

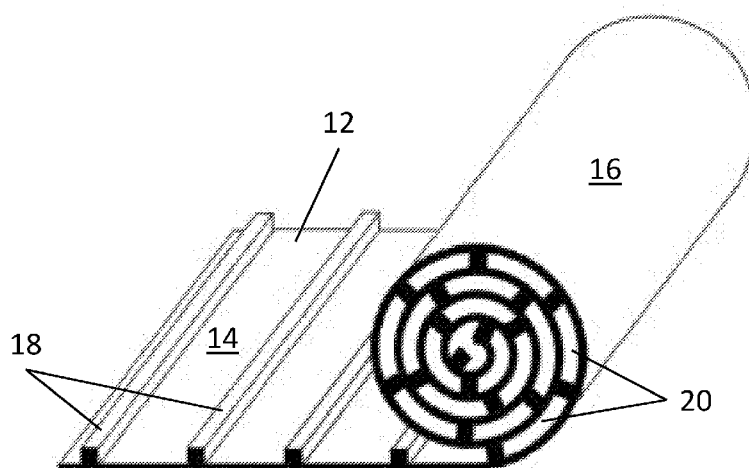


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(54) Title: ROLLED SCAFFOLD FOR LARGE SCALE CELL CULTURE IN MONOLAYER

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↙

Figure 1



(57) Abstract: The present invention provides rolled scaffold devices and cell culture systems that can provide a large surface-area-to-volume ratio for expanded cell culture. The rolled scaffolds minimize shear stress on cultured cells and support sufficient and uniform mass transfer rates of gases and nutrients. The rolled scaffolds can be connected to a media source via holders to support large-scale expansion and maintenance of cell cultures.



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
KM, ML, MR, NE, SN, TD, TG).

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**(88) Date of publication of the international search report:**

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 19/15063

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC(8) - C12M 1/00 (2019.01)  
 CPC - C12M 1/00

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)

See Search History Document

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

See Search History Document

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

See Search History Document

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 3,853,712 A (HOUSE et al.) 10 December 1974 (10.12.1974) Figs. 3-5; col 4 ln 24-29, col 5 ln 14-17.	1-2, 4, 7
Y	US 5,079,168 A (AMIOT) 07 January 1992 (07.01.1992) Figs. 1-4; col 5 ln 7-9, 64 ln 64 - col 6 ln 4, 24-27, 29-31, 40-47, col 8 ln 19-26, 38-45, 58-62, 66-col 9 ln 8.	3, 5-6
Y	US 4,689,302 A (GOLDBERG et al.) 25 August 1987 (25.08.1987) Figs. 4-6; col 4 ln 27-50.	3, 5-6
Y	US 2011/0196660 A1 (LIU et al.) 11 August 2011 (11.08.2011) Fig. 2B; para [0036].	13-17
Y	US 2018/0116959 A1 (THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL) 03 May 2018 (03.05.2018) Figs. 1A-D; para [0003], [0066], [0151], [0152], [0154].	13-14, 16-17
Y	"A review of roll-to-roll nanoimprint lithography" (KOOY et al.) 25 June 2014 (25.06.2014) Fig. 10; pgs 5-6, 12.	13, 15
A	US 2014/0306371 A1 (THE GOVERNING COUNCIL OF THE UNIVERSITY OF TORONTO) 16 October 2014 (16.10.2014) Figs. 1, 3A; para [0048].	16-17
A	US 2013/0184724 A1 (DOWNES et al.) 18 July 2013 (18.07.2013) Figs. 2-3; para [0189], [0190].	1-7, 13-17
A	US 5,869,329 A (BERNDT) 09 February 1999 (09.02.1999) Figs. 1-3; col 3 ln 3-14.	1-7, 13-17
A	US 5,240,322 A (HABER et al.) 31 August 1993 (31.08.1993) Figs. 1-3; col 3 ln 4-19.	1-7, 13-17

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" 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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" 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

"X" 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

"Y" 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

Date of the actual completion of the international search

01 October 2019

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 19/15063

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:  
\*-\* See Extra Sheet -\*

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1-7, 13-17

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 19/15063

-\*- Box III - Observations where Unity of Invention is lacking -\*-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I Claims 1-17 and 13-17, drawn to a rolled scaffold, or method of fabrication thereof, comprising spacers parallel to a cylindrical axis.

Group II Claims 8-12, drawn to a method of fabricating rolled scaffolds comprising etching.

Group III Claims 18-25, drawn to a cell culturing system.

-\*- SPECIAL TECHNICAL FEATURES -\*-

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the lack the same or corresponding special technical feature(s) for the following reasons:

Group I requires the special technical feature of a plurality of elongate spacers extending parallel to the axis of a cylindrical/rolled scaffold body, not required by the claims of Groups II-III.

Group II requires the special technical feature of the steps of etching a series of grooves into the top surface of a mold substrate and curing a material deposited in the grooves, not required by the claims of Groups I and III.

Group III requires the special technical features of one or more media reservoirs, tubing fluidly connected to the media reservoir, and one or more pumps connected to the tubing, not required by the claims of Groups I-II.

-\*- COMMON TECHNICAL FEATURES -\*-

The only shared technical feature(s) that would otherwise unify Groups I-III are a rolled scaffold comprising a planar film spanned by a plurality of elongate spacers.

However, these technical features do not represent a contribution to the prior art, because they are anticipated by US 4,689,302 A to GOLDBERG et al. (hereinafter "Goldberg").

Goldberg teaches a rolled scaffold (spiral reactor 50, Figs. 4-6; col 4 ln 27-29) comprising:  
a planar film (sheet(s) 54, Figs. 4-6; col 4 ln 33-36) spanned by a plurality of elongate spacers (56, Figs. 5-6; col 4 ln 44-46).

The only shared technical feature(s) that would otherwise unify Groups I and III are a rolled scaffold comprising a planar film spanned by a plurality of elongate spacers, wherein the elongate spacers maintain a space between the rolled film layers.

However, these technical features do not represent a contribution to the prior art, because they are anticipated by Goldberg.

Goldberg teaches a rolled scaffold (spiral reactor 50, Figs. 4-6; col 4 ln 27-29) comprising:  
a planar film (sheet(s) 54, Figs. 4-6; col 4 ln 33-36) spanned by a plurality of elongate spacers (56, Figs. 5-6; col 4 ln 44-46);  
wherein the elongate spacers maintain a space between the rolled film layers (height h, Fig. 6; col 4 ln 44-46).

As the common technical feature(s) of Groups I-III were known in the art at the time of the invention, they cannot be considered to be common technical feature(s) that would otherwise unify Groups I-III.

Therefore, Groups I-III lack unity under PCT Rule 13.