STANLEY MASON'S CHINESE TALLOW —TREE— PLANTATION

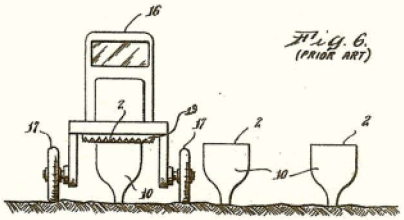

Fig. 6. (PRIOR ART)

1921—2005

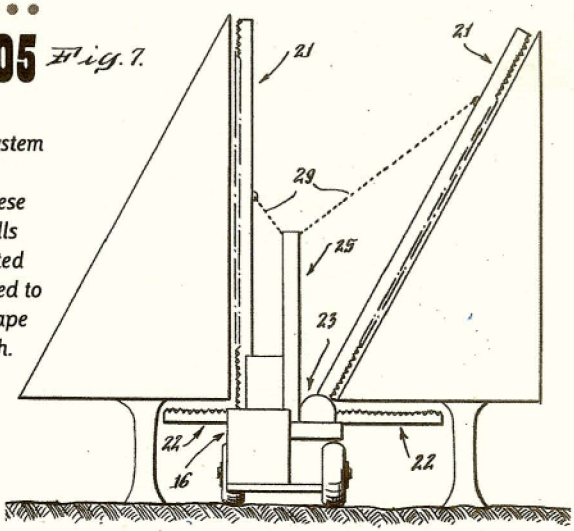

Fig. 7.

This patent for a system for harvesting tree crops such as Chinese tallow, and tea, calls for trees to be planted in rows and groomed to be triangular in shape to maximize growth.

It was always the ordinary, everyday American problems that intrigued Stanley Mason most. Like the day in 1949 when his wife asked him to change their infant's diaper. He looked at the square, flat disposable diaper and then at the round bottom before him, and decided there was a better way to do things. So he invented the contoured disposable diaper. Mason, in the five-decade invention career that followed, brought us many other commonplace household items. To name a few: the squeezable ketchup bottle, disposable surgical masks, granola bars, heated pizza boxes, dental floss dispensers, Masonware microwave ceramic cooking dishes, the "stringless" Bandaid packaging, the plastic underwire bra, and the contoured sanitary napkin.

Mason has an all-American persona to match his all-American inventions. He developed his first successful invention at the age of seven, when as a young boy in Trenton, New Jersey, his father refused to give him money to buy a fishing lure. Instead, his mother gave him a wooden clothes peg and suggested he fashion his own. He did. The wooden minnow was followed by numerous other matching wooden minnows, which sold for 26 cents each to his neighborhood pals. The grown-up Mason went to university, graduated with an engineering degree, and did a stint in the military, serving as a fighter pilot in the Second World War. Then he obtained several decent jobs with United States companies, designing products. He was fired several times, something he was quite proud of; as he bragged to a journalist in 1998, "You should always be fired in America." In total, Mason developed over 100 inventions and patented 60 of them.

In 1973, with the advent of Masonware, Mason began his own company, Simco Inc., which specialized in creating cosmetics, medical devices, and packaging for Fortune 500 companies. The company's offices were attached to his house, and he later wrote for an online newsletter about working at home, giving such practical advice as: set up personal boundaries, assign yourself regular work hours, dress for "the office," and make sure you have dedicated space with a door that closes and a sign to tell the household you are "at

work." He freely gave inventors advice, too, dispensing gems like "The trick is to find something that the customer will want before you set pencil to paper!"

Stanley Mason described himself as "an inventor of ordinary, everyday products — not high-tech, but common useful things." He was certainly a practical man, so it was not *entirely* out of character when he turned his attentions away from the small and everyday to tackle one of modern America's biggest challenges — the need for energy resources. The scope of the problem may have been new to Mason, but he applied his same basic philosophy. He thought about the problem from first principles and developed what he considered to be a simple, practical solution. Mason believed the answer was the Chinese tallow tree, an introduction from Asia and common throughout several Southern states. He thought the tree would make an excellent plantation crop, with its main product being oil. Mason got the idea from his knowledge of the Second World War. He knew that Chinese and Allied forces had used oil directly from the tree as diesel fuel during the hard times of the conflict. He cited some of its earlier champions, including Benjamin Franklin, who sent some seeds in 1772 to Dr. Noble Wimberly Jones in Georgia with the note, "tis a most useful plant."[1]

