WHAT IS CLAIMED AS NEW AND DESIRED TO BE PROTECTED BY LETTERS PATENT OF THE UNITED STATES OF AMERICA, IS:

1. An automated cascade impactor, comprising:

a vertical array of a plurality of impactor stages; and

a vertical array of a plurality of isolation stages comprising vertically arranged pairs of isolation stages, wherein each pair of said vertically arranged pairs of isolation stages comprises an upper isolation stage and a lower isolation stage;

whereby, when said plurality of impactor stages and said plurality of isolation stages are moved toward each other in an interdigitated manner, each pair of said plurality of isolation stages is interposed between successive impactor stages of said plurality of impactor stages, while at the same time, each impactor stage of said plurality of impactor stages is interposed between a lower isolation stage of an upper pair of said plurality of isolation stages and an upper isolation stage of a successively lower pair of said plurality of isolation stages.

2. The automated cascade impactor as set forth in Claim 1, wherein:

each one of said plurality of impactor stages comprises an impactor plate;

each one of said upper and lower isolation stages of a pair of isolation stages has a centrally recessed por-

tion defined therein for receiving one of said impactor plates from one of said plurality of impactor stages; and

a gripper arm assembly is provided for gripping said impactor plates, disposed within said plurality of impactor stages, and transferring said impactor plate from said plurality of impactor stages to said centrally recessed portions defined within said plurality of isolation stages,

whereby, when said plurality of impactor stages and said plurality of said plurality of isolation stages are moved toward each other in an interdigitated manner, each pair of said plurality of isolation stages, that is, an upper isolation stage and a lower isolation stage, is interposed between successive ones of said plurality of impactor stages, while at the same time, each one of said plurality of impactor plates is interposed between an upper one and a lower one of said pairs of isolation stages, and each one of said impactor stages is interposed between a lower isolation stage of an upper pair of said plurality of isolation stages and an upper isolation stage of a successively lower pair of said plurality of isolation stages.

3. The automated cascade impactor as set forth in Claim 1, further comprising:

an extension actuator operatively connected to at least one of said plurality of impactor stages so as to permit all of said plurality of impactor stages to move vertically away from each other such that all of said plurality of impactor stages are disposed in separated states with respect to each other, and to cause said plurality of impactor stages

to move vertically toward each other such that all of said plurality of impactor stages are disposed in compressed states with respect to each other;

an isolation actuator operatively connected to all of said plurality of isolation stages so as to respectively insert all of said plurality of isolation stages into spaces respectively defined between all of said plurality of impactor stages, and to respectively remove all of said plurality of isolation stages out from said spaces respectively defined between all of said plurality of impactor stages, when all of said plurality of impactor stages are disposed in said separated states with respect to each other, and to be respectively compressed between all of said plurality of impactor stages when all of said plurality of impactor stages are disposed in said compressed states with respect to each other whereby all of said plurality of isolation stages can isolate all of said plurality of impactor stages from each other.

4. The automated cascade impactor as set forth in Claim 2, wherein:

said gripper arm assembly comprises an upstanding standard;

a plurality of gripper arms are fixedly mounted upon said upstanding standard in vertically spaced pairs of gripper arms wherein each pair of gripping arms can grip one of said impactor plates when transferring said impactor plates from said impactor stages to said isolation stages, and when transferring said impactor plates from said isolation stages back to said impactor stages.

5. The automated cascade impactor as set forth in Claim 4, wherein:

dependent gripper arm pins depend from distal end portions of said gripper arms for gripping external peripheral portions of said impactor plates.

6. The automated cascade impactor as set forth in Claim 5, wherein:

said gripper arm assembly comprises structure for enabling movement of said gripper arms with multiple degrees of freedom whereby said plurality of pairs of gripper arms are able to be moved toward and away from said impactor stages, said plurality of gripper arms are able to be elevationally moved upwardly and downwardly so as to be disposed at elevational levels at which said plurality of gripper arms can remove said impactor plates from said impactor stages and deposit said impactor plates within said isolation stages, and said plurality of gripper arms are able to be moved toward and away from each other such that said pairs of gripper arm pins can grip and release said impactor plates.

