

**DECLARATION OF RALPH SHIRLEY, P.E., CFEI**

I, Ralph Shirley, P.E., CFEI, being of legal age do hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: 04/15/2016

/Ralph Shirley/  
Ralph Shirley  
(electronically signed with permission)

H&S Mfg. Co., Inc.  
v. Oxbo Int'l Co.  
IPR2016-00950

H&S Mfg. Co., Inc.  
Exhibit 1009

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## **I. Introduction**

1. I have been retained as an expert in connection with a Petition to be filed by H&S Manufacturing Company, Inc. seeking *inter partes* review of U.S. Patent No. 8,166,739 (“the ‘739 Patent”). This Declaration is my direct testimony in relation to the ‘739 Patent and specific matters I was asked to address. In making this Declaration, I have reviewed the ‘739 Patent, including the prosecution history of the ‘739 Patent, and the prior art relied upon in the Grounds set forth in this Declaration, and I have reviewed and relied upon the Attachments to this Declaration. I also relied upon certain assumptions concerning patent law standards, which I point out. In addition, I have relied upon the assertions made in the declaration of Dan Undersander with regard to the state of the art, market forces, and other indicia of obviousness.

## **II. Qualifications and Compensation**

2. Currently, I am the President of TEST, Inc. I have more than 40 years experience with the design and engineering of agricultural equipment. I hold bachelor and master degrees in Agricultural Engineering. I have been a Professional Engineer since 1979.

3. I was involved in designing components and vehicles for John Deere for 32 years including tractors and other vehicles for the worldwide markets. To be effective in these efforts I had to be familiar with the various changing farming technologies as they developed over the four decades of endeavor.

4. I have observed that a general theme in the world of agriculture has been lack of growth in commodity prices. That is, a bushel of grain costs today about what it did 30 and even 60 years ago. A second theme and corollary to the first follows as thus: The price of inputs to farming have gone up approximately ten fold every 30 years for over 60 years. The third theme and corollary to the first two themes follows as thus: In order to be competitive in the agricultural industry, where prices for produce have not changed but the cost of inputs has grown by about ten fold in each 30 years, the average acres farmed per person has also grown approximately ten fold in the same time period.

5. Changes that affected this growth of the industry have included increased use of machinery and increases in the power and speed of the machinery for tillage, planting and harvesting. The development of better seed, use of fertilizer and use of pest control has been effective to a point in increasing yields. In the 1980's a move started to reduce tillage. Awareness of compaction and soil erosion was heightened and the cost of fuel and machinery drove the market to do less tillage. There was more concern about driving heavy equipment and trucks

on the land. This drove the market to even wider implements to reduce traffic patterns. Recently, significant impact has been achieved by better control of delivery of the basic inputs to crop production such as seed, fertilizers and pest control. Alternative uses for the crops and processing methods (notably ethanol and bio Diesel) have also contributed to the growth in the industry. I have observed year after year, the power and speed of equipment has increased. The average size of tractors in the 1970s was about 100 hp, but growing. The average size of tractors today is about 270 hp. The top speed of most tractors in the 1970s was about 14-18 mph. Today, tractor top speeds exceed 30 mph and in some markets, over 45 mph.

6. Due to increased power and speed the width of tillage and seeding equipment has been able to increase thus increasing the acres a machine can prepare in a single day. This increase in coverage has led to more transport of the machines on the roads. The need to convert from wide field operations to save widths for road transport resulted in a variety of ways that equipment gets folded. Some equipment currently tills or plants crops with over 100 feet in a single pass while folding to less than 12 feet for transport on the road.

7. The limitations on harvesting have been observed to be the width of crop that can be harvested with each pass of the field. Folding heads on harvest

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