



CIRCLE OF FRIENDS
GMC
alumni

The Southland Air Bag

Including Comments on Development
of the GMC Suspension

Matt Frady

Outline

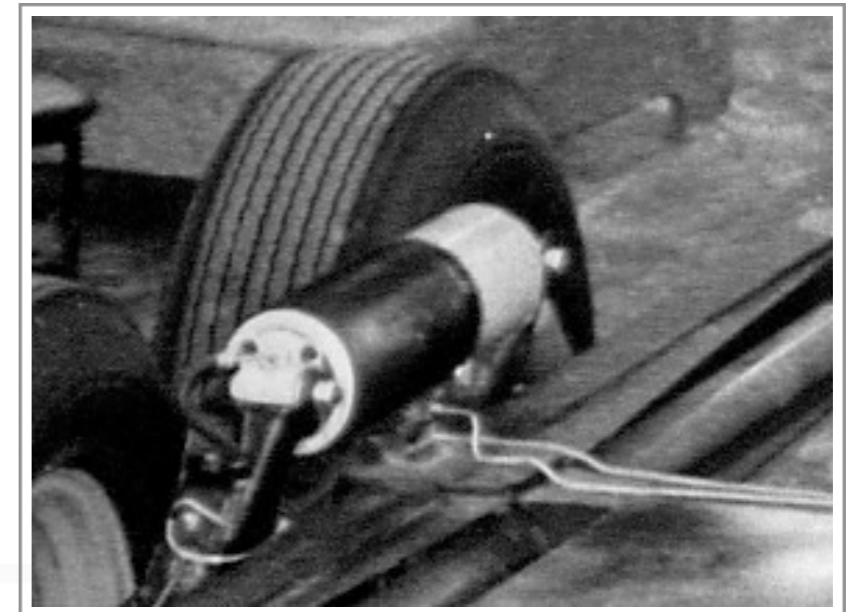
- History of air bag for GMC suspension
- Firestone decision
- Review of the four-bag systems
- Southland single cone design
- Air bag problems
- Q&A

History

- Purpose of air bag
- Early Research & Development
- Who developed
- Testing
- Performance

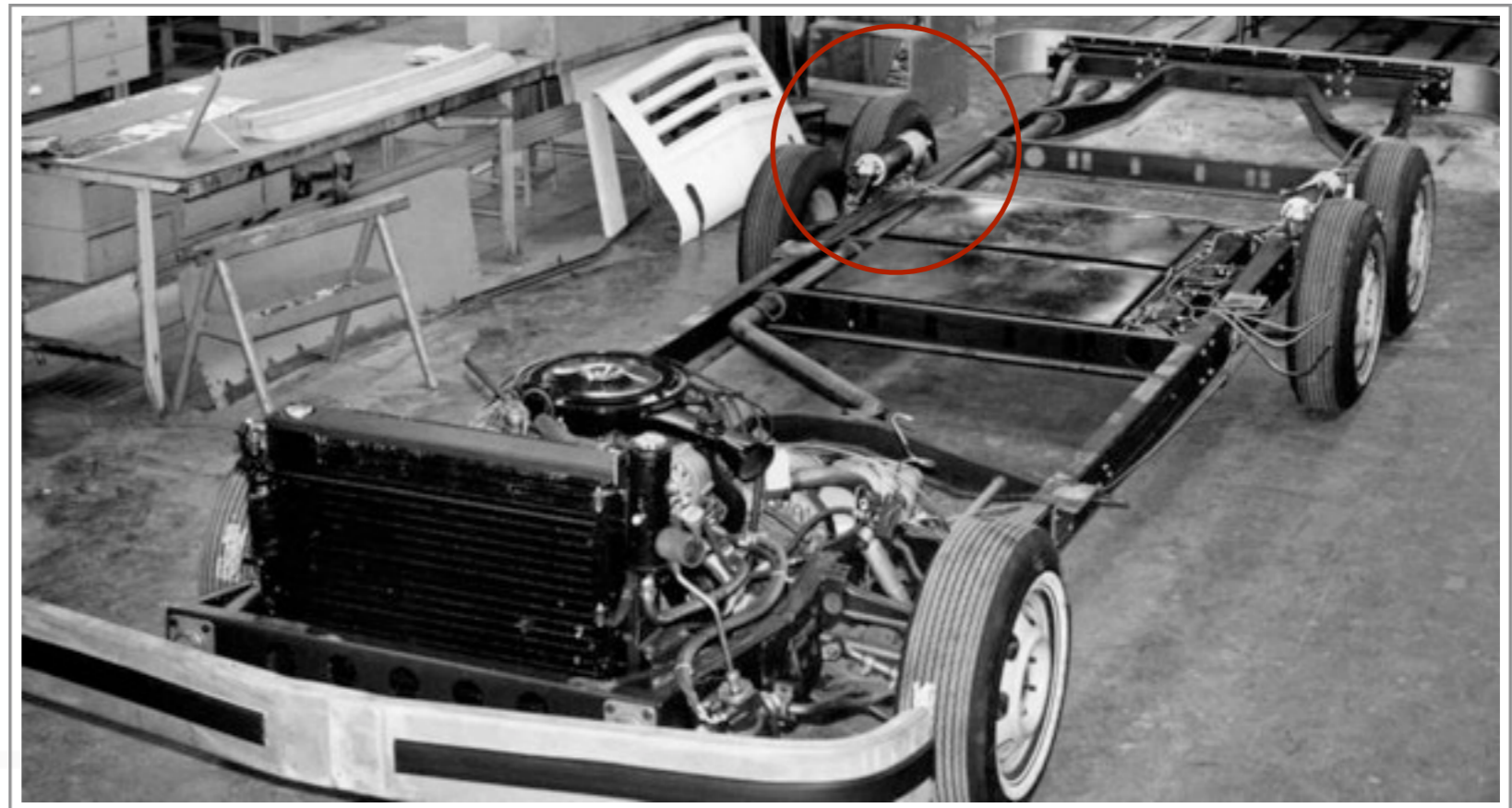
Early GMC Hydropneumatic Rear Suspension

