degrees from the first point. While each modular arc 132 of the platform 130 is precision machined, small deviations may be present at the joins between consecutive arcs 132.

15 The difference between the first and second diameter measurements give an indication of the "roundness" of the platform 130 i.e. whether the platform 130 is perfectly circular. In order to adjust the "roundness", the leg 120 of the stand 100 is lightly tapped inwardly at the measurement point where the respective diameter is larger. This step may be iterated until such a point where the
20 "roundness" of the platform 130 is fulfilled.

It is noted that the platform 130 is substantially heavy such that its weight prevents the legs 120 from shifting and losing position. Alternatively legs 120 additionally may be anchored to the floor by bolts. This may further increase the

stability of the legs 120.

In 730, the levelness of the platform 130 is verified. The levelness is verified by using a level gauge. The level gauge is placed on the upper surface of the platform 130, at a point of the platform 130 that is between the attachment points of two successive legs 120. If the platform 130 is not level the height of one the legs 120 is adjusted using jackscrew 124. When the platform 130 is level, the heights of the legs 120 may be preserved by tightening a nut of the jackscrew 124 which immobilizes the jackscrew 124.

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In 740, the cameras 110 are mounted onto the camera seats 190. The camera 110 is placed onto the camera seat 190 between the guiding pins 420. The camera 110 is screwed into place.

15 In 750, the camera seats 190 are mounted onto the platform 130. The receiving holes 510 of the camera seat 190 are mated with the locating pins 320 which have been tamped into the location holes 310 using a mallet.

Whilst exemplary embodiments of the invention have been described in detail,
20 many variations are possible within the scope of the invention as will be clear to a skilled reader. For example, while the platform 130 is described to be annular and suitable for a circular 360 degree all around capture system, the platform 130 however may be configured to be of a different geometry e.g. oval or arcuate and may be used for a sub-360 degree capture system.

Claims

1. A stand for a synchronised multiple perspective camera system comprising
a plurality of camera seats each configured to engage a synchronised
5 camera,
a platform having a plurality of discrete camera locations arranged about
a subject location, wherein there are substantially more discrete camera
locations than camera seats, and
an engagement portion between each camera seat and a predetermined
10 respective camera location.
2. The stand of claim 1 wherein the engagement portion comprises
precision machined holes in the camera seat and platform, and one or more pins
engaging the holes.
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3. The stand of claim 2 wherein the engagement portion comprises two or
more radially spaced pins.
4. The stand of any preceding claim wherein the platform comprises a
20 plurality of modules.
5. The stand of any preceding claim wherein the platform is annular.
6. The stand of claim 5 wherein the platform is a substantially circular ring

with a continuous circumference.

7. The stand of any preceding claim wherein the plurality of camera locations are angularly spaced by 2.5 degrees.

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8. The stand of any preceding claim wherein the seat further comprises a guiding pin for guiding the camera into the seat.

9. The stand of any preceding claim wherein platform further comprises a plurality of legs supporting the platform.

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10. The stand of claim 9 wherein each leg includes a height adjustment, a brace to an adjacent leg and/or an angled stand.

11. The stand of any preceding claim further comprising a housing for each camera.

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12. The stand of any preceding claim wherein each seat further comprises a jig for adjusting the orientation of the camera.

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13. A method for assembling a stand comprising
engaging at least two modules to form the stand, the stand having a plurality of discrete camera locations;
correcting the shape of the stand with a displacement gauge; and

correcting the level of the stand with a level gauge.

14. The method of claim 13 further comprising engaging a plurality of cameras to respective seats.

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15. The method of claim 14 further comprising engaging each seat with the stand at a respective camera location.