A New Paradigm In Wheel Loader Technology

Uni-Frame™ 4-Wheel Loader-Dozer-Tractor

Patented Internal Sliding Counterweight – All Wheel Steer - Crab Capability - Six Wheel Option

Steve Kole

I’m Steve Kole, the inventor of a patented Wheel Loader technology, which is the focus of this presentation, and offers an opportunity to grow your market share while maintaining your desired gross margins.
This presentation contains 16 Exhibit Boards, which act as Story Boards; to illustrate the outstanding performance benefits of the Uni-Frame™ Wheel Loader concept, particular to each unique design feature; as individually displayed per board.

The Introduction / Overview highlights the inventor and patent holder of the Uni-Frame™ Wheel Loader design, Steve Kole and the story of the Uni-Frame™ and its superior performance compared to industry standards.

The Summary / Conclusion explains how the Uni-Frame™ Wheel Loader product line can grow your market share, while maintaining your desired gross profit margins in the ‘new norm’ of decreasing world demand and increasing competition.

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Purpose

This presentation pertains to my new patented Uni-Frame™ 4 Wheel Loader which also operates as a Dozer and Tractor. This is due to its on-board patented Internal-Sliding Counterweight, All-Wheel Steer, Crab Steer capability and Six Wheel option. It has the potential to make a **major positive impact** on the worldwide Wheel Loader industry, as well as the Wheel Dozer and Wheel Tractor market.

Thesis

The synergy from the innovations incorporated into my proprietary Uni-Frame™ concept can increase your market share while maintaining your desired gross margins by offering a product which improves your customer’s bottom line by **decreasing** their machinery operating costs while **increasing** its payload and versatility.

Method

This is accomplished through increasing the traction efficiency by leveraging 6 technologies:

1. **Patented Internal-Sliding Counterweight** (Fore & Aft Internal-Sliding Ballast)
2. **Internal Chain Drive** (Proven to Out-Perform Conventional Power Train)
3. **Steerable Axles** (All-Wheel Steer and Crab Steer)
4. **2-in-1 Oscillating and Independently Linked Axle/s** (Rear or Front)
5. **Rigid Frame Construction** (Planetary Axles Interchangeable to 4 or 6 Wheels)
6. **Wheelbase length** (Longer for Smoother Ride and Greater Tongue Weight Capacity)

While the success of the above features has been individually proven, they have never been bundled together and applied to a Rubber Tire machine with my patented Internal-Sliding Counterweight. The means and benefits of doing so are demonstrated in my following presentation. First, please allow me a moment to introduce myself.

Background

I am the inventor of the **Bobcat A300 All-Wheel Steer Skid-Steer Loader** concept (left) which Bobcat built under my U.S. Patent (**4,782,906**) licensed to them in 1999. In 2001 the AWS went into production and detailed specifications, etc., can be seen on the Bobcat Company’s website.

In addition, I made the initial conceptual drawings and proposal for the Demag XPS Cross-Pit Spreader Concept (right) which caught the customer’s (Texas Utility Mining Company, Dallas, TX) attention which then led to Demag’s engineering of the XPS concept which cumulated in Texas Utilities Mining Company issuing a $27 million dollar purchase order for this six million pound crawler track machine.
My compensation, for my initial efforts as well as being the salesman of record, was in the mid six figures. An impressive video of the Demag XPS Cross-Pit Spreader can be viewed on my website at: http://www.4-wheelloader.com/Demag_XPS_Cross-pit_Spreadr.html

Also there is an equally impressive but shorter two minute YouTube video done by the Discovery Channel featuring the second XPS Cross-Pit Spreader (left) working at Texas Utilities (now known as Luminant Power) Winfield South Lignite Surface Mine near Mt. Pleasant, TX. The YouTube video is at: http://www.youtube.com/watch?v=3u15ZjnhOaE.

As you can see, I have a broad and proven track record in conceptualizing machinery that is successful in its design. Innovating to ‘build a better mouse-trap’ for construction / agriculture machinery began growing up as the oldest son on the family farm. My father, J.S. (Skeet) Kole Sr. was a successful entrepreneur/ inventor and enjoyed a close working relationship with the John Deere factory. In the Jan-Feb 2003 issue of the Two-Cylinder magazine, page six features a photo (right) of two John Deere’s Experimental Diesel “MX” Tractors taken at our farm in 1942 with the following caption:

“Back when the Model D was king, and seven years before the Model R was introduced, experimental Model MX Tractors were already working in rice. This pair of MX Diesels was shipped to the Kole & Kole Rice Farm south of Winnie, Texas in 1942. John Deere engineer Merlin Reese accompanied the pre-“Rs”, and lived with the Kole’s during field testing due to the isolated location of the farm and the muddy roads.”

For more information on my machinery, on-the-job training background, please see the ten page feature photo-story article in the Two-Cylinder magazine’s Jul-Aug 2003 issue.

**Benefits**

The Uni-Frame™ 4 Wheel Loader-Dozer-Tractor with its on-board patented Internal-Sliding Counterweight, All-Wheel Steer, Crab-Steer capability and Six-Wheel option, has the potential to enable the licensee to grow their market share in the Wheel Loader, as well as the Wheel Dozer and Wheel Tractor industry. The performance benefits of the Uni-Frame™ concept compared to the industry standard are illustrated on the next page.
Increasing traction is at the top of the list for engineers of construction and agriculture machinery. Because improved traction trickles down to the other items on their short list of design objectives such as; Drawbar pull, Fuel efficiency, Multi-performance, reduced Maintenance and increased Life cycle; all contribute to greater Productivity. Improving the ballast is one of the most cost efficient means of improving traction. The Uni-Frame™ design has a patented On-Board Internal-Sliding Counter Ballast System which enables the operator to maintain optimum balance fore and aft at the flick of a switch, harnessing the horsepower for greater traction and improved productivity.

5 Ways Uni-Frame™ Wheel Loader Exceeds Industry Standard

The chart below illustrates the actual percentage differences when comparing the Uni-Frame™ concept to the identical size Komatsu WA250PZ-6 Wheel Loader.

<table>
<thead>
<tr>
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<th>Difference</th>
<th>Uni-Frame™</th>
<th>Komatsu WA250PZ-6</th>
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<tr>
<td>1 Horsepower (net)</td>
<td>+ 30 %</td>
<td>* 180 HP</td>
<td>138 HP</td>
</tr>
<tr>
<td>2 Tipping Load</td>
<td>+ 20 %</td>
<td>20,616 LB</td>
<td>17,119 Lbs.</td>
</tr>
<tr>
<td>3 Wheel Base</td>
<td>+ 34 %</td>
<td>12' 9”</td>
<td>9' 6”</td>
</tr>
<tr>
<td>4 Turning Radius</td>
<td>- 25 %</td>
<td>12’ 10”</td>
<td>17’</td>
</tr>
<tr>
<td>5 Tail-End Overhang</td>
<td>- 54 %</td>
<td>2’ 9”</td>
<td>6’</td>
</tr>
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Below is a side-view drawing of the Uni-Frame™ Wheel Loader, which has the same operating weight and overall length as the Komatsu WA250PZ-6 Articulated Wheel Loader (click on image to enlarge). However, due to the unique design of the Uni-Frame™ Wheel Loader, it out-performs those in its class like the Komatsu Wheel Loader WA250PZ-6 as note in the above chart.
Uni-Frame™ Compared to Komatsu

On the above Exhibit Board, 1 of 16, the upper center drawing (sheet drawing 1 of 21) shows a side-view illustration of my proposed Uni-Frame™ Loader-Dozer-Tractor (less bucket), which has the same operating weight and overall length as the Komatsu WA250PZ-6 Articulated Wheel Loader (138 hp/27,778 lb). The Komatsu WA250PZ-6 was selected to be used as the benchmark machine in order to compare the differences and thus the additional benefits found in the proposed same size Four-Wheel AWS Uni-Frame™ concept. The superior performance of the proposed concept includes:

**Increase In**

- Horsepower of 30%
- Tipping capacity of 20%
- Wheelbase length of 34%

**Reduction In**

- Turning radius of 25%
- Tail-end overhang by 54%
Due to the increased wheel traction efficiency plus the incorporation of my patented Internal-Sliding Counterweight this AWS concept can successfully perform as a:

Multi-Purpose

✓ Wheel Loader/Dozer/Tractor (equipped with loader bucket arms)
✓ Wheel Dozer/Tractor (equipped with dozer blade push arms)
✓ Wheel AG/Scraper Tractor

