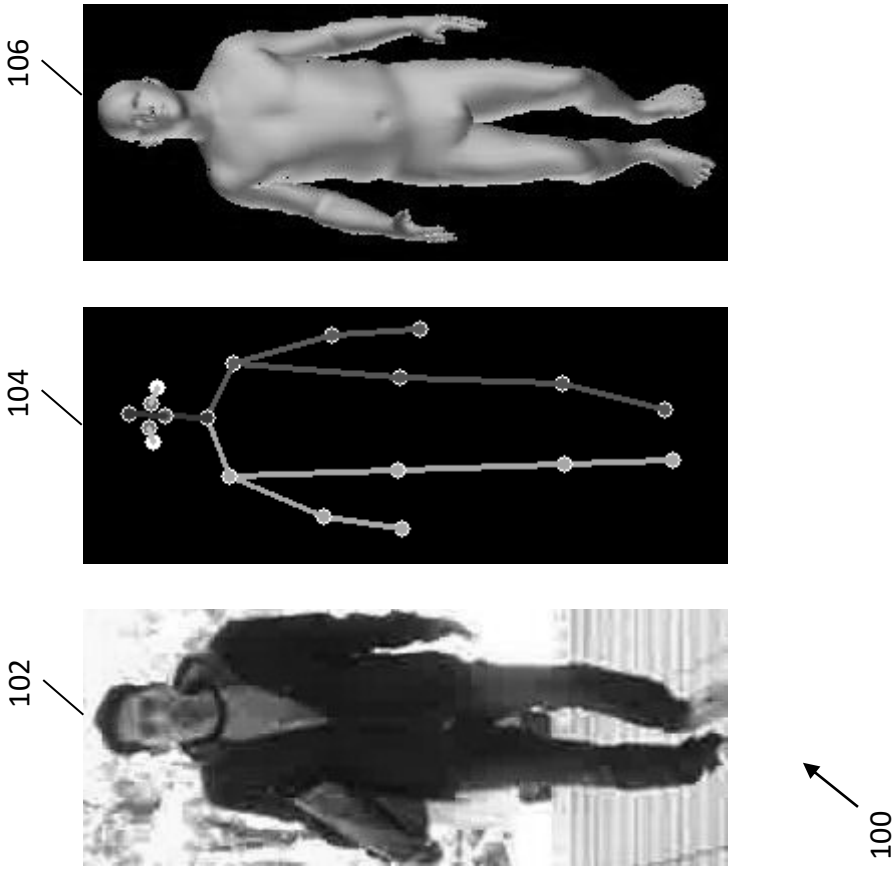


Fig. 1



Fig. 2B



Fig. 2A

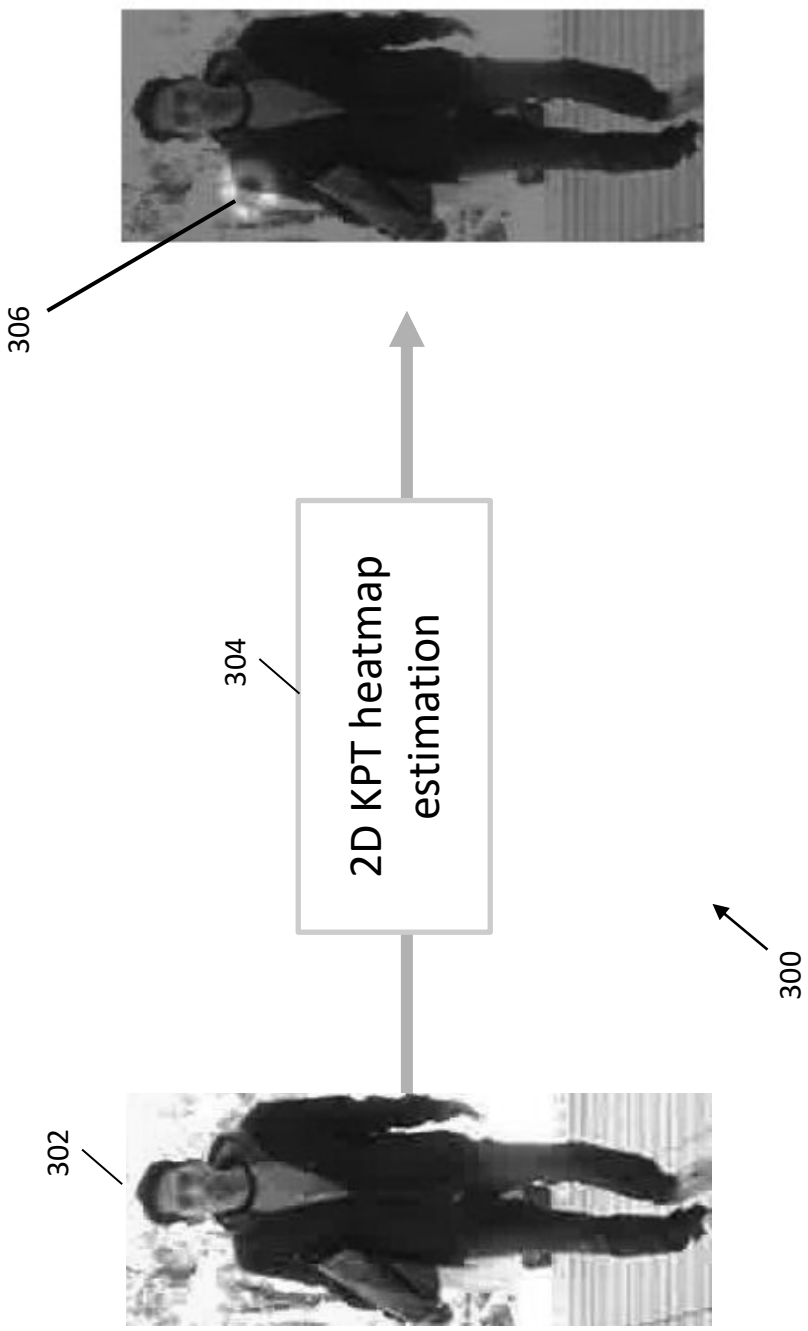


Fig. 3

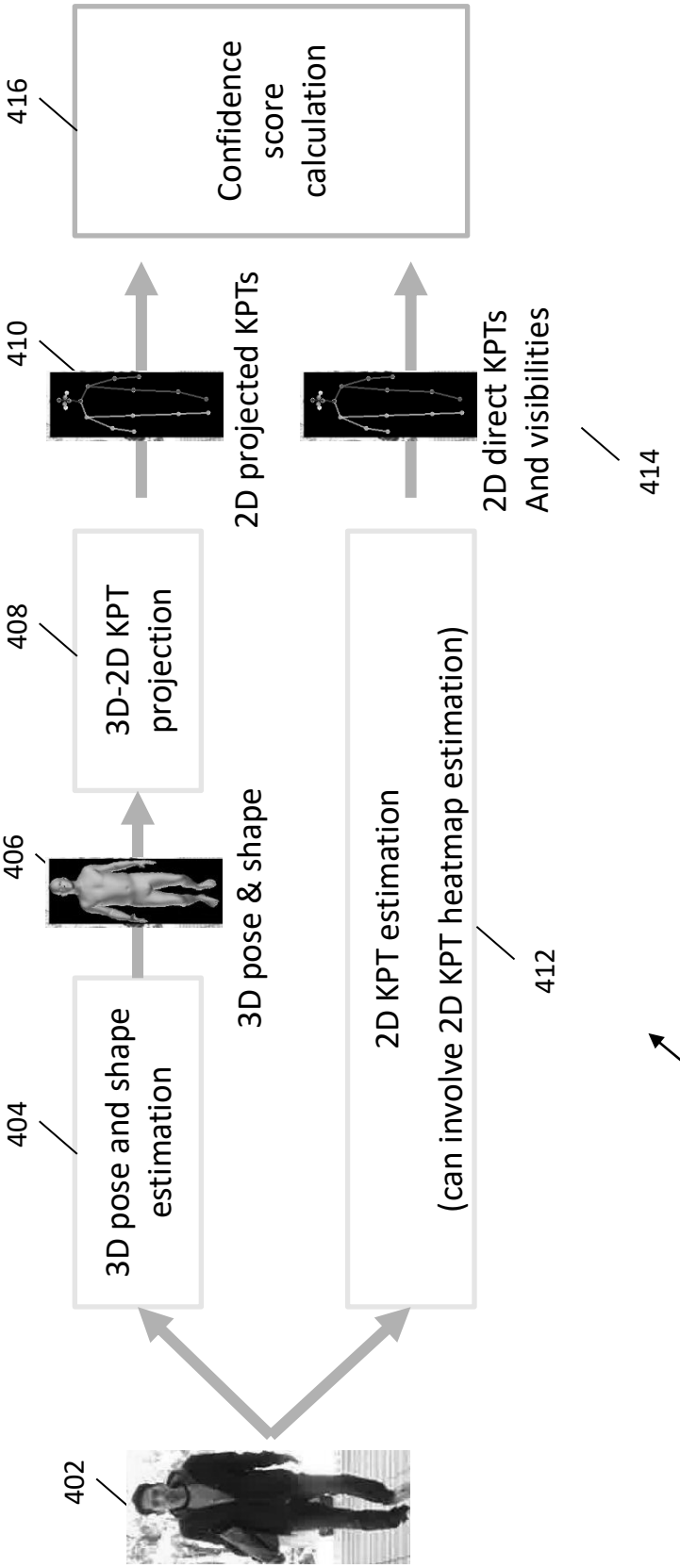

402
404
3D pose and shape estimation
406
3D pose & shape
408
3D-2D KPT projection
410
2D projected KPTs
416
Confidence score calculation
412
2D KPT estimation
(can involve 2D KPT heatmap estimation)
2D direct KPTs
And visibilities
414
400

Fig. 4

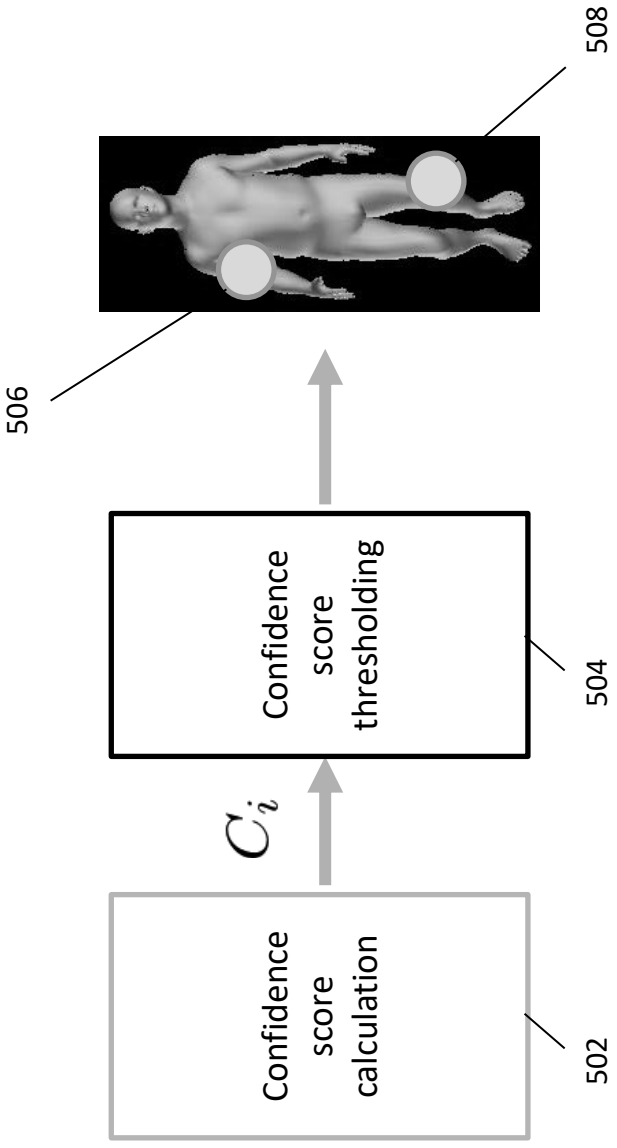

Confidence score calculation
502
C_i
Confidence score thresholding
504
506
508
500