It is true that the Chinese tallow tree (*Triadica sebifera*[2]) has a large potential yield of biofuel. Its seeds are 40 percent or more oil, and it yields about 500 gallons of oil per acre (4,733 L/ha) from its seeds. By comparison, an acre of soybeans can yield about 30 gallons (285 L/ha).[3] Soy is the most common biodiesel crop; the tallow tree is thus 15 times as "oily" as its biggest "competitor." Mason described the tree to be "like the pig. You use everything." The wax products that give the tallow tree its name can be used for making

1 Benjamin Franklin is credited with introducing the plant to the United States.

2 Also *Sapium sebiferum*.

3 Figures refer to Texas crops, as quoted by David Shermock, AgriBioFuels, Inc., from *Texas Agriculture*, (September 1, 2006), www.txfb.org/texasAgriculture/2006/090106/090106biodieselcorrection.htm.

candles and soap. The outside part of the seed can be used as a substitute for edible fats. Paints, varnishes, plastics, wood chips, and cattle feed are among its other potential commercial products. The wood is white and close-grained and can be used to make furniture. The flowers are favored by honeybees and produce a pleasant, light-colored honey. A black dye can be derived from the leaves. And, in addition to its oil, the tallow tree grows quickly so it is also a source of biomass to burn for further energy production.

Mason put his back into the Chinese tallow tree plantation plan. He courted politicians, agricultural bureaucrats, and corporations. He got to work on the mechanics of growing, harvesting, and producing, and he filed a patent for a system that improved on current methods of tree crop harvesting. He started a promotional campaign to garner support. In 1981, he gave a presentation to a congressional subcommittee — George Washington Carver style — with a suitcase of Chinese tallow seeds as a prop. It failed to really impress. He knocked on the doors of numerous corporations, seeking business partners in the venture. In the decades before his death, it had become his passion. He stated simply, "This is a project which must be done."

Mason did make some progress. In an article written for *America's Inventor*, he said that his company's work "received international attention and significant direct and in-kind support from the National Science Foundation, United States Department of Agriculture (USDA), Department of Energy (Energy-Related Inventions Program), the State of Hawaii, numerous academic research institutions, multinational interests such as Unilever, Anderson Clayton, Deutz Diesel, Johnson's Wax, and agricultural plantations in Hawaii." In 1985, the USDA Office of Critical Materials put the Chinese tallow tree on a list of potential commercial species. In the late '90s, Mason reported that his company was testing prototypes of the harvester he'd developed on the Hawaiian Islands.

Mason's patent for a row-crop growing and harvesting system[4] was an integral part of his plan. The goal was to maximize the growth of the tallow tree crop while developing an efficient, mechanical method of harvesting to replace the traditional hand-picking done in the tree's native lands. The system he devised required the trees (a tea tree plantation is the example given in the patent) to be grown in rows with just enough room in between to ensure the shadow of one row does not fall on the row next to it. The tree was to be grown and cut so that it took the shape of a right-sided triangle, with the hypotenuse facing south. Mason further explained how a tractor implement could be designed to cut and harvest the triangle trees. The implement would consist of long cutting blades — on one side a fully vertical blade to cut the "backs" of the trees in one row, and on the other side an angled blade to cut the slanted, south-facing sides of the trees in the adjacent row. Additional short blades on the implement would extend lower down on both sides to cut the bottoms of the trees.

When asked what they thought of this device, a John Deere PR representative responded with "farmers don't want trees in their fields." Tea is still picked by hand throughout the world, so the idea has not caught on in that sphere. In theory, the concept is sound, but engineer and tractor enthusiast Jeff Miller is "dubious that it would work practically. Mainly because plants tend to grow where the light is and would not keep the nice shape proposed." As Miller points out, however, tests would need to be conducted before anyone could make conclusions; those tests, as far as I'm aware, have not been done. Dr. John Cline, a professor at the University of Guelph specializing in pomology, the science of growing fruit, has said the crop arrangement is not only sound but has been put into practice in orchards, though the rows need to run north-south

4 US Patent Number 4,327,521.

and not east-west, as Mason proposed. This simple mistake highlights Mason's inexperience in agriculture — as his arrangement has half the exposed row crop facing north, receiving little sunlight.