The Uni-Frame offers the following functionalities:

6 Outstanding Features

1) **Patented Internal-Sliding Counterweight** *(Fore & Aft Internal-Sliding Ballast)*
2) **Internal Chain Drive** *(Proven to Out-Perform Conventional Power Train)*
3) **Steerable Axles** *(All-Wheel Steer and Crab Steer)*
4) **2-in-1 Oscillating and Independently Linked Axle/s** *(Rear or Front)*
5) **Rigid Frame Construction** *(Planetary Axles Interchangeable to 4 or 6 Wheels)*
6) **Wheelbase length** *(Longer for Smoother Ride and Greater Tongue Weight Capacity)*

The same common **Uni-Frame™** design allows for the installing of optional Six-Wheels at the point of manufacturing, according to the customer’s desires and needs. Its chain drive power train concept has been utilized successfully in various applications:

Proven In

✓ Motor Graders for **80 years**
✓ Skid-Steer Loaders for **50 years**
✓ Melroe Multi-Wheel Rubber Tire Dozer concept for **30 years**

On the next Exhibit Board, **2 of 16**, I will explain in detail how the performance benefits are obtained.
5 Benefits Explained

On the above Exhibit Board, 2 of 16, the top half is a benefits page spelling out in a spread sheet type format the actual percentage differences when comparing the Komatsu WA250PZ-6 Articulated Wheel Loader to the proposed Kole AWS Uni-Frame™ Wheel Loader, etc, concept. I will attempt to explain each item on the spread sheet and the mechanism that enables the listed benefits and additional capabilities to be obtained.

1) **30% Horsepower Increase**

This 30% increase in horsepower is achieved by slaving together the drive wheels on each side of the machine with a chain drive so that they are forced to pull in unison especially when operating in rough terrain on inconsistent footing. This chain drive power train is similar to what has been successfully utilized for over 80 years on Motor Graders, for over 50 years on Skid-Steer Loader and for over 30 years on the Melroe Multi-Wheel Rubber Tire dozers.

The 30% increase in horsepower was determined by utilizing the 155 lb/hp ratio as has the 180 hp Komatsu GD675-3 Motor Grader since the 27,825 lb weight bearing down over the tandem drive wheels of the Motor Grader is almost identical to the 27,778 lb total operating weight of the proposed AWS Uni-Frame™ Wheel Loader. Since both machines have chain drive power trains with the same weight bearing down on each of the four drive wheels they should then be able to handle the same horsepower to weight ratio.
Should you have reservations about the ability for a chain drive power train to effectively transfer more horsepower to the ground via a wheel when operating on inconsistent footing, then asks yourself this question?

**Question**

Why can Komatsu run 117% more horsepower in their 84 hp/8,068 lb SK1026-5 Skid-Steer Loader which has a chain drive power train, than they can on their comparable size 38.6 hp/8,100 lb WA50-6 Compact Wheel Loader, which has a conventional drive power train? Both machines have four driving wheels and are similar in operating weight.

**Answer**

Surely at least 30% of the 117% difference in horsepower must be credited to the increase traction efficiency of the chain drive power train utilized in the Skid-Steer Loader.

2) **20% Tipping Load Increase**

This 20% increase in tipping load is achieved by use of a One-Piece Rigid Frame which I call a Uni-Frame™. A Rigid Frame machine such as a Crawler Track Loader does not pay a tipping/lifting capacity penalty when turning such as does a conventional Articulated Wheel Loader. Thus the proposed Rigid Frame Uni-Frame™ concept enjoys the same extra tipping/lifting capacity when turning as does the conventional Rigid Frame Crawler Track Loader concept.

In addition, the ability to lengthen the wheelbase of the proposed concept by 34% causes the rear axle to be able to be relocated some 3’-3” further towards the rear of the machine. This relocation further from the front bucket on the machine causes the rear axle to now act as additional counterweight in helping to counterbalance the increased size of the bucket.

3) **34% Wheelbase Length Increase**

One of the main benefits of a 34% increase in the wheelbase length is a more stable ride. Conventional shorter wheelbase Articulated Wheel Loaders have a tendency to porpoise or lope due to having a fixed counterweight, rear engine, etc., located so far beyond the rear axle. The 34% increase in wheelbase length is achieved because of the ability to steer the steerable axles on each end of the proposed machine at a 32° angle for a total of 64° in steering.

This tighter 64° of total steering enables the proposed concept to have a longer wheelbase and still be able to turn a 25% shorter turning radius than can a conventional Articulated Wheel Loader which is limited to a total of 40° of steering.

4) **25% Turning Radius Reduction**

This 25% reduction in turning radius is achieved due to being able to steer the steerable axles at 32° on each end of the machine due to the machine having a Non-Articulating or Rigid Frame. As mention previously, this Rigid Frame enables the machine’s tipping/lifting capacity to remain constant whether traveling straight ahead or in a full turn no matter at what degree the steerable axles are steered at.
5) **54% Tail-End Overhang Reduction**

This 54% reduction in tail-end overhang is achieved by moving the rear axle as far as possible to the rear of the machine without the tires protruding beyond the end of the machine. This not only increases the wheelbase length as previously mentioned but it enables the proposed concept, when acting as a Pull Tractor, to be able to handle implements that have a heavy tongue weight such as Agriculture Scrapers.

This reduced tail-end overhang along with the incorporation of my patented Internal-Sliding Counterweight allows the proposed concept to stay in balance no matter what type of implement, etc., it is attached to or pulling on. In addition, the increased wheel traction of the chain drive power train gives this now balanced concept the ability to effectively perform as a Pull Tractor or as a Dozer.

7 **Additional Features**

The bottom half of the above Exhibit Board enumerates the additional capabilities of the proposed concept.

1) **Internal-Sliding Counterweight Balancing**

This patented Internal-Sliding Counterweight can be utilized to maximum benefit because of the design of the One-Piece, Uni-Frame™. The Rigid Frame’s barge type fabrication allows the internal movement of a sliding counterweight to be moved from the back half of the machine to the front half of the machine at the flip of a switch.

This is an important feature which allows the Wheel Loader to also perform effectively as a Dozer and as a Pull Tractor. When dozing or pulling, the Internal-Sliding Counterweight is moved to the front half of the machine in order to properly balance the machine so that the more efficient wheel traction created by the chain drive power train can be harnessed to be put to its maximum use.

2) **High-Speed Dozing**

The proposed concept can achieve High-Speed Dozing (4-6 mph) by taking advantage of the mobility of its wheels along with the chain drive's increased traction efficiency as well as the ability to balance the machine with the Internal-Sliding Counterweight, fore and aft, as needed to match the work load at hand.

High-Speed Dozing can be defined as approximately twice the speed of a conventional Crawler Track Dozer which operates in the 2-3 mph range when doing production type dozing. The Melroe Multi-Wheel Rubber Tire Dozer was my first introduction in 1978 to a High-Speed Dozer. Deere has added additional creditability to the concept when they introduced their Rubber Track HS764 High-Speed Dozer in 2008.

The difference in the Melroe Multi-Wheel Rubber Tire Dozer concept and Deere’s Rubber Track concept is that Melroe’s Wheel concept can do production type dozing whereas Deere’s machine is limited to grading type dozing only. In addition Deere’s machine must utilize a dolly if they are to successfully pull an implement with a heavy tongue weight.

My proposed machine will be able to do production type dozing similar to the Melroe Multi-Wheel as well as pull implements with heavy tongue weights without having the need to use a dolly to reduce the tongue weight on the rear of my machine. **It is my contention that the market for a High-Speed Dozer that can do production dozing is going to be vastly much larger than the market for a High-Speed Dozer that is limited to grading type dozing only.**
Crab-Steer

The Crab-Steer feature can be achieved because the proposed concept is designed with Steerable Axles. The Crab-Steer mode is what enables the machine to be able to successfully doze at a 45° blade angle without the machine being adversely compromised by the tremendous side draft forces created by the 45° angle of attack. It also makes the machine more stable thus enabling it to do a better job at fine grade dozing. Both the angle blade aspects and the stable ride aspects enabled by Crab-Steer feature will be further explained in more detail via the drawings, written narrative, etc., that appear on Exhibit Board 6 of 16.

3) Agriculture-Scraper Pull Tractor

The proposed concept can successfully operate as a AG/Scraper Pull Tractor because of its superior traction efficiency provided by the chain drive power train, its ability to pull implements, etc., with heavy tongue weights and the ability to balance the machine as needed by the movement fore and aft of my patented Internal Siding Counterweight.

