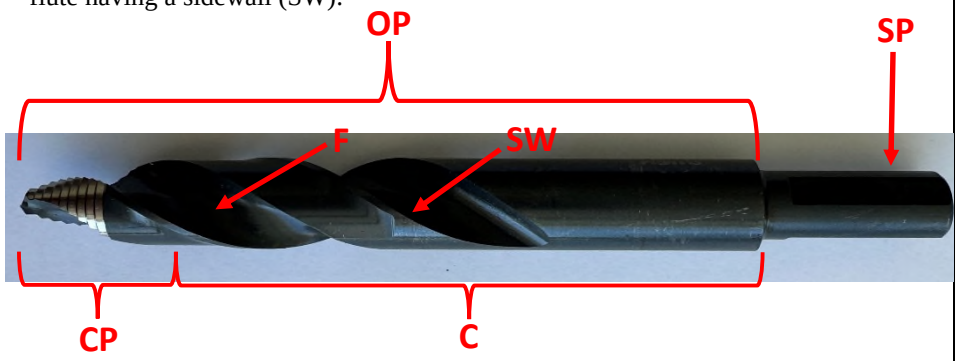
Tsteigen v. Viking Drill & Tool, Inc.

Nexus Patent Claims Chart for U.S. Patent No. 11,007,583
For the Astro 1/2” Twist Drill

Each Element of All Asserted Patent Claims	The Astro 1/2” Twist Drill
1. A twist drill, comprising: an operation portion comprising a cone portion and a cylinder portion axially fixed to the cone portion; a shank portion axially fixed to the cylinder portion opposite the cone portion; a spiral flute formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall;	Astro’s 1/2” twist drill comprises an operation portion (OP) comprising a cone portion (CP) and a cylinder portion (C) axially fixed to the cone portion; a shank portion (SP) axially fixed to the cylinder portion opposite the cone portion; a spiral flute (F) formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall (SW): 

a plurality of composite cutting blade groups formed sequentially and spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion, each of the plurality of composite cutting blade groups comprising:

a conical first step surface;

a cylindrical second step surface adjacent to the conical first step surface;

a major cutting edge defined by the intersection of the conical first step surface and the sidewall of the spiral flute;

a minor cutting edge defined by the intersection of the cylindrical second step and the sidewall of the spiral flute;

a cutting tip defined by the intersection of the major cutting edge, the minor cutting edge, and the sidewall of the spiral flute; and

It has a plurality of composite cutting blade groups ($G_1 \ldots G_n$) formed sequentially and spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion, each of the plurality of composite cutting blade groups comprising:

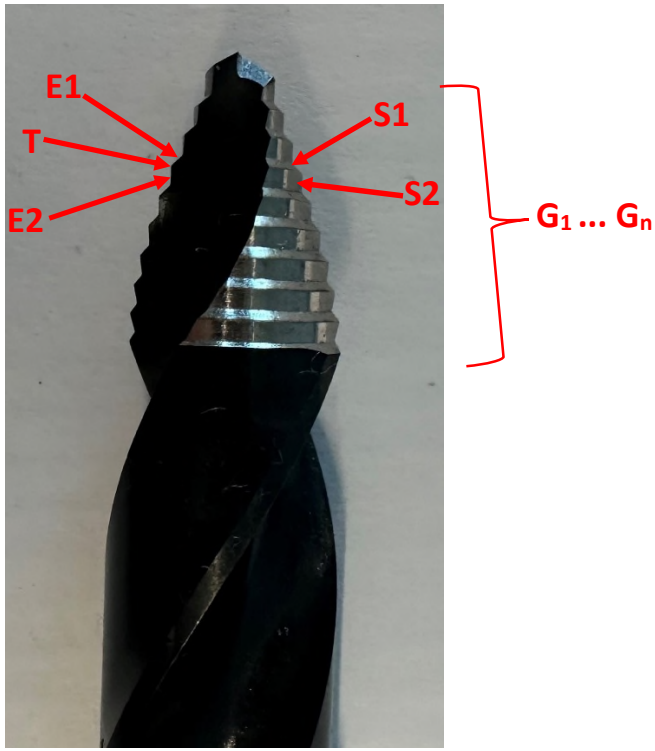
a conical first step surface (S1);

