CLAIMS

1. A molding apparatus comprising:

a mold cavity;

an ejector pin having a first surface exposed to the mold cavity and a second surface not exposed to the mold cavity; ~~and~~

a sensor or analog transducer capable of detecting the cavity pressure wave form in communicative contact with the ejector pin second surface, wherein the sensor or analog transducer is operable to sense mold cavity pressure through the ejector pin~~.~~; and

a spacer plate configured to contain the sensor or analog transducer, signal conditioning and wires; and

a retainer plate holding one end of the ejector pin; and

an ejector plate operable to force the ejector pin into the mold cavity wherein the sensor or analog transducer is fixably held between the ejector pin second surface and the ejector plate; and

a spacer plate fixably held between the retainer plate and the ejector plate wherein the spacer plate contains the sensor or analog transducer wires and signal conditioning devices; wherein

the signal conditioning devices are electrically coupled to the sensor or analog transducer.

~~2. The molding apparatus of claim 1 further comprising:~~

~~a retainer plate holding one end of the ejector pin; and~~

~~an ejector plate operable to force the ejector pin into the mold cavity wherein the sensor is fixably held between the ejector pin second surface and the ejector plate.~~

~~3. The molding apparatus of claim 2 further comprising a spacer plate fixably held between the retainer plate and the ejector plate.~~

~~4. The molding apparatus of claim 3 further comprising a signal conditioning circuit embedded within or onto the spacer plate and electrically coupled to the sensor.~~

~~5~~2. The molding apparatus of claim ~~3~~ 1 wherein the molding apparatus further comprises:

a first portion containing the molding cavity;

a second portion containing the ejector plate; and

a die spacing plate between the first and second portions to account for the thickness of the spacer plate.

~~3~~3. The molding apparatus of claim 1 further comprising:

an ejector plate operable to force the ejector pin into the mold cavity, wherein the ejector plate has a clearance hole that exposes the ejector pin second surface;

a clamping plate having a clearance hole concentric to the ejector plate clearance hole;

a transfer pin through the ejector plate and clamping plate clearance holes wherein a first surface of the transfer pin is in communicative contact with the ejector pin second surface; and

a cover plate wherein the sensor is held between the cover plate and a second surface of the transfer pin.

~~7~~4. The molding apparatus of claim 6 further comprising a sleeve lining the ejector plate clearance hole or the clamping plate clearance hole.

~~8~~5. The molding apparatus of claim 6 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

~~9~~6. The molding apparatus of claim 8 further comprising a signal conditioning circuit embedded within or mounted onto the surface of the spacer plate and electrically coupled to the sensor.

~~10~~7. A molding apparatus comprising:

a mold cavity;

a hollow ejector pin having a first end facing the mold cavity and a second end not facing the mold cavity; and

a sensor embedded in the hollow ejector pin first end, wherein the sensor is exposed to the mold cavity and wherein the sensor has a signal line routed through the hollow ejector pin, wherein the sensor is operable to sense a mold cavity parameter~~.~~; and

a retainer plate holding one end of the hollow ejector pin; and

an ejector plate operable to force the hollow ejector pin into the mold cavity; and

a spacer plate fixably held between the retainer plate and the ejector plate.; wherein

a signal conditioning circuit is embedded within or onto the spacer plate and electrically coupled to the sensor signal line.

~~11. The molding apparatus of claim 10 further comprising:~~

~~a retainer plate holding one end of the hollow ejector pin; and~~

~~an ejector plate operable to force the hollow ejector pin into the mold cavity.~~

~~12. The molding apparatus of claim 11 further comprising a spacer plate fixably held between the retainer plate and the ejector plate.~~

~~13. The molding apparatus of claim 12 further comprising a signal conditioning circuit embedded within or onto the spacer plate and electrically coupled to the sensor signal line.~~

~~14~~8. The molding apparatus of claim ~~12~~ 7wherein the molding apparatus further comprises:

a first portion containing the molding cavity;

a second portion containing the ejector plate; and

a die spacing plate between the first and second portions to account for the thickness of the spacer plate.

~~15~~9. The molding apparatus of claim ~~11~~ 7 wherein the molding apparatus further comprises a second sensor or analog transducer in communicative contact with the ejector pin second surface~~,~~ and the ejector plate and wherein the second sensor is fixably held between the hollow ejector pin containing the first sensor or analog transducer and the ejector plate, so as to simultaneously detect the cavity pressure waveform along with the first cavity parameter wave form. ~~second surface and the ejector plate and wherein the second sensor is operable to sense mold cavity pressure through the ejector pin.~~

~~16~~10. The molding apparatus of claim ~~15~~ 9 further comprising a second signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the second sensor.