7. The automated cascade impactor as set forth in Claim 6, wherein said structure for enabling said movement of said gripper arms with multiple degrees of freedom comprises:

a first linear guide rail and slide block for enabling said gripper arms to be moved toward and away from said

impactor stages, a second guide rail and second slide blocks for moving said plurality of gripper arms toward and away from each other, and a rack and pinion drive for moving said plurality of gripper arms elevationally upwardly and downwardly.

8. The automated cascade impactor as set forth in Claim 5, further comprising:

an impactor plate gripper arm pin wash assembly for washing and cleaning said gripper arm pins such that cross-contamination does not occur between drug doses.

9. The automated cascade impactor as set forth in Claim 8, wherein said impactor plate gripper arm pin wash assembly comprises:

an upstanding standard;

a plurality of vertically spaced washer plates fixedly mounted upon said upstanding stanrdard; and

a pair of impactor plate gripper arm pin wash wells formed upon each one of said plurality of vertically spaced washer plates for receiving said gripper arm pins dependent from distal end portions of said gripper arms.

10. The automated cascade impactor as set forth in Claim 1, wherein:

said plurality of impactor stages and said plurality of isolation stages are mounted upon a framework;

a rotary drive motor, having a rotary output drive shaft, for imparting rotational movements to said framework, said plurality of impactor stages, and said plurality of isolation stages; and

a mounting bracket fixedly mounted upon a distal end portion of said rotary output drive shaft of said rotary drive motor for mounting said framework, said plurality of impactor stages, and said plurality of isolation stages upon said rotary drive motor.

11. The automated cascade impactor as set forth in Claim 10, wherein:

said rotary drive motor is mounted upon linear guide rails such that linear reciprocation movements can also be imparted to said framework, said plurality of impactor stages, and said plurality of isolation stages.

12. The automated cascade impactor as set forth in Claim 10, wherein:

auxiliary vibrators are mounted upon said plurality of isolation stages so as to impart additional vibrations to said plurality of isolation stages.

13. The automated cascade impactor as set forth in Claim 1, wherein:

each one of said upper and lower isolation stages of a pair of said plurality of isolation stages is provided with a pair of diametrically opposed solvent ports for injecting and extracting solvent into and out from said upper and lower isolation stages.

14. The automated cascade impactor as set forth in Claim 2, wherein:

each one of said upper isolation stages of each pair of said plurality of isolation stages is provided with a pair of diametrically opposed solvent ports for injecting and extracting solvent into and out from said centrally recessed portion defined within said upper isolation stage for receiving one of said impactor plates from one of said plurality of impactor stages.

15. The automated cascade impactor as set forth in Claim 2, wherein:

each one of said lower isolation stages of each pair of said plurality of isolation stages is provided with a pair of diametrically opposed solvent ports for injecting and extracting solvent into and out from a centrally recessed portion defined within said lower isolation stage for receiving an upper peripheral portion of one of said plurality of impactor stages.

16. The automated cascade impactor as set forth in Claim 2, wherein:

said lower isolation stage of a first pair of said plurality of isolation stages is provided with an air/vacuum port, while said upper isolation stage of a second pair of said plurality of isolation stages is also provided with an air/vacuum port, wherein one of said impactor stages is interposed between said lower isolation stage of said first pair of said plurality of isolation stages and said upper isolation stage of said second pair of said plurality of isolation stages, whereby a pressure differential can be created across said impactor stage interposed between said lower isolation stage of said first pair of said plurality of isolation stages and said upper isolation stage of said second pair of said plurality of isolation stages such that solvent can be caused to traverse said impactor stage interposed between said lower isolation stage of said first pair of said plurality of isolation stages and said upper isolation stage of said second pair of said plurality of isolation stages.

17. The automated cascade impactor as set forth in Claim 2, wherein:

frits/membranes are disposed adjacent to said air/vacuum ports defined within said lower isolation stage of said first pair of said plurality of isolation stages and within said upper isolation stage of said second pair of said plurality of isolation stages so as to permit only air and vacuum conditions to pass through said air/vacuum ports de-

fined within said lower isolation stage of said first pair of said plurality of isolation stages and within said upper isolation stage of said second pair of said plurality of isolation stages.