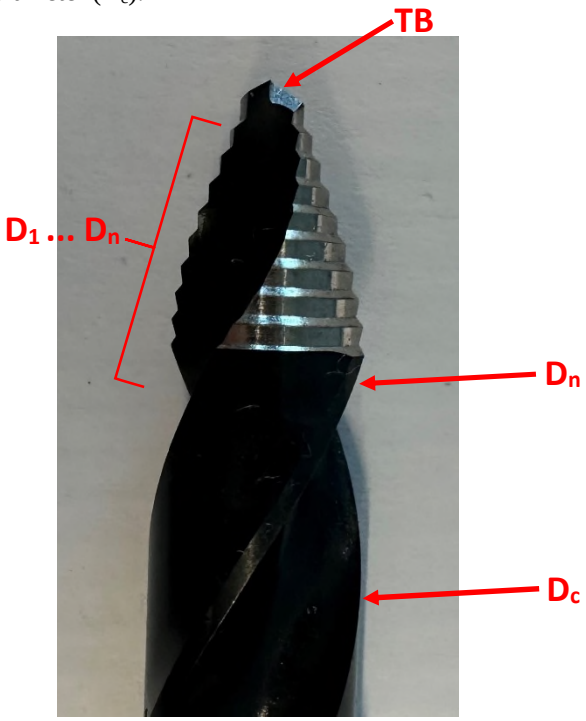
a cylindrical second step surface (S2) adjacent to the conical first step surface;

a major cutting edge (E1) defined by the intersection of the conical first step surface and the sidewall of the spiral flute;

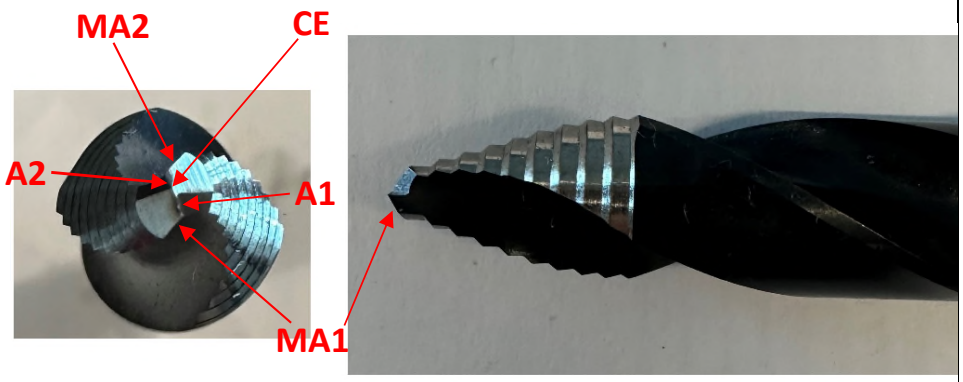
a minor cutting edge (E2) defined by the intersection of the cylindrical second step and the sidewall of the spiral flute;

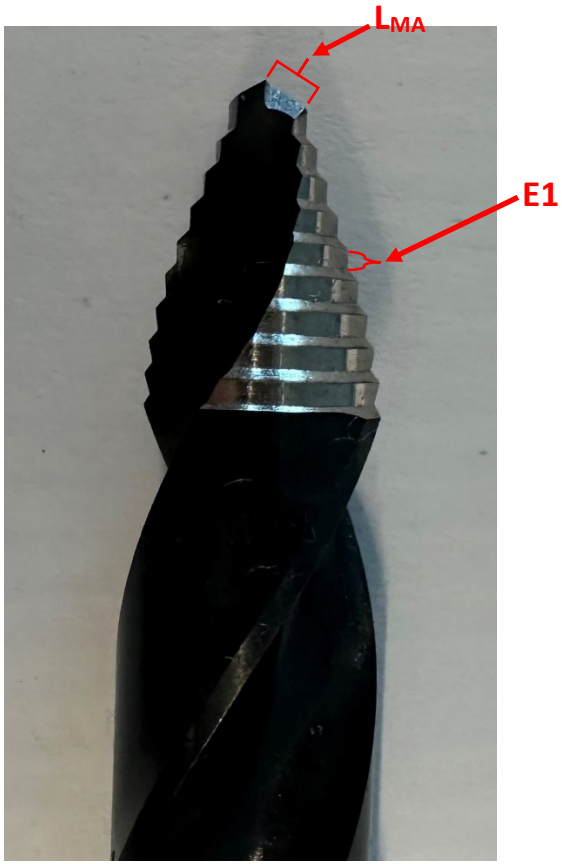
a cutting tip (T) defined by the intersection of the major cutting edge, the minor cutting edge, and the sidewall of the spiral flute:

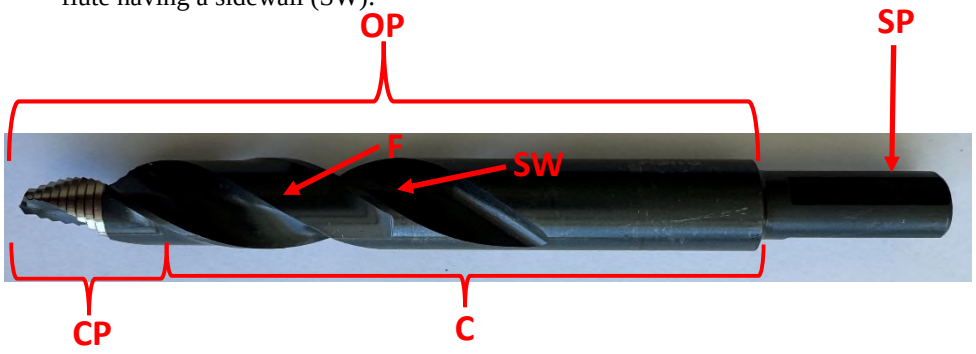


Each Element of All Asserted Patent Claims	The Astro 1/2” Twist Drill
a top blade provided on the front end of the cone portion;	And, Astro’s twist drill has a top blade (TB) provided on the front end of the cone portion.
wherein a diameter of each of the plurality of composite cutting blade groups increases sequentially from the front end of the cone portion to the rear end of the cone portion; and each of the plurality of composite cutting blade groups is configured to crush cutting chips into finer chips and the spiral flute is configured to shunt the finer chips; and	The diameter of each of the plurality of composite cutting blade groups ($D_1 \ldots D_n$) in Astro’s drill bits increases sequentially from the front end of the cone portion to the rear end of the cone portion; and each of the plurality of composite cutting blade groups is configured to crush cutting chips into finer chips and the spiral flute is configured to shunt the finer chips; and
wherein at least one cylindrical second step surface is immediately adjacent to a conical first step surface of a next composite cutting blade group; and the diameter of the last composite cutting blade group located at the rear end of the cone portion immediately adjacent to the cylinder portion is equal to the cylinder portion diameter.	And, at least one cylindrical second step surface in Astro’s drill bits is immediately adjacent to a conical first step surface of a next composite cutting blade group; and the diameter of the last composite cutting blade group located at the rear end of the cone (D_n) portion immediately adjacent to the cylinder portion is equal to the cylinder portion diameter (D_c): 

Each Element of All Asserted Patent Claims	The Astro 1/2” Twist Drill
2. The twist drill of claim 1 wherein, the minor cutting edge is configured to smooth the machined surface of the workpiece to improve surface quality.	Each minor cutting edge (E2) in Astro’s drill is configured to smooth the machined surface of the workpiece to improve surface quality by being immediately below cutting tip, which has just machined a surface of the workpiece, and close to cylindrical such that

Each Element of All Asserted Patent Claims	The Astro 1/2” Twist Drill
5. The twist drill of claim 1 wherein, the top blade comprises a chisel edge , two auxiliary cutting edges and two straight major cutting edges , the auxiliary cutting edge is respectively intersected with the straight major cutting edge and the chisel edge.	Likewise, the Astro drill provides a top blade (TB) on the front end of the cone portion, the top blade comprises a chisel edge (CE), two auxiliary cutting edges (A1 and A2) and two straight major cutting edges (MA1 and MA2), the auxiliary cutting edge is respectively intersected with the straight major cutting edge and the chisel edge: 

Each Element of All Asserted Patent Claims	The Astro 1/2” Twist Drill
7. The twist drill of claim 1 wherein, a straight major cutting edge length of the top blade is greater than each of the major cutting edges of the plurality of composite cutting blade groups.	The straight major cutting edge length (L_{MA}) of the top blade of Astro’s twist drill is greater than each of the major cutting edges (E1) of the plurality of composite cutting blade groups: 