~~17~~11. A molding apparatus comprising:

a mold cavity having an opening for an ejector pin;

a retainer plate having at least one opening operable to hold an ejector pin;

an ejector plate having a clearance hole concentric to the retainer plate opening; a clamping plate having a clearance hole concentric to the ejector plate opening; a transfer pin through the retainer plate opening, the ejector plate clearance hole, and clamping plate clearance hole, wherein a first surface of the transfer pin is exposed to the mold cavity through the mold cavity ejector pin opening and a second surface of the transfer pin is not exposed to the mold cavity;

a sensor in communicative contact with the transfer pin second surface, wherein the sensor is operable to sense mold cavity pressure through the transfer pin; and

a cover plate wherein the sensor is fixably held between the cover plate and transfer plate second surface.

~~18~~12. The molding apparatus of claim ~~17~~ 11 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

~~19~~13. The molding apparatus of claim ~~18~~ 12 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor.

~~20~~14. A molding apparatus comprising:

a mold cavity having an opening for an ejector pin;

a retainer plate having at least one opening operable to hold an ejector pin;

an ejector plate having a clearance hole concentric to the retainer plate opening; a clamping plate having a clearance hole concentric to the ejector plate opening; a hollow transfer pin through the retainer plate opening, the ejector plate clearance hole, and the clamping plate clearance hole, wherein the hollow transfer pin has a first end facing the mold cavity and a second end not facing the mold cavity;

a sensor embedded in the hollow transfer pin first end, wherein the sensor is exposed to the mold cavity and wherein the sensor has a signal line routed through the hollow transfer pin, wherein the sensor is operable to sense a mold cavity parameter; and a cover plate wherein the sensor is fixably held between the cover plate and the hollow transfer pin second end.

~~21~~15. The molding apparatus of claim ~~20~~ 14 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

~~22~~16. The molding apparatus of claim ~~21~~ 15 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor signal line.

~~23~~17. The molding apparatus of claim ~~20~~ 14 wherein the molding apparatus further comprises a second sensor in communicative contact with the hollow transfer pin second end, wherein the second sensor is fixably held between the hollow transfer pin second surface and the cover plate and wherein the second sensor is operable to sense mold cavity pressure through the hollow transfer pin.

~~24~~18. The molding apparatus of claim ~~23~~ 17 further comprising a second signal conditioning circuit embedded within the spacer plate and electrically coupled to the second sensor.

~~25~~19. A molding apparatus comprising:

an ejector plate operable to force an ejector pin in a mold cavity, wherein the ejector plate has a first side facing the mold cavity and a second side not facing the mold cavity;

a transfer pin having a first end in communicative contact with the .ejector plate second side, wherein the transfer pin is operable to stop the ejector plate;

a clamping plate having a clearance hole, wherein the transfer pin is through the clamping plate;

a sensor in communicative contact with a second end of the transfer pin, wherein the sensor is operable to sense ejector plate pressure through the transfer pin; and

a cover plate wherein the sensor is fixably held between the cover plate and a second end of the transfer pin.

~~26~~20. The molding apparatus of claim ~~25~~ 19 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

~~27~~21. The molding apparatus of claim ~~26~~ 20 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor.

~~28~~22. The molding apparatus of claim ~~25~~ 19 further comprising:

a second transfer pin having a first end in communicative contact with the ejector plate second side, wherein the second transfer pin is operable to stop the ejector plate; and

a second sensor in communicative contact with a second end of the second transfer pin, wherein the second sensor is operable to sense ejector plate pressure through the second transfer pin.

~~29~~23. The molding apparatus of claim ~~25~~ 19 further comprising:

a spacer plate fixably held between the cover plate and the clamping plate; and a signal conditioning circuit embedded within or mounted onto the surface of the spacer plate and electrically coupled to the first and second sensor, wherein the signal conditioning circuit is operable to sum first and second sensor pressures.

CLAIMS

What is claimed is:

1. A molding apparatus comprising:

a mold cavity;

an ejector pin having a first surface exposed to the mold cavity and a second surface not exposed to the mold cavity; and

a sensor in communicative contact with the ejector pin second surface, wherein the sensor is operable to sense mold cavity pressure through the ejector pin.