18. The automated cascade impactor as set forth in Claim 3, wherein:

said movements of said extension actuator and said isolation actuator are controlled by a programmable logic computer (PLC).

What is claimed as new and desired to be protected by Letters Patent of the United States of America, is:

1. An automated cascade impactor, comprising:

a vertical array of a plurality of impactor stages; and

a vertical array of a plurality of isolation stages comprising vertically arranged pairs of isolation stages, wherein each pair of said vertically arranged pairs of isolation stages comprises an upper isolation stage and a lower isolation stage;

whereby, when said plurality of impactor stages and said plurality of isolation stages are moved toward each other in an interdigitated manner, each pair of said plurality of isolation stages is interposed between successive impactor stages of said plurality of impactor stages, while at the same time, each impactor stage of said plurality of impactor stages is interposed between a lower isolation stage of an upper pair of said plurality of isolation stages and an upper isolation stage of a successively lower pair of said plurality of isolation stages.

2. The automated cascade impactor as set forth in claim 1, wherein:

each one of said plurality of impactor stages comprises an impactor plate;

each one of said upper and lower isolation stages of a pair of isolation stages has a centrally recessed portion defined therein for receiving one of said impactor plates from one of said plurality of impactor stages; and

a gripper arm assembly is provided for gripping said impactor plates, disposed within said plurality of impactor stages, and transferring said impactor plate from said plurality of impactor stages to said centrally recessed portions defined within said plurality of isolation stages,

whereby, when said plurality of impactor stages and said plurality of said plurality of isolation stages are moved toward each other in an interdigitated manner, each pair of said plurality of isolation stages, that is, an upper isolation stage and a lower isolation stage, is interposed between successive ones of said plurality of impactor stages, while at the same time, each one of said plurality of impactor plates is interposed between an upper one and a lower one of said pairs of isolation stages, and each one of said impactor stages is interposed between a lower isolation stage of an upper pair of said plurality of isolation stages and an upper isolation stage of a successively lower pair of said plurality of isolation stages.

3. The automated cascade impactor as set forth in claim 1, further comprising:

an extension actuator operatively connected to at least one of said plurality of impactor stages so as to permit all of said plurality of impactor stages to move vertically away from each other such that all of said plurality of impactor stages are disposed in separated states with respect to each other, and to cause said plurality of impactor stages to move vertically toward each other such that all of said plurality of impactor stages are disposed in compressed states with respect to each other;

an isolation actuator operatively connected to all of said plurality of isolation stages so as to respectively insert all of said plurality of isolation stages into spaces respectively defined between all of said plurality of impactor stages, and to respectively remove all of said plurality of isolation stages out from said spaces respectively defined between all of said plurality of impactor stages, when all of said plurality of impactor stages are disposed in said separated states with respect to each other, and to be respectively compressed between all of said plurality of impactor stages when all of said plurality of impactor stages are disposed in said compressed states with respect to each other whereby all of said plurality of isolation stages can isolate all of said plurality of impactor stages from each other.

4. The automated cascade impactor as set forth in claim 2, wherein:

said gripper arm assembly comprises an upstanding standard;

a plurality of gripper arms are fixedly mounted upon said upstanding standard in vertically spaced pairs of gripper arms wherein each pair of gripping arms can grip one of said impactor plates when transferring said impactor plates from said impactor stages to said isolation stages, and when transferring said impactor plates from said isolation stages back to said impactor stages.

5. The automated cascade impactor as set forth in claim 4, wherein: dependent gripper arm pins depend from distal end portions of said gripper arms for gripping external peripheral portions of said impactor plates.

6. The automated cascade impactor as set forth in claim 5, wherein:

said gripper arm assembly comprises structure for enabling movement of said gripper arms with multiple degrees of freedom whereby said plurality of pairs of gripper arms are able to be moved toward and away from said impactor stages, said plurality of gripper arms are able to be elevationally moved upwardly and downwardly so as to be disposed at elevational levels at which said plurality of gripper arms can remove said impactor plates from said impactor stages and deposit said impactor plates within said isolation stages, and said plurality of gripper arms are able to be moved toward and away from each other such that said pairs of gripper arm pins can grip and release said impactor plates.