- Initial design was a *hydropneumatic* system
- Used a power steering pump for hydraulic pressure
- Engineers: “Handled and road great.”
- GMC engineer admired the Citroen system
- Replaced by the air bag when a lower cost suspension was requested



First GMC Prototype

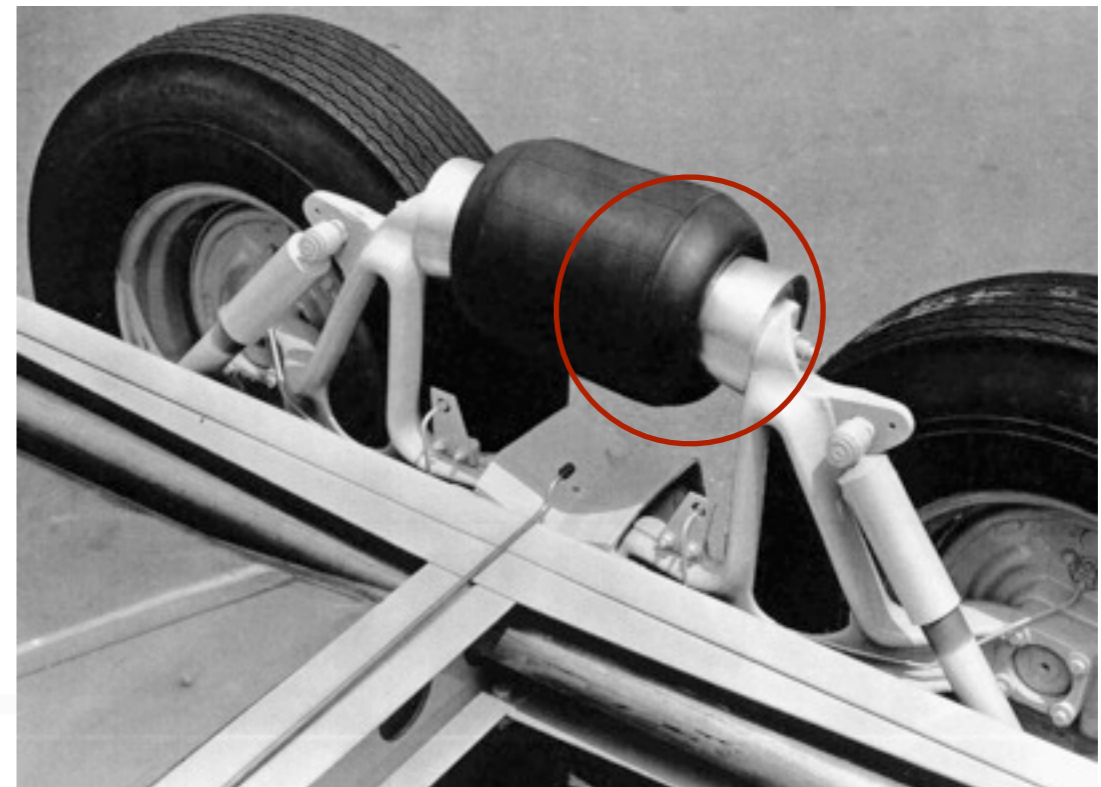
- Used *hydropneumatic* rear suspension
- This chassis was first prototype built
- Originally fitted with “square sides” body



Early GMC

First Design with Air Bag - 1971

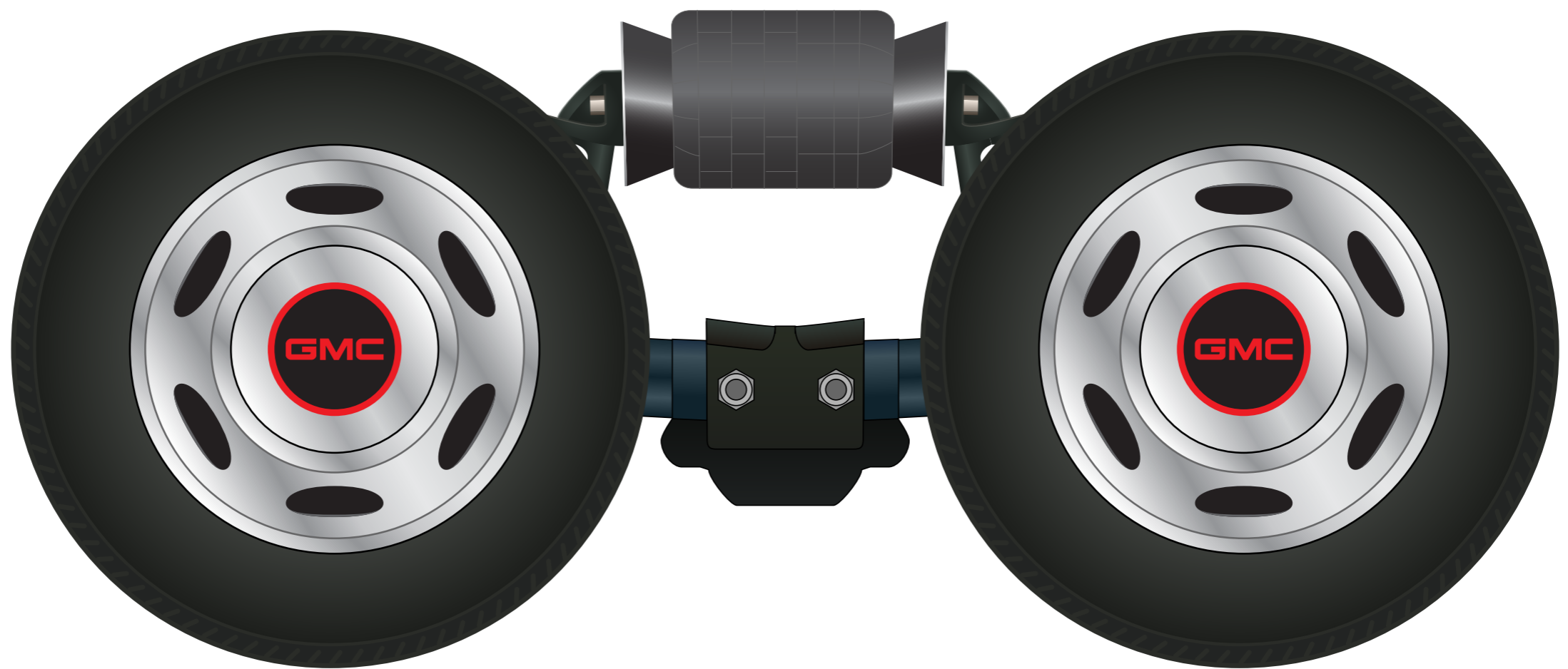
- This is first design with air spring (bag)
- Cones have very shallow ramp with notch
- Changes were made as a result of proving ground tests
- Other changes made when durability problems appeared in very early production



State of the Art Performance

- Cone style bag has sleeve which targets absorption
 - ✦ Bag rolls over sleeve (cone) creating dampener for any kind of impact
- Putting bag between two tandem wheels where both arms flex in and out result in:
 - ✦ twice as much work for bag
 - ✦ twice as much ride quality
- Made consumers and competitors stand in awe of this design

State of the Art Behavior

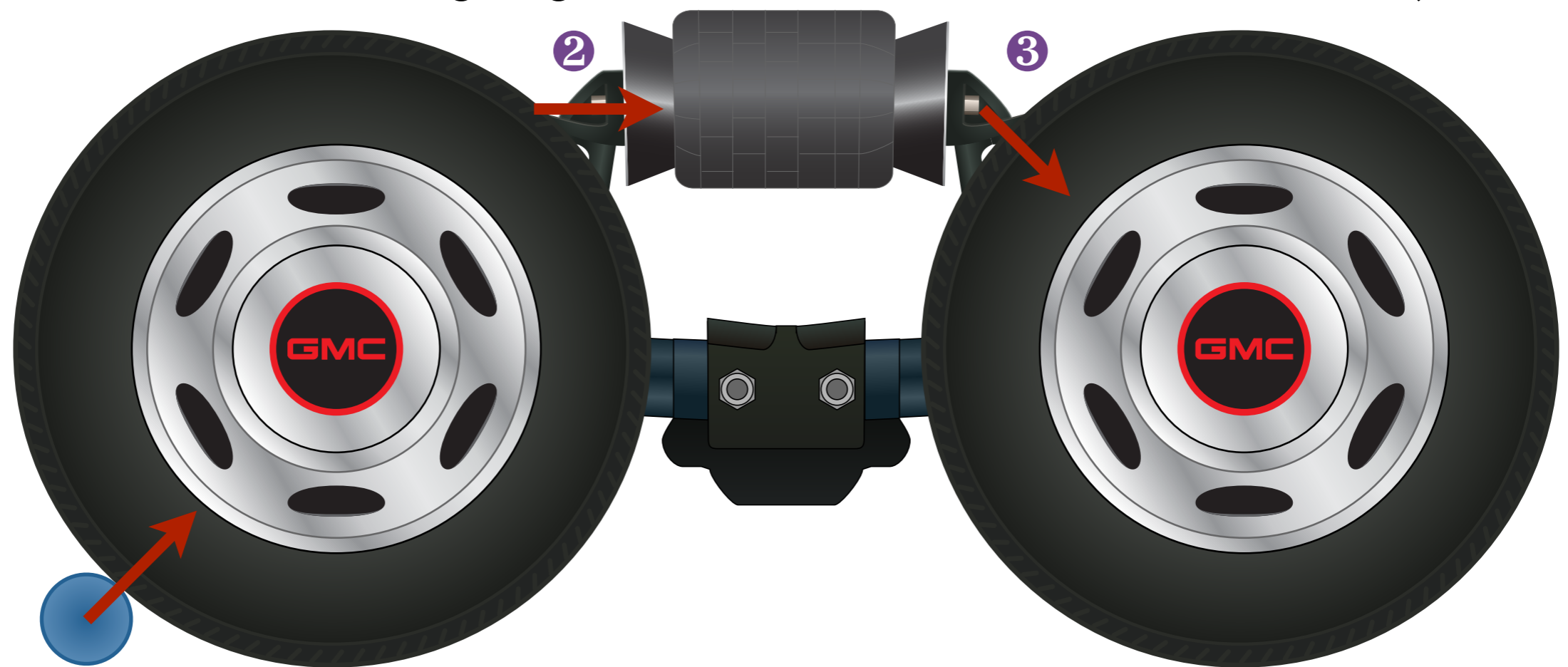


← Direction of Travel ←

State of the Art Behavior

Upward force of impact shifts pressure toward rear tire through bag

Pressure against rear tire helps “lift” coach over object



1 Leading tire encounters object

← Direction of Travel ←

Firestone

- Consideration
- Reality

So...

- If they had such a great system in the first place, why did they discontinue this airbag?
- Well, the answer to this question takes us all the way back to the beginning.

Why Did Firestone Cease Production?

- According to Zeb Sr., the prototype bag was designed as a motor mount for high-end industrial generators
- GM was only manufacturer create an automotive application for air spring ... never a large demand for the bag
- After motor mount use ceased, only GMC needed it
- Decreased demand
- Cost of retooling isn't justified by the quantity
- Issue changed from "if" to "when"

Alternative Systems

- Harrison dual bag design
- The “Q-bag” system

Dual Bag System

- Invented by Leigh Harrison
- Different kind of bag
 - ✦ Original bag is a “sleeve” bag
 - ✦ Dual bag uses a “double convoluted” type
- Many systems sold to replace original design
- Still in production today
- Southland has installed several since 1996



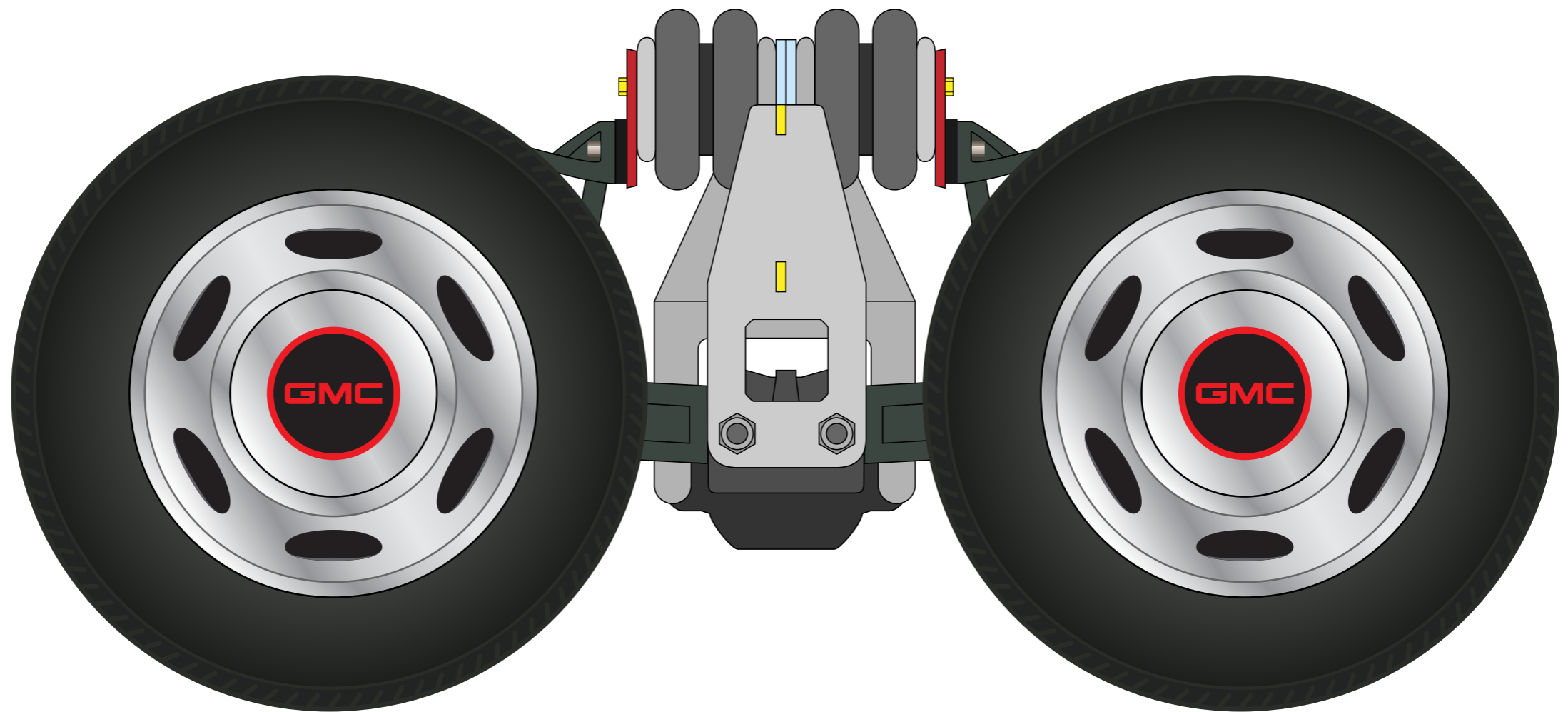
Advantages of Multiple Bags

- Control –
 - ✦ “you still have control of the coach even when you run off the road”
 - ✦ Very true!
- Four bag system adds
 - ✦ support and drive control
 - ✦ superior to the original bag system

Disadvantages

- Stiffer ride
- Reduced raise & lower travel
 - ✦ Convoluted bag designed for weight and stability, not ride control
 - ✦ No roll point
 - ✦ Primary purpose to “lift” not absorb
- Stiff / blunt impact over a bumpy terrain
- Ideal for six-wheel suspension

Multi-bag System

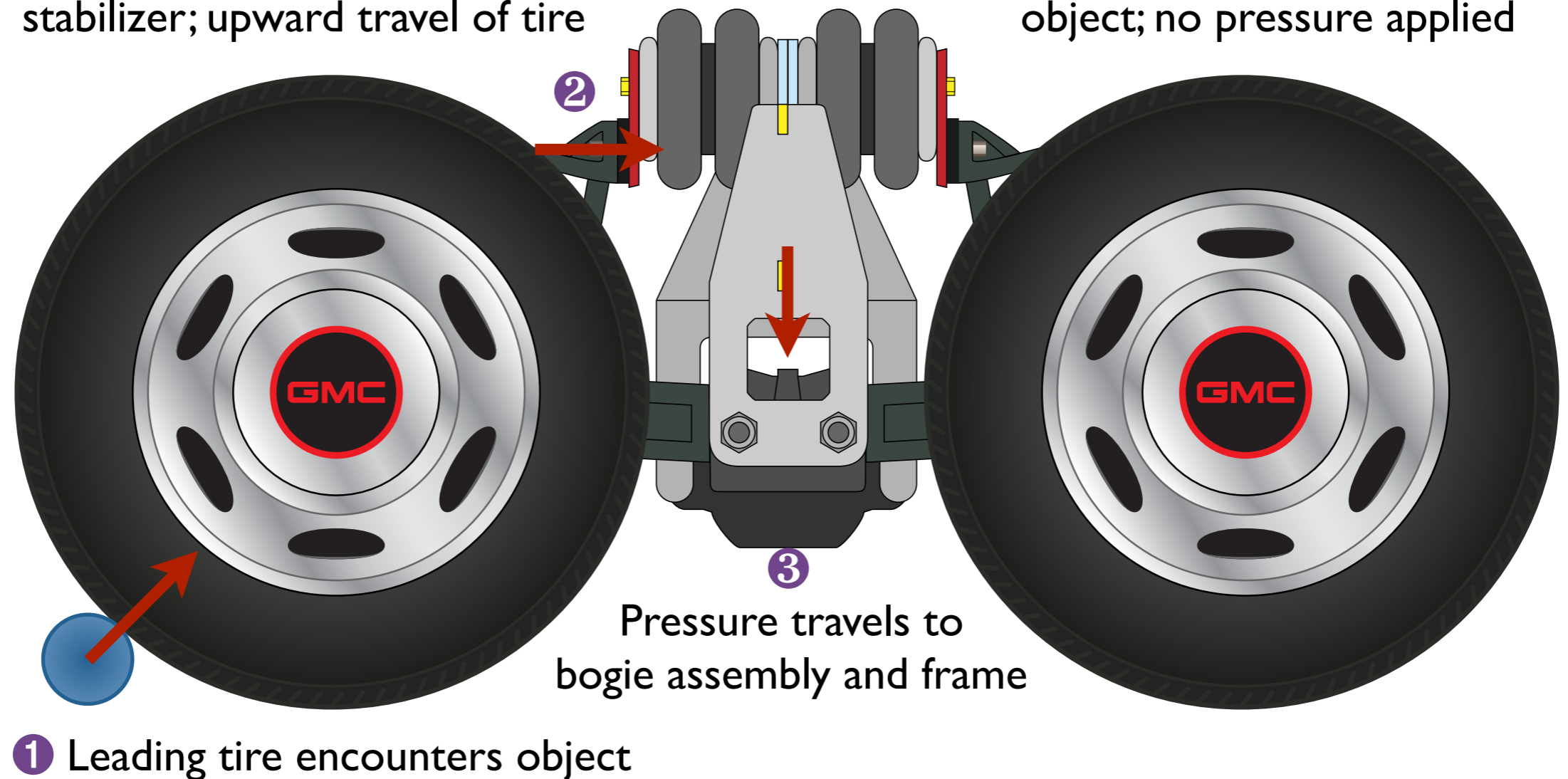


← Direction of Travel →

Multi-bag System

Force of impact shifts pressure toward stabilizer; upward travel of tire

Rear tire doesn't "lift" coach over object; no pressure applied



Q-bag System

- Re-engineered four bag
- Advantages
 - ✦ Improves stability
 - ✦ Improves handling
 - ✦ Offers some recovery after blowout
- Disadvantages
 - ✦ Stiffer ride
 - ✦ Reduced raise & lower travel



Southland

- Design objectives
- Considerations
- Advantages
- Disdvantages
- Air spring options

Southland Single Cone Design

1. Go back to the cone style bag (original design)
2. Get maximize ride height and leveling possibilities
3. Designed to hold the weight
4. Wouldn't be discontinued anytime soon

Southland Single Cone Design

1. Go back to the cone style bag (original design)
2. Get maximize ride height and leveling possibilities
3. Designed to hold the weight
4. Wouldn't be discontinued anytime soon
 - If would we could do all that and then get prices back into perspective, then we felt successful.
 - Well, after hours of phone conferences, expo talks, and a few lost hours in design, we were blown away at what we came up with.

Design Considerations

- Close to original bag
- Dual cone bag was out of the question.
 - ✦ Couldn't hold the weight, or
 - ✦ Out of the targeted price range.

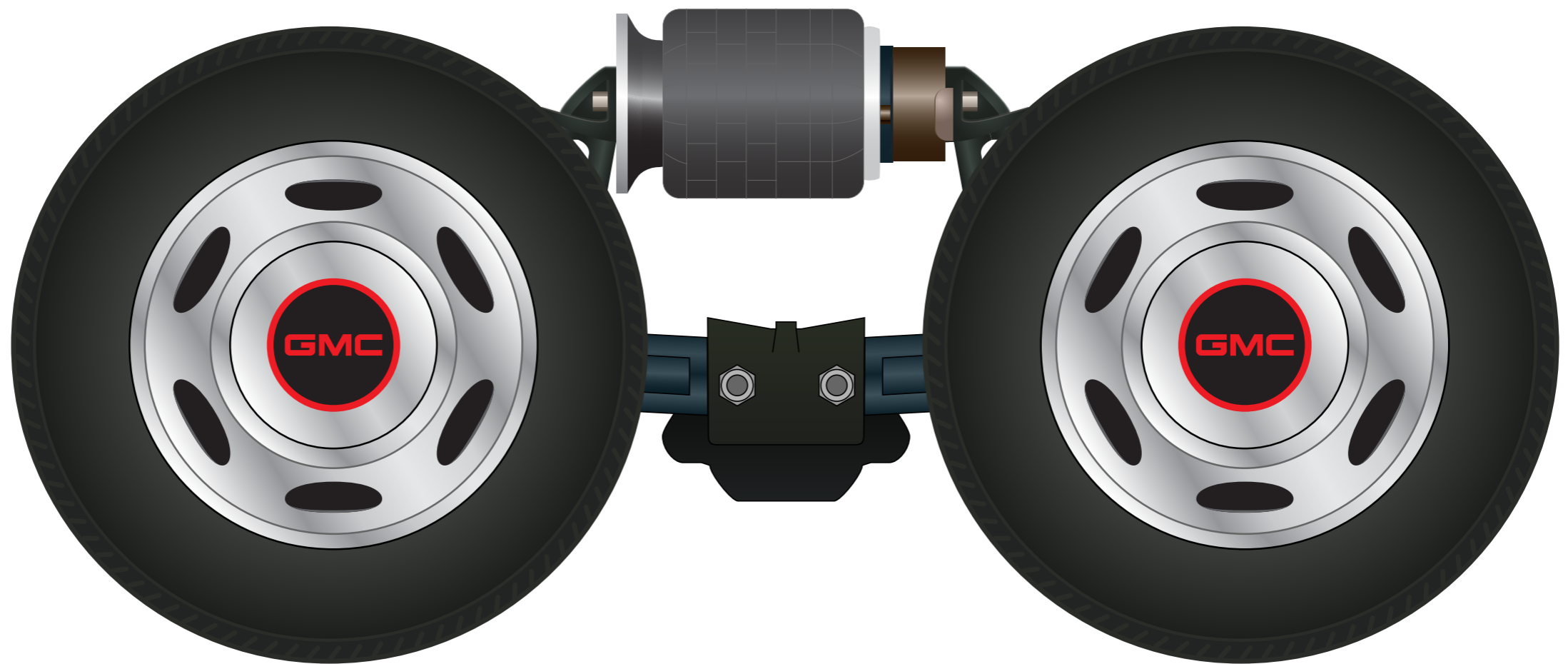
Single-cone bag

- 6-inch-deep, single sleeve replaces the original bag's 4-inch dual sleeves.
- Almost as much travel as the original bag
(Total travel is approximately 5.25 inches)
- 6-inch sleeve sits further inside airbag
 - ✦ Provides more support through the center
 - ✦ Keeps the airbag from “hot-dogging” over time.

Another advantage

- By pushing one cone, able to cut the air pressure roughly 12 to 15 PSI compared to the original
- Lower pressure yields a better ride than the original setup
- Weight capacity of 3200 pounds per bag
- Southland: “This is the best airbag that can be found”

Southland Single Cone System

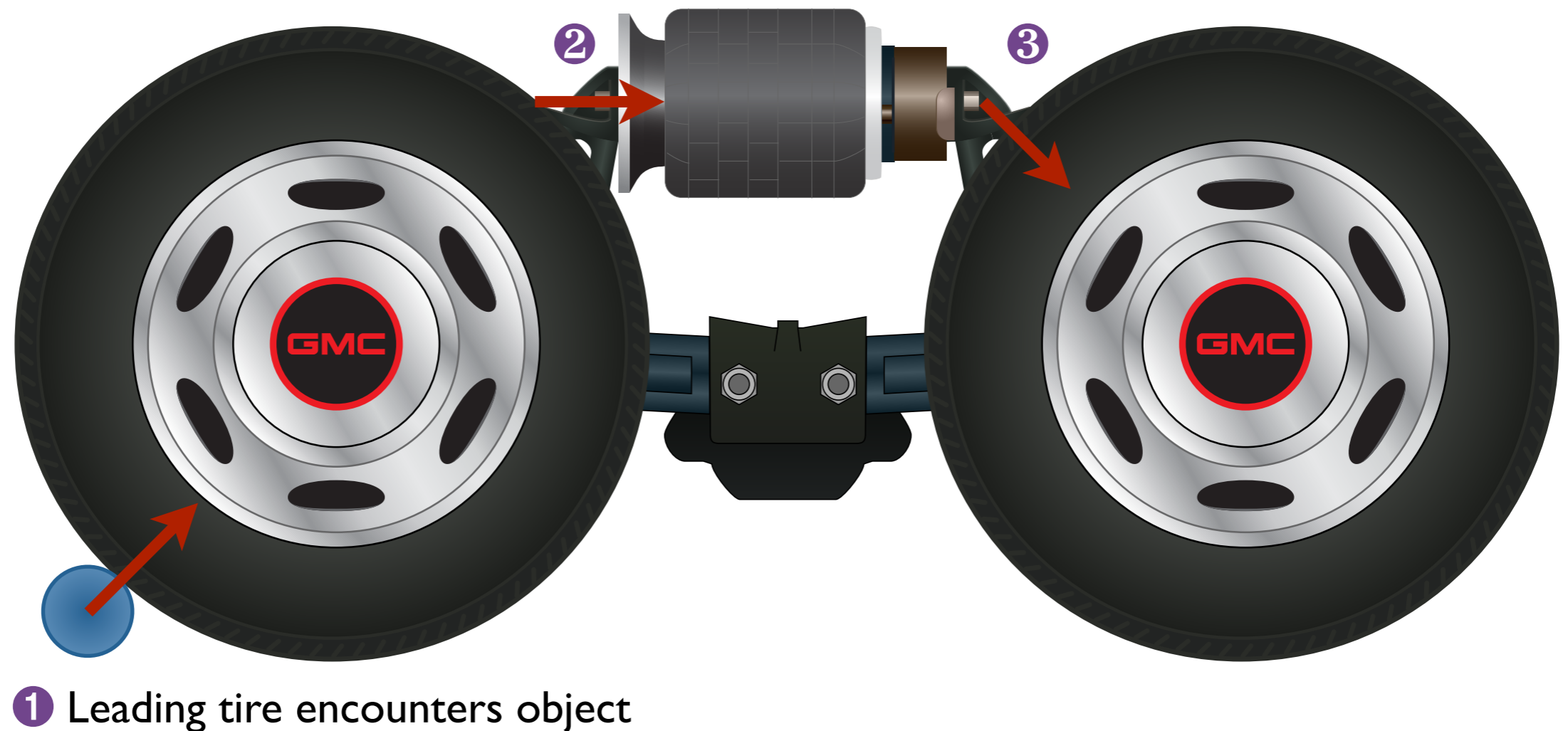


← Direction of Travel ←

Southland Single Cone System

Upward force of impact shifts pressure toward rear tire through bag

Pressure against rear tire helps “lift” coach over object



← Direction of Travel ←



Advantages

- New system at reasonable cost
- We have patented a kit that adds to lifespan of the bag
- Each airbag can be rotated 180 degrees to help preserve the shape (deflate and rotate annually, for instance)
- The air line is protected since it travel within the adaptor, not on the outside.
- Larger bottom brace on sleeve protects from damage due to tire blowout
- Easy installation – about like replacing an original bag

Disadvantages

- Not as much stability from swaying as with four bag
- Close tire to cone clearance



AIR SPRING SERVICE PARTS		UNINFLATED DIMENSIONS (APPROX.)		MAX LOAD @ 100 P.S.I.
STYLE	DESCRIPTION	HEIGHT	DIAMETER	PER AIR SPRING
1	Double Convoluted (One blind nut lower bead plate)	5.25	5.70	1600 lbs.
1	Double Convoluted	5.25	5.70	1600 lbs.
1	Double Convoluted	6.00	5.80	2400 lbs.
1	Double Convoluted	6.00	5.80	2400 lbs.
1	Double Convoluted	6.00	5.80	2400 lbs.
1	Double Convoluted	7.00	7.25	2500 lbs.
1	Double Convoluted	7.00	7.25	2500 lbs.
1	Double Convoluted	7.00	7.25	2500 lbs.
1	Double Convoluted	7.00	7.25	2500 lbs.
1	Double Convoluted	7.00	7.50	2820 lbs.
2	Single Convoluted (Combo Stud)	7.00	7.20	1760 lbs.
2	Single Convoluted	5.00	7.20	1760 lbs.
2	Single Convoluted	5.00	7.40	3000 lbs.
→ 3	Reversible Sleeve	10.00	6.62	3200 lbs.
3	Reversible Sleeve	11.00	6.62	3200 lbs.
4	70 MM Reversible Sleeve	8.25	3.50	1000 lbs.
5	Tapered Sleeve (LONG)	8.25	5.30	1500 lbs.
5	Tapered Sleeve (MEDIUM)	7.25	5.30	1500 lbs.
5	Tapered Sleeve (SHORT)	6.37	5.30	1500 lbs.
5	Tapered Sleeve	1.075	6.44	1500 lbs.

Common Problems & Solutions

- Air leaks
 - Upgradable improvements – Schrader valves
- All airbags “hotdog” at some point:
 - Rotatable
- Rear tire blowouts:
 - Quad Bag raise by increasing PSI
 - OEM and Southland – use chain

Supporting Hardware

- Pumps
- Valves
- Extensions



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Questions



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Southland Motorhome Center

4244 Sudderth Rd, Buford GA, 30518

(770) 271-7502

www.SouthlandMotorhome.com