Each Element of Each Asserted Patent Claim	Astro's 1/2" Twist Drill
8. A twist drill, comprising: an operation portion comprising a cone portion and a cylinder portion axially fixed to the cone portion; a shank portion axially fixed to the cylinder portion opposite the cone portion; a spiral flute formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall;	Astro's twist drill is a twist drill, comprising: an operation portion (OP) comprising a cone portion (CP) and a cylinder portion (C) axially fixed to the cone portion; a shank portion (SP) axially fixed to the cylinder portion opposite the cone portion; a spiral flute (F) formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall (SW): 

a plurality of composite cutting blade groups formed sequentially and spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion, each of the plurality of composite cutting blade groups comprising:

a conical first step surface;

a cylindrical second step surface adjacent to the conical first step surface

a major cutting edge defined by the intersection of the conical first step surface and the sidewall of the spiral flute;

a minor cutting edge defined by the intersection of the cylindrical second step and the sidewall of the spiral flute, the minor cutting edge being configured to smooth the machined surface of the workpiece to improve surface quality; and

a cutting tip defined by the intersection of the major cutting edge, the minor cutting edge, and the sidewall of the spiral flute;

It has a plurality of composite cutting blade groups formed sequentially and spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion, each of the plurality of composite cutting blade groups comprising:

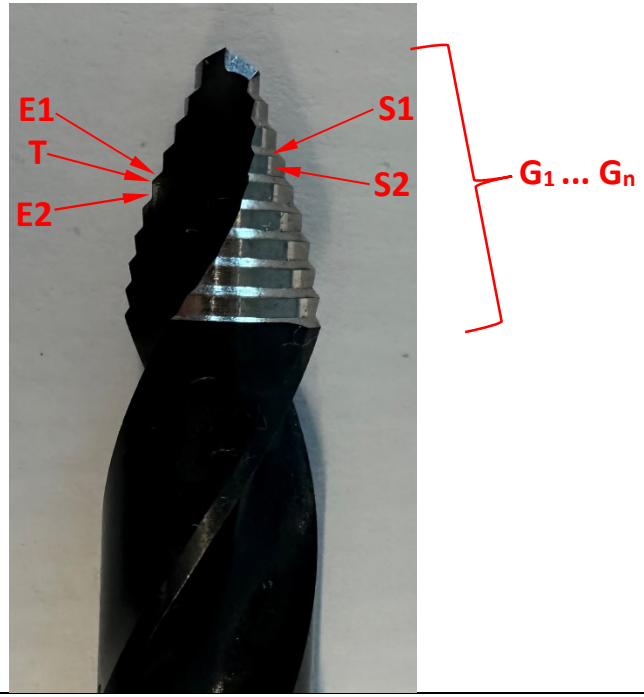
a conical first step surface;

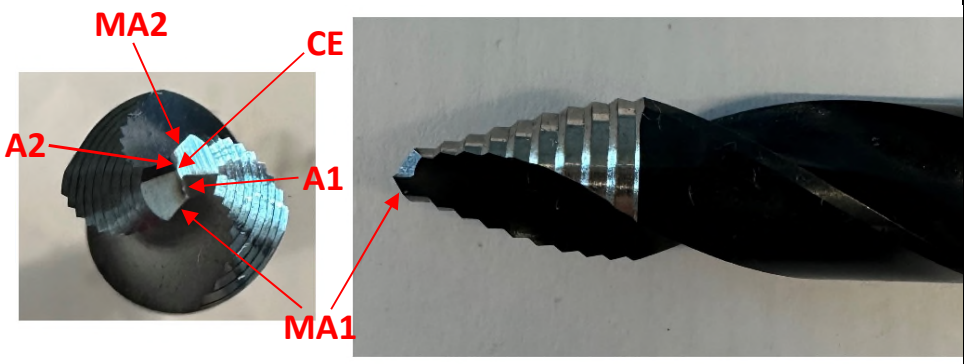
a cylindrical second step surface adjacent to the conical first step surface