7. The automated cascade impactor as set forth in claim 6, wherein said structure for enabling said movement of said gripper arms with multiple degrees of freedom comprises:

a first linear guide rail and slide block for enabling said gripper arms to be moved toward and away from said impactor stages, a second guide rail and second slide blocks for moving said plurality of gripper arms toward and away from each other, and a rack and pinion drive for moving said plurality of gripper arms elevationally upwardly and downwardly.

8. The automated cascade impactor as set forth in claim 5, further comprising:

an impactor plate gripper arm pin wash assembly for washing and cleaning said gripper arm pins such that cross-contamination does not occur between drug doses.

9. The automated cascade impactor as set forth in claim 8, wherein said impactor plate gripper arm pin wash assembly comprises:

an upstanding standard;

a plurality of vertically spaced washer plates fixedly mounted upon said upstanding standard; and

a pair of impactor plate gripper arm pin wash wells formed upon each one of said plurality of vertically spaced washer plates for receiving said gripper arm pins dependent from distal end portions of said gripper arms.

10. The automated cascade impactor as set forth in claim 1, wherein:

said plurality of impactor stages and said plurality of isolation stages are mounted upon a framework;

a rotary drive motor, having a rotary output drive shaft, for imparting rotational movements to said framework, said plurality of impactor stages, and said plurality of isolation stages; and

a mounting bracket fixedly mounted upon a distal end portion of said rotary output drive shaft of said rotary drive motor for mounting said framework, said plurality of impactor stages, and said plurality of isolation stages upon said rotary drive motor.

11. The automated cascade impactor as set forth in claim 10, wherein:

said rotary drive motor is mounted upon linear guide rails such that linear reciprocation movements can also be imparted to said framework, said plurality of impactor stages, and said plurality of isolation stages.

12. The automated cascade impactor as set forth in claim 10, wherein:

auxiliary vibrators are mounted upon said plurality of isolation stages so as to impart additional vibrations to said plurality of isolation stages.

13. The automated cascade impactor as set forth in claim 1, wherein:

each one of said upper and lower isolation stages of a pair of said plurality of isolation stages is provided with a pair of diametrically opposed solvent ports for injecting and extracting solvent into and out from said upper and lower isolation stages.

14. The automated cascade impactor as set forth in claim 2, wherein:

each one of said upper isolation stages of each pair of said plurality of isolation stages is provided with a pair of diametrically opposed solvent ports for injecting and extracting solvent into and out from said centrally recessed portion defined within said upper isolation stage for receiving one of said impactor plates from one of said plurality of impactor stages.

15. The automated cascade impactor as set forth in claim 2, wherein:

each one of said lower isolation stages of each pair of said plurality of isolation stages is provided with a pair of diametrically opposed solvent ports for injecting and extracting solvent into and out from a centrally recessed portion defined within said lower isolation stage for receiving an upper peripheral portion of one of said plurality of impactor stages.

16. The automated cascade impactor as set forth in claim 2, wherein:

said lower isolation stage of a first pair of said plurality of isolation stages is provided with an air/vacuum port, while said upper isolation stage of a second pair of said plurality of isolation stages is also provided with an air/vacuum port, wherein one of said impactor stages is interposed between said lower isolation stage of said first pair of said plurality of isolation stages and said upper isolation stage of said second pair of said plurality of isolation stages, whereby a pressure differential can be created across said impactor stage interposed between said lower isolation stage of said first pair of said plurality of isolation stages and said upper isolation stage of said second pair of said plurality of isolation stages such that solvent can be caused to traverse said impactor stage interposed between said lower

isolation stage of said first pair of said plurality of isolation stages and said upper isolation stage of said second pair of said plurality of isolation stages.

17. The automated cascade impactor as set forth in claim 2, wherein:

frits/membranes are disposed adjacent to said air/vacuum ports defined within said lower isolation stage of said first pair of said plurality of isolation stages and within said upper isolation stage of said second pair of said plurality of isolation stages so as to permit only air and vacuum conditions to pass through said air/vacuum ports defined within said lower isolation stage of said first pair of said plurality of isolation stages and within said upper isolation stage of said second pair of said plurality of isolation stages.

18. The automated cascade impactor as set forth in claim 3, wherein:

said movements of said extension actuator and said isolation actuator are controlled by a programmable logic computer (PLC).