4) Optional Differential-Steer

The proven Differential-Steer concept as utilized on Caterpillar and Deere’s Rubber Track Agriculture Tractors can also be utilized on my proposed concept because of its dual-path port and starboard chain drive train.

Should a customer desire to have a machine with additional steering than what is already allowed with a total of 64° of steering then this can be achieved by having an optional Differential-Steering system working in conjunction with the Steerable Axles. An example of where a customer might want this option is where the machine will be utilized full-time as a Pipeline Dozer in backfilling a trench with a 45° blade angle of attack.

5) Optional Diesel-Electric Hybrid

The clean and simple design of the One-Piece, Uni-Frame™ allows the easily incorporation of a Single Electric-Drive Motor to be coupled directly to the Differential similar to what Caterpillar is doing on their recently introduced Diesel-Electric D7E Track Type Tractor. A side view drawing depicting the proposed Electric-Drive Uni-Frame™ can be seen on the bottom half of Exhibit Board 7 of 16 (drawing 10 of 21).

Optional Six-Wheel

The One-Piece Uni-Frame™ design allows, at the point of manufacture, the easily bolting-on of another planetary drive axle between the front and rear drive axles, which thus allows the manufacturing of a Six-Wheel machine from the same common Uni-Frame™ concept.

This feature was taken from the proven Multi-Wheel design of the Melroe Multi-Wheel Rubber Tire Dozer concept which has been operating successfully for over 30 years on a 24/7 basis at the Gerald Gentleman Power Plant in Sutherland, Nebraska.

The proposed Uni-Frame™ Six-Wheel concept will appear to look somewhat like the Fendt TriSix Tractor concept which can be viewed along with the Melroe Multi-Wheel concept on videos on my website at: www.4-wheelloader.com. It will have superior traction efficiency as when compared to the Six-Wheel Fendt Trisix concept,
as well as the ability to balance the proposed Uni-Frame™ machine with the patented Internal-Sliding Counterweight.

On the next Exhibit Board, 3 of 16 will be explained in more detail the bolt-on planetary drive axle concept with use of photos, etc., from the Melroe Multi-Wheel Rubber Tire Dozer.
**Removable Planetary Axles • Exhibit Board 3 of 16**

Uni-Frame™ 4-Wheel Loader-Dozer-Tractor
Patented Internal-Sliding Counterweight
All-Wheel Steer – Crab Capability – Six Wheel Option

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**Six Wheels**

The above Exhibit Board, 3 of 16, was included for purposes of explaining how easily planetary drive axles can be bolted-on to the middle of the **Uni-Frame™** at the factory should a customer desire to have a Six-Wheel machine. This exhibit board photos show the Melroe Multi-Wheel Rubber Tire Dozer main frame with a series of four bolt-on planetary drive axles on both the starboard and port side of the machine, as seen in photo # 6 and 9.

With the Melroe Multi-Wheel design, a planetary drive axle could be un-bolted and removed without affecting the workings of the internal drive chain mechanism. In other word the machine could continue to operate on the remaining three wheels on that respective side of the machine. The only thing necessary would be to place a bolt-on cover over the area where the planetary drive axle was removed, as seen in photos 3 and 8 to prevent any oil from splashing out of the chain tank or to prevent any dirt, etc., from entering into the chain tank.

This ability to easily add or remove a bolt-on planetary drive axle is due to the Melroe Multi-Wheel design utilizing a tube type drive axle which the chain sprockets are attached to. The tube axle is then supported by bearings which are mounted in the two side walls of each respective port or starboard chain tank, as seen in photos 1 and 2, where the bearings then provide support to each end of the short tube axle. This tube axle has splines cut into it on the inside of the tube, as seen in photos 3 and 8, from which the planetary drive stub axle with matching splines as seen in photo 7, can then be easily inserted.
Multi-Wheel Success

This Melroe Multi-Wheel Rubber Tire Dozer tube axle design has been successfully utilized for over 30 years operating 24/7 dozing coal at the Gerald Gentleman Power Plant in Sutherland, Nebraska. Based on this proven success, it was only prudent that I leverage the benefits derived from this successful design by incorporating it into my proposed Uni-Frame™ concept, so that two additional planetary drive axles could be easily inserted into the Uni-Frame™ tube axles, which are permanently incorporated into the mid-point portion of the machine’s power-train, regardless of whether the Uni-Frame™ is equipped with Four-Wheels or the optional Six-Wheels.

Thus the same common Uni-Frame™ could be equipped, at the point of manufacturing, to be built either with Four-Wheels or optional Six-Wheels depending upon the customer’s needs and desires. On the next Exhibit Board, 4 of 16, The Uni-Frame™ design will be explained in detail.
Uni-Frame™ Design

The above Exhibit Board, 4 of 16, includes 4 of the 21 drawing illustrations that I produced pertaining to my Uni-Frame™ presentation. In the upper left-hand quadrant of the exhibit board is located drawing 2 of 21 which is an isometric depiction of the One-Piece Uni-Frame™ which has a fixed overall wheelbase of 12’ 9” and which has a fixed overall length of 16’ 6”.

The Uni-Frame™ is robust, clean and simple in design and can be fabricated from steel plate. In the top portion of the Uni-Frame™ is a sealed internal cavity which runs the entire overall length of the Uni-Frame™. This internal cavity is what houses the patented Internal-Sliding Counterweight and which also allows for easy and quick sliding of the Internal-Sliding Counterweight from one end of the machine to the other.

Internal Counterweight

A cut-a-way port side view of this internal cavity, sliding counterweight, etc., can be viewed on drawing 3 of 21 located in the lower-left hand quadrant of this exhibit board. The proposed 4,000 lb Internal-Sliding counterweight is depicted in blue color and the remaining open area of the internal cavity is depicted in yellow color.

The worm screw that is utilized to move the sliding counterweight fore and aft is depicted in brown color. In this same drawing the port side primary drive chain is depicted in pink color and the port side secondary chains are depicted in green color.
Power Systems

In the upper right-hand quadrant of this exhibit board is a top view of drawing 4 of 21. This drawing shows the proposed location of the engine, hydraulic pumps, hydraulic drive motor and the differential. The hydraulic pumps and hydraulic drive motor can be easily replaced, at the point of manufacture, by either a torque converter-transmission-drive shaft mechanical drive system or by either a diesel-electric generator-single electric drive motor system. All proposed three systems, hydraulic, mechanical, diesel-electric are depicted on Exhibit Board 7 of 16.

12’ 10” Turning Radius

In the lower right-hand quadrant of this Exhibit Board 4 of 16, can be found drawing 5 of 21, which depicts a cut-a-way top view of the chain drives and the 2-in-1 oscillating rear axle/s mechanism of the Uni-Frame™ equipped with Four-Wheels. In addition, is depicted the total steering angle of 64° along with the short 12’ 10” turning radius.

Both the starboard and port primary drive chains are high-lighted in pink color and both the starboard and port secondary drive chains are high-lighted in green color. The 2-in-1 Oscillating and Independently Linked Rear Axles (starboard and port) are high-lighted in orange color and the 64° total steering angle along with the short 12’ 10” turning radius is high-lighted in yellow color. Also on this drawing 5 of 21, you will note the A-A, B-B, and C-C cross-section indicators at the front, middle and rear respectively of the Uni-Frame™.

On the next Exhibit Board, 5 of 6, the cross-section markers will indicate locations of the three cross-sections: A-A, B-B and C-C.
Internal-Sliding Balance

On the above Exhibit Board, 5 of 16, the drawings #6 thru #8 of 21 is intended to illustrate what the Uni-Frame™ Internal-Sliding Counterweight, drive chains, etc., would look like if you were to slice the machine in two at the A-A, B-B, and C-C cross-sections points as indicated on drawing 5 of 21 on Exhibit Board 4 of 16. The patented Internal-Sliding Counterweight is high-lighted by the color blue.

The Uni-Frame™ port and starboard primary drive chains are high-lighted by the color pink. The port and starboard secondary drive chains are high-lighted by the color green. Drawing 7 of 21 also shows the standard Differential or optional Differential-Steer Differential with location of its power input shaft which can either be powered by Hydro-Stat power, Mechanical power or Electric power as illustrated on drawings 3 and 10 of 21 located on Exhibit Board 7 of 16.

Oscillating Axles

In addition, drawings 8 and 9 of 21 on this Exhibit Board 5 of 16 are intended to aid in illustrating the 2-in-1 Oscillating and Independently Linked Rear Axles. The Rear Axles and Hydraulic Cylinders P and S are high-lighted by the color orange. The Electro-Mechanical Valve in the hydraulic loop connecting the two cylinders is high-lighted by the color yellow.