Harvesting methods aside, the Chinese tallow tree shows some promise as a biofuel crop, at least theoretically. However, there is a potential problem. This tree is an invasive species, which outcompetes native species of deciduous trees. It spreads; it overtakes; it destroys. Since the 1700s, this woody plant has subsisted on United States soil, but for two hundred years its spread was not a threat. The United States Department of Agriculture, unaware of its potential to do damage, helped it become established and increased its range. In the early 1900s, they planted it along the Gulf Coast with the best of intentions, considering it a possible oil-producing crop. The tree now grows in most counties in Texas, Florida, Louisiana, and along the Carolina coast. It is also established in California and Arkansas. It occurs commonly enough that colorful names for it have sprung up regionally, like the popcorn tree, chicken tree, and Florida aspen.

The Chinese tallow tree is one of the "dirty dozen."[5] Today, it is on the Nature Conservancy's list of most wanted invasive species, and Florida, Louisiana, Mississippi, and Texas have formal plans to eradicate it in sensitive areas and manage it in order to limit the damage. And the damage can be extensive. The Chinese tallow tree has destroyed large tracts of prairie in Texas and marshes in Louisiana, and it outcompetes native tree species in some forest habitats as well, wiping out other plants and animals in the process. It thrives in a wide variety of habitats in both sun and shade: grasslands, swamps, brackish waters, and upland forests. Field tests and models have shown that the tree is capable of spreading and thriving well beyond its current range to areas as far north as Illinois, New Jersey, Maryland, as well as patches along the West Coast. It is known to change soil chemistry, altering the habitat in the long

5 A "dirty dozen" list is a common way to define the most important invasive species.

term and the plants that can grow there. It has displaced native deciduous plants in many areas, where it grows in monocultural stands in vacant lots, abandoned fields, and in hedgerows. Many animals, including most (but not all) insects that rely on native plants for food, are displaced by it, although some songbirds use it. It is considered by the USDA to be responsible for the near extinction of several grassland bird species. The sap in its leaves and berries is poisonous to humans, and even touching it can cause skin rashes in some people. In short, the Chinese tallow tree is a nemesis of biodiversity. Like many invasive species, the Chinese tallow tree has an impressive reproductive rate. It starts to reproduce in three years or less, produces an average of 100,000 seeds a year, and continues to do so for about a hundred years. Stumps re-sprout, and roots send up new shoots. In other words, once established it is "virtually impossible to eliminate."

There are a couple of tiny silver linings to the tallow tree's invasion. For one, the species has proven useful as a study model for learning about the nature of invasive species in general. This is pretty important stuff, as invasive species are one of the prime forces evoking change in ecosystems globally. While trading plants between regions of the world has been occurring for millennia, the explosion of global travel and trade, as well as other hefty environmental pressures, has brought invasive species to the forefront of environmental issues. The Chinese tallow tree has been the object of a recent study to help determine exactly what it is about invasive species that makes them so good at outcompeting the natives. Is it that they have fewer natural enemies? Or, are they better able to recover from the damage done by those enemies? Is there something in the genes of the invasive individuals that makes them so good at taking over?

To test these ideas, Jianwen Zou grew Chinese tallow tree saplings in pairs in the United States out in the open, where animals and pests could eat them. Some sapling pairs were from United States trees, and others were saplings that came from modern-day Chinese tallow trees in China. The research compared the genetics

from China to the stock that has successfully become invasive since its introduction 300 years ago. The results were intriguing. Both the American and Chinese saplings had equal amounts of pest and disease damage, and the American saplings had greater amounts of feeding damage from herbivores. Animals seemed to prefer them. However, the American saplings responded to the feeding with a speed of recovery and growth not seen in the Chinese saplings. The invasive Chinese tallow tree in the United States is thus different from its Chinese ancestor in a critical aspect that allows it to spread rapidly: it has a superior ability to tolerate damage and grow quickly in recovery.

Sound like a likely candidate to solve some of America's problems? Mason had plans other than eradication for the Chinese tallow tree. His vision was to grow Chinese tallow tree plantations in Hawaii as a replacement crop for the suffering pineapple plantations there. He wanted to kill several birds with one stone, providing economic diversification for Hawaii, as well as a source of energy for a state that does not have any energy resources of its own.

There is some continuing interest in the potential of Chinese tallow for biofuel. David Shermock of AgriBioFuels Inc. in Houston, Texas, thinks it could be grown in orchard situations on scrubland not currently used for any crops to an extent that would make a difference both to the United States' "fuel security" and agricultural economy. Paul Olivier, who runs an engineering firm in Louisiana, has also suggested the plant could be used for biofuel or, at the very least, burned for energy production in the process of eradicating it. There is some scientific research being done on the plant with a view to its potential as a biofuel, with presentations at conferences in 1985 and 2005. The tree has also been determined to be a potential source of wood for construction and particleboard. However, the majority of research currently underway is related to its status as a current pest, not as a potential crop. A list of the current crops being considered for biofuel production in Texas does not include the Chinese tallow tree. Hawaii's discussion of biofuel does not include mention of the tree either.

Biofuel technology has a strong base in Hawaii because the state does need to find alternatives to importing petroleum. Shell has invested in research looking at producing fuel from algae grown and harvested in ponds. Hawaii is a leader in the reuse of cooking oil for transportation fuel, and research has shown that methanol from existing crops is a viable energy alternative that could supply about 10 percent of Hawaii's fuel needs. The waste from sugarcane, pineapple, and other cash crops, as well as eucalyptus and the native leucana tree, are all potential biomass sources under consideration. In fact, electricity has been produced in Hawaii from sugarcane waste biomass as early as 1935. What's more, Hawaii's ecosystem is delicate and unique. Tourism in Hawaii accounts for about a third of the state's gross product, so preventing degradation of the ecosystem is a primary concern for more than one reason. The thought of introducing such a known aggressive invader raises hackles.

Clearly, the idea to use the Chinese tallow tree as a biofuel in Hawaii is not such a great one. However, Mason is not alone in his biofuel judgments; among scientists there is currently a full-fledged debate raging regarding the use of invasive species for biofuels. The issue is that the characteristics of a plant that make it an excellent biofuel candidate are many of the same characteristics found in highly successful destructive invaders. The list of these characters includes: long canopy life, no known pests or diseases, storage of nutrients below ground, rapid growth in spring to outcompete weeds, and efficient use of water. In fact, some of the top candidates for biofuel crops in North America today include invasive species like giant reed, *Miscanthus* hybrids, reed canary grass, and switchgrass. The latter species are native to parts of the United States; however, they can be invasive in other regions. Controlling the spread of these species would be extremely difficult because chemical control is too expensive on rangelands or government lands. Biological control is also likely to be avoided, as there is a risk of the agent spreading beyond the intended species to target other genetically related plants, such as corn, oats, and wheat.

Most exotic species introduced into foreign lands are not

successful. The displaced organisms do not take hold and instead fizzle out and die. It is a very small subset that becomes invasive. Those that do get established, however, tend to do extremely well — and outstrip the local competition. In many ways, inventors such as Stanley Mason that venture outside their field of expertise are themselves an alien species. When they delve into foreign territory and apply their innovative abilities to foreign topics, they are more likely than not to miss the mark. Their ideas, lacking experience and theoretical background, disappear without a trace. Mason's idea for the Chinese tallow tree in Hawaii is one such seed that did not get established.

Every so often, however, an inventor who delves outside his or her field can approach a problem unencumbered by background knowledge and come up with a solution that not only takes hold but thrives, primarily *because* it is exotic. In *The Sources of Invention*, a short list of inventions developed by people working outside their field includes: Gillette, a cork salesman who invented the safety razor; Carlson, a patent lawyer who invented xerography; the undertaker who invented the telephone dialing system; the musicians who invented Kodachrome; and Dunlop, a veterinarian who invented the pneumatic tire.

It is a gamble to venture outside your expertise; you might turn up trumps, but more likely turnips.

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