2. The molding apparatus of claim 1 further comprising:

a retainer plate holding one end of the ejector pin; and

an ejector plate operable to force the ejector pin into the mold cavity wherein the sensor is fixably held between the ejector pin second surface and the ejector plate.

3. The molding apparatus of claim 2 further comprising a spacer plate fixably held between the retainer plate and the ejector plate.

4. The molding apparatus of claim 3 further comprising a signal conditioning circuit embedded within or onto the spacer plate and electrically coupled to the sensor.

5. The molding apparatus of claim 3 wherein the molding apparatus further comprises:

a first portion containing the molding cavity;

a second portion containing the ejector plate; and

a die spacing plate between the first and second portions to account for the thickness of the spacer plate.

6. The molding apparatus of claim 1 further comprising:

an ejector plate operable to force the ejector pin into the mold cavity, wherein the ejector plate has a clearance hole that exposes the ejector pin second surface;

a clamping plate having a clearance hole concentric to the ejector plate clearance hole;

a transfer pin through the ejector plate and clamping plate clearance holes wherein a first surface of the transfer pin is in communicative contact with the ejector pin second surface; and

a cover plate wherein the sensor is held between the cover plate and a second surface of the transfer pin.

7. The molding apparatus of claim 6 further comprising a sleeve lining the ejector plate clearance hole or the clamping plate clearance hole.

8. The molding apparatus of claim 6 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

9. The molding apparatus of claim 8 further comprising a signal conditioning circuit embedded within or mounted onto the surface of the spacer plate and electrically coupled to the sensor.

10. A molding apparatus comprising:

a mold cavity;

a hollow ejector pin having a first end facing the mold cavity and a second end not facing the mold cavity; and

a sensor embedded in the hollow ejector pin first end, wherein the sensor is exposed to the mold cavity and wherein the sensor has a signal line routed through the hollow ejector pin, wherein the sensor is operable to sense a mold cavity parameter.

11. The molding apparatus of claim 10 further comprising:

a retainer plate holding one end of the hollow ejector pin; and

an ejector plate operable to force the hollow ejector pin into the mold cavity.

12. The molding apparatus of claim 11 further comprising a spacer plate fixably held between the retainer plate and the ejector plate.

13. The molding apparatus of claim 12 further comprising a signal conditioning circuit embedded within or onto the spacer plate and electrically coupled to the sensor signal line.

14. The molding apparatus of claim 12 wherein the molding apparatus further comprises:

a first portion containing the molding cavity;

a second portion containing the ejector plate; and

a die spacing plate between the first and second portions to account for the thickness of the spacer plate.

15. The molding apparatus of claim 11 wherein the molding apparatus further comprises a second sensor in communicative contact with the ejector pin second surface, wherein the second sensor is fixably held between the hollow ejector pin second surface and the ejector plate and wherein the second sensor is operable to sense mold cavity pressure through the ejector pin.

16. The molding apparatus of claim 15 further comprising a second signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the second sensor.

17. A molding apparatus comprising:

a mold cavity having an opening for an ejector pin;

a retainer plate having at least one opening operable to hold an ejector pin;

an ejector plate having a clearance hole concentric to the retainer plate opening;

a clamping plate having a clearance hole concentric to the ejector plate opening;

a transfer pin through the retainer plate opening, the ejector plate clearance hole, and clamping plate clearance hole, wherein a first surface of the transfer pin is exposed to the mold cavity through the mold cavity ejector pin opening and a second surface of the transfer pin is not exposed to the mold cavity;

a sensor in communicative contact with the transfer pin second surface, wherein the sensor is operable to sense mold cavity pressure through the transfer pin; and

a cover plate wherein the sensor is fixably held between the cover plate and transfer plate second surface.

18. The molding apparatus of claim 17 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

19. The molding apparatus of claim 18 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor.

20. A molding apparatus comprising:

a mold cavity having an opening for an ejector pin;

a retainer plate having at least one opening operable to hold an ejector pin;

an ejector plate having a clearance hole concentric to the retainer plate opening;

a clamping plate having a clearance hole concentric to the ejector plate opening;

a hollow transfer pin through the retainer plate opening, the ejector plate clearance hole, and the clamping plate clearance hole, wherein the hollow transfer pin has a first end facing the mold cavity and a second end not facing the mold cavity;

a sensor embedded in the hollow transfer pin first end, wherein the sensor is exposed to the mold cavity and wherein the sensor has a signal line routed through the hollow transfer pin, wherein the sensor is operable to sense a mold cavity parameter; and

a cover plate wherein the sensor is fixably held between the cover plate and the hollow transfer pin second end.

21. The molding apparatus of claim 20 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

22. The molding apparatus of claim 21 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor signal line.

23. The molding apparatus of claim 20 wherein the molding apparatus further comprises a second sensor in communicative contact with the hollow transfer pin second end, wherein the second sensor is fixably held between the hollow transfer pin second

surface and the cover plate and wherein the second sensor is operable to sense mold cavity pressure through the hollow transfer pin.

24. The molding apparatus of claim 23 further comprising a second signal conditioning circuit embedded within the spacer plate and electrically coupled to the second sensor.

25. A molding apparatus comprising:

an ejector plate operable to force an ejector pin in a mold cavity, wherein the ejector plate has a first side facing the mold cavity and a second side not facing the mold cavity;

a transfer pin having a first end in communicative contact with the ejector plate second side, wherein the transfer pin is operable to stop the ejector plate;

a clamping plate having a clearance hole, wherein the transfer pin is through the clamping plate;

a sensor in communicative contact with a second end of the transfer pin, wherein the sensor is operable to sense ejector plate pressure through the transfer pin; and

a cover plate wherein the sensor is fixably held between the cover plate and a second end of the transfer pin.

26. The molding apparatus of claim 25 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

27. The molding apparatus of claim 26 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor.

28. The molding apparatus of claim 25 further comprising:

a second transfer pin having a first end in communicative contact with the ejector plate second side, wherein the second transfer pin is operable to stop the ejector plate; and

a second sensor in communicative contact with a second end of the second transfer pin, wherein the second sensor is operable to sense ejector plate pressure through the second transfer pin.

29. The molding apparatus of claim 25 further comprising:

a spacer plate fixably held between the cover plate and the clamping plate; and

a signal conditioning circuit embedded within or mounted onto the surface of the spacer plate and electrically coupled to the first and second sensor, wherein the signal conditioning circuit is operable to sum first and second sensor pressures.

CLAIMS

1. A molding apparatus comprising:

a mold cavity;

an ejector pin having a first surface exposed to the mold cavity and a second surface not exposed to the mold cavity;

a sensor or analog transducer capable of detecting the cavity pressure wave form in communicative contact with the ejector pin second surface, wherein the sensor or analog transducer is operable to sense mold cavity pressure through the ejector pin; and

a spacer plate configured to contain the sensor or analog transducer, signal conditioning and wires; and

a retainer plate holding one end of the ejector pin; and

an ejector plate operable to force the ejector pin into the mold cavity wherein the sensor or analog transducer is fixably held between the ejector pin second surface and the ejector plate; and

a spacer plate fixably held between the retainer plate and the ejector plate wherein the spacer plate contains the sensor or analog transducer wires and signal conditioning devices; wherein

the signal conditioning devices are electrically coupled to the sensor or analog transducer.

2. The molding apparatus of claim 1 wherein the molding apparatus further comprises:

a first portion containing the molding cavity;

a second portion containing the ejector plate; and

a die spacing plate between the first and second portions to account for the thickness of the spacer plate.

3. The molding apparatus of claim 1 further comprising:

an ejector plate operable to force the ejector pin into the mold cavity, wherein the ejector plate has a clearance hole that exposes the ejector pin second surface;

a clamping plate having a clearance hole concentric to the ejector plate clearance hole;

a transfer pin through the ejector plate and clamping plate clearance holes wherein a first surface of the transfer pin is in communicative contact with the ejector pin second surface; and

a cover plate wherein the sensor is held between the cover plate and a second surface of the transfer pin.

4. The molding apparatus of claim 6 further comprising a sleeve lining the ejector plate clearance hole or the clamping plate clearance hole.

5. The molding apparatus of claim 6 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

6. The molding apparatus of claim 8 further comprising a signal conditioning circuit embedded within or mounted onto the surface of the spacer plate and electrically coupled to the sensor.

7. A molding apparatus comprising:

a mold cavity;

a hollow ejector pin having a first end facing the mold cavity and a second end not facing the mold cavity; and

a sensor embedded in the hollow ejector pin first end, wherein the sensor is exposed to the mold cavity and wherein the sensor has a signal line routed through the hollow ejector pin, wherein the sensor is operable to sense a mold cavity parameter; and

a retainer plate holding one end of the hollow ejector pin; and

an ejector plate operable to force the hollow ejector pin into the mold cavity; and

a spacer plate fixably held between the retainer plate and the ejector plate.; wherein

a signal conditioning circuit is embedded within or onto the spacer plate and electrically coupled to the sensor signal line.

8. The molding apparatus of claim 7wherein the molding apparatus further comprises:

a first portion containing the molding cavity;

a second portion containing the ejector plate; and

a die spacing plate between the first and second portions to account for the thickness of the spacer plate.

9. The molding apparatus of claim 7 wherein the molding apparatus further comprises a second sensor or analog transducer in communicative contact with the ejector pin second surfaceand the ejector plate and wherein the second sensor is fixably held between the hollow ejector pin containing the first sensor or analog transducer and the ejector plate, so as to simultaneously detect the cavity pressure waveform along with the first cavity parameter wave form.

10. The molding apparatus of claim 9 further comprising a second signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the second sensor.

11. A molding apparatus comprising:

a mold cavity having an opening for an ejector pin;

a retainer plate having at least one opening operable to hold an ejector pin;

an ejector plate having a clearance hole concentric to the retainer plate opening; a clamping plate having a clearance hole concentric to the ejector plate opening; a transfer pin through the retainer plate opening, the ejector plate clearance hole, and clamping plate clearance hole, wherein a first surface of the transfer pin is exposed to the mold cavity

through the mold cavity ejector pin opening and a second surface of the transfer pin is not exposed to the mold cavity;

a sensor in communicative contact with the transfer pin second surface, wherein the sensor is operable to sense mold cavity pressure through the transfer pin; and

a cover plate wherein the sensor is fixably held between the cover plate and transfer plate second surface.

12. The molding apparatus of claim 11 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

13. The molding apparatus of claim 12 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor.

14. A molding apparatus comprising:

a mold cavity having an opening for an ejector pin;

a retainer plate having at least one opening operable to hold an ejector pin;

an ejector plate having a clearance hole concentric to the retainer plate opening; a clamping plate having a clearance hole concentric to the ejector plate opening; a hollow transfer pin through the retainer plate opening, the ejector plate clearance hole, and the clamping plate clearance hole, wherein the hollow transfer pin has a first end facing the mold cavity and a second end not facing the mold cavity;

a sensor embedded in the hollow transfer pin first end, wherein the sensor is exposed to the mold cavity and wherein the sensor has a signal line routed through the hollow transfer pin, wherein the sensor is operable to sense a mold cavity parameter; and a cover plate wherein the sensor is fixably held between the cover plate and the hollow transfer pin second end.

15. The molding apparatus of claim 14 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

16. The molding apparatus of claim 15 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor signal line.

17. The molding apparatus of claim 14 wherein the molding apparatus further comprises a second sensor in communicative contact with the hollow transfer pin second end, wherein the second sensor is fixably held between the hollow transfer pin second surface and the cover plate and wherein the second sensor is operable to sense mold cavity pressure through the hollow transfer pin.

18. The molding apparatus of claim 17 further comprising a second signal conditioning circuit embedded within the spacer plate and electrically coupled to the second sensor.

19. A molding apparatus comprising:

an ejector plate operable to force an ejector pin in a mold cavity, wherein the ejector plate has a first side facing the mold cavity and a second side not facing the mold cavity;

a transfer pin having a first end in communicative contact with the .ejector plate second side, wherein the transfer pin is operable to stop the ejector plate;

a clamping plate having a clearance hole, wherein the transfer pin is through the clamping plate;

a sensor in communicative contact with a second end of the transfer pin, wherein the sensor is operable to sense ejector plate pressure through the transfer pin; and

a cover plate wherein the sensor is fixably held between the cover plate and a second end of the transfer pin.

20. The molding apparatus of claim 19 further comprising a spacer plate fixably held between the cover plate and the clamping plate.

21. The molding apparatus of claim 20 further comprising a signal conditioning circuit embedded within or mounted onto the spacer plate and electrically coupled to the sensor.

22. The molding apparatus of claim 19 further comprising:

a second transfer pin having a first end in communicative contact with the ejector plate second side, wherein the second transfer pin is operable to stop the ejector plate; and

a second sensor in communicative contact with a second end of the second transfer pin, wherein the second sensor is operable to sense ejector plate pressure through the second transfer pin.

23. The molding apparatus of claim 19 further comprising:

a spacer plate fixably held between the cover plate and the clamping plate; and a signal conditioning circuit embedded within or mounted onto the surface of the spacer plate and electrically coupled to the first and second sensor, wherein the signal conditioning circuit is operable to sum first and second sensor pressures.