The 2-in-1 Oscillating and Independently Linked Rear Axles have two operating modes which can be activated from the operators cab by the flip of a switch. When the Electro-Mechanical Valve is in the open position the two independent linked axles act like a single beam oscillating axle.
In other words it operates in a see-saw fashion whereas when the port axle/tire is going down the starboard axle/tire is going up as illustrated in drawing 8 of 21. This mode I would describe as the Mobility Mode to be used when you traveling over ditches, levees in traveling from one location to another, etc.

When the Uni-Frame™ Electro-Mechanical Valve is closed the two independent linked axles would be locked horizontally so that all four axles/wheels on the machine would be operating in the same plane similar to a conventional Rigid Frame Bobcat or Caterpillar, etc., Skid-Steer Loader or the large Rigid Frame Melroe Multi-Wheel Rubber Tire Dozer.

When All-Wheels are locked in same plane, this can be described as the Maximum Traction Mode and would be utilize when maximum traction is needed such as when doing production straight or angle dozing or the need to maximize stability when doing fine grade angle dozing while operating with the Steerable Axles in the Crab-Steer mode.

On the next Exhibit Board, 6 of 16, the enhanced stability due to locking all the four axles/wheels in the same plane while operating in the Crab-Steer Mode will be addressed in more detail.
Crab-Steer

On the above Exhibit Board, 6 of 16, the drawing illustrations attempt to explain how successful 45° Angle Blade dozing can be accomplished with a PAT Dozer Blade by placing the Steerable Planetary Axles in the Crab-Steer Mode. In addition, a detailed explanation will be given as to how a Four-Wheel machine’s fine grade dozing ability can be enhanced by increasing the stability of the machine by closing the Electro-Mechanical Valve on the 2-in-1 Oscillating and Independently Linked Axles while operating the machine in the Crab-Steer Mode.

Drawing 11 of 21, located in the upper left-hand quadrant of this exhibit board, shows a top view illustration of a Four-Wheel AWS Uni-Frame™ Loader-Dozer-Tractor attacking the material at a 45° blade angle of attack. This is accomplished by pre-setting the PAT Blade at a 30° angle while at the same time pre-setting the front axle at a Crab-Steer angle of 15°. This combination of 30° PAT Blade angle coupled with the 15° Crab-Steer angle provides the necessary 45° blade angle of attack.

45° High-Speed Dozing

From that point on the steering of the machine is accomplished by steering only the rear axle similar to how a Grain Combine or Forklift is steered.
This combination of a 15° Crab-Steering angle coupled with the 30° angle setting of the PAT Blade causes the center of the machine’s traction to be offset to one side of the center of the blade’s load. The offsetting of the center of traction from the center of the blade allows the neutralizing or cancelling out of the tremendous side draft forces created when dozing at a 45° blade angle of attack.

The closest analogy I can compare this to, is similar to what is accomplished by an Articulated Motor Grader. The Articulated Motor Grader was invented to eliminate the tendency of the front wheels/front end of the Motor Grader to slide sideways due to the tremendous side draft forces generated when blading at a 45° blade angle of attack.

When the Motor Grader frame is articulated it offsets the center of the traction wheels to one side of the center of the blade’s load thus neutralizing or cancelling out the tremendous side draft forces generated when blading at a 45° angle, thus facilitating high speed dozing without the front of the machine drifting/sliding to one side.

**US Bureau of Mines**

My proposed concept as illustrated in drawing 11 of 21, located in the upper left-hand quadrant of this exhibit board, is the only way to successfully doze material at a 45° angle of attack with a blade that is mounted out in front of the machine as is done on conventional Track and Wheel Dozers.

There have been serious attempts to master this problem mainly that which was done by the UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF MINES as outlined in their FINAL REPORT dated, February 1978 with the title: APPLICATION OF HIGH VOLUME EARTHMOVING METHODS TO THE RECLAMATION OF AREA MINED SPOIL BANKS.

**Texas Utilities Mine**

This 113 page report explains how they reclaimed 1,431 acres of surface mine spoil banks during a 23 month period beginning 5-16-75 and ending 3-3-77 while using various experimental blades, etc., two of which are the prototype Balderson Big Dude and Double Dude Angle Blades both of which were powered by two Caterpillar D9H Track Tractors (410 hp/110,000 lb each). See photos #1 thru 12 on Exhibit Board 13 of 16, taken in 1977, of the prototype Balderson Big Dude Angle Blade working at Texas Utilities Big Brown Lignite Surface Mine located near Fairfield, TX.

See photos #2 thru 12 on Exhibit Board 14 of 16, taken in 1980, of the prototype Balderson Double Dude Angle Blade working at Texas Utilities Martin Lake Lignite Surface Mine located near Tatum-Henderson TX. Also see photos #1 thru 12 on Exhibit Board 12 of 16, taken in 1978, of the prototype 45° PAT Blade mounted on the front of the Melroe Multi-Wheel Rubber Tire Dozer with the majority of the photos showing the machine working at Texas Utilities Monticello Lignite Surface Mine located near Mount Pleasant, TX.

More written details, specifications, etc., will be given on the above mentioned prototype Multi-Wheel, Big Dude and Double Dude Angle Blades on their respective Exhibit Boards #12 thru 14 of 16 later on in this presentation.
Drawing 13 of 21, in the upper right-hand quadrant of this Exhibit Board 6 of 16, shows a top view illustration of a 4-Wheel 
**Uni-Frame™** Loader-Dozer-Tractor equipped with a 4-in-1 Loader Bucket being utilized as a Dozer Blade while 
presetting the front axle at a 24° Crab-Steer angle in order to achieve a 24° blade angle of attack. Again from this 
point forward, the machine will be steered only by the rear axle/s similar to how a Grain Combine or Forklift is 
esteered.

The reason for selecting 24° as the angle of attack is because that is the maximum angle that the popular Deere 750J 
and 850J PAT Dozers are capable of operating at. The scenario illustrated in this drawing 13 of 21 could be one where 
the customer may want to select the optional Differential-Steer Differential in order to provide additional steering 
behind that which is provided by the 32° steerable axle.

**Improved Traction**

In other words a customer who owned my proposed Four-Wheel AWS **Uni-Frame™** Loader-Dozer-Tractor could 
effectively backfill an open trench with his 4-in-1 Loader Bucket dozing at the same 24° angle of attack identical to 
that of the Deere 750J & 850J PAT Track Dozers.

Not only could my proposed concept effectively manage the side draft forces generated by the 24° blade angle but 
the superior traction provided by the chain drive power train would transfer the necessary additional wheel traction 
to the ground while the patented Internal-Sliding Counterweight would provide the optimum balance in order to 
harness to the maximum this increase in traction through more productive work.

Drawing 12 of 21, in the lower left-hand quadrant of this Exhibit Board 6 of 16, shows a port-side view of what a 
Four-Wheel AWS **Uni-Frame™** machine looks like when it is being Crab-Steered at an angle of 15° with all 4-Wheels 
rigidly locked in the same horizontal plane due to the closing of the Electro-Mechanical Valve on the 2-in-1 Oscillating 
and Independently Linked Rear Axles.

**Stabilized Ride**

In this mode where the frame and axles are all locked together in the same horizontal plane, similar to a conventional 
Skid-Steer Loader, the machine can cross over without being jostled, an imaginary/hypothetical 18” wide trench 
that has been cut in the roadway perpendicular to the machine’s line of travel (see drawings 11 and 12 of 21).

This serendipitous smooth-ride benefit created by Crab-Steering a Four-Wheel rigid frame machine will cause the 
machine to have a more stable ride with reduced tendency to porpoise or lope thus this enhances the machine’s 
ability to do fine grade dozing.

If you will note in drawing 12 of 21 that one front tire leads or lags the other front tire by 12 inches when Crab- 
Steering the machine at a 15° angle of steering. These 12 inches of lead-lag is what allows a rigid frame machine to 
cross over the 18 inch trench without being jostled.

My best way to explain this is to use the analogy of a Conventional Roller Skate vs. an In-Line Roller Skate. 
Skating on a concrete sidewalk, which has expansion joints in it, is hazardous to your health when doing so on 
Conventional Skates. Skating on the same sidewalk with In-Line Skates creates no danger to the skater.
The reason for this is that when the front axle on a Conventional Roller Skate comes to a crack in the sidewalk the two front wheels will fall into the crack and then it is downhill from there (no pun intended). When the In-Line Roller Skate comes to that same crack in the sidewalk, the front wheel instead of falling into the crack is supported by the other three remaining in-line wheels which then cause the front wheel to bridge over the crack and thus not be jostled by it.

This process is repeated as each of the four in-line wheels take their respective turns in crossing over the crack in the sidewalk. Thus this is why you can see skater’s on In-Line Skates successfully skating lickety-split on sidewalks that are full of cracks, broken pieces, etc.

Drawing 14 of 21, in the lower right-hand quadrant of this exhibit board is identical to drawing 12 of 21 except for the fact that the Crab-Steering angle has been increased to 24° which creates an even more dramatic lead-lag effect with respect to the front tires, etc. The explanation of this is identical to what I did on drawing 12 of 21.

The next Exhibit Board, 7 of 16, will illustrate the different power input drive sources available due to the versatility of Uni-Frame™ concept.
3 Power Sources

The above Exhibit Board, 7 of 16, was included for purposes of explaining how easily the One-Piece Uni-Frame™ concept, at the point of manufacture, can be easily equipped with a choice of either three different power input drive sources connected directly to the machine’s Differential such as: Hydro-Stat, Mechanical, or Electric.

Drawing 3 of 21 illustrates a Hydro-Stat Hydraulic Drive concept similar to what is used on the Komatsu WA250PZ-6 Wheel Loader. The upper half drawing 10 of 21 in the middle of the exhibit board depicts a Mechanical Drive-Shaft concept similar to what is used on large 4WD Agriculture-Scraper Tractors and the illustration in the lower half of drawing 10 of 21 depicts a Electric Motor Drive concept similar to what is used on the just recently introduced Caterpillar D7E Diesel-Electric Track Tractor.

These choices on drive systems would be made by the customer at the initial point of manufacture so that the factory could build the machine according to the customer’s needs and desires. The same decision making process applies to making a choice between whether the customer prefers the Uni-Frame™ to be built as a Four-Wheel or as an optional Six-Wheel machine.

The third and final choice the customer could make, is does he want the common Uni-Frame™ concept to be manufactured as a primary Wheel Loader (with loader bucket lift arms) or as a primary Wheel Dozer (with dozer blade push arms) or as a primary AG/Scraper Pull Tractor.
The next Exhibit Board, 8 of 16, depicts the various implement configurations available with the Uni-Frame™ concept.
The above Exhibit Board, 8 of 16, illustrates the Uni-Frame™ concept equipped in the following configurations:

**High-Speed PAT Dozer (Four-Wheel)**

Four-Wheel High-Speed PAT Dozer (Upper left-hand quadrant on this exhibit board. See drawing illustration 15 of 21). Note how the cab and engine module have been moved forward which gives the dozer operator a better view of the blade, etc.

**AG/Scraper Tractor (Four-Wheel)**

Four-Wheel AG/Scraper Tractor (Lower left-hand quadrant on exhibit board. See drawing illustration 16 of 21). Note how the operator’s cab is reversed on the AG/Scraper Tractor and that the 2-in-1 Oscillating Independently Linked Axles is now functioning as a Front-Axle whereas on the Four-Wheel High-Speed Dozer, etc., the 2-in-1 Oscillating Independently Linked Axles was functioning as a Rear-Axle.

**High-Speed PAT Dozer (Six-Wheel)**

Six-Wheel High-Speed PAT Dozer (Upper right-hand quadrant on exhibit board. See drawing Illustration 17 of 21). Note the same forward location of the operator’s cab and engine module applies to the Six-Wheel High Speed PAT Dozer as does on the above Four-Wheel High-Speed PAT Dozer.
Drawing illustration 18 of 21, in the lower right-hand quadrant on this exhibit board, depicts a top-view of a Six-Wheel /Four-Wheel Steer High-Speed PAT Dozer which steers similar to the Fendt Trisix Tractor. This is how the Six-Wheel AWS Uni-Frame™ concept will steer when it is not in the Crab-Steer mode. In other words, during normal steering, other than Crab-Steering, the Middle Axle/s will stay in a fixed straight ahead position during the entire turning of the machine.

Again I would like to reiterate the definition of a High-Speed Dozer, which can be defined as a Dozer that can doze twice as fast as a conventional Crawler Track Type Dozer. Thus a High-Speed Dozer’s speed is in the 4 to 6 mph range. This increase in speed is achievable by taking advantage of the mobility of Wheels or Rubber Tracks as when compared to conventional Crawler Track Type Dozers.

The next Exhibit Board 9 of 16, will highlight its various steering modes.
The above Exhibit Board, 9 of 16, depicts the following:

**Six-Wheel/Four-Wheel Steering**

Drawing illustration 19 of 21, in the upper left-hand quadrant on this exhibit board, depicts a top-view of a Six-Wheel AWS in the Four-Wheel Steer mode. As explained in Drawing Illustration 18 of 21 on the previous Exhibit Board #8 of 16, where the machine is turning around a radius, the front and rear tires do the steering while the center tires are locked in a straight ahead mode. Thus this is what I describe as Six-Wheel/Four-Wheel steer.

Also, see the note on the drawing where I am proposing to use a modified Motor Grader Blade as my Dozer Blade on this concept. My proposed blade is identified as a 12’x26”x1” Komatsu GD675-3 Motor Grader “Hybrid” PAT Dozer/Grader Blade with 9” high Spill-Guard welded to the top two-thirds center portion of the blade.

The purpose of using a Motor Grader Blade is to take maximum advantage of the High-Speed capability of the proposed machine. When dozing at High-Speed (4 to 6 mph) the dirt handles easier if it can be kept rolling/moving/alive-like by the increased curvature of a Motor Grader Blade as when compared to a conventional Dozer Blade which has less curvature.
One of the things that we learned from the Melroe Multi-Wheel Rubber Tire Dozer’s PAT Angle Dozer Blade (see Exhibit Board 12 of 16) was that the Melroe’s Multi-Wheel Rubber Tire Dozers High-Speed could not be utilized to its full potential because the PAT Blade’s minimum curvature was causing the dirt to be pushed/slid/dead-like similar to the dead-like characteristics of a conventional Crawler Track Dozer Blade instead of rolling/moving/alive-like characteristics similar to a conventional Motor Grader Blade.

My contention is that a Motor Grader Blade, half as high and moving twice as fast, will move as much material per hour, etc., as a Crawler Dozer Blade, that is twice as high and moving half as fast. The Motor Grader Blade will weigh less along with the dirt being more alive-like makes the machine easier to manage while still maintaining the same productivity per hour, etc.

The proposed 9” high Spill-Guard in the two-thirds center portion of the blade is designed to come into play when the blade is being utilized for straight dozing purposes. This 9” high blade extension will allow the Motor Grade Blade’s “Hybrid” design to carry a larger load of material when dozing straight ahead.

**Crab-Steering (Six-Wheel)**

Drawing illustration 20 of 21, in the lower left-hand quadrant of this Exhibit Board 9 of 16, is a top-view of a Six-Wheel AWS version in a Crab-Steer mode. As you recall, the Crab-Steer mode is what enables the machine to successfully achieve 45° Angle Blade Dozing. This Six-Wheel AWS explanation would be identical to what I explained on the Four-Wheel AWS version that was depicted on drawing illustration 11 of 21 that appeared on Exhibit Board #6 of 16.

The only difference would be that on the Six-Wheel version the rear axle/wheels and the middle axle/wheel’s steering would be slaved together so they would steer in unison. The front axle/wheels remain constant at their preset Crab-Steer angle of 15°.

**AG/Scraper Tractor (Six-Wheel)**

Drawing illustration 21 of 21, in the upper right-hand quadrant of this exhibit board, is a side-view of a Six-Wheel /Four-Wheel Steer AG/Scraper Tractor version configured similar to the Four-Wheel/AG Scraper Tractor version that was explained and depicted on drawing illustration 16 of 21 that appeared on Exhibit Board 8 of 16.

**Fendt Trisix Tractor (Six-Wheel w/ Four-Wheel Steer)**

The four photos in the lower right-hand quadrant of this Exhibit Board 9 of 16 are of the Six-Wheel/Four-Wheel Steer Fendt Trisix Tractor. The top two photos show the finished version of the Fendt Trisix which can be viewed on the second and third of three Fendt Trisix videos on my website at: www.4-wheelloader.com. The bottom two photos show the prototype version of the Fendt Trisix which can be view on the first of the three videos. This first of three videos shows the Fendt Trisix making an impressive U-Turn at the end of a field while pulling a ground engaging implement at high-speed.

The next Exhibit Board, 10 of 16, discusses the application of the Articulated Rubber Tire Dozer and the Crawler Track Dozer.
Rubber Tire over Crawler Track

The above Exhibit Board, 10 of 16, consists of twelve color photos pertaining to the Clark-Michigan 380 Rubber Tire Dozer (photo #1 thru 6), the Clark-Michigan 280 Rubber Tire Dozer (Photos #7 thru 11) and the Caterpillar D9H Crawler Track Dozer (photo #12).

These photos show the conventional Articulated Rubber Tire Dozer concepts working in various applications in order to demonstrate what potential this conventional Articulated Rubber Tire Dozer concept might have in doing some of the work presently being done by the conventional Crawler Track Dozers such as the Caterpillar D9H (410 hp/110,000 lb).

Crawler Track Costs

These field demonstrations were done at the request of the customer, Texas Utilities Mining Company, and was carried out at three of their different Lignite Surface Mining operations in hopes that this Rubber Tire concept could reduce their maintenance costs associated with operating a Crawler Track machine in very abrasive sandy-clay type soils which create very high wear, thus vastly shortening the life of a conventional Crawler Track Dozer’s undercarriage.
At the time, in 1977, the customer had to do three Crawler Track undercarriage repair jobs per year per machine. Each track repair job was costing them $25,000, thus one machine was costing a total of $75,000 per year just to maintain the Crawler Tracks.

**Crawler Undercarriage Costs**

This cost did not include anything having to do with the power train system such as the final drives, transmission or engine, etc. Granted the Crawler Track machines were running 24/7 or an average of 5,000 operating hours per year but the customer was still “squealing like a pig hung in a gate” due to the $75,000 annual repair costs to the undercarriage of each of their Crawler Track Dozers.

The Clark-Michigan 380 Rubber Tire Dozer (472 hp/110,000 lb) accumulated approximately 600 hours on the hour meter during these various demonstrations while working in applications such as: dozing reclamation soil, as seen in photos 5 and 6; cleaning off the top of the coal seam, as seen in photo 3; ripping of the coal seam, as seen in photo 4; and dozing of fly ash, as seen in photos #9, 10 and 11.

The conventional drive Articulated Rubber Tire Dozer concept proved out to work fine as long as it was working on a footing that was constant such as cleaning the top of the coal seam, ripping the coal seam or dozing in fly ash. The moment you put it in an earth moving operation where it was operating in rough terrain on inconsistent footing its performance was degraded considerably due to poor traction, wheel slippage, etc.

**Melroe Multi-Wheel Success**

Thus the outcome of these demonstrations proved out the limitation of the conventional Articulated Rubber Tire Dozer concept when operating in rough terrain on inconsistent footing. Since the majority of the dozing to be done in a Lignite Surface Mine has to do with dozing reclamation spoil in rough terrain, the conventional Articulated Rubber Tire Dozer concept had to be ruled out as a serious contender in taking over some of the work presently being done by the conventional Crawler Track Dozer concept.

This failure of the conventional Articulated Rubber Tire Dozer concept is what caused me to continue searching which then eventually led me to the Melroe Multi-Wheel Rubber Tire Dozer concept which is illustrated with photos and written narrative on the next two Exhibit Boards, 11 and 12 of 16 (also see 3 of 16).
The Pull Test • Exhibit Board 11 of 16
Uni-Frame™ 4-Wheel Loader-Dozer-Tractor
Patented Internal-Sliding Counterweight
All-Wheel Steer – Crab Capability – Six Wheel Option

The above Exhibit Board, 11 of 16, consists of twelve photos pertaining to the Melroe Multi-Wheel Rubber Tire Dozer concept working in various applications as follows:

**Melroe Pull Tractors**

Photos #1, 2, 3 & 4 shows twin Melroe Multi-Wheels (900 hp/275,000 lb each) rigged out as Pull Tractors working on the ARCO-Alaska project on the North Slope of Alaska. Each of the twin Melroe Multi-Wheel Pull tractors are equipped with Michelin Tires plus a swinging hitch and are pulling a German Goldhoffer Trailer which has 380 Radial Tires, all of which are steerable. The Goldhoffer Trailer’s are transporting Building Modules that weight from **600 to 1500 tons** each across the tundra on the North Slope of Alaska.

When the purchase order was placed for these twin units, it stipulated that one of the machines had to be able to pull a loaded Goldhoffer Trailer alone by itself. **Mr. Goldhoffer** himself was present when the pull tests were sanctioned by an outside testing firm and he stated; “**that this was the first time, ever, that anyone had built a single power module that could pull his trailer when fully loaded**”. These twin units were the last two units of the ten built by the Melroe Multi-Wheel Company out of Longmont, CO.

**Melroe PAT Dozer**

Photo 5 of 6 shows a Melroe Multi-Wheel PAT Dozer doing ripping work with a Single Shank Kelly Ripper in a Wyoming Surface Coal Mine.
Melroe Rubber Tire Dozer

Photos #6, 7 and 8 shows the Melroe Multi-Wheel Rubber Tire Dozer dozing coal equipped with a 22’ wide x 8.5’ high Deep-U Coal Blade. The first 2 of the 10 Melroe Multi-Wheel machines manufactured were equipped with Deep-U Coal Blades as shown in photos 7 and 8. The twin units were delivered in 1978 to the Gerald Gentleman Power Plant in Sutherland, Nebraska.

These twin machines operated 24/7 for twenty years from 1978 to 1998 dozing coal in the coal storage pile at the Gerald Gentleman Power Plant. When the twin units were retired they were replaced with a reconditioned Melroe Multi-Wheel that had been completely rebuilt after being acquired out of a California bone yard.

User Testimony

The unit (as seen in photos 6 and 12) that was acquired out of the California bone yard was originally the unit we had in Texas in 1978 which was #5 of 10 built by Melroe Multi-Wheel Company out of Longmont, CO. The people at Gerald Gentleman Power Plant were so enamored with the performance of units # 1 and 2 that in 1998 they retrieved what was remaining of unit #5 out of the California bone yard and hauled it back to Gillette Wyoming where they contracted with a mining machinery repair shop to rebuild the unit back to like-new reconditioned status for a cost of $650,000.

I mentioned this because, anytime an end user is so enamored with the performance of a concept that they are willing to spend $650,000 rebuilding a hulk that is twenty years of age, their actions speak louder than what any words can say about the concept’s performance, etc. The performance of the basic Melroe Multi-Wheel concept is the main reason I have invested, since 1987, the time and money that I have in patents related to leveraging its basic performance to an even higher level through improved productivity, versatility, etc.

Melroe 22’ x 8’ Dozer Blade

Photo’s 9 and 10 shows the Melroe Multi-Wheel equipped with 22’ wide x 8.5’ high Standard-U Dozer Blade dozing spoil dirt in land reclamation in a Surface Coal Mine in Pennsylvania. The Crawler Track Dozer in the background on photo 10 is a Fiat-Allis HD41 (524 hp/124,000 lb) which, at the time in 1978, was the largest Crawler Track Dozer on the market. This was prior to Caterpillar’s introduction of their D10 size machine.

Melroe 26’ / 37° Dozer Blade

Photo 11 shows the Melroe Multi-Wheel equipped with a 26’ wide x 7’ high Angle Blade that is capable of angling 37° in either direction. The machine is doing Angle Blade Land Reclamation work by dozing down the Dragline spoil piles in a Surface Coal Mine in Wyoming.

Melroe 26’ / 45° Dozer Blade

Photo 12 shows the Melroe Multi-Wheel equipped with a prototype 26’ wide x 7’ high Angle Blade that was, at the request of Texas Utilities Mining Company, designed to angle 45° in either direction. This unit is #5 of 10, built by the Melroe Brothers, and the photo was taken in 1978 at Texas Utilities Monticello Lignite Surface Mine near Mount Pleasant, TX. The next Exhibit Board, 12 of 16, looks closer at this blade.
The above Exhibit Board, 12 of 16, consists of twelve color photos of the Melroe Multi-Wheel Rubber Tire Dozer equipped with the prototype 26’ wide x 7’ high Angle Blade that was designed, at the request of Texas Utilities Mining Company, to be capable of angling at 45° in either direction.

45° Dozing Challenge

Texas Utilities Mining Company was willing to pay for a 90 day demo/rental to see if this prototype 45° Angle Blade could be made to perform. They agreed to pay $90,000 in rental for 90 days with an option to purchase the machine provided the 45° Angle Blade could be made to work.

The Multi-Wheel had the traction to successfully handle the blade when it was in the Straight Dozing mode but when angled at 45° the side draft forces created problems with the Multi-Wheel’s ability to steer in a straight line or to stay on course. The tremendous side-draft forces created by the 45° angle of attack caused the machine to continually drift to one side.

Steering also became an issue when we tested the Multi-Wheel concept in the Straight Dozer mode. As long as the machine was traveling to and fro in a straight line its dozing performance in rough terrain on inconsistent footing is something to behold but its downfall came when you attempted to work in a confined area where you had to do a great deal of twisting and turning.
Tight quarter maneuvering that required the Skid-Steering of a machine that was 30’ in length and 15’ in width and weight 220,000 lb was just too cumbersome. It did not help out our case that the machine was 27% under-powered, with its total of 670 hp, as when compared with the later Multi-Wheel units that were equipped with a total of 850 hp.

The Melroe Multi-Wheel Company was undercapitalized from the get-go, especially considering the size of the unit that they were attempting to introduce to the market. Introducing a new concept in the 850 hp/220,000 lb size range would tax a company with the financial depth of Caterpillar or Deere much less an undercapitalized company the size of the Melroe Multi-Wheel Company. Their undercapitalization along with the economic downturn of the 1980’s was their undoing.

If you recall, in 1989, even Caterpillar lost money for the first time in the history of their company thus this will tell you how bad the economic conditions got to in the late 1980’s. What is amazing to me is that the Melroe Multi-Wheel Company, as undercapitalized as it was, was able to get ten units of that size of a machine built and sold prior to running out of money.

45° Dozing Solution

During the period from 1978 to 1987, I was constantly trying to figure out to solve the problems that were holding back the harnessing of the innate wheel traction potential that I had witness first hand within the Multi-Wheel concept. One day in, 1987, as I am driving down IH 30 in NE Texas the idea came to me that if you added steerable axles to the Melroe Multi-Wheel concept it would not only solve the Straight Dozer tight quarter maneuvering problem but it would also solve the drifting steering problem caused by the tremendous side-draft forces of a 45° Angle Blade.

The next Exhibit Board, 13 of 16, looks at the United States efforts to address this challenge.
The above Exhibit Board, 13 of 16, consists of twelve color photos of a prototype Balderson Big-Dude Angle Blade (41’ 1” in length x 6’ 6” in height and set at a fixed angle of 40°).

**US Bureau of Mines**

As previously mentioned in my explanation on Exhibit Board 6 of 16, this prototype blade is one of the Angle Blades developed by the United States Department of The Interior, Bureau of Mines, in an attempt to lower the cost of mine reclamation in surface mines. This blade was powered by two CAT D9H Crawler Track Dozers (410 hp/110,000 lb each) with the blade mounted to the front of one of the D9H’s and with the second D9H acting as a pull tractor in assisting the first D9H.

You can see in photo #10 on this exhibit board where the second/lead D9H is pulling on a cable that is connected to the leading point of the Big-Dude Blade which is mounted on and being carried by the first/following D9H.

**45° Optimum**

The Bureau of Mines determined that the least expensive method of dozing material short distances is to do it with an Angle Blade where the Crawler Track Dozer is continually moving in one direction without having to continually back up and go forward while also having to continually twist and turn as required when reclaiming a Dragline spoil pile in a surface mine. They determined that the ideal angle to move material latterly is an angle of 45°.
As previously mentioned, there is a 113 page final report dated February 1978, reporting on the United States Department of The Interior, Bureau of Mines work done pertaining to reclaiming 1,431 acres during a 23 month period beginning 5-16-75 and ending 3-3-77. The title of the report is: APPLICATION OF HIGH VOLUME EARTHMOVING METHODS TO THE RECLAMATION OF AREA MINED SPOIL BANKS.

**Backfilling and Plowing**

This work done by the Bureau of Mines is what peaked my interest and started me on the quest to solve the problem of how to successfully doze material at a 45° angle of attack with a blade mounted on the front of a machine. Now that I have solved that problem, this same 45° angle blade concept can be downsized to be utilized in the construction industry as I will attempt to explain later on Exhibit Boards #15 and #16 of 16.

Two obvious applications for construction size machinery would be as a 45° angle blade Pipeline Dozer utilized to backfilled an open trench as well as a 45° angle blade machine utilized as a Snow Plow. These are obvious uses and thus I did not bother to address them with an exhibit board type explanation. The photos on this exhibit board pertaining to the prototype Balderson Big-Dude Angle Blade was taken in 1977 by yours truly at Texas Utilities Big Brown Lignite Surface Mine near Fairfield, TX.

The next Exhibit Board, 14 of 16, approaches this challenge by increasing the angle of the dozer blade.
The above Exhibit Board, 14 of 16, consists of twelve color photos of which eleven (2 thru 12) are of the prototype Balderson Double Dude Angle Blade (48’ 8” in length x 6’ 7” in height and set at a fixed angle of 45°).

Mining and Construction

As previously mentioned in my explanation on Exhibit Board 6 of 16, this prototype blade is one of the Angle Blades developed by the United States Department of The Interior, Bureau of Mines, in an attempt to lower the cost of mine reclamation in surface mines.

This blade was powered by two CAT D9H Crawler Track Dozers (410 hp/110,000 lb each) with the twin D9H’s sitting behind the blade while at same time having the blade mounted/attached to both D9H’s with the D9H’s slaved together in a side by side configuration (photos 1 & 2).

The two D9H’s are slaved together in a staggered fashion (photos 3, 4, 5 & 6) so as to enable the fixed Angle Blade to attack the material at a 45° angle of attack. The two D9H’s had one operator who sat in the operator’s cab of the lead machine while at same time was able to operate the controls of the second machine via remote controls.
The Bureau of Mines determined that the least expensive method of dozing material short distances is to do it with an Angle Blade where the Crawler Track Dozer is continually moving in one direction without having to continually back up and go forward while also having to continually twist and turn as required when reclaiming a Dragline spoil pile in a surface mine. They determined that the ideal angle to move material latterly is an angle of 45°.

As previously mentioned, there is a 113 page final report dated February 1978, reporting on the United States Department of Interior, Bureau of Mines work done pertaining to reclaiming 1,431 acres during a 23 month period beginning 5-16-75 and ending 3-3-77. The title of the report is: APPLICATION OF HIGH VOLUME EARTHMOVING METHODS TO THE RECLAMATION OF AREA MINED SPOIL BANKS.

This work done by the Bureau of Mines is what peaked my interest and started me on the quest to solve the problem of how to successfully doze material at a 45° angle of attack with a blade mounted on the front of a machine.

Now that I have solved that problem, this same 45° angle blade concept can be downsized to be utilized in the construction industry as I will attempt to explain later on Exhibit Boards 15 & 16 of 16. Two obvious applications for construction size machinery would be as a 45° angle blade Pipeline Dozer utilized to backfilled an open trench as well as a 45° angle blade machine utilized as a Snow Plow. These are obvious uses and thus I did not bother to address them with an exhibit board type explanation.

The photos on this exhibit board pertaining to the prototype Balderson Double-Dude Angle Blade was taken in 1980 by yours truly at Texas Utilities Martin Lake Lignite Surface Mine near Tatum-Henderson, TX. Photo 1 on this exhibit board is of two D9H’s slaved together and connected behind a 24’ wide Balderson Straight Blade.

The next Exhibit Board, 15 of 16, looks at greater efficiency in the stabilizing of road base material.
The above Exhibit Board, 15 of 16, consists of sixteen color photos pertaining to the stabilizing of road base material using a Water Truck, Motor Grader and a Compactor.

The Asphalt Solution

Before I explain why I included these photos which were taken by yours truly around 1992-1993, I would like to reference a most recent July 17, 2010 article that appeared on the front page of THE WALL STREET JOURNAL. The article was titled: *Asphalt Is Replaced By Cheaper Gravel; 'Back to Stone Age'* . The author of the article was Lauren Etter.

The point of the WSJ article is that a multitude of county governments with miles of county road can no longer afford to keep them paved with asphalt thus they are ripping/grinding the old existing asphalt road surface up and thus returning the road back into a gravel road.

More for Less

When you do this it creates a need for Water Trucks, Motor Graders and Compactors to be utilized to stabilize the now ripped up or ground up old road base. When stabilizing road base on an isolated county or oil field or a mine haul road, etc., the Motor Grader is usually the bottle neck to getting the job done quickly. I say this from actual on the job experience as shown in the sixteen color photos that appear on photos 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 & 16 of this Exhibit Board.
What I experienced is that on these type of jobs there is only one Motor Grader available and thus the Water Truck and Compactor are continuously waiting for the Motor Grader to roll/mix the road base material back and forth in order to get the water, soil cement, chemical road base stabilizer, etc., thoroughly mixed in prior to compacting.

The rolling back and forth may have to be done multiple times with additional water added each time until optimum moisture conditions are obtained in order to achieve ideal compaction density whenever the Compactor is allowed to go to work. When I was on these isolate jobs out in the country and going through these ordeals the contractor usually had a Wheel Loader/Tool-Carrier on the job that was parked and thus not being utilized.

**Machinery Synergy**

My thoughts were if he had a Four-Wheel AWS Uni-Frame™ Loader/Tool-Carrier we could quick couple a Degelman (Canada) PAT Blade on the front of it and then by Crab-Steering the machine we could get in behind the Motor Grader and assist the Motor Grader in rolling over/mixing the road base material with a 45° angle of attack similar to what the Motor Grader was doing.

This would allow the speeding up of the mixing of the road base material which would then remove the bottleneck caused by having to continually wait on only one available Motor Grader to mix the material with its blade set at a 45° angle of attack.

Let me emphasize, it is not my intention to do away with the Motor Grader for it is irreplaceable when it comes to doing blade work on a road. My contention is that we can complement the production of the Motor Grader with a Wheel Loader/ Tool-Carrier which is usually always on the job but not always being fully utilize, especially during the task of road base stabilization.

If nothing else, the proposed Four-Wheel AWS Uni-Frame™ Loader-Dozer-Tractor concept could act as a Pull Tractor in pulling the Compactor as seen in photo #8 or assist the Motor Grader in ripping up the old road base as seen in photos #9 & 10 on this exhibit board.

The next Exhibit Board, 16 of 16, notes the increased productivity of machinery capable of multi-purpose applications.
This final Exhibit Board, 16 of 16, consists of twelve color photos showing a Motor Grader, Wheel Loader and Crawler Track Dozer working in various applications on a highway widening project in Dallas, TX. In addition, drawing illustration 11 of 21 appears in the lower right quadrant of this exhibit board.

Leveraging Resources

This is a project that I drove by each day in 1989-1990 when I was living in Dallas, TX. Thus I was able to observe the different pieces of construction equipment on the job and how they were put to use and how might the job be done more efficiently should my Four-Wheel AWS Uni-Frame™ Loader/Tool-Carrier concept be employed in lieu of the conventional Articulated Wheel Loader that appears in photos 5, 6, & 7 on this Exhibit Board.

Motor Grader

Photos 1 and 2, shows a Motor Grader using its blade to skin/remove the grass adjacent to the edge of the existing highway. This task was necessary for the contractor wanted to reclaim the old asphalt for later use.

As described on the previous Exhibit Board 15 of 16, my proposed Four-Wheel AWS Uni-Frame™ Loader/Tool-Carrier could be equipped with a quick-attach Degelman PAT Blade, thus if my propose Uni-Frame™ concept had been on this project, in lieu of the conventional Wheel Loader, it could have been utilized to assist or complement the Motor Grader in the process of removing the grass and thus shorten the time spent on this task. Again let me state, it is my contention to compliment the Motor Grader and not to replace it.
Photos 3 and 4 show the Motor Grader in the process of ripping up the old asphalt road shoulder and angle blading it into a furrow in order that it might be reclaimed for future use. Again, my Uni-Frame™ concept could assist the Motor Grader in this task because of the Uni-Frame™ superior wheel traction due its chain drive power train and its superior balance which can be achieved by movement fore and aft of its patented Internal-Sliding Counterweight (Exhibit Board 5 of 16).

Again, this ripping and angle blading task time frame could be shortened because of the Uni-Frame™ ability to complement and assist the Motor Grader in both the ripping and angle blading portion of this project.

Wheel Loader

Photos 5 and 6 shows the Wheel Loader being utilized to load the old ripped up asphalt into a dump truck so that it can be hauled to a storage pile for future use. In this case my propose Four-Wheel AWS Uni-Frame™ Loader/Tool-Carrier concept would use the quick-attachment to detach from the Degelman PAT Blade and to reattach onto a loader bucket.

Track Dozer

Photos #9, 10, 11 & 12 shows a Crawler Track Dozer pulling a disk in preparing the road base for widening of the highway. I included these photos to show that a conventional Wheel Loader, due to its poor pulling traction and its poor weight distribution/balance, cannot effectively be used as a Pull Tractor thus a Crawler Track machine had to be imported to the job specifically for the purpose of pulling the disk.

Uni-Frame™ Loader-Dozer-Tractor

Had my proposed Four-Wheel AWS Uni-Frame™ Loader/Tool-Carrier concept been on the job it could have been used to pull the disk because of its Pull Tractor characteristics which are attributed to its superior wheel traction and the ability to balance the machine fore and aft to the task at hand.

Here is a case in point where if my proposed Four-Wheel AWS Uni-Frame™ Loader-Tool Carrier concept had been on this road construction project its superior productivity and versatility could have been harnessed to the maximum due to its ability to effectively perform as an angle blade machine, as a ripping machine, as a loading machine and as a pulling machine.

Drawing illustration 11 of 21 in the lower right-hand quadrant of this exhibit board is a top view showing how the proposed Four-Wheel AWS Uni-Frame™ concept can successfully angle doze at a 45° angle of attack by Crab-Steering the machine at 15° while setting the PAT Blade angle at 30°.

This is the same drawing illustration that appears in the upper left-hand quadrant of Exhibit Board 6 of 16 which has a more detailed explanation of how the Uni-Frame™ AWS concept can successfully achieve angle blading at a 45° angle of attack.
I believe the **Uni-Frame™** Wheel Loader-Dozer-Tractor concept with its range of features listed below has the potential to make a major positive impact on the worldwide Wheel Loader, Wheel Dozer and Wheel Tractor Industry; and do so across a broad range of equipment sizes.

1) **Patented Internal-Sliding Counterweight** (Optimizes Fore & Aft Ballast)
2) **Internal Chain Drive** (Increases Traction- Proven to Out-Perform Conventional Power Train)
3) **All-Wheel Steerable Axles** (Tighter Turning Radius)
4) **Crab Steer Capability** (45° High-Speed Angle Dozing/Material Processing)
5) **2-in-1 Oscillating and Independently Linked Axle/s** (Rear or Front)
6) **Rigid Frame Construction** (Increased Lifting Capacity-Planetary Axles Interchangeable To 4 Or 6 Wheels)
7) **Longer Wheelbase length** (Stable-Smoother Ride And Greater Tongue Weight Capacity)
8) **Optional Six-Wheel Capability** (Increased Floatation, Traction & Stability)
9) **Optional Differential Steer** (Enhances 45° Angle-Blade Dozing While Utilizing Crab Steer)
10) **3 Choices of Power Inputs Into a Single Differential**
    - Mechanical (Similar to 4-Wheel Drive Articulated AG-Scraper Tractors)
    - Electric Drive (Similar To Caterpillar’s D7E Electric Drive Track-Type Tractor/Dozer Concept)
    - Hydra-Stat (Similar to Komatsu WA250PZ-6 Wheel Loader)

The 30 percent increase in wheel traction efficiency is tantamount to a 30 percent increase in fuel efficiency based on their approximate 1 to 1 ratio to one another. This benefit alone, in the ‘Green’ era hopefully is sufficient motivation to get a manufacture and or governmental agency to aggressively move forward with the development and testing of this energy saving design.

The patented Internal-Sliding Counterweight (U.S. Patents 7,124,853 and 6,779,617) would enable the proposed concept to provide a manufacture a proprietary marketing advantage until the latest patent expired in 2024. A protected selling position on such a uniquely versatile and more productive Wheel Loader would enable a licensee to inoculate themselves from the slings and arrows of a prolonged down market which it appears may be with us for years to come.

I am available to address questions at your convenience, and you may contact me as noted below. Thank you for taking the time to review this presentation.

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Conclusion to Exhibit Board Presentation
Uni-Frame™ 4-Wheel Loader-Dozer-Tractor
Patented Internal-Slapping Counterweight
All-Wheel Steer – Crab Capability – Six Wheel Option

Market Share
In The

‘New Norm’

Who Gains?
Who Loses?

Caterpillar
Komatsu
Volvo

John Deere