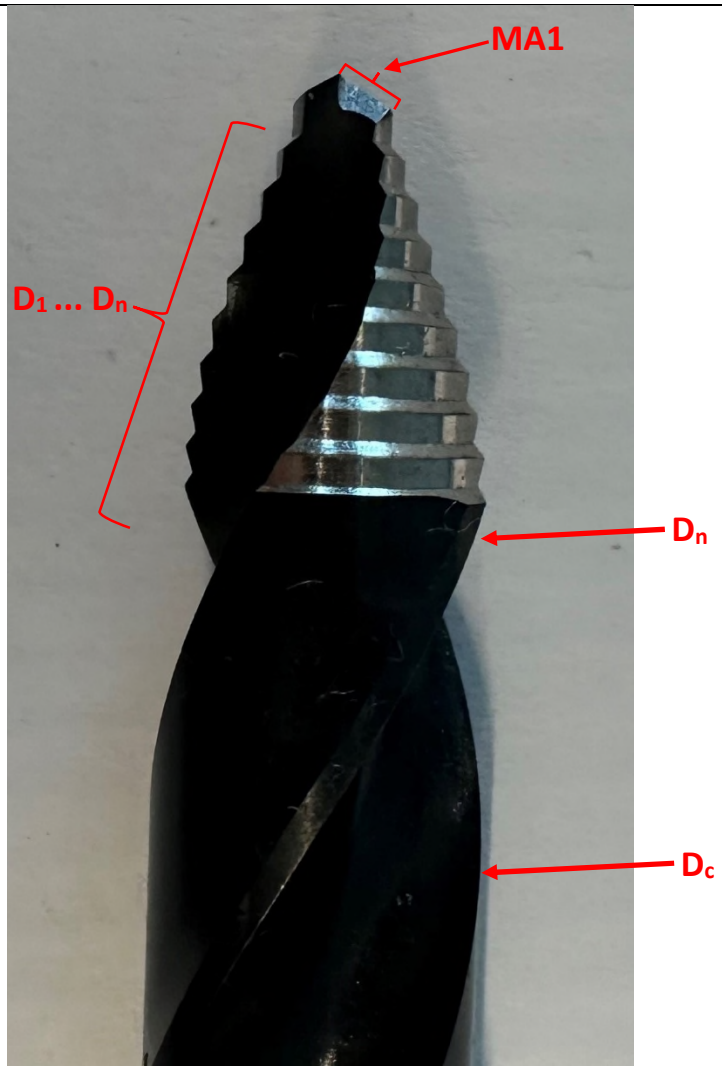
a major cutting edge defined by the intersection of the conical first step surface and the sidewall of the spiral flute;

a minor cutting edge defined by the intersection of the cylindrical second step and the sidewall of the spiral flute, the minor cutting edge being configured to smooth the machined surface of the workpiece to improve surface quality; and

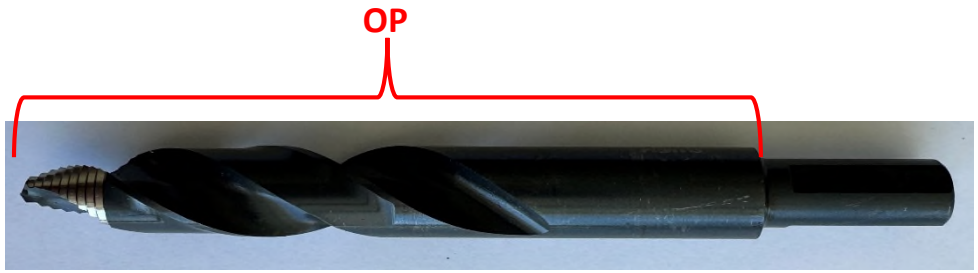
a cutting tip defined by the intersection of the major cutting edge, the minor cutting edge, and the sidewall of the spiral flute:

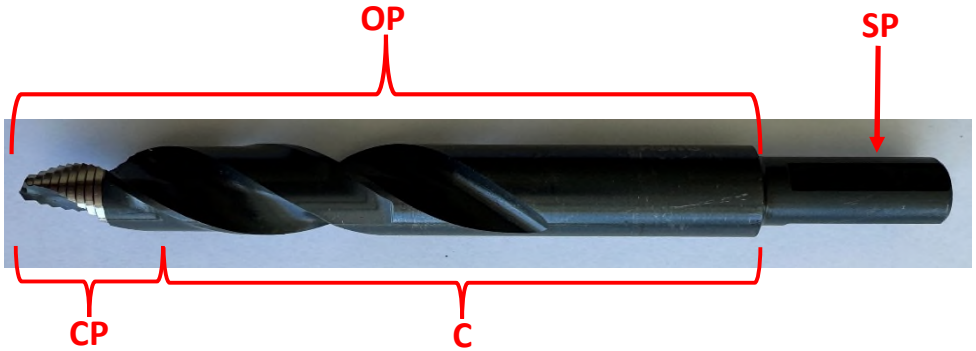
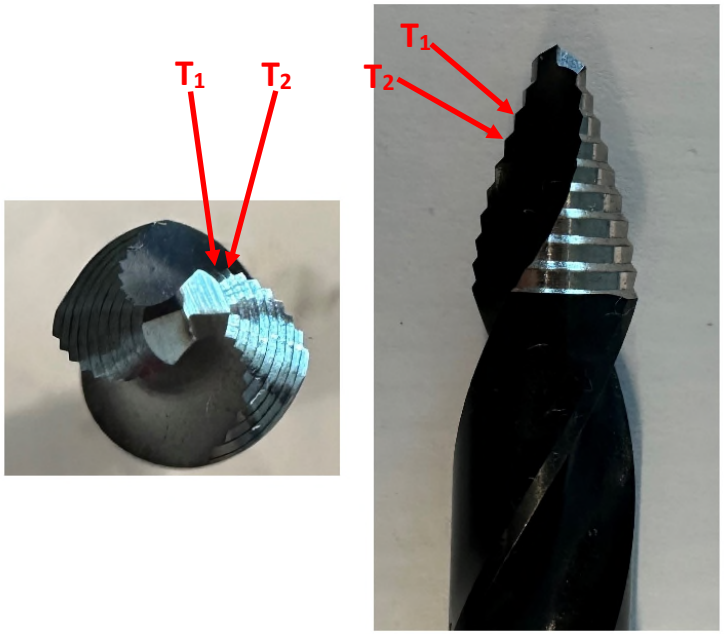