Fig. 5

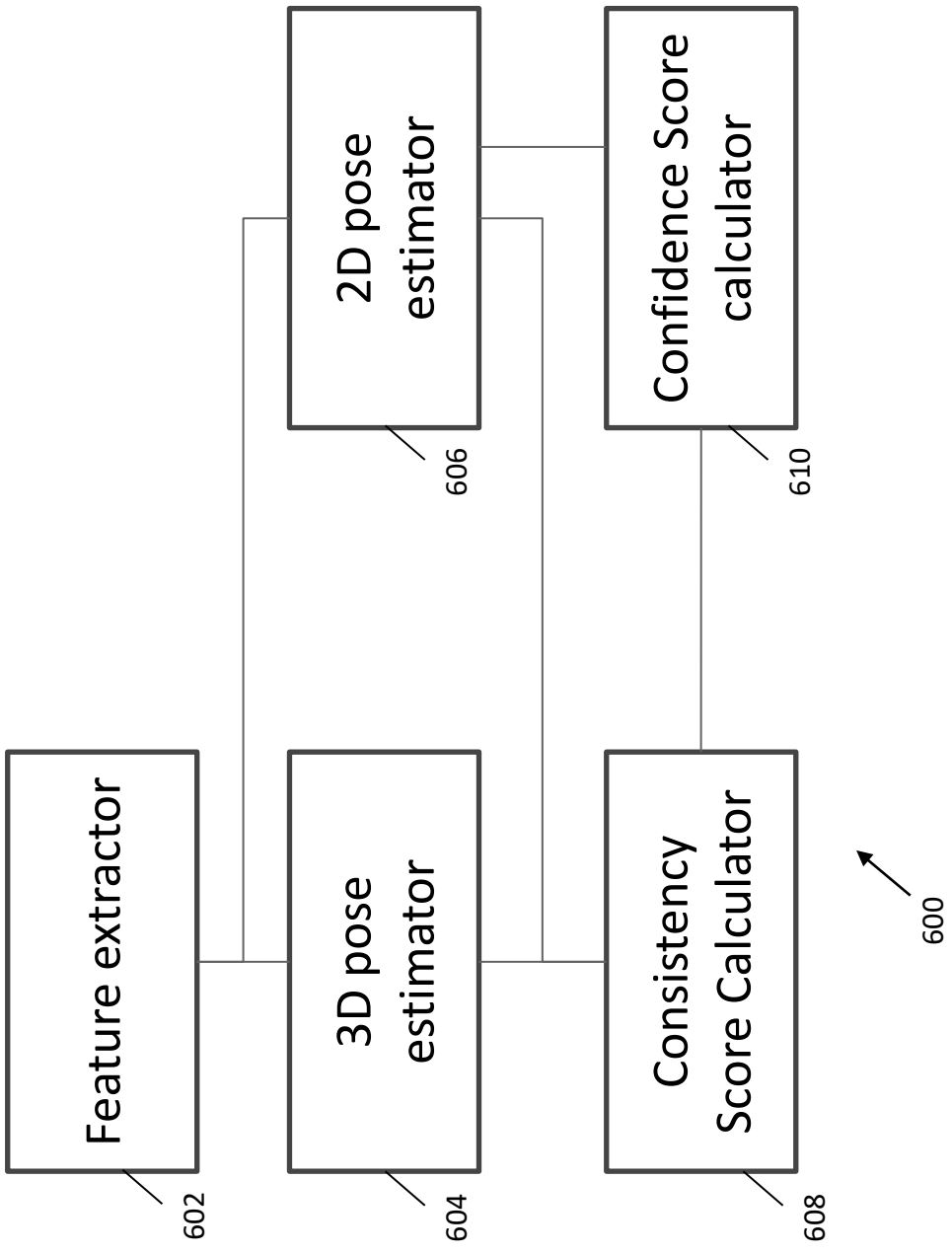

Feature extractor
602
3D pose estimator
604
2D pose estimator
606
Consistency Score Calculator
608
Confidence Score calculator
610
600

Fig. 6

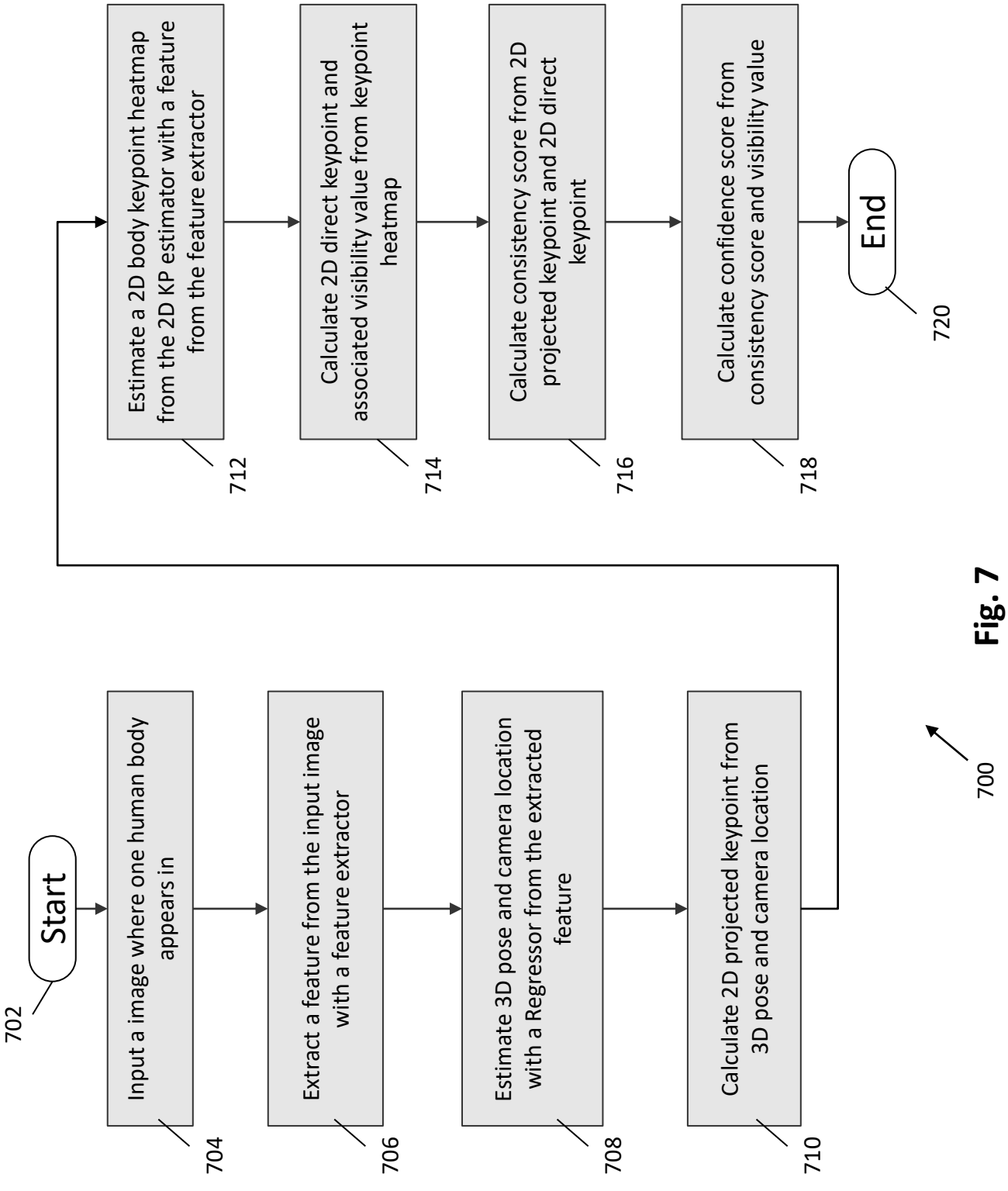

Start
702
Input a image where one human body appears in
704
Extract a feature from the input image with a feature extractor
706
Estimate 3D pose and camera location with a Regressor from the extracted feature
708
Calculate 2D projected keypoint from 3D pose and camera location
710
Estimate a 2D body keypoint heatmap from the 2D KP estimator with a feature from the feature extractor
712
Calculate 2D direct keypoint and associated visibility value from keypoint heatmap
714
Calculate consistency score from 2D projected keypoint and 2D direct keypoint
716
Calculate confidence score from consistency score and visibility value
718
End
720
700

Fig. 7

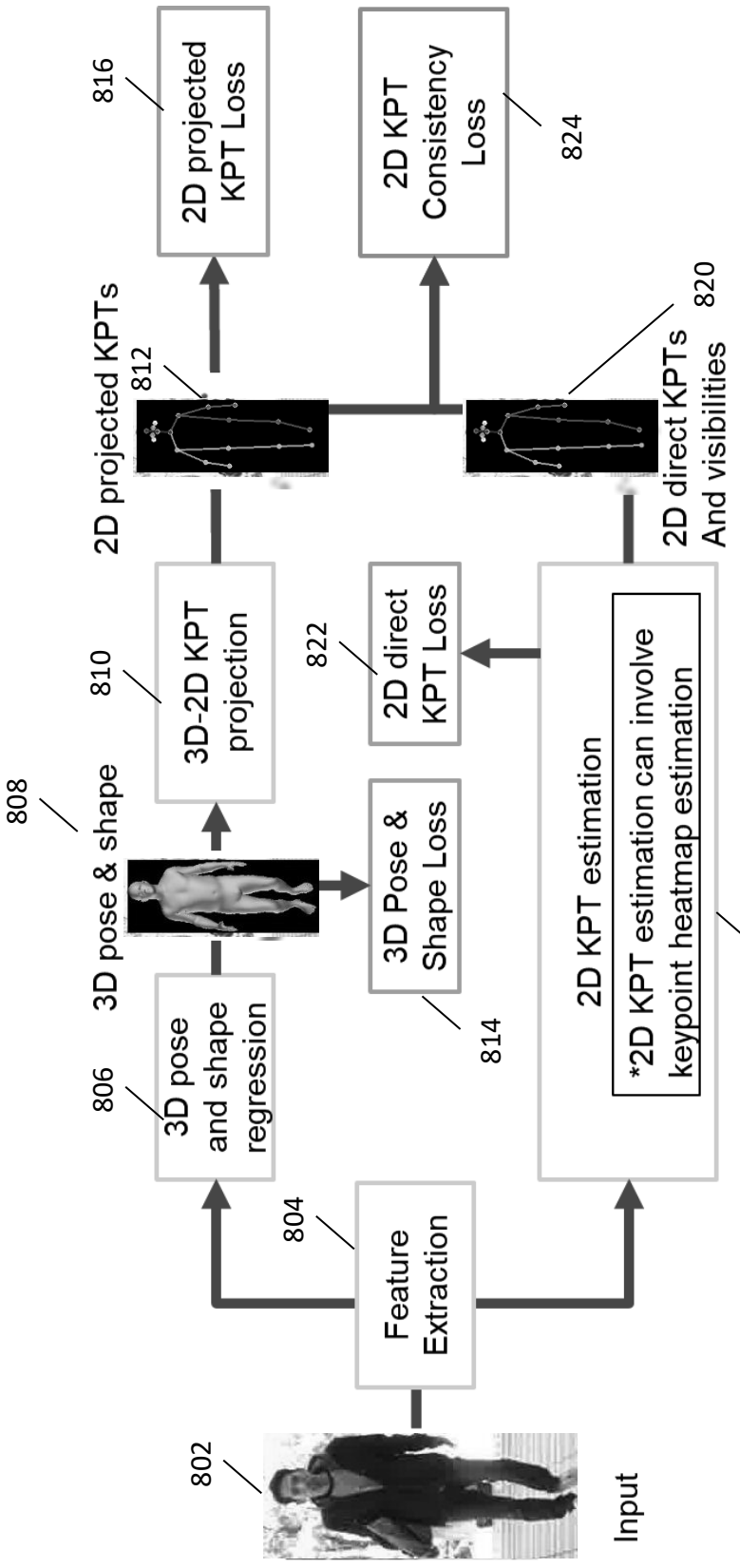

802
Input
804
Feature Extraction
806
3D pose and shape regression
808
3D pose & shape
810
3D-2D KPT projection
812
2D projected KPTs
814
3D Pose & Shape Loss
816
2D projected KPT Loss
818
2D KPT estimation
*2D KPT estimation can involve keypoint heatmap estimation
820
2D direct KPTs And visibilities
822
2D direct KPT Loss
824
2D KPT Consistency Loss
800

Fig. 8

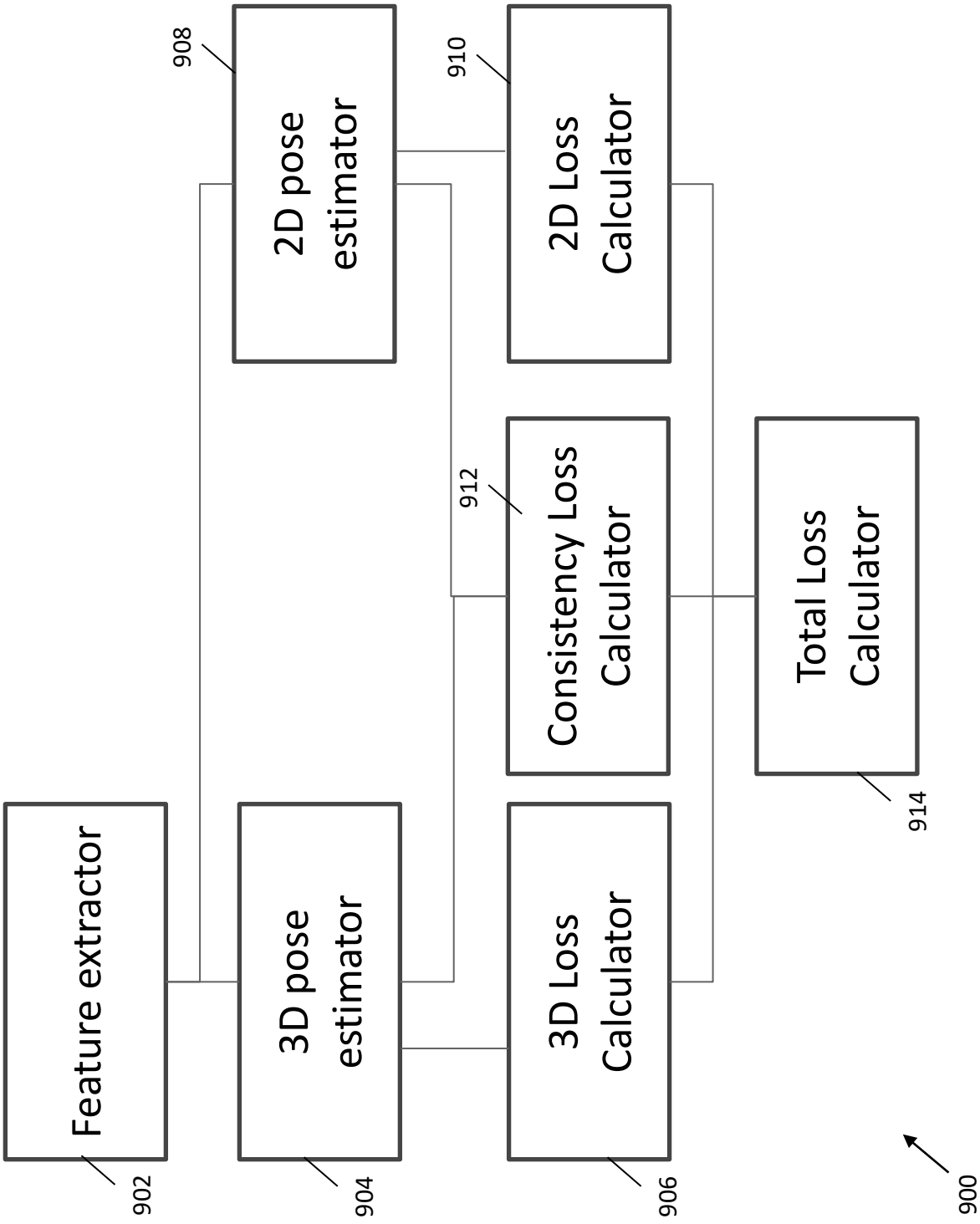

Feature extractor
902
3D pose estimator
904
3D Loss Calculator
906
2D pose estimator
908
2D Loss Calculator
910
Consistency Loss Calculator
912
Total Loss Calculator
914
900

Fig. 9

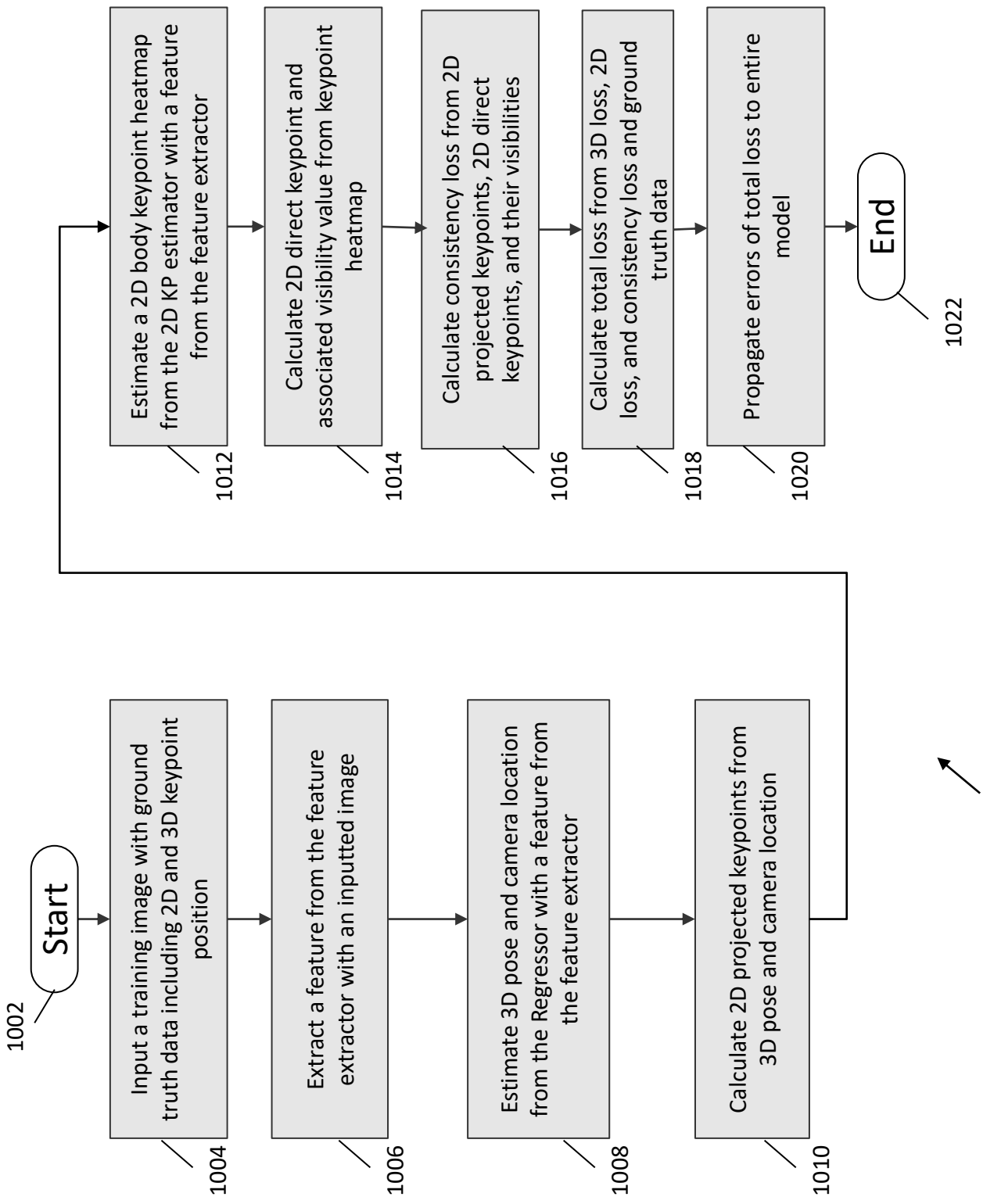

Start
1002
Input a training image with ground truth data including 2D and 3D keypoint position
1004
Extract a feature from the feature extractor with an inputted image
1006
Estimate 3D pose and camera location from the Regressor with a feature from the feature extractor
1008
Calculate 2D projected keypoints from 3D pose and camera location
1010
Estimate a 2D body keypoint heatmap from the 2D KP estimator with a feature from the feature extractor
1012
Calculate 2D direct keypoint and associated visibility value from keypoint heatmap
1014
Calculate consistency loss from 2D projected keypoints, 2D direct keypoints, and their visibilities
1016
Calculate total loss from 3D loss, 2D loss, and consistency loss and ground truth data
1018
Propagate errors of total loss to entire model
1020
End
1022
1000

Fig. 10

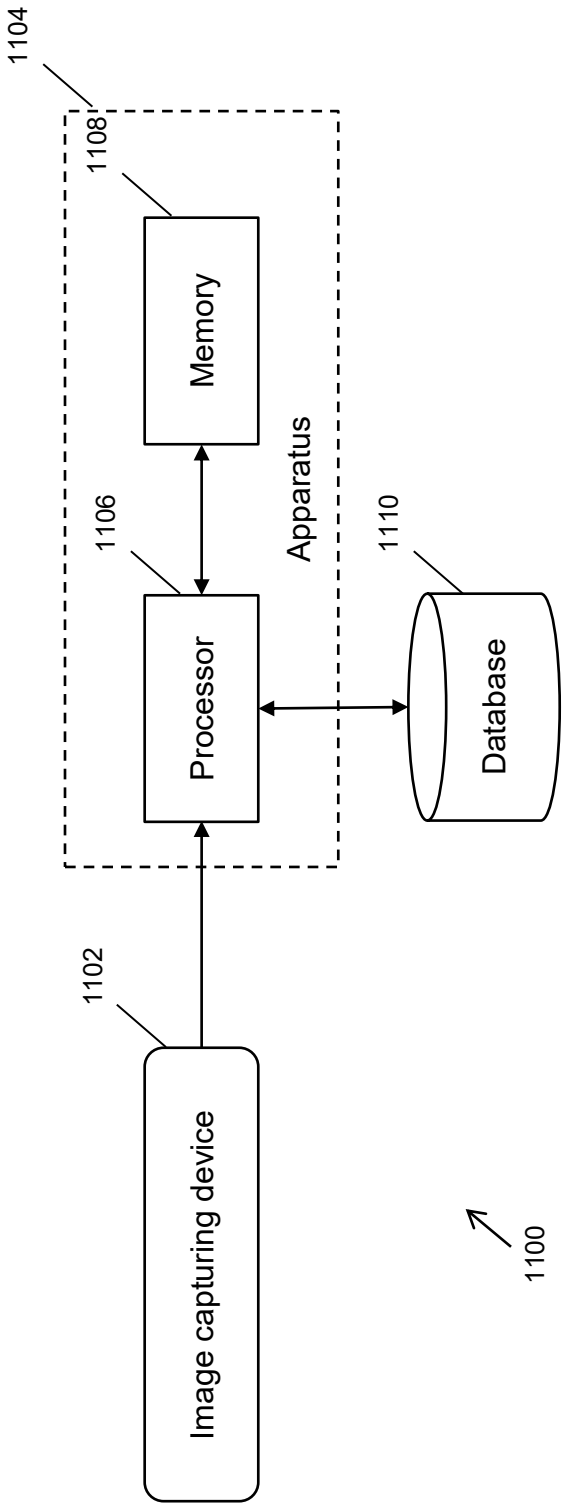

1104
1108
Memory
Apparatus
1106
1110
Processor
Database
1102
Image capturing device
1100

Fig. 11

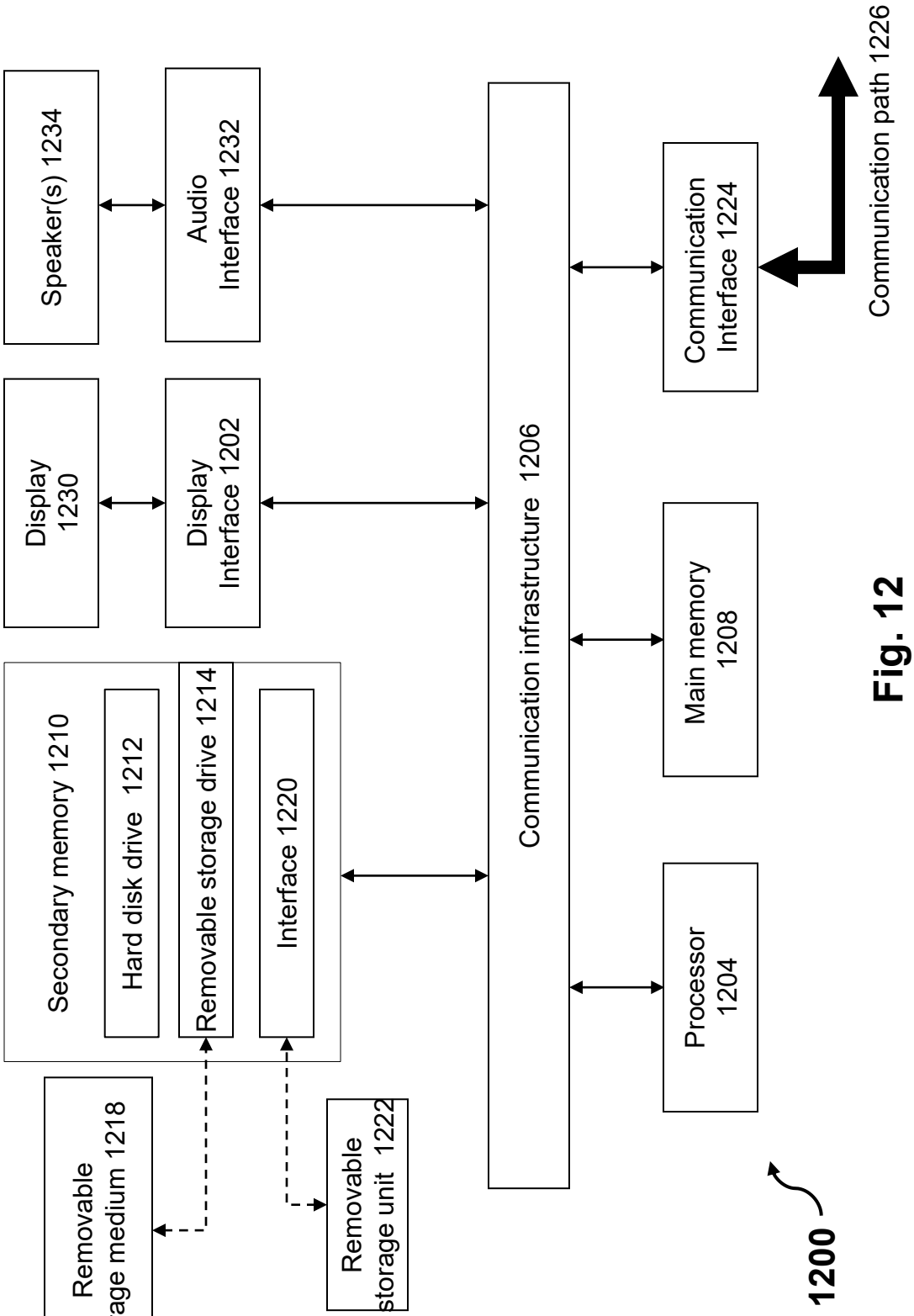

Speaker(s) 1234
Audio Interface 1232
Display 1230
Display Interface 1202
Secondary memory 1210
Hard disk drive 1212
Removable storage drive 1214
Interface 1220
Communication infrastructure 1206
Communication Interface 1224
Communication path 1226
Main memory 1208
Processor 1204
Removable storage medium 1218
Removable storage unit 1222
1200

Fig. 12