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(54) Title: METHOD FOR TRIMMING BLANKS

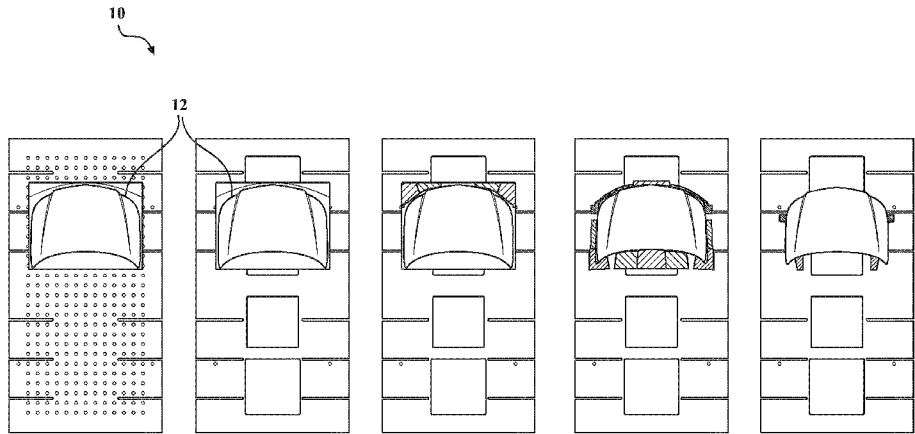


FIG. 1

(57) Abstract: A system and method for manufacturing a metal component, for example a steel or aluminum component for a vehicle, is provided. The system include a plurality of die stations in a production line. One of the die stations includes an upper drawing die and a lower drawing die design to both draw and trim a metal blank, preferably in the same die stroke, to form the metal component having a desired shape. The metal component can be transferred to additional die stations to remove the scrap and for additional processing, such as rough trimming, trimming with a cam, or flanging. Trimming the metal blank during the drawing step can eliminate additional die stations and allows a cam to more easily trim the metal component at another die station.

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METHOD FOR TRIMMING BLANKS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This PCT International Patent Application claims the benefit of and priority to U.S. Provisional Patent Application Serial No. 63/431,786, filed December 12, 2022, titled “Method For Trimming Blanks,” the entire disclosure of which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The invention relates generally to a system and method for manufacturing metal components, for example steel or aluminum components for vehicles.

2. Related Art

[0003] Metal components, such as components formed of steel, aluminum or aluminum alloys for vehicle applications, are oftentimes formed by drawing, stamping, and/or pressing a blank in dies which are located in a production line. The method of manufacturing the components also typically includes trimming, piercing, and/or flanging in separate dies or outside of the production line entirely. Oftentimes, the manufacturing process is costly and time consuming. In addition, the production line including the dies typically requires a significant amount of space. More efficient methods of manufacturing the metal components is desired.

SUMMARY

[0004] One aspect of the disclosure provides a system for manufacturing a metal component, for example a steel or aluminum component for a vehicle. The system includes a plurality of die stations. One of the die stations includes an upper drawing and die and a lower drawing die designed to perform a drawing and trimming step on a metal blank in a single die

stroke. Alternatively, one of the die stations includes an upper forming and die and a lower forming die designed to perform a forming and trimming step on a metal blank in a single die stroke.

[0005] Another aspect of the disclosure provides a method for manufacturing a metal component, for example a steel or aluminum component for a vehicle. The method includes drawing and trimming, or forming and trimming, a metal blank into the shape of a metal component at a single die station and during a single die stroke.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Other advantages of the present invention will be readily appreciated, as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0007] Figure 1 illustrates a system for manufacturing metal components, including a plurality of die stations in a production line, according to an example embodiment;

[0008] Figures 2a and 2b illustrate an upper drawing die and a lower drawing die according to an example embodiment;

[0009] Figures 3a and 3b illustrate an upper forming die and a lower forming die according to an example embodiment; and

[0010] Figure 4 illustrates a form shape present in an upper drawing die according to an example embodiment.

DESCRIPTION OF EXAMPLE EMBODIMENTS

[0011] One aspect of the invention provides a system **10** and method for manufacturing metal components **12**, for example, metal components **12** formed of steel, aluminum, or aluminum alloys for vehicle applications. The system **10** includes a plurality of die stations **14**

arranged in a production line. An example of the production line including the die stations **14** is shown in Figure 1.

[0012] According to the example embodiment of Figure 1, the first die station **14a** of the production line includes an upper drawing die **16** and a lower drawing die **18**. During the manufacturing process, a blank formed of metal, such as steel, aluminum, or aluminum alloy, is disposed between the upper drawing die **16** and the lower drawing die **18**. The blank could be formed of another type of metal, as long as the metal has characteristics suitable for a drawing and trimming operation, for example sufficient flow. During the drawing operation, the metal blank is heated, and the upper and lower drawing dies **16**, **18** apply a tensile force to the blank. The metal blank is pulled so that it stretches and transforms into the metal component **12** having a desired shape. The desired shape depends on the shape of the upper and lower drawing dies **16**, **18**. According to the example embodiment of Figure 1, the metal component **12** is a hood for a vehicle. However, various different parts could be formed, for example a fender, door, or another part for a vehicle.

[0013] During the step of drawing the blank to form the metal component **12**, the upper and lower drawing dies **16**, **18** also perform a trimming or cutting step on the metal blank. According to the example embodiments, the drawing dies **16**, **18** are designed with features sufficient to trim an edge off the metal blank while the drawing dies **16**, **18** apply the tensile stress to the metal blank and form the metal blank to the desired shape. An example of the upper drawing die **16** and the lower drawing die **18** of the first die station **14a** is shown in Figures 2a and 2b. According to this example, the upper and lower drawing dies **16**, **18** include an upper cutting edge **20** and a lower cutting edge **22** which together trim the metal component **12**. The upper and lower drawing dies **16**, **18** are typically formed of steel. The upper drawing die **16** is

preferably solid, and the lower drawing die **18** can be designed to trim the metal component **12** on a solid pedestal, outside a binder surface of the lower drawing die **18** which is used during the forming process. The trimming along the lower drawing die **18** can also be conducted at different stages.

[0014] The shape of the metal component **12** formed during the drawing step should allow the metal component **12** to be trimmed in the drawing dies **16**, **18**. The trimming step creates a piece of scrap metal along the edge of the metal component **12**. The scrap metal remains very loosely attached to the metal component **12** after the trimming step. After the drawing and trimming step, the metal component **12** is transferred from the first die station **14a** to a subsequent die station **14** for additional processing.

[0015] According to the example embodiment, after drawing and trimming the metal component **12** at the first die station **14a**, the process includes transferring the metal component **12**, with the scrap still connected, to a second die station **14b**. An automated method can be used to transfer the metal component **12** from the first die station **14a** to the second die station **14b**. The second die station **14b** can include various different types of dies. According to the example embodiment, the second die station **14b** is referred to as a holding station and no forming of the metal component **12** is done at this station. However, the second die station **14b** does include an upper forming die **24** and a lower forming die **26** capable of performing additional shaping of the metal component **12**. Blowers are preferably located near the second die station **14b**, and the lower forming die **26** of the second die station **14b** of the example embodiment includes a scrap shoot **28**. During the manufacturing process, the blowers blow the loose scrap off the metal component **12** and into the scrap shoot **28** for removal from the system **10**. According to the example embodiment, when the metal component **12** arrives at the second die station **14b**, the

metal component **12** is placed on the lower forming die **26** and the scrap metal is immediately removed by the blowers and scrap shoot **28**. An example of the upper and lower forming dies **24, 26**, and the scrap shoot **28**, is shown in Figures 3a and 3b.

[0016] According to an alternate embodiment, instead of trimming the metal component **12** during the drawing step at the first die station **14a**, only the drawing occurs at the first die station **14a**, and the upper and lower forming dies **24, 26** of the second die station **14b** are designed with features for trimming the metal component **12** during the forming step. According to yet other embodiments, other types of forming dies are designed for both forming and trimming the metal component **12** in a single die station **14** and in a single die stroke.

[0017] According to preferred embodiments, the upper drawing die **16** is designed with a form shape **30**, typically a protrusion, in the area of the scrap of the metal component **12** which is cut away during the trimming step. The form shape **30** or protrusion pulls the edge or scrap portion of the metal component **12** away from the upper drawing die during the drawing and trimming step to eliminate burring. An example of the form shape **32** or protrusion is shown in Figure 4. This form shape **30** or protrusion can also be formed in the upper forming die **24** or in another die which is used to both form and trim the metal component **12**.

[0018] The production line can include one or more additional die stations **14** following the second die station **14b**. In the example embodiment of Figure 1, the third die station **14c**, which typically includes trimming and piercing, is removed since the trimming is conducted during the drawing step at the first die station **14a**. The fourth die station **14d** includes additional trimming of the metal component **12** using a cam, and the fifth die station **14e** includes flanging the metal component **12**. However, the die stations **14** could perform various different operations instead of or in addition to those disclosed herein.

[0019] The system **10** and method disclosed herein provides numerous advantages over comparative systems and methods that including drawing or forming separate from trimming. For example, an offline blanking step to trim the metal blank prior to the drawing step may be eliminated when the drawing or forming and trimming steps are combined. Also, as indicated above, the system **10** and method provides for improved management of the scrap metal. Drawing and trimming the metal component **12** at the first die station **14a** leads to less scrap on the metal component **12** when the metal component **12** enters the following die stations **14** where additional trimming occurs. It is desirable to have less scrap during the additional trimming steps to avoid packaging issues. The combined drawing and trimming step may eliminate the need for certain die stations entirely. Further, when the drawing and trimming are conducted together, for example at the first die station **14a**, the subsequent trimming step using the cam is improved. Since a significant portion of the excess material is already removed from the metal component **12**, the cam is able to more easily travel between the dies of the die station **14**, and cam overhead is reduced.

[0020] Obviously, many modifications and variations of the present invention are possible in light of the above teachings and may be practiced otherwise than as specifically described while within the scope of the following disclosure and claims.

CLAIMS

What is Claimed is:

1. A system for manufacturing a metal component, comprising:
a plurality of die stations, wherein one of the die stations is designed to perform a drawing or forming and trimming step on a metal blank during a single die stroke
2. The system of claim 1, wherein the plurality of die stations includes a first die station and a second die station;
the first die station includes a first upper drawing die and a first lower drawing die which are designed to apply a tensile force to the blank and stretch the metal blank;
the first upper drawing die and first lower drawing die having a shape that forms the metal blank into the shape of a metal component; and
the first upper drawing die including a first upper cutting edge and the first lower drawing die including a first lower cutting edge for together trimming the metal blank while the first upper drawing die and the first lower drawing die apply the tensile force to the metal blank.
3. The system of claim 2, wherein the first lower drawing die includes a binder surface and a pedestal disposed outside of the binder surface.
4. The system of claim 1, wherein the second die station includes a second upper forming die and a second lower forming die capable of shaping the metal component after the metal component is formed at the first die station.

5. The system of claim 1, wherein the second die station includes a second upper forming die and a second lower forming die; and the second lower forming die includes a scrap shoot for receiving scrap trimmed from the metal component.

6. The system of claim 5 including a plurality of blowers for blowing the scrap off the metal component and into the scrap shoot.

7. The system of claim 1, wherein the metal component is a hood, fender, or door of a vehicle.

8. The system of claim 1, wherein the first upper forming die and the first lower forming die are formed of steel.

9. The system of claim 1, wherein the plurality of die stations includes a first die station and a second die station;

the first die station includes a first upper drawing die and a first lower drawing die each formed of steel and which are designed to apply a tensile force to the blank and stretch the metal blank;

the first upper drawing die and first lower drawing die having a shape that forms the metal blank into the shape of a metal component, wherein the metal component is a hood, fender, or door of a vehicle;

the first upper drawing die including a first upper cutting edge and the first lower drawing die including a first lower cutting edge for together trimming the metal blank while the first upper drawing die and the first lower drawing die apply the tensile force to the metal blank;

the first lower drawing die including a binder surface and a pedestal disposed outside of the binder surface;

the second die station including a second upper forming die and a second lower forming die capable of shaping the metal component after the metal component is formed at the first die station;

the second lower forming die including a scrap shoot for receiving scrap trimmed from the metal component; and

a plurality of blowers for blowing the scrap off the metal component and into the scrap shoot.

10. The system of claim 1, wherein the plurality of die stations includes a first die station and a second die station;

the first die station includes a first upper drawing die and a first lower drawing die each formed of steel and which are designed to apply a tensile force to the blank and stretch the metal blank;

the first upper drawing die and the first lower drawing die having a shape that forms the metal blank into the shape of a metal component, wherein the metal component is a hood, fender, or door of a vehicle;

the second die station including a second upper forming die and a second lower forming die capable of shaping the metal component after the metal component is formed at the first die

station, the second lower forming die including a scrap shoot for receiving scrap trimmed from the metal component;

the second upper drawing die including a second upper cutting edge and the second lower drawing die including a second lower cutting edge for together trimming the metal blank;

the second lower forming die including a scrap shoot for receiving scrap trimmed from the metal component; and

a plurality of blowers for blowing the scrap off the metal component and into the scrap shoot.

11. A die station, comprising:

a first upper drawing die and a first lower drawing die each formed of steel and which are designed to apply a tensile force to the blank and stretch the metal blank;

the first upper drawing die and first lower drawing die having a shape that forms the metal blank into the shape of a metal component, wherein the metal component is a hood, fender, or door of a vehicle; and

the first upper drawing die including a first upper cutting edge and the first lower drawing die including a first lower cutting edge for together trimming the metal blank while the first upper drawing die and the first lower drawing die apply the tensile force to the metal blank.

12. The die station of claim 11, wherein the first upper drawing die and the first lower drawing die are formed of steel.

13. A method for manufacturing a metal component, comprising the steps of:

drawing or forming a metal blank into a shape of a metal component; and
trimming the metal component;
wherein the drawing or forming and trimming steps are performed at a single die station.

14. The method of claim 13, wherein the drawing or forming and trimming steps are performed in a single die stroke.

15. The method of claim 13, wherein the drawing or forming and the trimming steps are performed at a first die station;

the first die station including a first upper drawing die and a first lower drawing die each formed of steel;

the first upper drawing die and the first lower drawing die applying a tensile force to the metal blank and/or stretching the metal blank during the drawing or forming step;

the first upper drawing die including a first upper cutting edge and the first lower drawing die including a first lower cutting edge for together conducting the trimming step.

16. The method of claim 15 including transferring the metal component to a second die station; and blowing scrap trimmed from the metal component into a scrap shoot at the second die station.

17. The method of claim 16, wherein the step of transferring the metal component to the second die station is automated.

18. The method of claim 16 including additional shaping of the metal component at the second die station.

19. The method of claim 13, wherein the first lower drawing die includes a binder surface and a pedestal disposed outside of the binder surface for conducting the trimming step.

20. The method of claim 13, wherein the metal component is a hood, fender, or door of a vehicle.

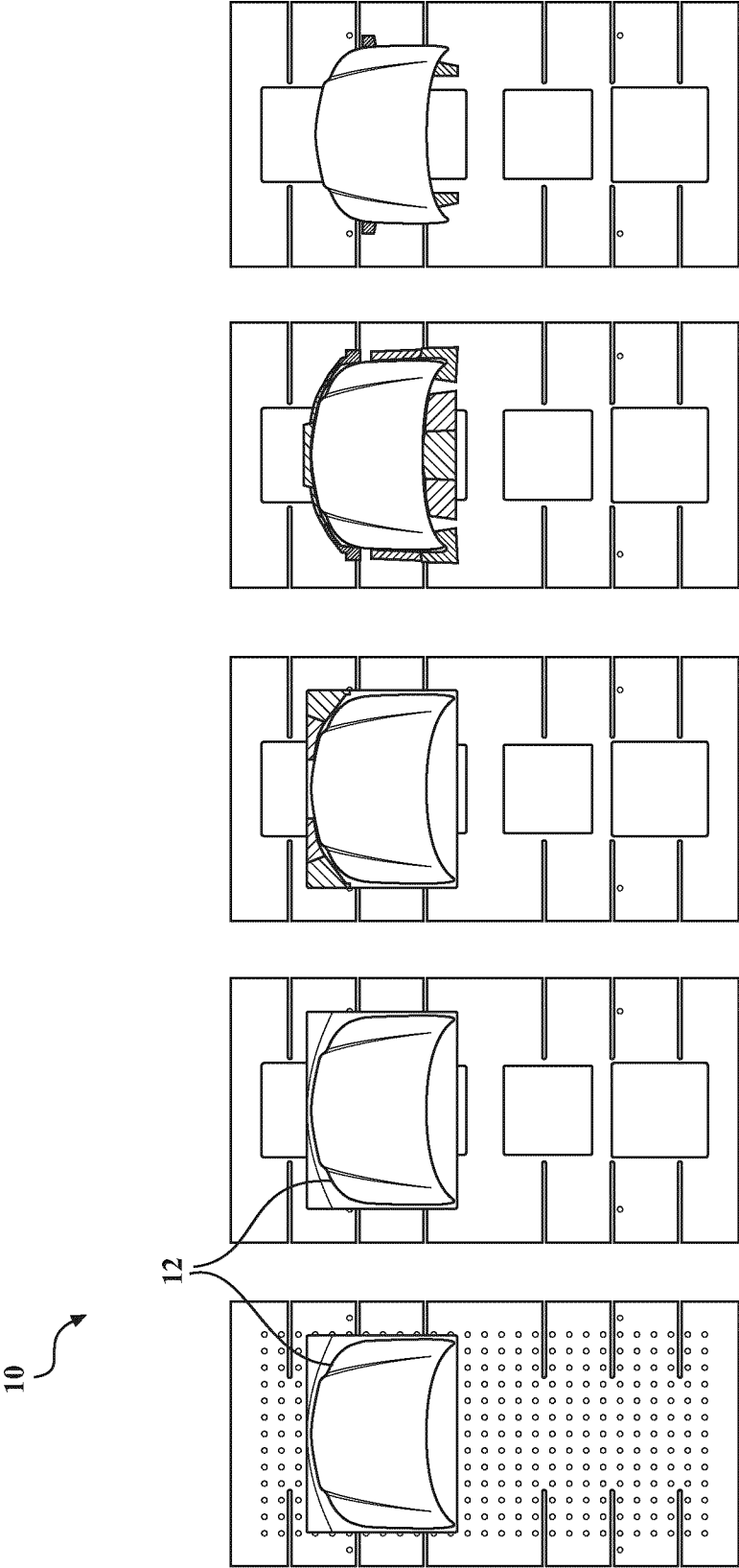


FIG. 1

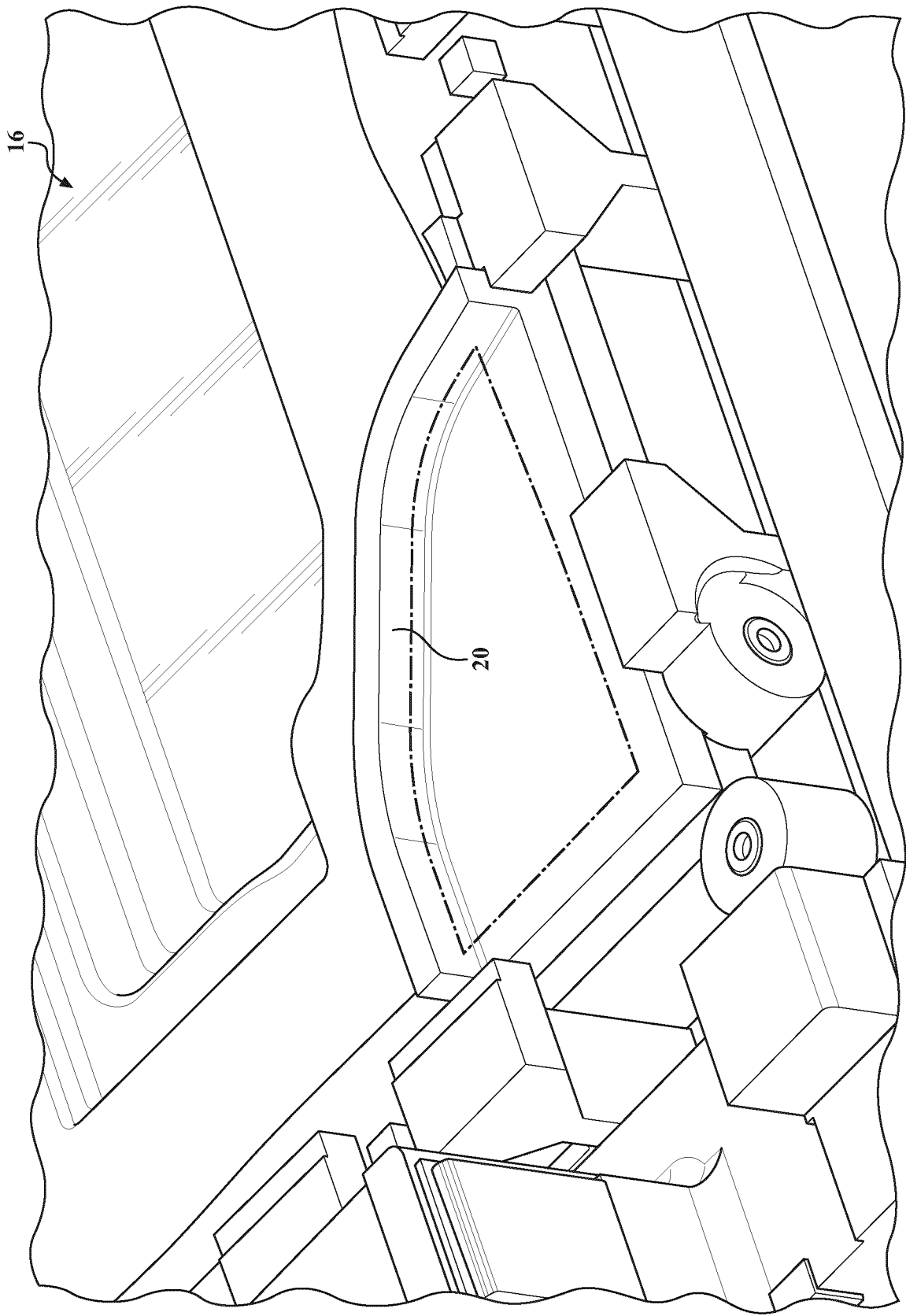


FIG. 2A

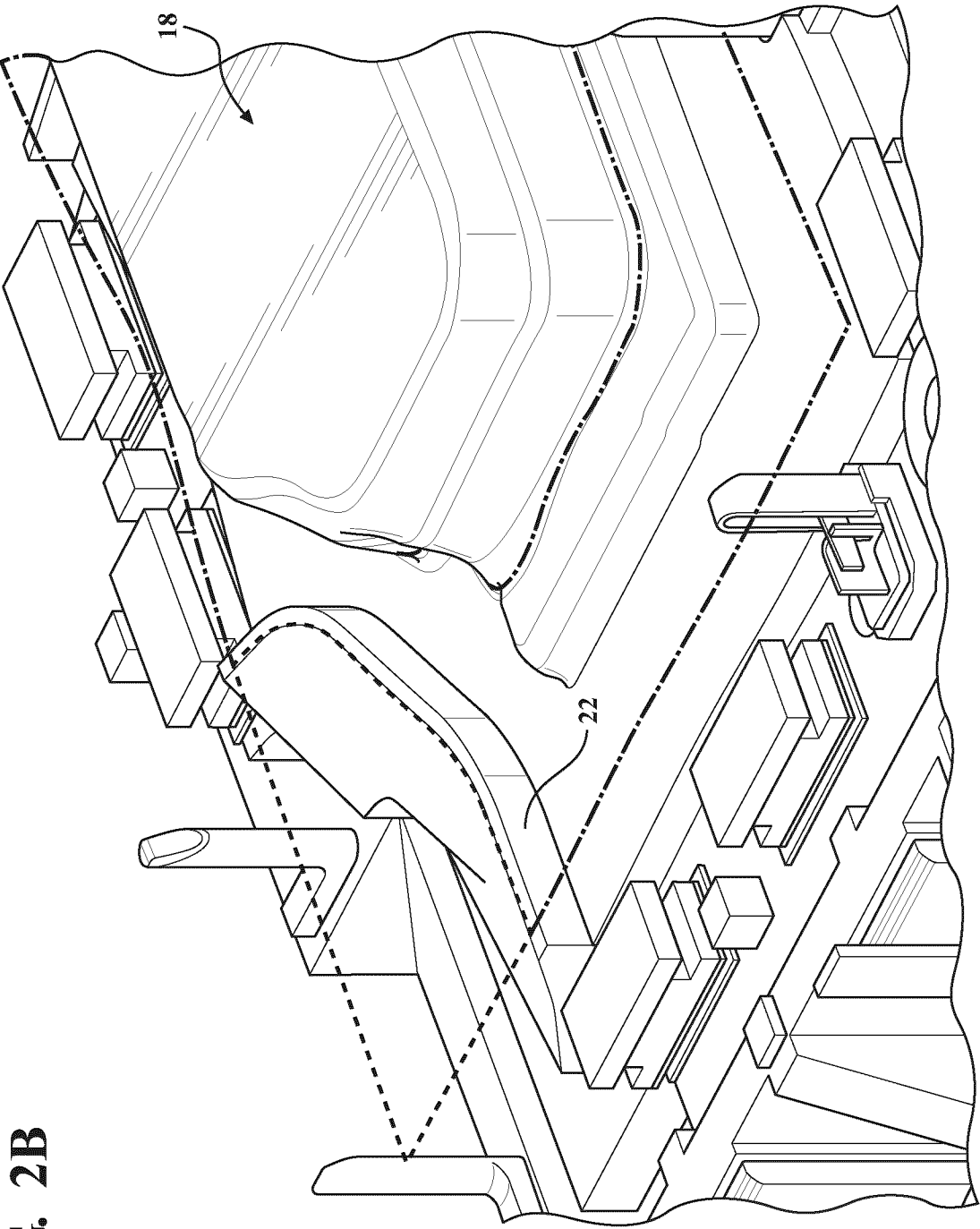


FIG. 2B

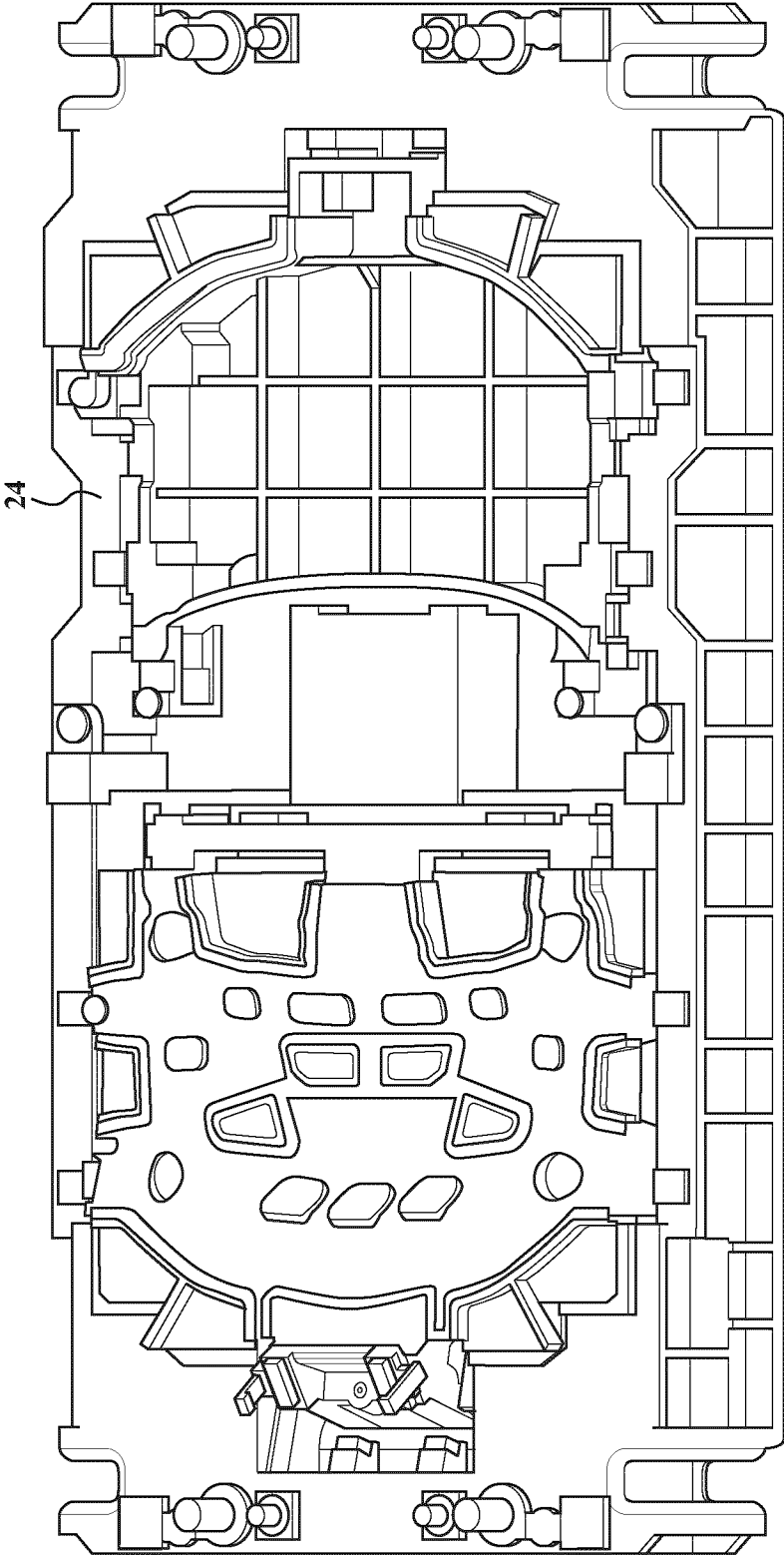


FIG. 3A

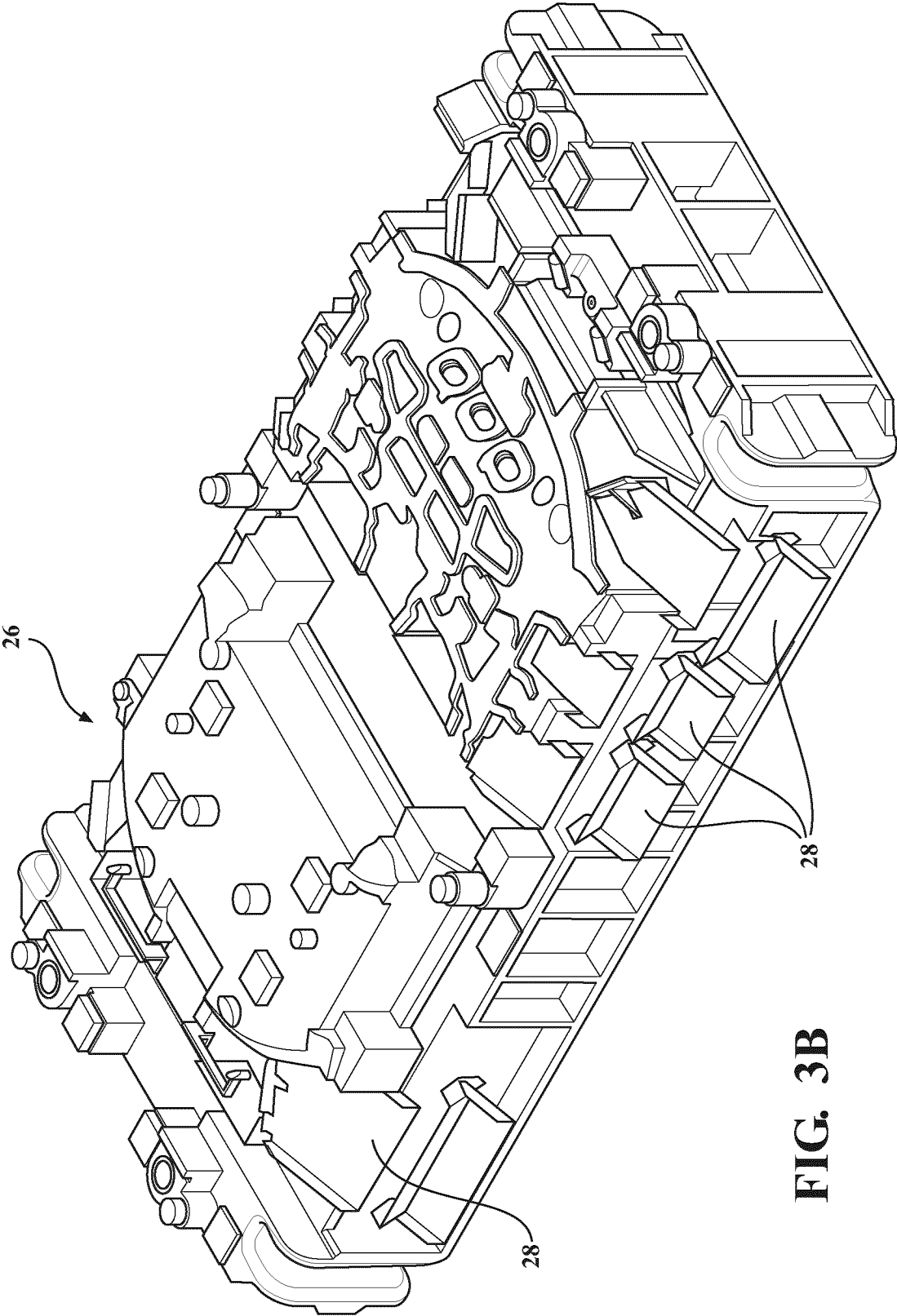


FIG. 3B

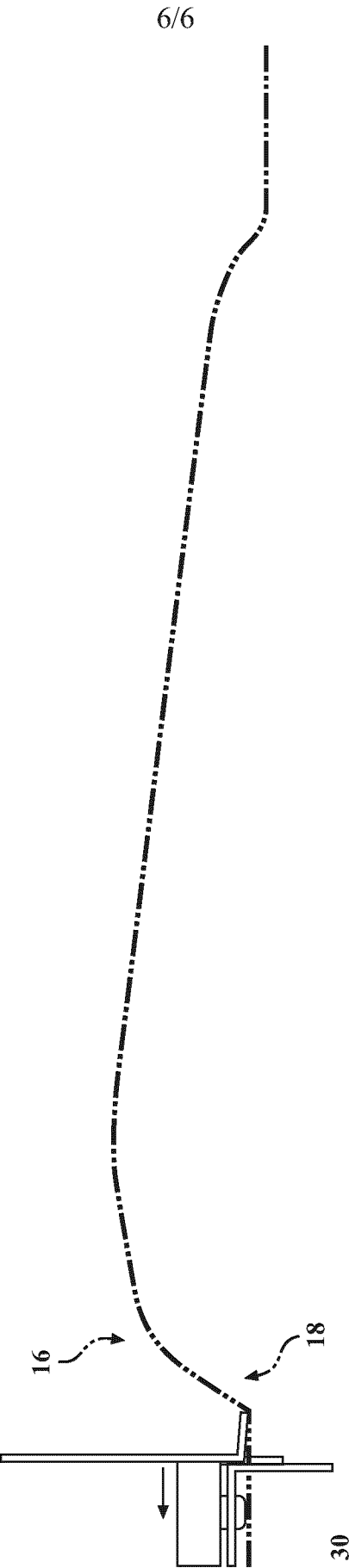


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2023/051635

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **B21D 24/16** (2006.01), **B21D 22/20** (2006.01), **B21D 37/08** (2006.01), **B21D 53/88** (2006.01)

CPC: , B21D 22/20 (2020.01), B21D 24/005 (2020.01), B21D 37/08 (2020.01), B21D 53/88 (2020.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B21D-024/16 OR B21D-022/20 OR B21D-037/08 OR B21D-053/88

CPC: B21D-024/005 OR B21D-022/20 OR B21D-037/08 OR B21D-053/88

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Questel Orbit(FAMPat)

keywords: draw+, form+, chute+, shoot+, scrap+, trim+, blade+, single+, subseq+, semi-finish+, final+, prelim+, finsh+, air+, blower+, station+, auto+, car, veh+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X Y	JPH08-117880A Takahashi, S et al. 14 May 1996 (14-05-1996) *Abstract; paragraphs 1,23-24,28,31-32,51-56*	11-15,19-20 1-10, 16-18
X Y	US20070164470A1 Sasaki, J et al. 19 July 2007 (19-07-2007) *Figures; paragraphs 39-49*	11-15,19-20 1-10, 16-18

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* "A" "D" "E" "L" "O" "P"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance document cited by the applicant in the international application earlier application or patent but published on or after the international filing date document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) document referring to an oral disclosure, use, exhibition or other means document published prior to the international filing date but later than the priority date claimed	"T" "X" "Y" "&"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art document member of the same patent family
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Date of the actual completion of the international search
12 February 2024 (12-02-2024)Date of mailing of the international search report
13 March 2024 (13-03-2024)Name and mailing address of the ISA/CA
Canadian Intellectual Property Office
Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 819-953-2476

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA2023/051635

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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