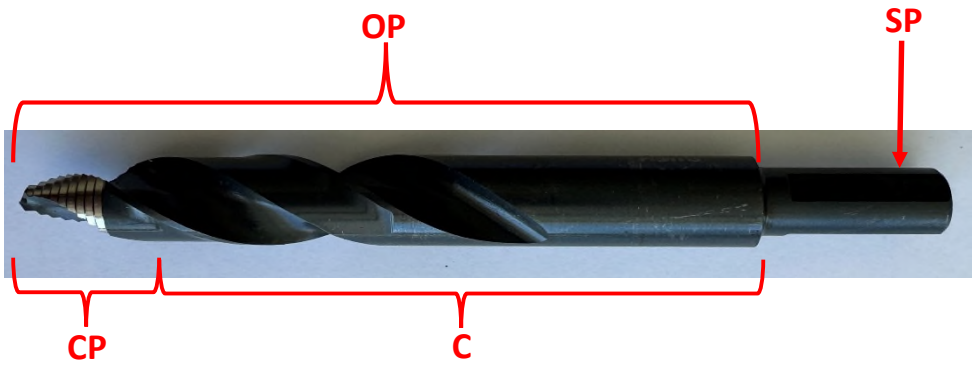
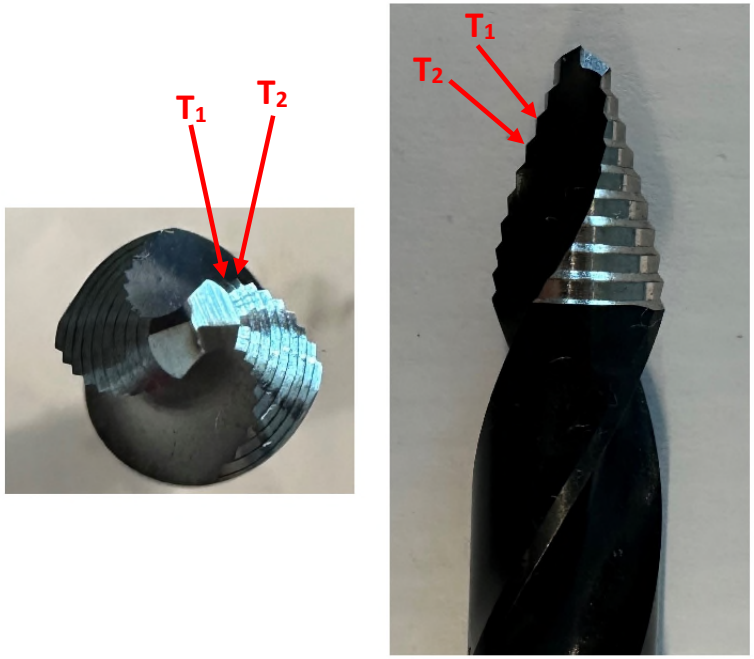
a top blade provided on the front end of the cone portion, the top blade comprises a chisel edge, two auxiliary cutting edges and two straight major cutting edges, the auxiliary cutting edge is respectively intersected with the straight major cutting edge and the chisel edge;	And, the Astro twist drill provides a top blade (TB) on the front end of the cone portion, the top blade comprises a chisel edge (CE), two auxiliary cutting edges (A1 and A2) and two straight major cutting edges (MA1 and MA2), the auxiliary cutting edge is respectively intersected with the straight major cutting edge and the chisel edge: 
wherein a diameter of each of the plurality of composite cutting blade groups increases sequentially from the front end of the cone portion to the rear end of the cone portion; and each of the plurality of composite cutting blade groups is configured to crush cutting chips into finer chips and the spiral flute is configured to shunt the finer chips; and	wherein a diameter of each of the plurality of composite cutting blade groups (D_1 … D_n) increases sequentially from the front end of the cone portion to the rear end of the cone portion; and each of the plurality of composite cutting blade groups is configured to crush cutting chips into finer chips and the spiral flute is configured to shunt the finer chips; and
wherein at least one cylindrical second step surface is immediately adjacent to a conical first step surface of a next composite cutting blade group; and the diameter of the last composite cutting blade group located at the rear end of the cone portion immediately adjacent to the cylinder portion is equal to the cylinder portion diameter.	wherein at least one cylindrical second step surface is immediately adjacent to a conical first step surface of a next composite cutting blade group; and the diameter of the last composite cutting blade group located at the rear end of the cone (D_n) portion immediately adjacent to the cylinder portion is equal to the cylinder portion diameter (D_c):


MA1
D1 ... Dn
Dn
Dc

12. The twist drill of claim 8 wherein, a straight major cutting edge length of the top blade is greater than each of the major cutting edges of the plurality of composite cutting blade groups.	The straight major cutting edge length (L_{MA}) of the top blade of Astro's twist drill is greater than each of the major cutting edges (E1) of the plurality of composite cutting blade groups:
13. The twist drill of claim 8 wherein, a straight minor cutting edge length of the top blade is greater than each of the minor cutting edges of the plurality of composite cutting blade groups.	The straight minor cutting edge length (L_{MI}) of the top blade of Astro's twist drill is greater than each of the minor cutting edges (E2) of the plurality of composite cutting blade groups:

14. The twist drill of claim 8 wherein, the operation portion is configured to disperse a cutting force on each of the plurality of composite cutting blade groups within a drill hole of a workpiece when at least a portion of the cylinder portion is also within the workpiece.	The operation portion (OP) of Astro's twist drill is configured to disperse a cutting force on each of the plurality of composite cutting blade groups within a drill hole of a workpiece when at least a portion of the cylinder portion is also within the workpiece: 

15. The twist drill of claim 8 wherein the cylinder portion is longer than the cone portion.	In Astro's twist drill, the cylinder portion (C) is longer than the cone portion (CP): 
18. The twist drill of claim 8 wherein the cutting tips of the plurality of composite cutting blade groups are formed spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion.	In Astro's twist drill, the cutting tips (T1…Tn) of the plurality of composite cutting blade groups are formed spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion: 

19. The twist drill of claim 1 wherein the cylinder portion is longer than the cone portion.	In Astro's twist drill, the cylinder portion (C) is longer than the cone portion (CP): 

22. The twist drill of claim 1 wherein the cutting tips of the plurality of composite cutting blade groups are formed spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion.	In Astro's twist drill, the cutting tips (T_1,… T_n) of the plurality of composite cutting blade groups are formed spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion: